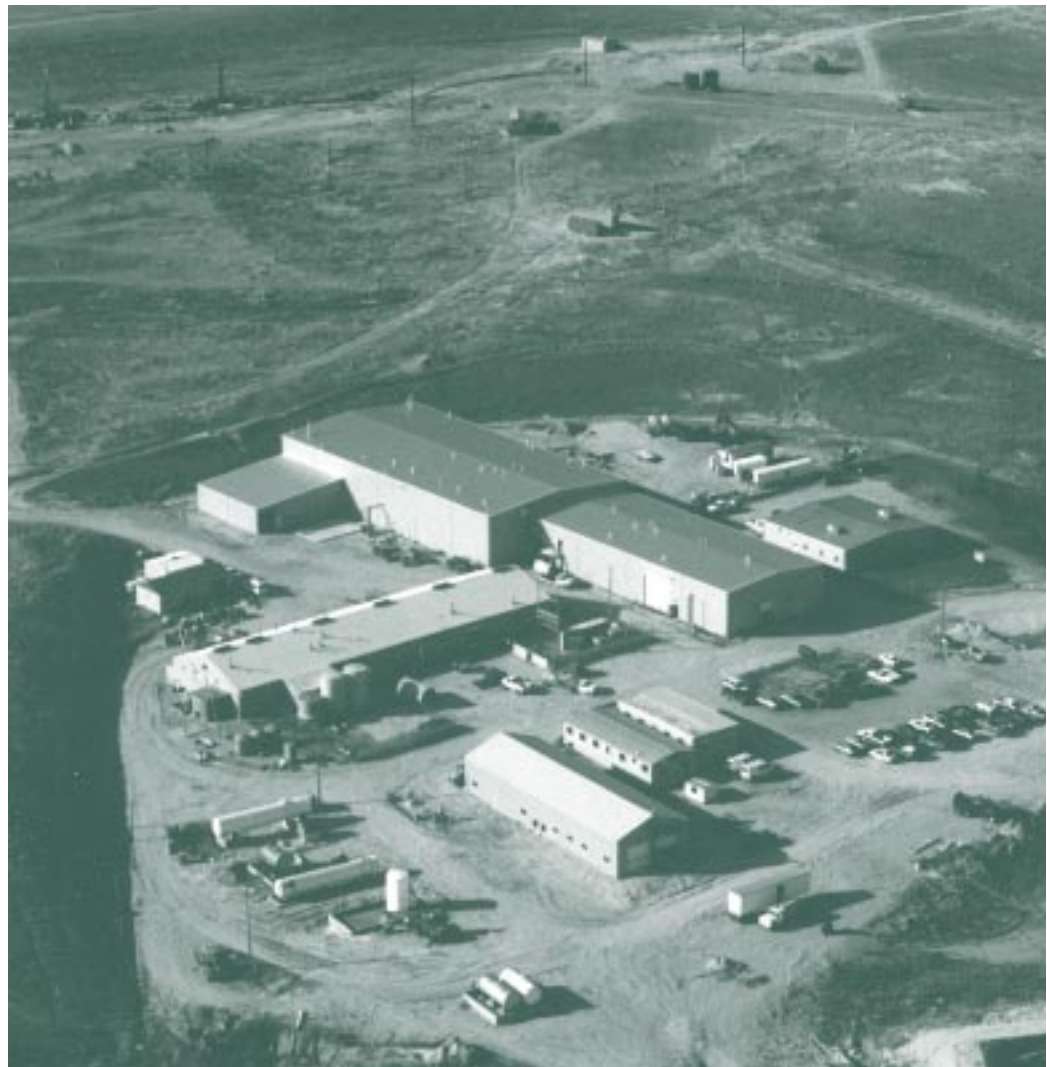


1997

Uranium Industry Annual



April 1998



Energy
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Uranium Industry Annual 1997

April 1998

Energy Information Administration
Office of Coal, Nuclear, Electric and Alternate Fuels
U.S. Department of Energy
Washington, DC 20585

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Contacts

This report was prepared by staff of the Coal, Nuclear and Renewables Division, Office of Coal, Nuclear, Electric and Alternate Fuels. General information about this publication may be obtained from Dr. Z. D. Nikodem, (202/426-1179, email zdenek.nikodem@eia.doe.gov).

Specific questions regarding the various sections of the report should be addressed to the following staff personnel:

Exploration, production, employment, and marketing activities:

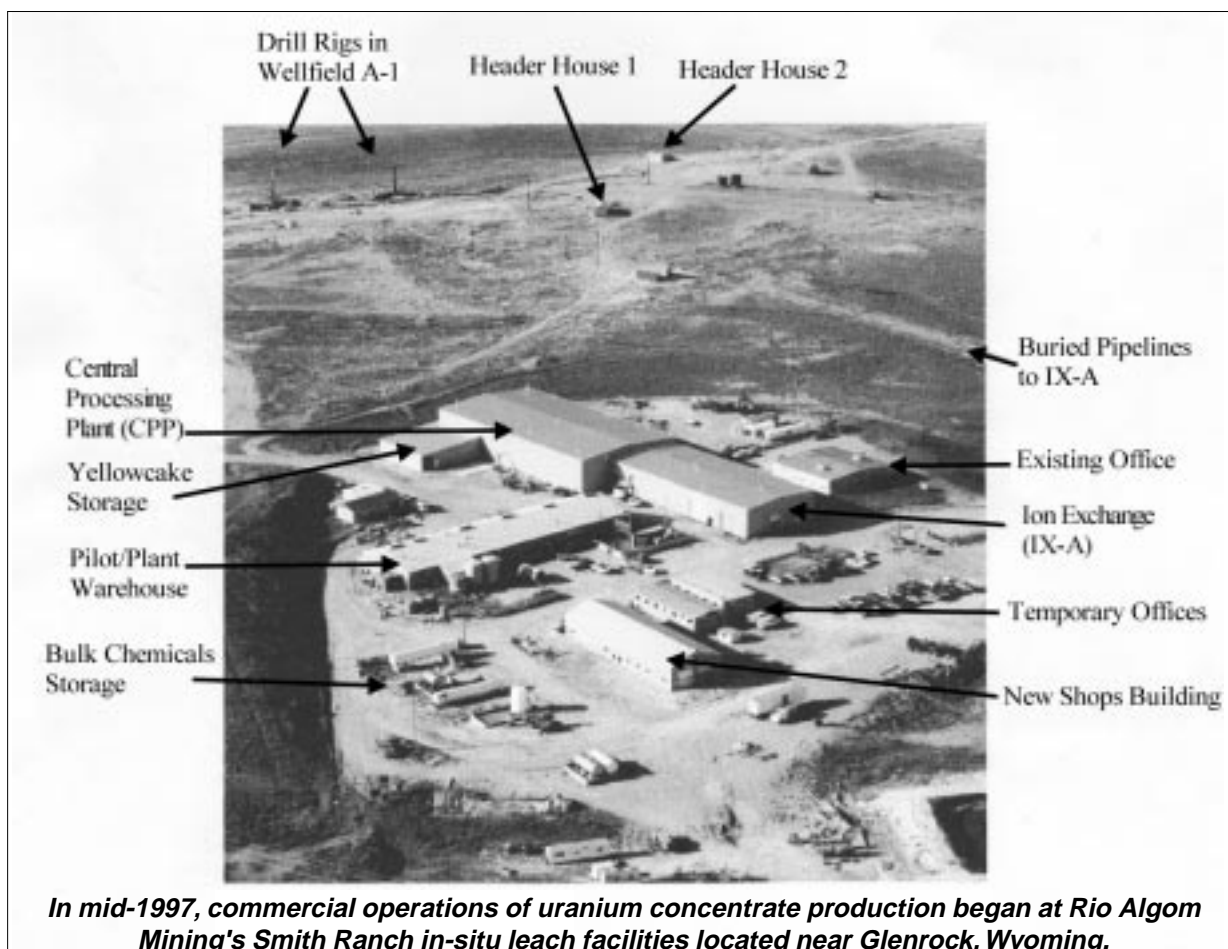
Douglas Bonnar on (202) 426-1249;
or email address: douglas.bonnar@eia.doe.gov

Reserves and resources:

Luther Smith on (202) 426-1140;
or email address: luther.smith@eia.doe.gov

Survey methodology and operations:

Charles Johnson on (202) 426-1178;
or email address: charles.johnson@eia.doe.gov



Preface

The *Uranium Industry Annual 1997* (UIA 1997) provides current statistical data on the U.S. uranium industry's activities relating to uranium raw materials and uranium marketing. The UIA 1997 is prepared for use by the Congress, Federal and State agencies, the uranium and nuclear electric utility industries, and the public. It contains data for the period 1988 through 2007 as collected on the Form EIA-858, "Uranium Industry Annual Survey."

Data collected on the "Uranium Industry Annual Survey" provide a comprehensive statistical characterization of the industry's activities for the survey year and also include some information about industry's plans and commitments for the near-term future. Where aggregate data are presented in the UIA 1997, care has been taken to protect the confidentiality of company-specific information while still conveying accurate and complete statistical data.

The legal authority for Form EIA-858, "Uranium Industry Annual Survey," comes from Section 13b of the Federal Energy Administration Act of 1974 (15 U.S.C. 2210b).

On October 24, 1992, the Congress enacted the Energy Policy Act of 1992 (EPACT 1992), Public Law 102-486. This law provides under Subtitle B, 42 USC § 2296b-4, Sec. 1015, that:

". . . the owner or operator of any civilian nuclear power reactor shall report to the Secretary (of Energy), acting through the Administrator of the Energy Information Administration, for activities of the previous fiscal year—

(1) the country of origin and the seller of any uranium or enriched uranium purchased or imported into the United States either directly or indirectly by such owner or operator; and

(2) the country of origin and the seller of any enrichment services purchased by such owner or operator."

The information is required to be made available to the Congress annually. For 1992 through 1995, this information was provided in a separate issue entitled Uranium Purchases Report, that is no longer being produced. The data is now contained in Chapter 2 (pages 11 and 13, Tables 12, 22, 23, and 25) of this report.

Data on uranium raw materials activities for 1988 through 1997, including exploration activities and expenditures, EIA-estimated reserves, mine production of uranium, production of uranium concentrate, and industry employment, are presented in Chapter 1. Data on uranium marketing activities for 1994 through 2007, including purchases of uranium and enrichment services, enrichment feed deliveries, uranium fuel assemblies, filled and unfilled market requirements, and uranium inventories, are shown in Chapter 2.

The methodology used in the 1997 survey, including data edit and analysis, is described in Appendix A. The methodologies for estimation of resources and reserves are described in Appendix B. A list of respondents to the "Uranium Industry Annual Survey" is provided in Appendix C. The Form EIA-858 "Uranium Industry Annual Survey" is shown in Appendix D. For the readers convenience, metric versions of selected tables from Chapters 1 and 2 are presented in Appendix E along with the standard conversion factors used. A glossary of technical terms is at the end of the report.

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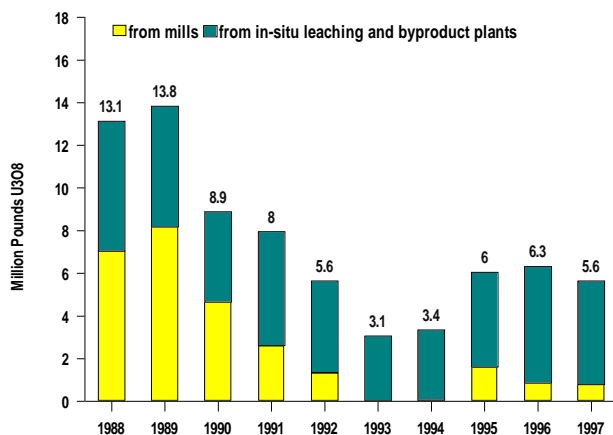
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Highlights

Uranium Raw Material Activities

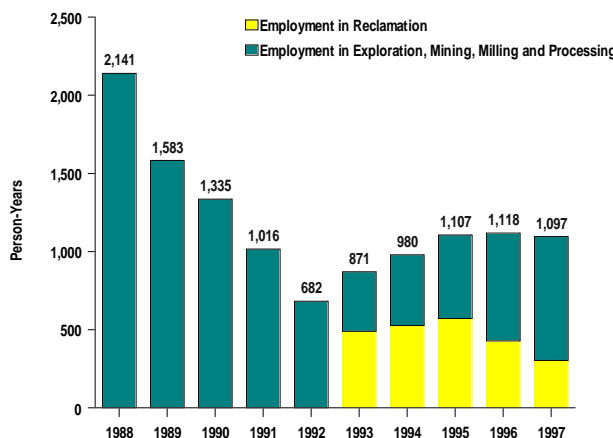
U.S. uranium production (in the form of uranium concentrate) in 1997 totaled 5.6 million pounds, a decrease of 11 percent from the 1996 level (Table H1). Eleven uranium concentrate production facilities operated in the United States. Uranium production at U.S. uranium mills accounted for 14 percent; and in-situ leaching and as a byproduct of phosphate processing combined for 86 percent (Figure H1). Three mills produced uranium concentrate, not by conventional milling of uranium-bearing ore, but by processing uranium from other feed materials.

Figure H1. U.S. Uranium Concentrate Production, 1988-1997



Total exploration and development expenditures in 1997 were \$30.4 million. Employment in the raw materials sector of the uranium industry totaled 1,097 person years (Figure H2), an increase in production sector was offset by a decrease in reclamation sector.

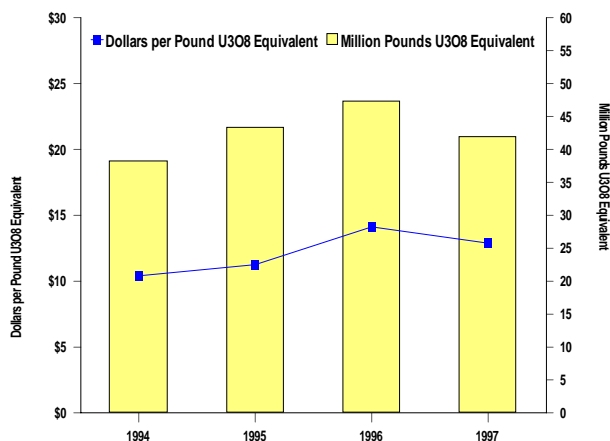
Figure H2. U.S. Uranium Employment, 1988-1997



Uranium Marketing Activities

U.S. utilities purchased from U.S. and foreign suppliers a total of 42.0 million pounds U_3O_8e (equivalent) of deliveries during 1997 (Table H2). The average price paid by the utilities was \$12.88 per pound U_3O_8e , a decrease of 9 percent compared with the 1996 price (Figure H3).

Figure H3. Uranium Purchases by U.S. Utilities, 1994-1997



Fuel assemblies loaded into U.S. commercial nuclear power reactors during 1997 contained 48.7 million pounds U_3O_8e (Table H3). Uranium inventories held at the end of the year by U.S. utilities declined in 1997 to 63.9 million pounds U_3O_8e . This represented a 3 percent decrease from the level of inventories at the end of 1996 (Figure H4).

Figure H4. Fuel Assemblies Loaded into U.S. Commercial Nuclear Power Reactors and Uranium Inventories of U.S. Utilities, 1994-1997

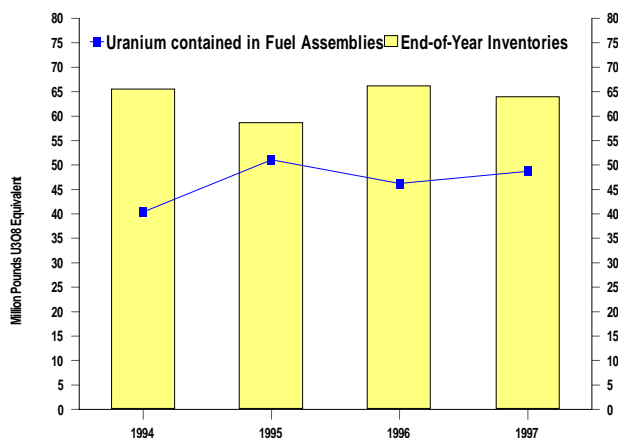


Table H1. Raw Materials Summary Statistics of the U.S. Uranium Industry, 1988-1997

Items	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Exploration and Development										
Surface Drilling (million feet)	3.0	2.2	1.7	1.8	1.1	1.1	0.7	1.3	3.0	4.9
(million meters)	0.9	0.7	0.5	0.6	0.3	0.3	0.2	0.4	0.9	1.5
Expenditures ^a (million dollars)	20.1	14.8	17.1	17.8	14.5	11.3	3.7	6.0	10.1	30.4
Reserves at End of Year										
(million pounds U ₃ O ₈ , \$US30 per pound)	289	277	265	304	295	292	294	290	285	281
(thousand metric tons U, \$US80 per kilogram)	111	107	102	117	114	112	113	112	110	108
Mine Production of Uranium										
(million pounds U ₃ O ₈)	9.5	9.7	5.9	5.2	1.0	2.1	2.5	3.5	4.7	4.7
(thousand metric tons U)	3.7	3.7	2.3	2.0	0.4	0.8	1.0	1.4	1.8	1.8
Uranium Concentrate Production										
(million pounds U ₃ O ₈)	13.1	13.8	8.9	8.0	5.6	3.1	3.4	6.0	6.3	5.6
(thousand metric tons U)	5.1	5.3	3.4	3.1	2.2	1.2	1.3	2.3	2.4	2.2
Uranium Concentrate Shipments										
(million pounds U ₃ O ₈)	12.8	14.8	13.0	8.4	6.9	3.4	6.3	5.5	6.0	5.8
(thousand metric tons U)	4.9	5.7	5.0	3.2	2.6	1.3	2.4	2.1	2.3	2.2
Employment (person-years expended) ...	2,141	1,583	1,335	1,016	682	871	980	1,107	1,118	1,097

^aExpenditures are in nominal U.S. dollars.

Note: Specific references for each category of data and year are provided in various detailed text or tables included in the main body of this report. For 1993 through 1997, total employment includes reclamation employment.

Sources: Energy Information Administration: **1988-1996-Uranium Industry Annual 1996** (April 1997); **1997-Form EIA-858, "Uranium Industry Annual Survey"** (1997).

Table H2. Transaction Summary Statistics of the U.S. Uranium Industry, 1994-1997

Actual Deliveries	1994		1995		1996		1997	
	Quantity	Weighted-Average Price	Quantity	Weighted-Average Price	Quantity	Weighted-Average Price	Quantity	Weighted-Average Price
Purchases by U.S. Brokers and Traders								
(million pounds U ₃ O ₈ e; dollars per pound U ₃ O ₈ e)	30.8	8.29	22.9	9.53	25.3	12.61	19.7	11.00
(thousand metric tons U; dollars per kilogram U)	11.8	21.56	8.8	24.79	9.7	32.79	7.6	28.60
Purchases by U.S. Utilities								
(million pounds U ₃ O ₈ e; dollars per pound U ₃ O ₈ e)	38.3	10.40	43.4	11.25	47.3	14.12	42.0	12.88
(thousand metric tons U; dollars per kilogram U)	14.7	27.03	16.7	29.24	18.2	36.71	16.1	33.49
Foreign Purchases by U.S. Suppliers and Utilities								
(million pounds U ₃ O ₈ e; dollars per pound U ₃ O ₈ e)	36.6	8.95	41.3	10.20	45.4	13.15	43.0	11.81
(thousand metric tons U; dollars per kilogram U)	14.1	23.27	15.9	26.52	17.5	34.19	16.5	30.69
Foreign Sales by U.S. Suppliers and Utilities								
(million pounds U ₃ O ₈ e; dollars per pound U ₃ O ₈ e)	17.7	11.34	9.8	13.48	11.5	14.20	17.0	12.39
(thousand metric tons U; dollars per kilogram U)	6.8	29.49	3.8	35.06	4.4	36.92	6.5	32.22

U₃O₈e = U₃O₈ equivalent.

Note: Prices are in nominal U.S. dollars.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1994-1997).

Table H3. Summary Statistics of Uranium Fuel and Commercial Inventories, 1994-1997

Items	1994	1995	1996	1997 ^P
Fuel Assemblies Loaded into U.S. Commercial Nuclear Power Reactors				
(million pounds U ₃ O ₈ e)	40.4	51.1	46.2	48.7
(thousand metric tons U)	15.5	19.7	17.8	18.7
Commercial Inventories at the End of the Year				
U.S. Utility Inventories				
(million pounds U ₃ O ₈ e)	65.4	58.7	66.1	63.9
(thousand metric tons U)	25.2	22.6	25.4	24.6
U.S. Utility and Supplier Inventories				
(million pounds U ₃ O ₈ e)	86.9	72.5	80.0	75.8
(thousand metric tons U)	33.4	27.9	30.8	29.2

U₃O₈e = U₃O₈ equivalent.

P=Preliminary data. Final 1996 data reported in the 1997 survey.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1995-1997).

1. U.S. Uranium Raw Materials Industry

Introduction

The levels of activity in the U.S. uranium raw materials industry overall were mixed during 1997, compared with 1996. While expenditures for exploration, drilling, and related activities reported for 1997 were three times more than in 1996 (Figure 1), mine production of uranium remained constant (Figure 2), but total uranium concentrate production decreased in 1997 (Figure 3). Total employment for uranium exploration, mining, milling, and processing increased in 1997 compared with 1996 (Figure 4), with mining claiming a 24 percent increase. Employment for reclamation activities continued to decline.

Uranium concentrate was produced in 1997 from in-situ leach methods and as a byproduct of phosphate processing. Also, uranium was recovered from the processing of mine water and other materials.

Exploration and Development Activities

Land Holdings and Acquisitions

U.S. uranium exploration companies held 840 thousand acres for all exploration purposes at the end of 1997 (Table 1). This represents a large increase of land held for exploration at year end, and reverses the trend of declining exploration land held by companies in the United States. About 550,000 acres were acquired for exploration at a total cost of \$8.2 million (Table 2). The types of land acquired and held include fee land, mineral fee leases, patented and unpatented mining claims, and options to purchase mineral fee land.

Surface Drilling

Surface drilling (exploration and development) in the United States was 4.9 million feet in 7,793 holes (Table 1). Development drilling expenditures in 1997 was \$16.5 million, a \$10.9 million increase compared with 1996, while exploration drilling expenditures increased \$1.9 million (Figure 5).

Expenditures for Uranium Exploration and Development

Total U.S. uranium exploration and development expenditures in 1997 were \$30.4 million, consisting of (in millions) \$8.2 for land, \$20.0 for surface drilling, and \$2.2 for other exploration activities (Table 2). This total represents a 203 percent increase over the 1996 level. Participation from foreign sources to U.S. exploration expenditures in 1997 were \$4.3 million, which represents 14 percent of the total U.S. expenditures in 1997.

Estimates of U.S. Uranium Reserves

As of the end of 1997, the EIA's estimates of uranium reserves in the \$30- and \$50-per-pound categories were 281 and 931 million pounds, respectively. Underground mining reserves accounted for about one-half of the total reserves in each cost category (Table 3). Three States, New Mexico, Texas and Wyoming, contained about 74 percent of \$30-per-pound U_3O_8 reserves (Appendix B, Table B4). Reserves estimates represent the quantities of uranium (as U_3O_8) that occur in known deposits such that portions of the mineralized deposits can be recovered at specific costs under current regulations using state-of-the-art mining and milling methods.

Mine Production of Uranium

During 1997, a total of 4.7 million pounds U_3O_8 of uranium were produced by mining and is the same level of production as in 1996 (Table 4). Production continued at an underground mine, but openpit mines remain inactive. Uranium was also recovered from waste mine-water and from reclamation activities at closed in situ mine sites. Compared with 1996, in situ leach mine production decreased 7 percent in 1997. Overall, there were eight uranium mines that commercially operated during part or all of 1997, one more than in 1996 (Table 4).

Concentrate Production and Shipments

Total U.S. uranium concentrate production in 1997 was 5.6 million pounds U_3O_8 , 11 percent below the 1996 level (Table 5). Concentrate production from conventional mills was 0.8 million pounds.

Concentrate production in the "Other Processing" category includes production from in situ leaching and as a byproduct of phosphate processing. Compared with 1996, this category decreased 11 percent and totaled 4.9 million pounds U_3O_8 in 1997 (Table 5).

Shipments of uranium concentrate from domestic production facilities (mills, in situ and phosphate byproduct plants) totaled 5.8 million pounds in 1997 (Table 5). Shipments exceeded production for the first year since 1994 (Figure 6).

Status of Uranium Processing Facilities

At the end of 1997, six U.S. mills were inactive based on their conventional milling capacity of 14,400 tones of ore per day (Table 6). Three of the inactive conventional mills produced uranium concentrate from waste stream materials and from mine water during 1997.

Eight nonconventional uranium producing plants, consisting of six in-situ leach plants and two phosphate byproduct plants, were in commercial operation in the United States at the end of 1997. These plants had a combined rated capacity of 8.1 million pounds U_3O_8 per year (Table 7), an increase due to the Smith Ranch plant going from pilot program to commercial operation in 1997. Seven nonconventional plants were inactive at the end of 1997. Four of the five inactive in-situ leach plants had produced a small amount of uranium concentrate in 1997 from restoration activities. The two inactive byproduct plants in Florida were closed indefinitely.

The locations of active and inactive U.S. uranium concentrate production facilities, along with the locations of major uranium reserve areas, are shown in Figure 7.

Employment

Employment in the U.S. uranium raw materials industry in 1997 was reported as 1,097 person years expended (Table 8). Compared with 1996, 1997 employment overall declined by 2 percent. However, employment levels in individual categories changed significantly: mining rose by 24 percent and milling by 13 percent, while, reclamation employment declined by 29 percent, and exploration employment remained the same. For the second year, reclamation employment was less than the combined employment in uranium exploration, mining, milling and processing. Three States, Colorado, Texas and Wyoming, accounted for 73 percent of the total employment in 1997 (Table 9).

Figure 1. Exploration and Development Expenditures, 1988-1997

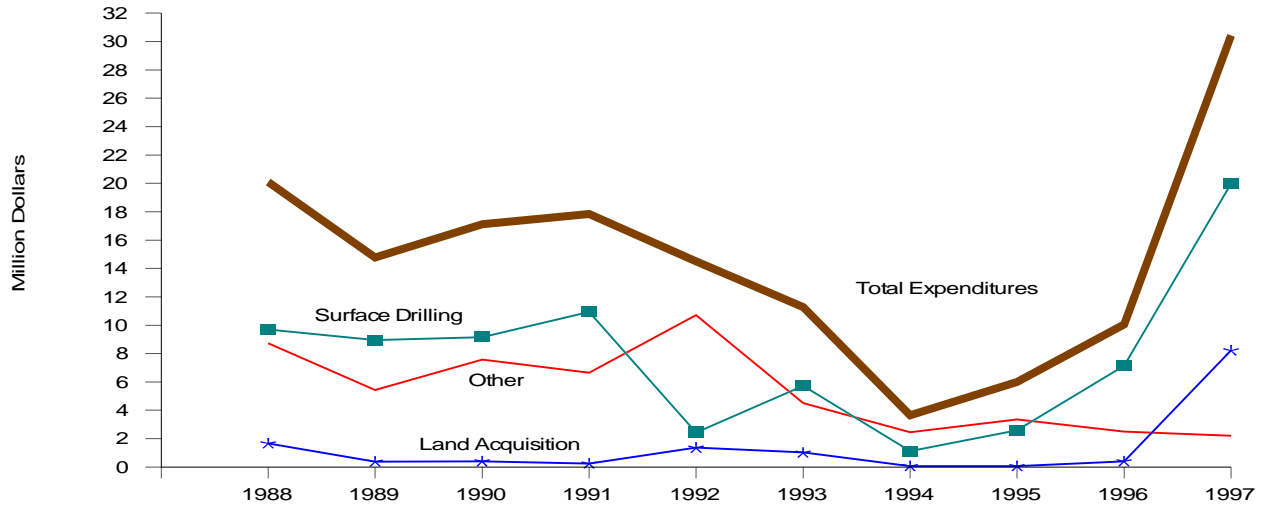


Figure 2. U.S. Uranium Mine Production, 1988-1997

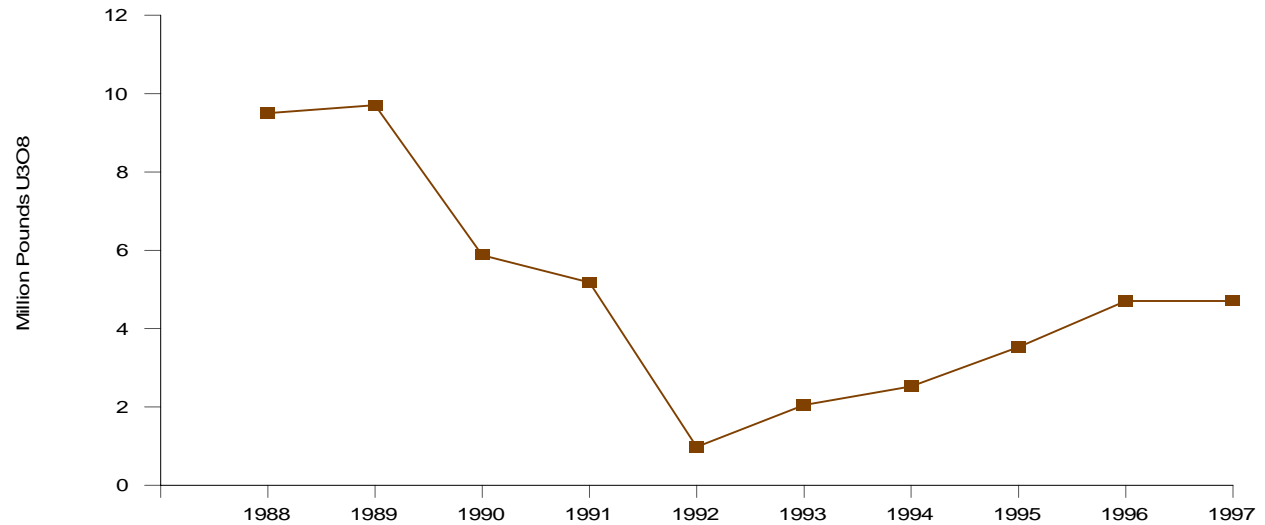
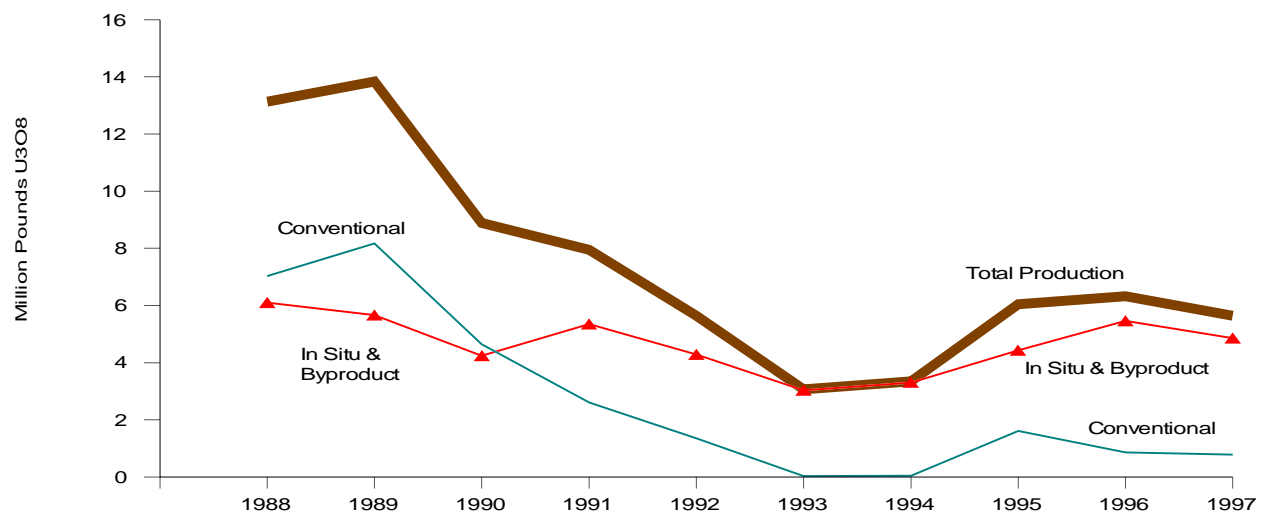


Figure 3. U.S. Uranium Concentrate Production, 1988-1997



Sources: Energy Information Administration: 1988-1996-Uranium Industry Annual 1996 (April 1997). 1997-Form EIA-858, "Uranium Industry Annual Survey" (1997).

Figure 4. Employment - Uranium Raw Materials Sector, 1988-1997

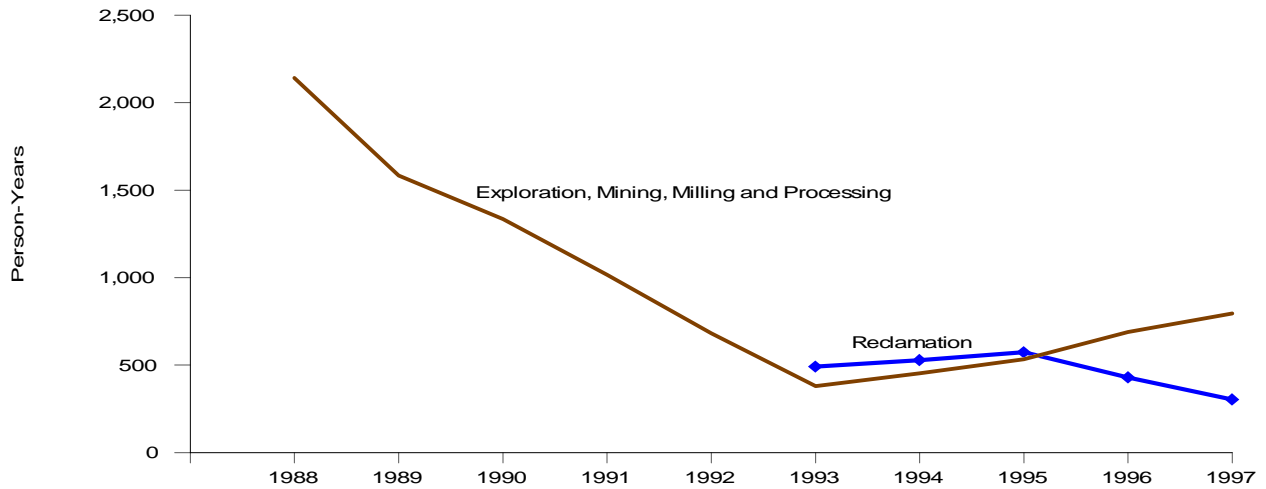


Figure 5. U.S. Uranium Exploration and Development Surface Drilling Expenditures, 1988-1997

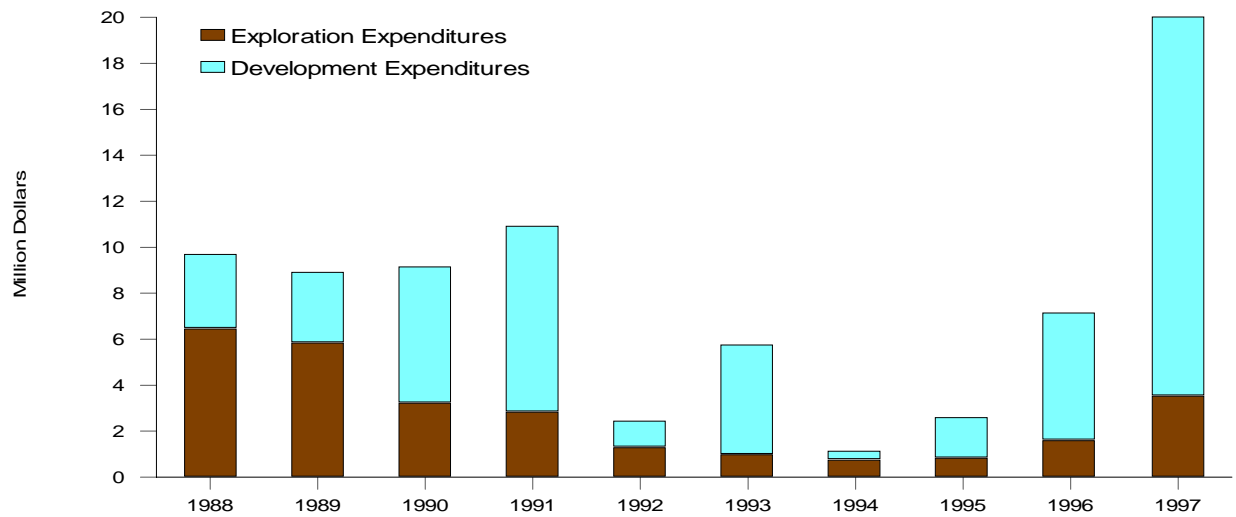
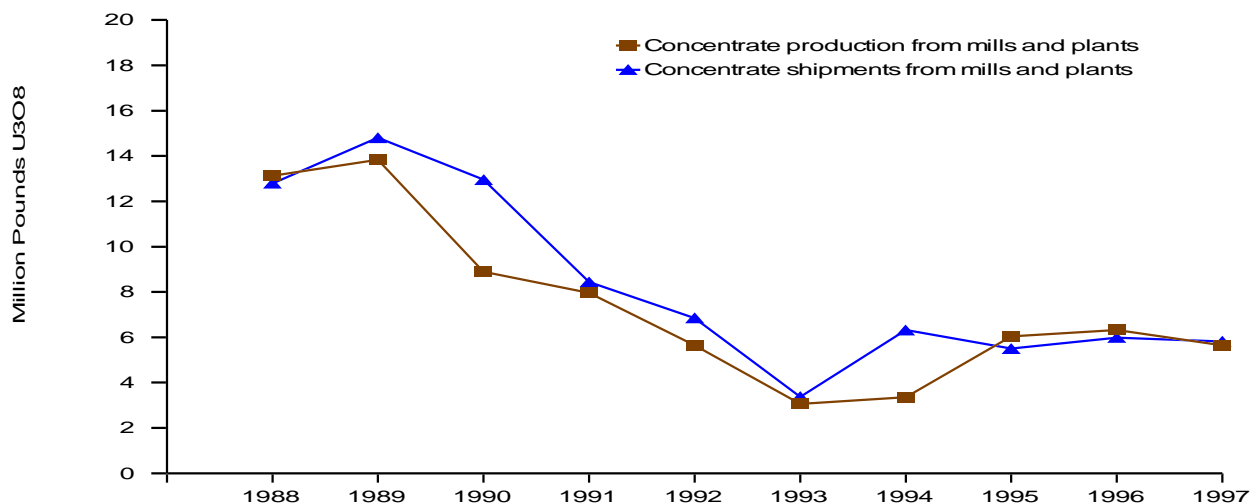
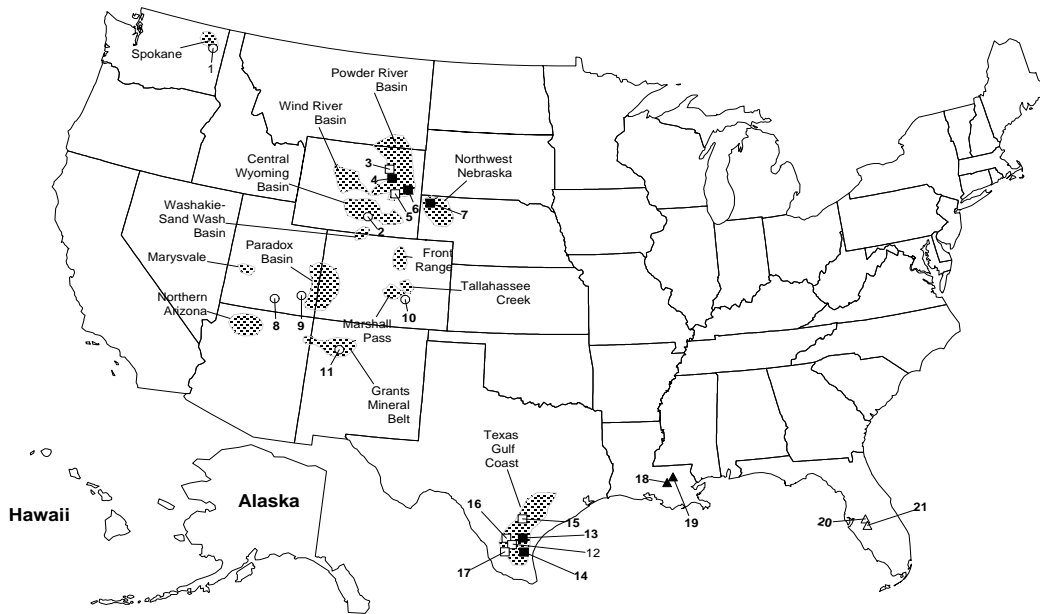


Figure 6. U.S. Uranium Concentrate Production and Shipments, 1988-1997



Sources: Energy Information Administration: 1988-1996-Uranium Industry Annual 1996 (April 1997). 1997-Form EIA-858, "Uranium Industry Annual Survey" (1997).

Figure 7. Major U.S. Uranium Reserve Areas and Status of Mills and Plants, 1997




Active at the End of 1997

- 4. Malapai Resources, Christensen Ranch
- 6. Converse County Mining Venture, Highland
- 5. Rio Algom Mining, Smith Ranch
- 7. Crow Butte Resources, Crow Butte
- 13. Uranium Resources, Rosita
- 14. Uranium Resources, Kingsville Dome
- 18. IMC-Agrico, Sunshine Bridge
- 19. IMC-Agrico, Uncle Sam

Inactive at the End of 1997

- 1. Dawn Mining, Ford ^a
- 2. Green Mountain Mining Venture, Sweetwater
- 3. Malapai Resources, Irigaray ^b
- 8. U.S. Energy, Shootaring
- 9. International Uranium (USA), White Mesa ^c
- 10. Cotter Corp., Canon City
- 11. Rio Algom Mining, Ambrosia ^d
- 12. Malapai Resources, Holiday-EI Mesquite ^b
- 15. Everest Minerals, Hobson
- 16. COGEMA Mining, West Cole ^b
- 17. Malapai Resources, O'Hern ^b
- 20. IMC-Agrico, Plant City
- 21. IMC-Agrico, New Wales

Uranium Production Centers		
Active	Inactive	
●	○	Conventional Mills
■	□	In Situ Leach Plant
▲	△	Byproduct From Phosphate Processing
		Major Uranium Reserve Areas ^e

^aRecovered uranium by processing the waste stream at a mine water treatment plant during 1997.

^bRecovered uranium by processing water from in situ leach mine restoration during 1997.

^cRecovered uranium by processing from waste steam materials during 1997.

^dRecovered uranium by processing mine water solution during 1997.

^eMajor areas containing reasonably assured resources at \$50-per-pound U₃O₈ or less.

Sources: Based on U.S. Department of Energy, Grand Junction Project Office (GJPO), *National Uranium Resource Evaluation, Interim Report* (June 1979) Figure 3.2; GJPO data files; and Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1997).

Table 1. U.S. Uranium Land and Surface Drilling Activities, 1988-1997

Year	Land Exploration		Surface Drilling Exploration			Surface Drilling Development			Surface Drilling Exploration and Development		
	Acres Acquired during Year (thousand)	Acres Held at End of Year (thousand)	Number of Holes	Feet (thousand)	Cost (thousand dollars)	Number of Holes	Feet (thousand)	Cost (thousand dollars)	Number of Holes	Feet (thousand)	Cost (thousand dollars)
1988	90	1,700	2,029	1,280	6,440	3,176	1,730	3,260	5,205	3,010	9,700
1989	28	1,529	2,087	1,430	5,820	1,753	800	3,120	3,840	2,230	8,940
1990	38	1,209	1,507	870	3,210	1,908	810	5,950	3,415	1,680	9,160
1991	32	1,060	1,624	973	2,832	1,573	869	8,114	3,197	1,842	10,946
1992	85	788	935	562	1,267	833	502	1,162	1,768	1,064	2,429
1993	65	455	355	223	983	1,665	885	4,754	2,020	1,108	5,737
1994	9	325	519	341	736	477	316	383	996	657	1,119
1995	7	259	584	402	790	1,728	947	1,799	2,312	1,348	2,589
1996	36	288	1,118	883	1,602	3,577	2,163	5,549	4,695	3,046	7,150
1997	550	840	1,935	1,327	3,544	5,858	3,555	16,448	7,793	4,882	19,992

Note: Totals may not equal sum of components because of independent rounding.

Sources: Energy Information Administration: **1988-1996-Uranium Industry Annual 1996** (April 1997). **1997-Form EIA-858, "Uranium Industry Annual Survey" (1997).**

Table 2. Expenditures for Exploration and Development of Uranium in the United States, 1988-1997 (Thousand Dollars)

Year	Surface Drilling	Land Acquisition	Other Exploration and Development Expenditures	Total U.S. Expenditures	Foreign Participation	
					Expenditures	Percent of Total U.S. Expenditures
1988	9,700	1,670	8,730	20,100	8,900	44
1989	8,940	390	5,430	14,770	6,100	41
1990	9,160	400	7,580	17,120	2,530	15
1991	10,946	250	6,649	17,845	3,500	20
1992	2,429	1,365	10,716	14,510	8,004	55
1993	5,737	1,024	4,509	11,270	8,527	76
1994	1,119	71	2,464	3,654	1,864	51
1995	2,589	69	3,350	6,009	2,078	35
1996	7,150	403	2,500	10,054	4,416	44
1997	19,992	8,226	2,207	30,426	4,254	14

Note: Totals may not equal sum of components because of independent rounding.

Sources: Energy Information Administration: **1988-1996-Uranium Industry Annual 1996** (April 1997). **1997-Form EIA-858, "Uranium Industry Annual Survey" (1997).**

Table 3. Forward-Cost Uranium Reserves by Mining Method, 1997

Mining Method	Forward-Cost Category					
	\$30 per pound			\$50 per pound		
	Ore (million tons)	Grade ^a (percent U ₃ O ₈)	U ₃ O ₈ (million pounds)	Ore (million tons)	Grade ^a (percent U ₃ O ₈)	U ₃ O ₈ (million pounds)
Underground	25	0.273	139	143	0.163	465
Openpit	10	0.139	29	163	0.079	257
In Situ Leaching	43	0.130	113	126	0.077	194
Other ^b	< 1	0.264	< 1	15	0.050	15
Total	79	0.177	281	446	0.104	931

^aWeighted average percent U₃O₈ per ton of ore.

^bIncludes heap leach, mine water, and low grade stockpiles.

Notes: Uranium reserves that could be recovered as a byproduct of phosphate and copper mining are not included in this table. Reserves values in forward-cost categories are cumulative: that is, the quantity at each level of forward-cost includes all reserves at the lower costs. Totals may not equal sum of components because of independent rounding.

Sources: Estimated by Energy Information Administration, Office of Coal, Nuclear, Electric and Alternate Fuels, based on industry conferences, U.S. Department of Energy, Grand Junction Projects Office data files, and Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1997).

Table 4. U.S. Uranium Mine Production and Number of Mines and Sources, 1988-1997

Mining Method	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Underground (thousand pounds U ₃ O ₈)	5,400	5,300	W	W	W	0	0	0	W	W
Openpit (thousand pounds U ₃ O ₈)	W	W	1,881	2,528	W	0	0	0	0	0
In Situ Leaching (thousand pounds U ₃ O ₈)	W	W	W	W	W	W	2,448	3,372	4,379	4,084
Other ^a (thousand pounds U ₃ O ₈)	4,100	4,400	3,995	2,654	986	2,050	78	156	326	626
Total Mine Production (thousand pounds U ₃ O ₈)	9,500	9,700	5,876	5,182	986	2,050	2,526	3,528	4,705	4,710
Number of Mines Operated										
Underground	17	19	27	6	4	0	0	0	1	1
Openpit	4	2	2	2	1	0	0	0	0	0
In Situ Leaching	11	9	7	6	4	5	5	5	6	7
Other Sources ^b	0	2	3	1	8	7	7	7	6	6
Total Mines and Sources	32	32	39	15	17	12	12	12	13	14

^aFor 1988 and 1989, "Other" includes production from openpit, in situ leach, heap leach, mine water, and water-treatment plant solutions. Production quantities were rounded to the nearest 100 thousand pounds. For 1990 and 1991, "Other" includes production from underground, in situ leach, heap leach (1990), mine water, water treatment plant solutions (1990), and restoration. For 1992, "Other" includes production from underground, openpit, and in situ leach mines and uranium bearing water from mine workings, tailings ponds, and restoration. For 1993, the "Other" includes production from in situ leach mines and uranium bearing water from mine workings and restoration. For 1994 and 1995, "Other" includes production from uranium bearing water from mine workings and restoration. For 1996 and 1997, "Other" includes production from an underground mine and uranium bearing water from mine workings and restoration.

^bOther Sources includes, in various years, heap leach, mine water, mill site cleanup and mill tailings, well field restoration, and low-grade stockpiles as sources of uranium.

W=Data withheld to avoid disclosure. The data are included in the total for "Other."

Notes: Totals may not equal sum of components because of independent rounding. Table does not include byproduct production and sources.

Sources: Energy Information Administration: **1988-1996-Uranium Industry Annual 1996** (April 1997); **1997-Form EIA-858, "Uranium Industry Annual Survey"** (1997).

Table 5. U.S. Uranium Concentrate Processing Operations, 1988-1997

Processing Operations	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Ore Fed to Process ^a (thousand tons)	1,214	1,235	722	639	256	0	0	167	44	0
Percent U ₃ O ₈ ^b	0.288	0.323	0.293	0.198	0.229	—	—	0.520	0.500	—
Contained U₃O₈ (thousand pounds)										
In Ore	6,998	7,977	4,227	2,529	1,171	0	0	1,739	444	0
Other Feed Materials ^c	507	429	485	179	181	42	78	163	409	911
Total Mill Feed (thousand pounds U ₃ O ₈) ..	7,505	8,406	4,712	2,708	1,353	42	78	1,902	853	911
In-Process Inventory Change	136	-234	-244	-122	-25	10	24	157	-137	52
(thousand pounds U ₃ O ₈)										
Concentrate Produced at Mills										
(thousand pounds U ₃ O ₈)										
Theoretical ^d	7,369	8,640	4,956	2,830	1,377	31	54	1,744	990	859
Actual	7,034	8,175	4,649	2,608	1,359	30	46	1,615	860	784
Recovery as Percent of Mill Feed	95.5	94.6	93.8	92.2	98.7	—	—	92.6	86.8	91.2
Tailings and Unaccountable										
(thousand pounds U ₃ O ₈)	335	465	307	222	18	1	8	130	130	76
Other Processing^e										
(thousand pounds U ₃ O ₈)	6,096	5,662	4,237	5,344	4,286	3,033	3,306	4,428	5,461	4,859
Total Uranium Concentrate Production										
(thousand pounds U ₃ O ₈)	13,130	13,837	8,886	7,952	5,645	3,063	3,352	6,043	6,321	5,643
Total Concentrate Shipped From Mills and Plants										
(thousand pounds U ₃ O ₈)	12,791	14,808	12,957	8,437	6,853	3,374	6,319	5,500	5,982	5,817

^aUranium ore "fed to process" in any year can include: ore mined and shipped to a mill during the same year, ore that was mined during a prior year and later shipped from mine-site stockpiles, and/or ore obtained from drawdowns of stockpiles maintained at a mill site.

^bWeighted average percent U₃O₈ per ton of ore.

^cIncludes for various years uranium from low-grade ore, mill cleanup, mine water, tailings water, heap leaching, and waste stream materials, except as footnoted below.

^dAt 100-percent recovery.

^eU₃O₈ concentrate production from in situ leaching and as a byproduct of phosphate processing. The total for 1988 includes U₃O₈ recovered from reclamation and mine water at some mills that did not report processing of uranium ore for that year.

— = Not applicable.

Note: Totals may not equal sum of components because of independent rounding.

Sources: Energy Information Administration: **1988-1996-Uranium Industry Annual 1996** (April 1997); **1997-Form EIA-858, "Uranium Industry Annual Survey"** (1997).

Table 6. Operating Status of Conventional Uranium Mills, End of the Year, 1994-1997

Mill Owner	Name and State	Milling Capacity ^a (short tons of ore per day)	Operating Status at End of the Year			
			1994	1995	1996	1997
Cotter	Canon City (CO)	1,200	I	I	I	I
Dawn Mining	Ford (WA)	450	I	I	I	I
International Uranium (USA)	White Mesa (UT)	2,000	I	O	I	I
Green Mountain Mining Venture	Sweetwater (WY)	3,000	I	I	I	I
Rio Algom Mining	Ambrosia Lake (NM)	7,000	I	I	I	I
U.S. Energy/Plateau Resources	Shootaring (UT)	^b 750	I	I	I	I
Summary of Mill Status						
Number of Mills						
Operating ^c	--	--	0	1	0	0
Inactive	--	--	6	5	6	6
Total	--	--	6	6	6	6
Available Milling Capacity						
Operating (tons of ore per day)	--	--	0	2,000	0	0
Inactive (tons of ore per day)	--	--	14,650	12,400	14,400	14,400
Total Available Capacity (tons of ore per day)	--	--	14,650	14,400	14,400	14,400
Average Daily Mill Feed						
(tons of ore per day) ^d	--	--	0	476	127	0
Percent of Total Available Capacity ^e	--	--	0	3	1	0

^aMilling capacity based on historical data and data reported on Form EIA-858 for 1997.

^bFor 1994, Shootaring's capacity was 1,000 short tons of ore per day.

^cNumber that milled uranium-bearing ore at the end of year.

^dRounded value. Based on 350 workdays per year and total ore fed to process during the year shown in Table 5.

^eRounded value. Calculated based on ore fed to process (Table 5) during 350 workdays per year.

O=Operating at the end of the year; I=Inactive at the end of the year.

-- = Not applicable.

Sources: Energy Information Administration: **1994-1996-Uranium Industry Annual 1996** (April 1997). **1997-Form EIA-858, "Uranium Industry Annual Survey"** (1997).

Table 7. Operating Status of Nonconventional Uranium Plants, 1997

Plant Owner	Name and State	Plant Type	Rated Capacity ^a (thousand pounds U ₃ O ₈ per year)	Operating Status at the End of the Year ^b
Converse County Mining Venture	Highland (WY)	In Situ Leach	2,000	O
COGEMA Mining	West Cole (TX)	In Situ Leach	200	I
Crow Butte Resources	Crow Butte (NE)	In Situ Leach	1,000	O
Everest Minerals	Hobson (TX)	In Situ Leach	1,000	I
IMC-Agrico Company	Sunshine Bridge (LA)	Phosphate Byproduct	420	O
IMC-Agrico Company	Uncle Sam (LA)	Phosphate Byproduct	750	O
IMC-Agrico Company	Plant City (FL)	Phosphate Byproduct	608	I
IMC-Agrico Company	New Wales (FL)	Phosphate Byproduct	750	I
Malapai Resources	Christensen Ranch (WY)	In Situ Leach	650	O
Malapai Resources	Holiday-EI Mesquite (TX)	In Situ Leach	600	I
Malapai Resources	Irigaray (WY)	In Situ Leach	350	I
Malapai Resources	O'Hern (TX)	In Situ Leach	^c 0	I
Rio Algom Mining	Smith Ranch (WY)	In Situ Leach	1,000	O
Uranium Resources	Kingsville Dome (TX)	In Situ Leach	1,300	O
Uranium Resources	Rosita (TX)	In Situ Leach	1,000	O

^aMilling capacity based on data reported on Form EIA-858 for 1997.

^bO=Operating at the end of the year; I=Inactive at the end of the year.

^cMalapai Resources did not report a rated capacity for the O'Hern plant.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1997).

Table 8. Employment in the U.S. Uranium Industry by Category, 1988-1997
(Person-Years)

Year	Employment Categories					Total
	Exploration	Mining	Milling	Processing	Reclamation ^a	
1988	144	849	572	576	NA	2,141
1989	86	659	367	471	NA	1,583
1990	73	664	304	293	NA	1,335
1991	52	411	191	361	NA	1,016
1992	51	219	129	283	NA	682
1993	36	133	65	145	491	871
1994	41	157	105	149	528	980
1995	27	226	121	161	573	1,107
1996	27	333	155	175	429	1,118
1997	30	413	175	175	303	1,097

^aData on reclamation employment was not collected prior to 1993.

NA = Not available.

Note: Totals may not equal sum of components because of independent rounding.

Sources: Energy Information Administration: **1988-1996-Uranium Industry Annual 1996** (April 1997); **1997-Form EIA-858, "Uranium Industry Annual Survey"** (1997).

Table 9. Employment in the U.S. Uranium Industry by State, 1997
(Person-Years)

State(s)	Total	Percent of Total
Wyoming	373	34
Texas	216	20
Colorado	213	19
Arizona, New Mexico, Utah	159	14
Other ^a	136	12
Total	1,097	100

^aIncludes Florida, Illinois, Louisiana, Nebraska, and Washington.

Notes: Totals may not equal sum of components because of independent rounding. Total employment includes 303 person years for reclamation.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1997).

2. Uranium Marketing Activities in the United States

Introduction

Movement of both natural and enriched uranium materials illustrates, for 1997, the normal market mechanisms used by U.S. suppliers and utilities to procure and dispose of uranium (Figure 8). The uranium quantities throughout this chapter are expressed as U_3O_8 equivalent (U_3O_8e). U.S. utilities purchase uranium each year both from U.S. suppliers (domestic purchases) and foreign suppliers (foreign purchases).

U.S. suppliers are U.S.-based firms that exchange, loan, purchase, or sell uranium. They can include uranium brokers, converters, enrichers, fabricators, traders, producers, and uranium property holders. Foreign suppliers are non-U.S. based firms that market uranium into and from the United States.

Uranium market activities of U.S. utilities include purchases of uranium from domestic and foreign sources (origins), contracting for future supplies, and anticipated uranium requirements of U.S. utilities. In addition, this chapter also presents enrichment activities, the amount of uranium loaded into reactors, and the year-end 1997 status of uranium inventories.

Uranium Market Activity of U.S. Utilities

Uranium Purchases

In 1997, U.S. utilities received a total of 42.0 million pounds U_3O_8e (Figure 9), and the average price was \$12.88 per pound (Table 10 and Figure 10). Compared with 1996, the quantity is a decrease of 11 percent and price of 9 percent. Foreign-origin uranium accounted for 33.9 million pounds (81 percent) of the deliveries (Figure 11) at an average price of \$12.78 per pound (Table 11). Approximately 40 percent of all uranium purchased by U.S. utilities was Canadian origin (Table 12), while only 19 percent was domestically produced. In rank order, the next three foreign country origins were Australia (10 percent), Russia (9 percent), and Uzbekistan (7 percent) (Figure 12).

The 32 firms that sold uranium to the utilities are shown in the following list. Fifteen of the 32 firms (designated with an asterisk) made deliveries under purchase contracts signed in 1997.

Uranium Sellers to U.S. Utilities

Cameco Corporation*
China Nuclear Energy Industry Corp.
COGEMA, Inc.
COGEMA Mining, Inc.
Connecticut Yankee Atomic Power*
Energy Resources of Australia
GE Nuclear Energy*
Geomex Minerals, Inc.
Global Nuclear Services & Supply Ltd.*
International Uranium Corp.*
Nuclear Electric Ltd.*
Nuclear Fuel Resources, Inc.*
Nuclear Fuels Corp. (Rio Grande)*
Nuexco Trading Corp.
NUKEM, Inc.*
Pathfinder Mines Corporation
Power Resources, Inc.
Rio Algom Mining Corporation
RTZ Minerals Services Limited
Sheep Mountain Partners
Siemens Power Corporation
The Uranium Exchange Company*
U.S. Energy Corporation
U.S. Enrichment Corporation (USEC)
UG U.S.A., Inc.*
Uranerz Exploration & Mining Ltd.*
Uranerz U.S.A., Inc.
Urangesellschaft Mbh
Uranium Resources, Inc.*
Westinghouse Electric Company*
Western Mining Corp. (Olympic Dam)
WOLFCO Trading, Inc.*

The utilities purchased uranium of several material types (Table 13). Uranium concentrate (U_3O_8) accounted for 84 percent of the purchases, uranium hexafluoride (UF_6) was 10 percent, and enriched uranium was 6 percent (Figure 13).

Domestic purchases of uranium (both U.S. and foreign-origin) in 1997 totaled 18.7 million pounds U_3O_8e , 4.2 million pounds less than the deliveries for 1996 (Table 14). The average price of these domestic purchases in 1997 was \$12.87 per pound.

Foreign purchases of uranium (only foreign-origin) from foreign suppliers in 1997 totaled 22.5 million pounds U_3O_8e , 1.1 million pounds less than the deliveries for 1996. The average price of these foreign purchases in 1997 was \$12.89 per pound.

Uranium Price Distributions and Contract Types

A pricing mechanism was reported for each price of a uranium delivery. One mechanism, contract-specified pricing which includes fixed prices and base-escalated prices, was dominant for deliveries in 1995 through 1997 (Table 14). While average prices declined for each other type of pricing mechanism, for contract-specified its average price increased compare with 1996.

The octile distributions (Table 15) provide an indication of the price range for all the reported prices, without publishing the actual lowest and highest price. The prices are grouped into 8 equal amounts from the total uranium deliveries with reported prices. The average price for each of the 8 groups is presented. The quartile distributions provide an idea of the U.S. utilities weighted-average price range. From lowest to highest, their average prices are broken into 4 groups where each group's weighted-average price is presented.

During 1997, 17 percent of the deliveries to utilities involved spot and short-term contracts, and the remaining 83 percent involved medium-term and long-term contracts (Table 16). The average price for spot contracts was \$11.61 per pound, but for long-term contracts it was \$13.46 per pound. More deliveries for each material type were made under medium-term contracts in 1997 (Figure 14).

New Purchases

The quantity of uranium delivered in 1997, under 29 purchase contracts signed in 1997, was 5.8 million pounds U_3O_8e , and the average price was \$11.25 per pound (Table 17). Twenty-three new spot contracts accounted for 81 percent of these total purchase contracts.

Future deliveries reported for 1998 through 2007, for contracts signed in 1997, total 44.8 million pounds. Of this quantity, firm deliveries amount to 36.7 million pounds (Table 18).

Anticipated Uranium Market Requirements

Future deliveries for 1998-2007, based on contracts reported in effect at the end of 1997, for all purchase contracts consisted of 148.7 million pounds for firm deliveries and 41.8 million pounds for optional deliveries (Table 19). Foreign suppliers have contracts for 60 percent of the existing firm deliveries to utilities through 2007 (Figure 15 and Table 19).

At the end of 1997, cumulative unfilled uranium requirements for commercial nuclear reactors for 1998 through 2007 were reported to be 290.0 million pounds U_3O_8e (Table 20). The quantity of firm and optional deliveries of uranium for the same period under existing purchase contracts totaled 190.5 million pounds (Table 21). The contracted deliveries and unfilled requirements combined represent the U.S. utilities anticipated market requirements of uranium. The total 10-year requirements of U.S. utilities, at the end of 1997, was 480.6 million pounds.

The unfilled requirements category, as reported at the end of 1997, constitutes a small portion of anticipated market requirements in 1998 (Figure 16). However, it increases to 58 percent of total anticipated requirements by 2002 and to 98 percent by 2007. For the years 1998 through 2001 it would appear that utilities meet all of their reported feed deliveries to uranium enrichers by their contracted and unfilled requirements, i.e. anticipated market requirement (Figure 17). However, for 2002 through 2007, the utilities' reported enrichment feed deliveries are less than their anticipated market requirements, indicating perhaps a period of uranium inventory buildup or an expectation of enriched uranium product purchases.

Uranium Feed for Enrichment

In 1997, U.S. utilities delivered 40.3 million pounds U_3O_8e of natural uranium feed to domestic and foreign enrichment suppliers (Table 22). U.S.-origin uranium accounted for 6.7 million pounds (17 percent) of the feed deliveries (Table 23). Deliveries to the United States Enrichment Corporation (USEC) enrichment plants accounted for 32.3 million pounds, or 80 percent of the total.

A total of 8.0 million pounds of uranium feed was delivered to foreign enrichment plants in 1997. It represented 20 percent of total feed deliveries in 1997, compared with 21 percent in 1996.

At the end of 1997, the U.S. utilities reported that the amount of natural uranium feed to be shipped for enrichment for the years 1998 through 2007 will vary between 40 million and 50 million pounds annually (Table 24).

Purchases of Enrichment Services

In 1997, 8.9 million separative work units (SWU) were purchased by U.S. utilities under enrichment services contracts (Table 25.) USEC provided 68 percent of the utilities' SWU and foreign enrichers the remaining 32 percent. In comparison, in 1996 U.S. enrichment plants provided 72 percent of the utilities' enrichment needs.

The 10 firms that were reported as the sellers of enrichment services for these SWU deliveries in 1997 are shown in the following list.

Enrichment Service Sellers to U.S. Utilities

China Nuclear Energy Industry Corp.
COGEMA, Inc.
Global Nuclear Service & Supply, Ltd.
Northeast Utilities
Nuexco Trading Corp.
NUKEM, Inc.
Union Electric
United States Enrichment Corporation (USEC)
Urenco, Ltd.
Westinghouse

The long-term enrichment service contracts were dominant in 1997, and represented 80 percent of SWU deliveries that were provided at both U.S. and foreign enrichment plants (Table 26). In contrast, uranium enrichment under spot contracts represents only 3 percent of SWU deliveries.

Fuel Assemblies

The total amount of uranium contained in fuel assemblies loaded into U.S. commercial nuclear reactors during 1997 was 48.7 million pounds U_3O_8e (Table 27). This was 2.5 million pounds more than in 1996 (Figure 18). These quantities do not include uranium in fuel assemblies removed from reactors that were reloaded.

Foreign Purchases of Uranium

The U.S. utilities and U.S. suppliers, i.e., primarily U.S. producers and U.S. brokers and traders, purchased from foreign suppliers 43.0 million pounds U_3O_8e that was received in 1997 (Table 28). The average price for these foreign purchases was \$11.81 per pound U_3O_8e . This is 10 percent lower than the 1996 average price of \$13.15 per pound.

U.S. brokers and traders, a primary supplier of uranium, purchased 19.7 million pounds U_3O_8e of deliveries during 1997 at an average price of \$11.00 per pound (Table 29). Most of the uranium (15.7 million pounds or 80 percent) was from foreign suppliers. In 1996, by comparison, U.S. brokers and traders purchased 25.3 million pounds U_3O_8e at an average price of \$12.61 per pound (Figure 19).

Foreign Sales of Uranium

In 1997, uranium sold to foreign suppliers and foreign utilities totaled 17.0 million pounds U_3O_8e , 48 percent more than in 1996. The average price was \$12.39 per pound, 13 percent less than in 1996 (Table 30 and Figure 20). Of the foreign sales, 62 percent was foreign-origin and 38 percent was U.S.-origin uranium. U.S. brokers and traders sold 8.4 million pounds at an average price of \$11.72 per pound in 1997.

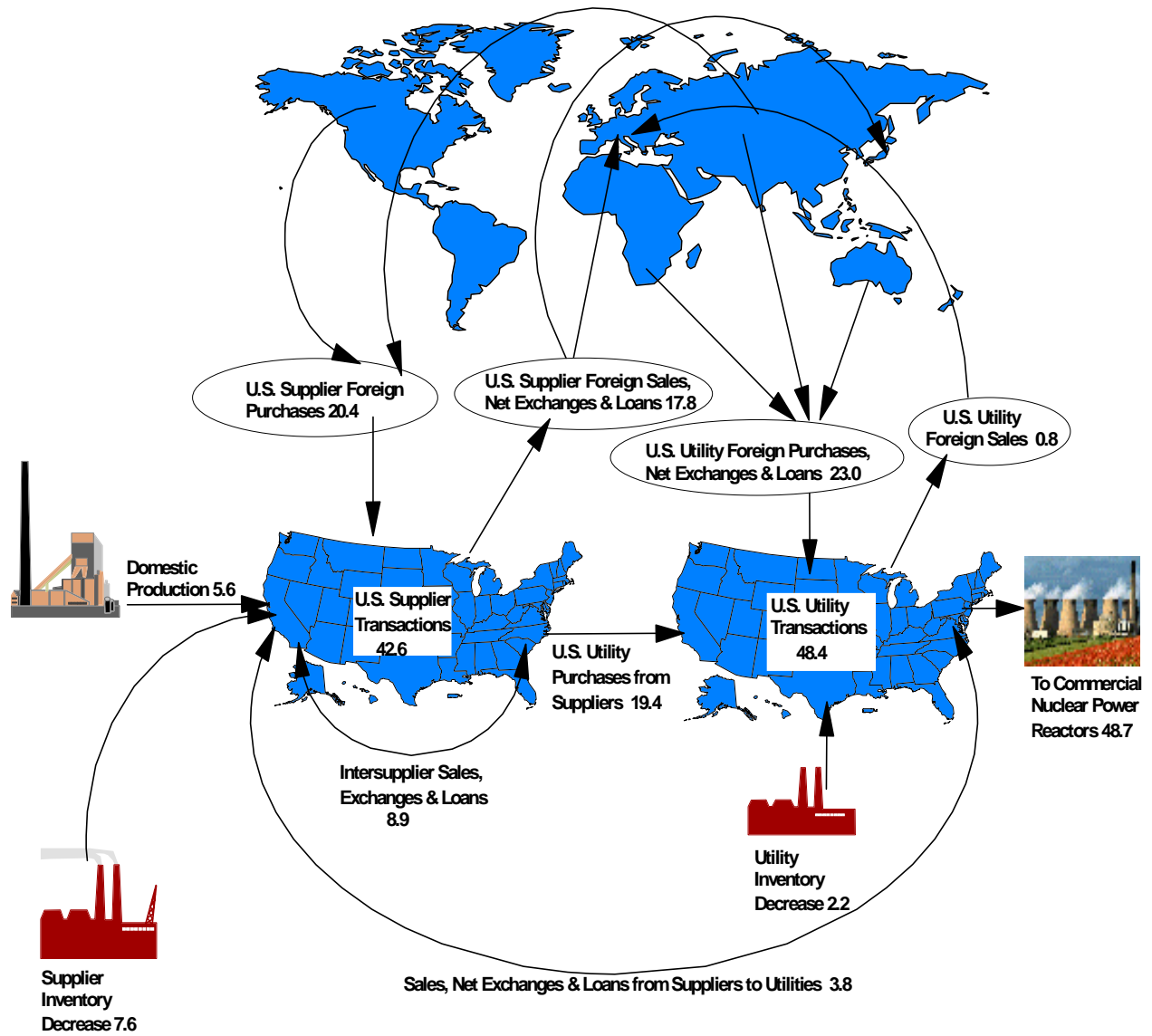
Uranium Inventories

Total commercial inventories of all material types, as of December 31, 1997, were 75.8 million pounds U_3O_8e , a decrease of 4.2 million pounds compared with the end of 1996 (Table 31). U.S. utility inventories decreased by 2.2 million pounds or 3 percent (Figure 21), and enriched uranium declined the most (Figure 22). U.S. supplier inventories totaled 11.9 million pounds at the end of 1997, a decrease of 15 percent.

The U.S. Department of Energy and the United States Enrichment Corporation reported natural feed and enriched uranium inventories for commercial nuclear power reactors of 102.9 million pounds at year-end 1997, a decrease of 5 percent.

Uranium concentrate inventories on hand, in storage, or at conversion plants at the end of 1997 were 35.1 million pounds U_3O_8 (Table 32). U.S. producers' concentrate inventories totaled 6.3 million pounds (Table 33).

Figure 8. Uranium Marketing Activity During 1997



Notes: Quantities are in million pounds U₃O₈ equivalent.
 Source: Prepared by the Energy Information Administration, Office of Coal Nuclear, Electric and Alternate Fuels, based on data reported on Form EIA-858 for 1997.

Figure 9. Quantity of U.S. Utility Purchases of Uranium by Supplier and Delivery Year, 1994-1997

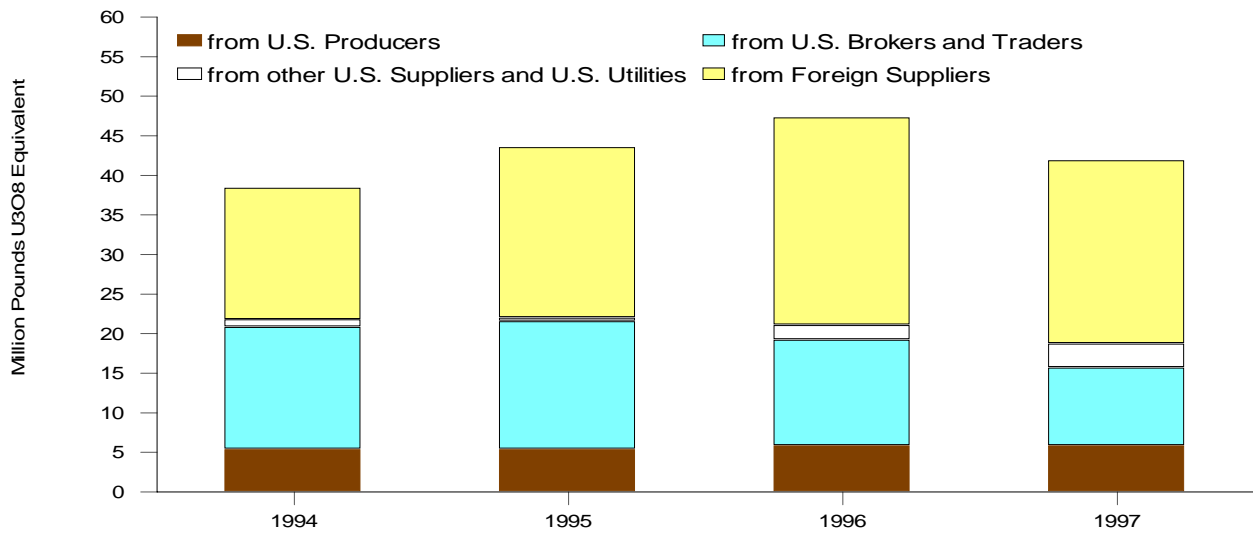


Figure 10. Weighted-Average Price of U.S. Utility Purchases of Uranium by Supplier and Delivery Year, 1994-1997

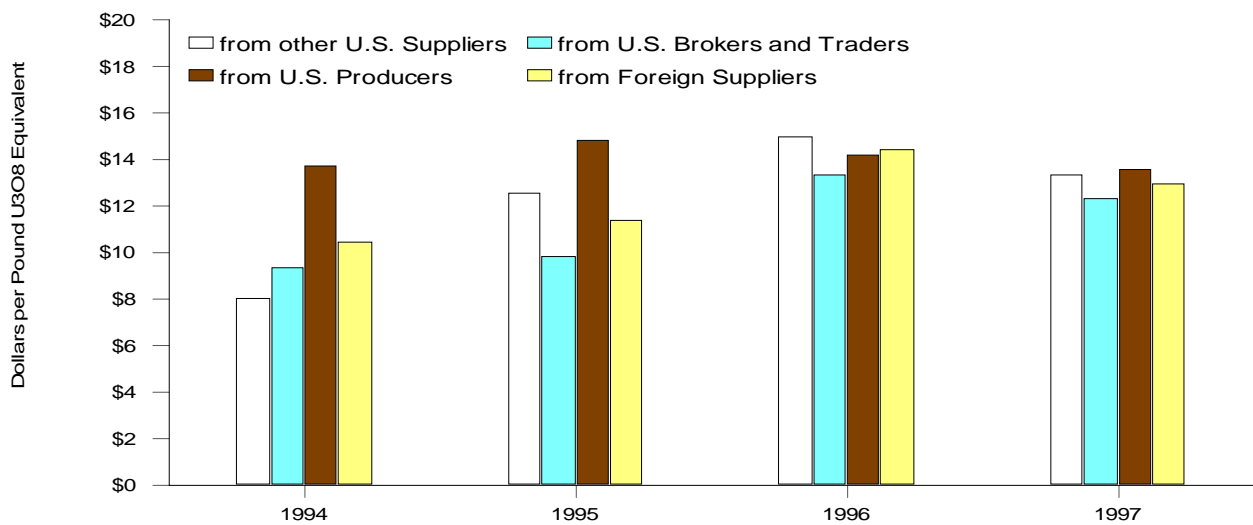
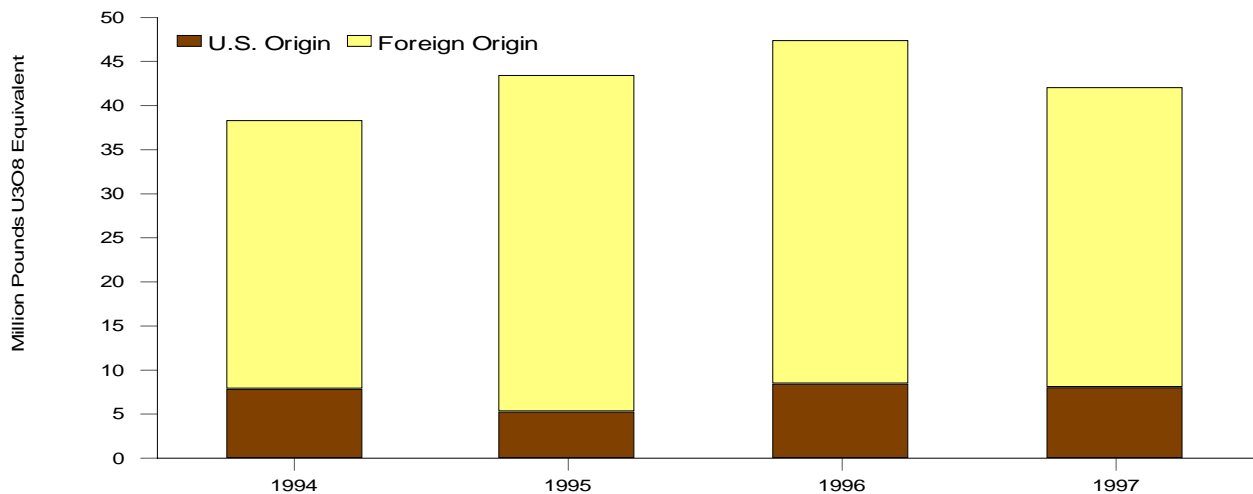


Figure 11. Quantity of U.S. Utility Purchases of Uranium by Origin and Delivery Year, 1994-1997



Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1994-1997).

Figure 12. U.S. Utility Purchases of Uranium by Selected Country Origin and Delivery Year, 1997

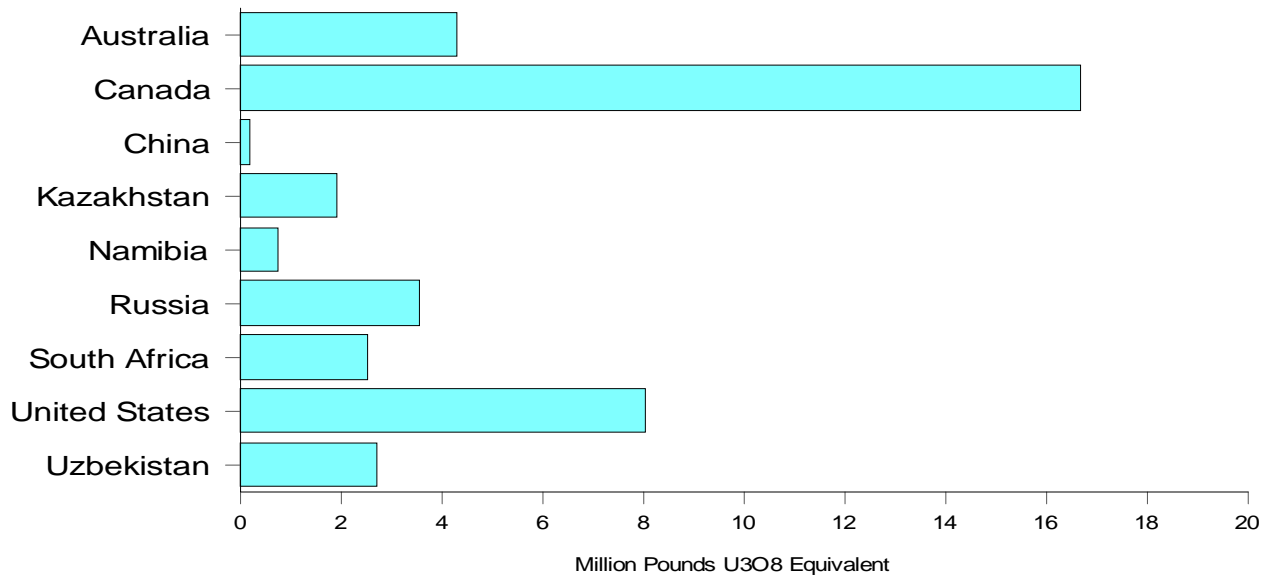


Figure 13. U.S. Utility Purchases of Uranium by Material Type and Delivery Year, 1994-1997

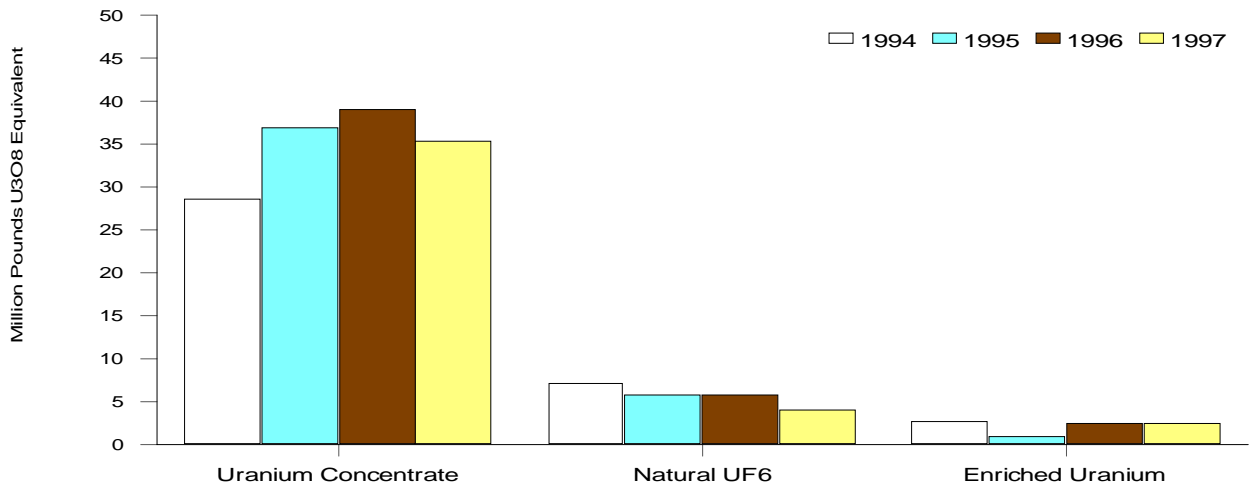
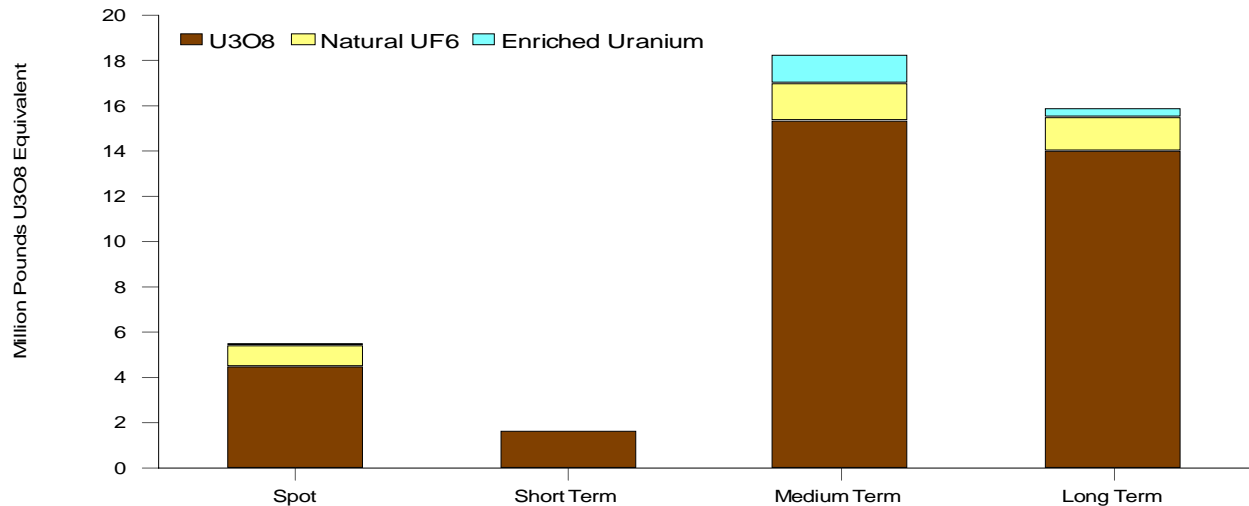


Figure 14. U.S. Utility Purchases of Uranium by Contract Type and Material Type, 1997 Deliveries



Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1994-1997).

Figure 15. U.S. Utility Contracted Purchases of Uranium by Supplier, Firm Deliveries, and Delivery Year, 1998-2007

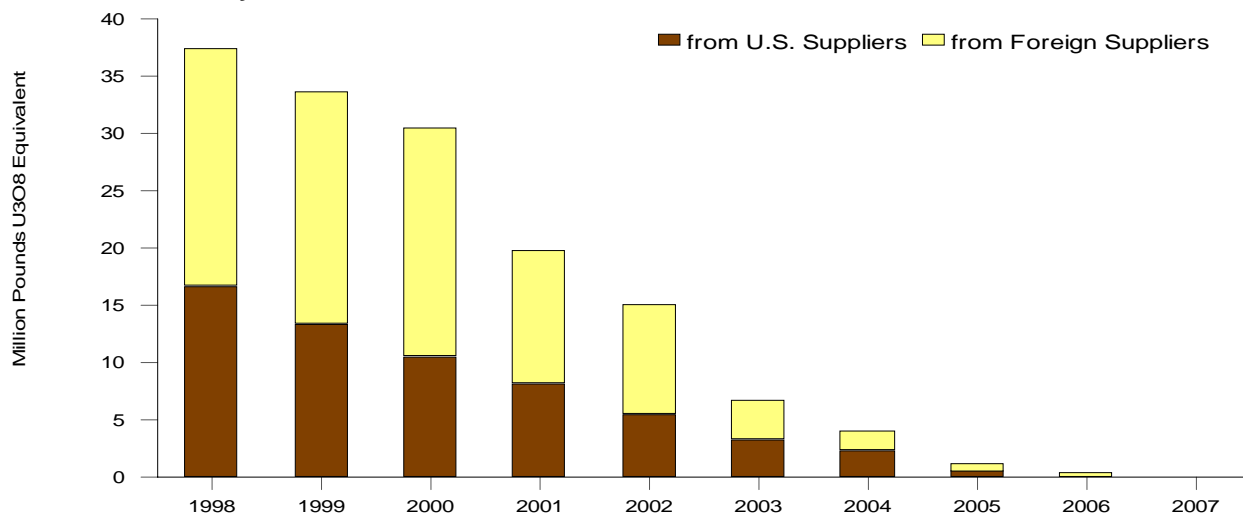


Figure 16. U.S. Utility Annual Unfilled Uranium Requirements, 1998-2006

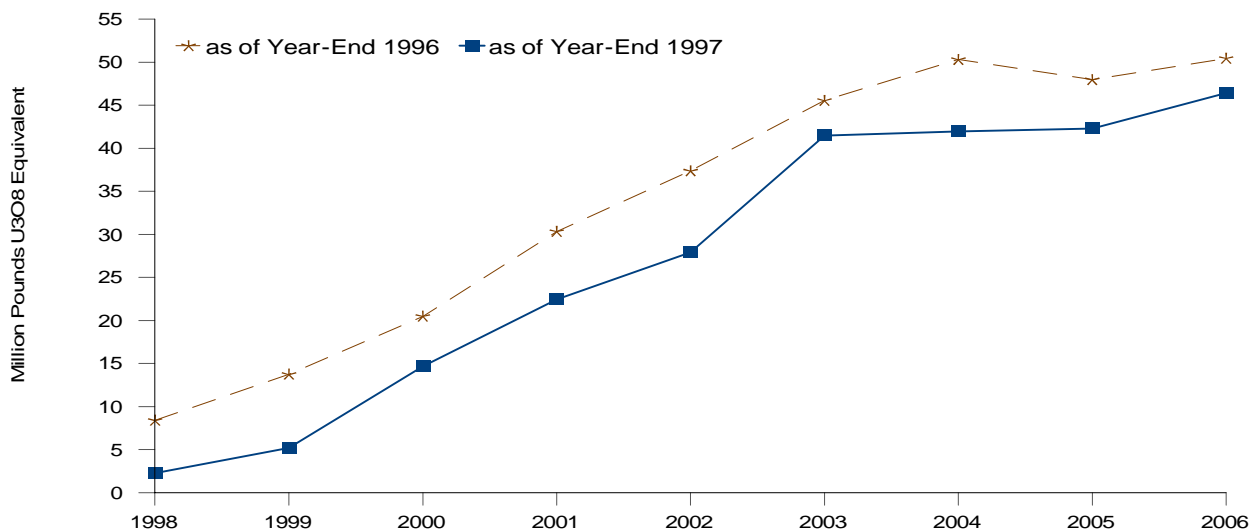
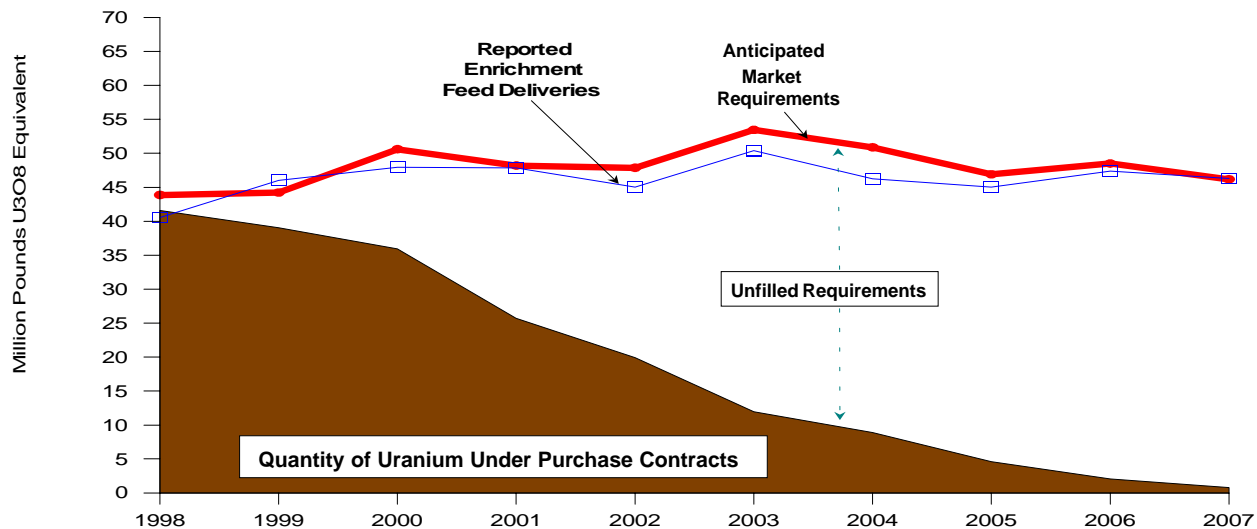


Figure 17. Anticipated Uranium Market Requirements of U.S. Utilities, 1998-2007



Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1997).

Figure 18. Uranium in Fuel Assemblies Loaded into U.S. Commercial Nuclear Reactors by Year, 1994-1997

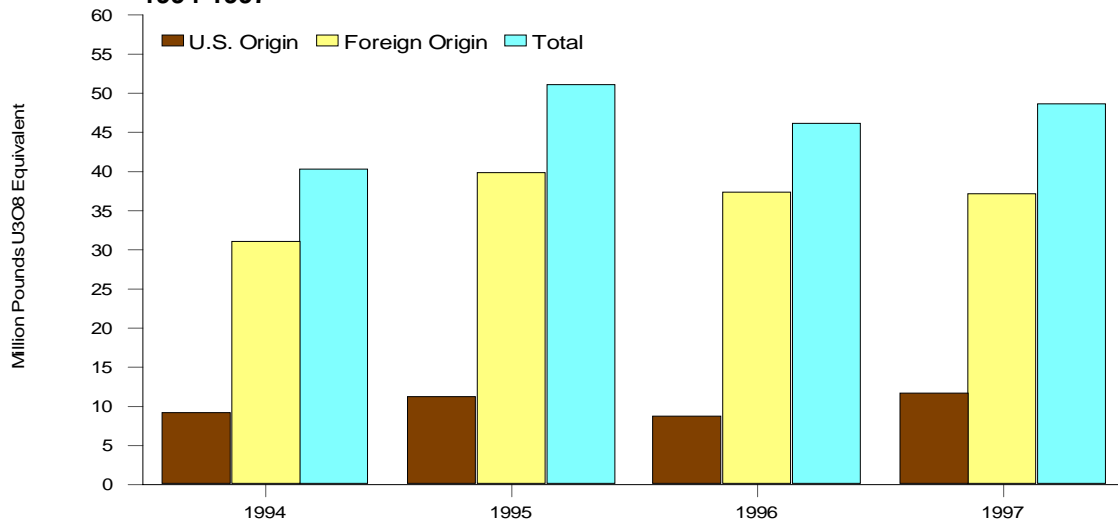


Figure 19. U. S. Broker and Trader Purchases of Uranium by Quantity, Weighted-Average Price, and Delivery Year, 1994-1997

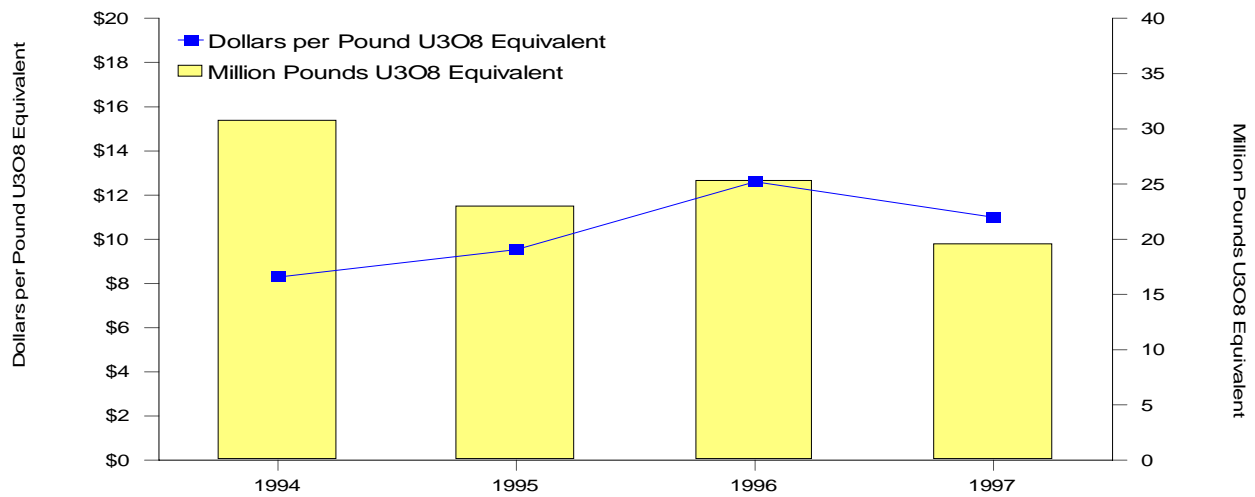
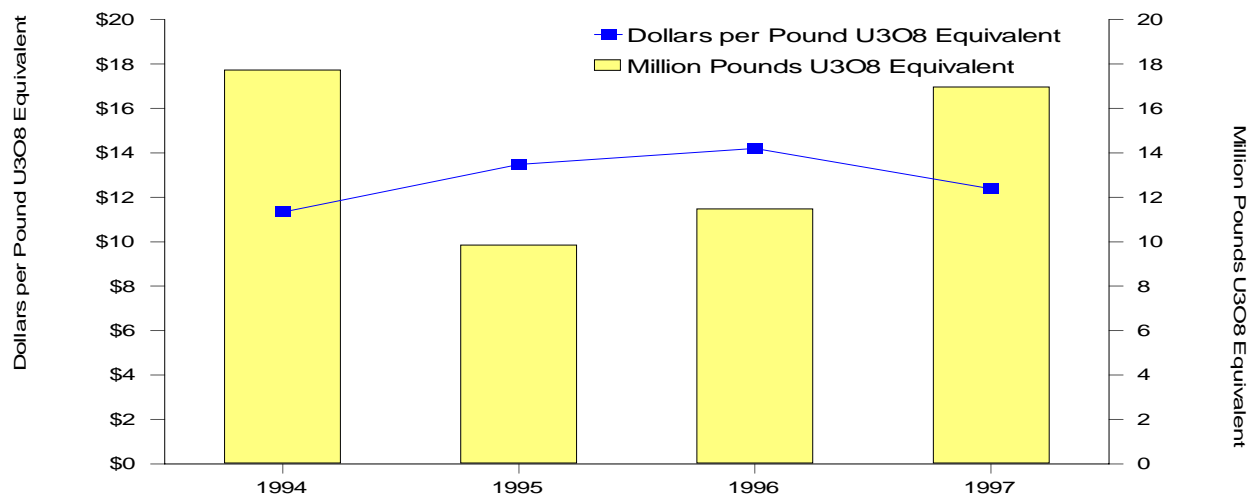


Figure 20. Foreign Sales of Uranium by Quantity, Weighted-Average Price, and Delivery Year, 1994-1997



Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1994-1997).

Figure 21. Commercial Uranium Inventories at End of the Year, 1994-1997

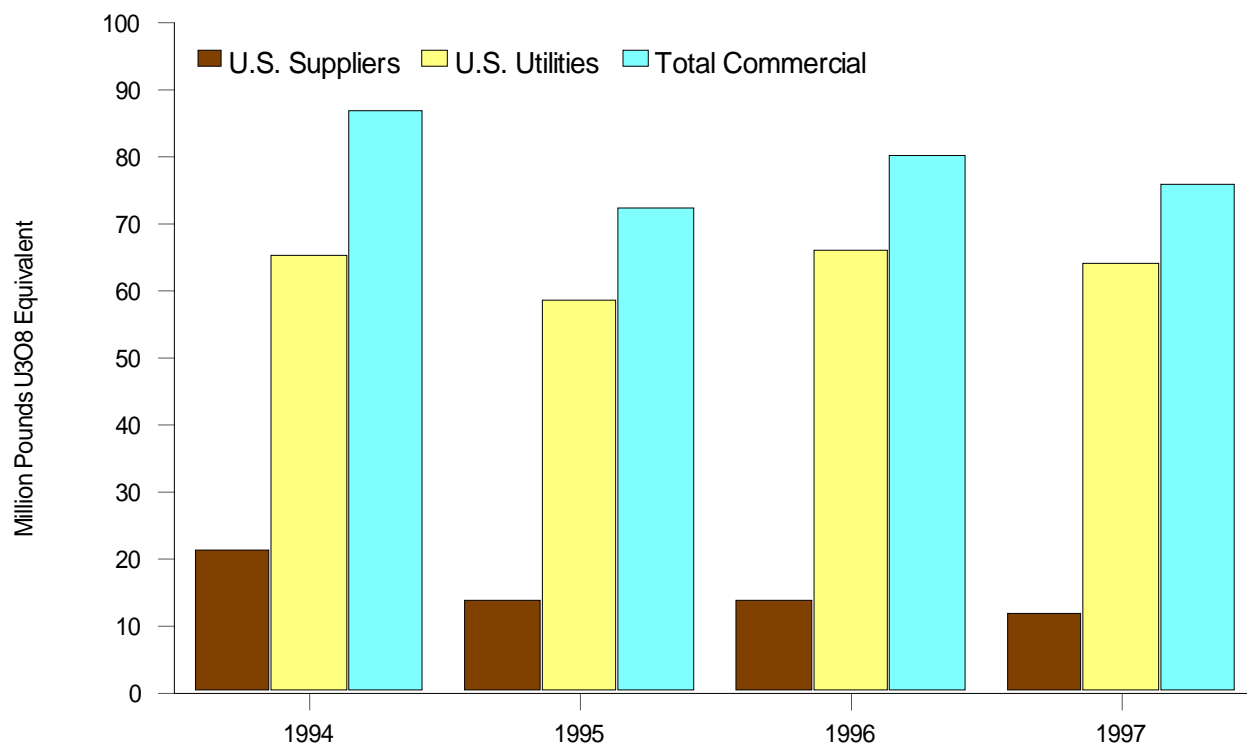
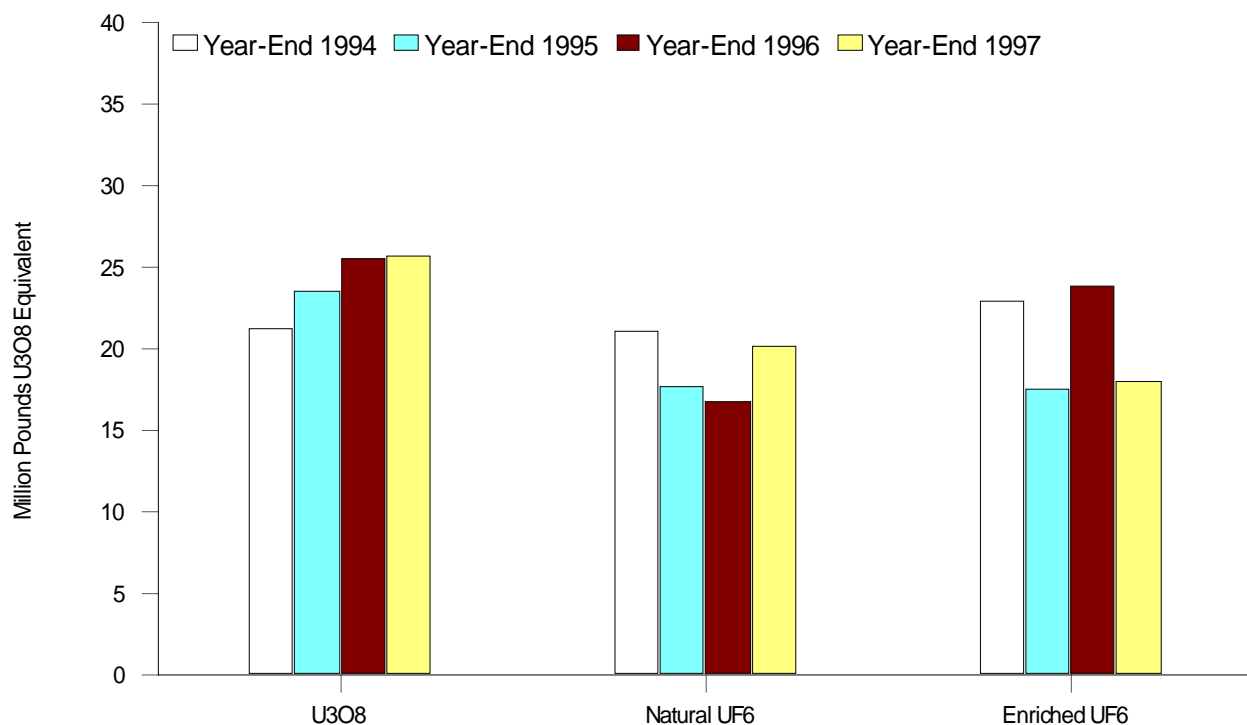


Figure 22. U.S. Utility Uranium Inventories at End of the Year, 1994-1997



Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1994-1997).

Table 10. U.S. Utility Contracted Uranium by Supplier, Transaction Type, and Delivery Year, 1994-1997

(Thousand Pounds U₃O₈ Equivalent; Dollars per Pound U₃O₈ Equivalent)

Actual Deliveries	1994	1995	1996	1997
Received by U.S. Utilities from U.S. Producers:				
Purchases of U.S.-Origin and Foreign-Origin Uranium	5,442	5,289	5,766	5,732
Weighted-Average Price	13.72	14.84	14.20	13.60
Received by U.S. Utilities from U.S. Brokers and Traders:				
Purchases of U.S.-Origin and Foreign-Origin Uranium	15,284	16,202	13,322	9,890
Weighted-Average Price	9.34	9.83	13.36	12.31
Received by U.S. Utilities from other U.S. Utilities:				
Purchases	0	0	0	W
Weighted-Average Price	—	—	—	W
Received by U.S. Utilities from other U.S. Suppliers:				
Purchases of U.S.-Origin and Foreign-Origin Uranium	1,092	561	1,885	W
Weighted-Average Price	8.04	12.52	14.98	W
Received by U.S. Utilities from Foreign Suppliers:				
Purchases of U.S.-Origin and Foreign-Origin Uranium	16,463	21,389	26,360	23,361
Weighted-Average Price	10.43	11.40	14.45	12.91
Total Received by U.S. Utilities:				
Purchases of U.S.-Origin and Foreign-Origin Uranium	38,281	43,441	47,333	41,961
Weighted-Average Price	10.40	11.25	14.12	12.88

— = Not applicable.

W=Data withheld to avoid disclosure.

Note: "Other U.S. Suppliers" are U.S. converters, enrichers, and fabricators.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1994-1997).

Table 11. U.S. Utility Contracted Uranium by Origin, Transaction Type and Delivery Year, 1994-1997

(Thousand Pounds U₃O₈ Equivalent; Dollars per Pound U₃O₈ Equivalent)

Actual Deliveries	1994	1995	1996	1997
Received by U.S. Utilities of U.S.-Origin Uranium:				
Purchases	7,718	5,246	8,299	8,072
Weighted-Average Price	12.08	14.20	14.62	13.36
Received by U.S. Utilities of Foreign-Origin Uranium:				
Purchases	30,563	38,195	39,034	33,889
Weighted-Average Price	9.97	10.84	14.02	12.78
Total:				
Purchases	38,281	43,441	47,333	41,961
Weighted-Average Price	10.40	11.25	14.12	12.88

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1994-1997).

Table 12. U.S. Utility Purchases of Uranium by Origin Country and Delivery Year, 1995-1997
(Thousand Pounds U₃O₈ Equivalent; Dollars per Pound U₃O₈ Equivalent)

Origin Country	Actual Deliveries in 1995		Actual Deliveries in 1996		Actual Deliveries in 1997	
	Purchases	Weighted-Average Price	Purchases	Weighted-Average Price	Purchases	Weighted-Average Price
All Purchases:						
Australia	4,448	10.98	4,558	14.66	4,351	13.11
Canada	16,799	11.82	19,093	14.35	16,713	12.78
China	293	11.49	371	15.31	231	17.62
France	W	W	W	W	0	—
Gabon	W	W	W	W	W	W
Germany	W	W	968	13.54	W	W
Kazakhstan	3,097	8.99	1,495	14.63	1,934	12.73
Kyrgyzstan	W	W	0	—	W	W
Mongolia	W	W	W	W	W	W
Namibia	530	9.88	W	W	774	14.63
Netherlands	W	W	W	W	0	—
Niger	W	W	W	W	0	—
Russia	5,500	9.45	5,434	12.69	3,594	12.63
Slovakia	0	—	W	W	0	—
South Africa	1,002	12.57	1,671	13.36	2,573	11.52
Spain	W	W	0	—	0	—
Tajikistan	W	W	W	W	0	—
Ukraine	W	W	991	13.59	W	W
United Kingdom	W	W	0	—	0	—
Uzbekistan	3,895	8.61	3,462	13.51	2,756	13.19
Total Foreign	38,195	10.84	39,034	14.02	33,889	12.78
United States	5,246	14.20	8,299	14.62	8,072	13.36
Total Purchases	43,441	11.25	47,333	14.12	41,961	12.88
Domestic Purchases:						
Australia	2,333	10.64	807	15.47	702	12.62
Canada	2,326	13.19	3,335	13.49	4,025	12.36
China	W	W	371	15.31	W	W
France	0	—	W	W	0	—
Gabon	0	—	W	W	0	—
Germany	W	W	W	W	W	W
Kazakhstan	1,760	8.30	256	14.52	519	12.51
Kyrgyzstan	W	W	0	—	0	—
Mongolia	W	W	W	W	0	—
Namibia	W	W	W	W	W	W
Netherlands	0	—	W	W	0	—
Niger	0	—	W	W	0	—
Russia	3,776	9.47	4,350	12.81	2,438	12.74
Slovakia	0	—	W	W	0	—
South Africa	W	W	896	12.69	866	10.82
Tajikistan	W	W	0	—	0	—
Ukraine	W	W	991	13.59	0	—
United Kingdom	W	W	0	—	0	—
Uzbekistan	W	W	W	W	2,296	13.18
United States	5,246	14.20	8,299	14.62	8,072	13.36
Total Domestic Purchases	22,302	11.11	23,657	13.81	19,416	12.87
Foreign Purchases:						
Australia	2,115	11.35	3,751	14.48	3,649	13.21
Canada	14,473	11.60	15,758	14.52	12,688	12.91
China	W	W	0	—	W	W
France	W	W	0	—	0	—
Gabon	W	W	W	W	W	W
Germany	0	—	W	W	0	—
Kazakhstan	1,337	9.90	1,239	14.66	1,415	12.81
Kyrgyzstan	0	—	0	—	W	W
Mongolia	0	—	0	—	W	W
Namibia	W	W	0	—	745	14.79
Netherlands	W	W	0	—	0	—
Niger	W	W	0	—	0	—
Russia	1,724	9.42	1,084	12.22	1,156	12.40
South Africa	W	W	775	14.14	1,707	11.88
Spain	W	W	0	—	0	—
Tajikistan	W	W	W	W	0	—
Ukraine	0	—	0	—	W	W
Uzbekistan	W	W	W	W	460	13.25
Total Foreign Purchases	21,139	11.39	23,676	14.41	22,545	12.89

W=Data withheld to avoid disclosure. — = Not applicable.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1995-1997).

Table 13. U.S. Utility Purchases of Uranium by Origin and Material Type, 1997 Deliveries
(Thousand Pounds U₃O₈ Equivalent; Dollars per Pound U₃O₈ Equivalent)

Actual Deliveries	U ₃ O ₈	Natural UF ₆	Enriched Uranium	Total
Received by U.S. Utilities of U.S.-Origin Uranium:				
Purchases	5,122	W	W	8,072
Weighted-Average Price	13.48	W	W	13.36
Received by U.S. Utilities of Foreign-Origin Uranium:				
Purchases	30,221	W	W	33,889
Weighted-Average Price	12.75	W	W	12.78
Total:				
Purchases	35,343	4,089	2,529	41,961
Weighted-Average Price	12.86	12.98	13.19	12.88

W=Data withheld to avoid disclosure.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1997).

Table 14. Average Price and Quantity for Purchases of Uranium by U.S. Utilities by Pricing Mechanisms and Delivery Year, 1995-1997
(Dollars per Pound U₃O₈ Equivalent; Thousand Pounds U₃O₈ Equivalent)

Pricing Mechanisms	Domestic Purchases ^a			Foreign Purchases ^b			Total Purchases		
	1995	1996	1997	1995	1996	1997	1995	1996	1997
Contract-Specified Pricing									
Weighted-Average Price	10.58	13.40	13.33	12.96	13.98	14.21	11.16	13.55	13.65
Quantity with Reported Price	17,065	16,657	13,091	5,584	5,988	7,349	22,649	22,645	20,440
Market-Related Pricing									
No Floor Type									
Weighted-Average Price	10.19	13.66	11.20	10.85	14.75	12.44	10.72	14.45	12.03
Quantity with Reported Price	2,119	2,208	1,878	8,278	5,669	3,814	10,397	7,877	5,692
Floor Type									
Weighted-Average Price	17.86	16.13	14.52	10.84	14.64	11.96	11.81	14.92	12.21
Quantity with Reported Price	683	2,249	707	4,291	9,766	6,582	4,974	12,015	7,289
Market Related Total									
Weighted-Average Price	12.05	14.91	12.11	10.85	14.68	12.14	11.07	14.73	12.13
Quantity with Reported Price	2,802	4,457	2,585	12,569	15,435	10,396	15,371	19,892	12,981
Contract Specified and Market Related Total									
Weighted-Average Price	10.79	13.72	13.13	11.50	14.48	13.00	11.13	14.10	13.06
Quantity with Reported Price	19,867	21,114	15,676	18,153	21,423	17,745	38,020	42,537	33,421
Spot-Market Pricing									
Weighted-Average Price	9.07	14.90	11.03	10.26	14.26	12.39	9.90	14.61	11.80
Quantity with Reported Price	748	1,689	2,497	1,706	1,428	3,249	2,454	3,117	5,746
Other Pricing^c									
Weighted-Average Price	15.87	15.88	14.09	11.34	12.89	12.75	13.92	13.22	13.07
Quantity with Reported Price	1,687	100	481	1,280	825	1,551	2,967	925	2,032
All Pricing Mechanisms									
Weighted-Average Price	11.11	13.81	12.87	11.39	14.41	12.89	11.25	14.12	12.88
Quantity with Reported Price	22,302	22,903	18,654	21,139	23,676	22,545	43,441	46,579	41,199

^aUranium of both U.S. and foreign origin.

^bUranium of foreign origin only.

^cCategory used to report pricing mechanisms that are different from the other categories.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1995-1997).

Table 15. Price Distributions of Uranium Purchases by U.S. Utilities by Delivery Year, 1995-1997
(Thousand Pounds U₃O₈ Equivalent; Dollars per Pound U₃O₈ Equivalent)

Distributions	Actual Deliveries in 1995		Actual Deliveries in 1996		Actual Deliveries in 1997	
	Quantity with Reported Price	Weighted-Average Price	Quantity with Reported Price	Weighted-Average Price	Quantity with Reported Price	Weighted-Average Price
Octile^a:						
First	5,430	7.50	5,822	10.72	5,150	9.85
Second	5,430	9.34	5,822	11.93	5,150	10.53
Third	5,430	9.85	5,822	12.62	5,150	11.37
Fourth	5,430	10.40	5,822	13.70	5,150	12.29
Fifth	5,430	11.06	5,822	14.65	5,150	12.89
Sixth	5,430	11.61	5,822	15.23	5,150	13.81
Seventh	5,430	12.17	5,822	15.76	5,150	15.04
Eighth	5,430	18.05	5,822	18.34	5,150	17.29
Total	43,441	11.25	46,579	14.12	41,199	12.88
Quartile^b:						
First	15,601	9.48	12,352	12.61	7,442	11.18
Second	13,620	10.74	18,626	13.92	16,808	12.27
Third	5,037	11.69	10,926	14.73	10,035	13.29
Fourth	9,183	14.75	4,675	17.50	6,914	15.63
Total	43,441	11.25	46,579	14.12	41,199	12.88

^aOctile distribution divides total pounds of uranium delivered (with a price) into eight distributions by price and provides the quantity-weighted average price for each distribution.

^bQuartile distribution divides total pounds of uranium delivered (with a price) into four distributions by each utility's aggregate weighted-average price and provides the quantity and average price for each distribution.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1995-1997).

Table 16. U.S. Utility Uranium Purchases by Contract Type and Material Type, 1997 Deliveries
(Thousand Pounds U₃O₈ Equivalent; Dollars per Pound U₃O₈ Equivalent)

Material Type	Spot Contracts		Short-term Contracts		Medium-term Contracts		Long-term Contracts		Total	
	Quantity with Reported Price	Weighted Average Price	Quantity with Reported Price	Weighted Average Price	Quantity with Reported Price	Weighted Average Price	Quantity with Reported Price	Weighted Average Price	Quantity with Reported Price	Weighted Average Price
U ₃ O ₈	4,452	11.22	1,595	14.64	15,304	12.40	13,992	13.67	35,343	12.86
Natural UF ₆	W	W	0	—	1,701	13.44	W	W	4,089	12.98
Enriched Uranium	W	W	0	—	1,196	14.14	W	W	1,767	13.19
Total	5,509	11.61	1,595	14.64	18,201	12.61	15,894	13.46	41,199	12.88

W=Data withheld to avoid disclosure.

— = Not applicable.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1997).

Table 17. Contracts Signed by U.S. Utilities in 1997 by Contract Type, 1997 Deliveries
(Thousand Pounds U₃O₈ Equivalent; Dollars per Pound U₃O₈ Equivalent)

Purchase Contract Type	Quantity of Actual Deliveries Received in 1997	Weighted-Average Price	Number of Purchase Contracts
Spot	4,679	11.11	23
Short-term	W	W	2
Medium-term	619	11.48	3
Long-term	W	W	1
Total	5,796	11.25	29

W = Data withheld to avoid disclosure.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1997).

Table 18. U.S. Utility Contracted Purchases of Uranium, Signed in 1997, by Delivery Year, 1998-2007
(Thousand Pounds U₃O₈ Equivalent)

Year of Delivery	Firm Deliveries	Optional Deliveries	Total Deliveries
1998	8,722	782	9,504
1999	7,207	1,320	8,527
2000	6,923	1,985	8,908
2001	5,839	1,250	7,089
2002	4,733	1,172	5,905
2003	2,621	380	3,001
2004	650	610	1,260
2005	0	610	610
2006	0	0	0
2007	0	0	0
Total	36,695	8,109	44,804

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1997).

Table 19. U.S. Utility Contracted Purchases of Uranium from Suppliers, in Effect at the End of 1997, by Delivery Year, 1998-2007
(Thousand Pounds U₃O₈ Equivalent)

Year of Delivery	Purchases from U.S. Suppliers		Purchases from Foreign Suppliers		Purchases from All Suppliers	
	Firm Deliveries	Optional Deliveries	Firm Deliveries	Optional Deliveries	Firm Deliveries	Optional Deliveries
1998	16,621	1,459	20,741	2,780	37,362	4,239
1999	13,361	1,859	20,228	3,581	33,589	5,440
2000	10,484	1,761	20,074	3,611	30,558	5,372
2001	8,174	2,418	11,604	3,527	19,778	5,945
2002	5,467	1,532	9,663	3,273	15,130	4,805
2003	3,234	2,786	3,475	2,454	6,709	5,240
2004	2,297	1,692	1,770	3,141	4,067	4,833
2005	495	852	637	2,597	1,132	3,449
2006	0	752	421	899	421	1,651
2007	0	0	0	800	0	800
Total	60,133	15,111	88,613	26,663	148,746	41,774

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1997).

Table 20. Unfilled Uranium Requirements of U.S. Utilities, 1998-2007
(Thousand Pounds U₃O₈ Equivalent)

Year	As of December 31, 1996		As of December 31, 1997	
	Annual	Cumulative	Annual	Cumulative
1998	8,388	8,388	2,258	2,258
1999	13,740	22,128	5,179	7,437
2000	20,480	42,608	14,671	22,108
2001	30,339	72,947	22,464	44,572
2002	37,381	110,328	27,911	72,483
2003	45,564	155,892	41,490	113,973
2004	50,321	206,213	41,959	155,932
2005	47,970	254,183	42,314	198,246
2006	50,449	304,632	46,416	244,662
2007	NR	—	45,370	290,032

NR=Not Reported. — = Not applicable.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1996-1997).

Table 21. Anticipated Uranium Market Requirements of U.S. Utilities, 1998-2007, as of December 31, 1997
(Thousand Pounds U₃O₈ Equivalent)

Year	Quantity of Uranium Under Purchase Contracts	Unfilled Requirements	Anticipated Market Requirements	Enrichment Feed Deliveries
1998	41,601	2,258	43,859	40,540
1999	39,029	5,179	44,208	46,038
2000	35,930	14,671	50,601	47,970
2001	25,723	22,464	48,187	47,858
2002	19,935	27,911	47,846	45,029
2003	11,949	41,490	53,439	50,410
2004	8,900	41,959	50,859	46,238
2005	4,581	42,314	46,895	45,025
2006	2,072	46,416	48,488	47,385
2007	800	45,370	46,170	46,290
Total	190,520	290,032	480,552	462,783

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1997).

Table 22. U.S. Utility Deliveries of Uranium Feed by Enrichment Country and Delivery Year, 1995-1997
(Thousand Pounds U₃O₈ Equivalent)

Enrichment Plant Location	Actual Deliveries in 1995			Actual Deliveries in 1996			Actual Deliveries in 1997		
	U.S.- Origin	Foreign- Origin	Total	U.S.- Origin	Foreign- Origin	Total	U.S.- Origin	Foreign- Origin	Total
China	0	0	0	0	0	0	0	0	0
France	W	W	4,802	378	6,026	6,404	W	W	2,998
Germany	W	W	870	W	W	W	0	W	W
Netherlands	W	W	951	W	W	W	0	0	0
Russia	837	1,874	2,711	248	1,543	1,791	W	W	2,886
United Kingdom	0	1,059	1,059	W	W	598	W	W	W
Foreign Total	1,390	9,003	10,393	700	9,728	10,428	515	7,496	8,011
United States	7,786	26,115	33,901	8,306	30,345	38,651	6,195	26,096	32,291
Total	9,176	35,118	44,294	9,006	40,073	49,079	6,710	33,592	40,302

W=Data withheld to avoid disclosure.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1995-1997).

Table 23. U.S. Utility Deliveries of Uranium Feed for Enrichment by Origin Country and Delivery Year, 1995-1997
(Thousand Pounds U₃O₈ Equivalent)

Origin Country of Feed	Actual Deliveries in 1995			Actual Deliveries in 1996			Actual Deliveries in 1997		
	To U.S. Enrichers	To Foreign Enrichers	Total	To U.S. Enrichers	To Foreign Enrichers	Total	To U.S. Enrichers	To Foreign Enrichers	Total
Australia	2,890	410	3,300	5,058	723	5,781	3,732	654	4,386
Brazil	W	0	W	0	0	0	0	0	0
Canada	15,533	2,186	17,719	17,469	2,959	20,428	12,366	1,988	14,354
China	W	0	W	W	W	120	203	0	203
France	W	0	W	0	0	0	0	0	0
Gabon	W	W	218	W	W	21	0	W	W
Germany	365	0	365	W	W	801	W	0	W
Kazakhstan	W	W	2,469	1,531	563	2,094	W	W	993
Kyrgyzstan	0	W	W	0	0	0	W	0	W
Mongolia	W	0	W	W	0	W	286	0	286
Namibia	738	0	738	W	W	282	415	0	415
Niger	0	0	0	0	W	W	0	W	W
Russia	1,936	5,072	7,008	1,952	1,333	3,285	4,305	952	5,257
South Africa	W	W	709	1,364	644	2,008	1,837	479	2,316
Spain	W	0	W	0	0	0	0	0	0
Tajikistan	805	0	805	W	0	W	W	W	W
Ukraine	W	W	401	0	W	W	0	0	0
United Kingdom	W	0	W	W	0	W	0	0	0
Uzbekistan	W	W	514	1,587	2,273	3,860	1,785	2,256	4,041
Foreign Total	26,115	9,003	35,118	30,345	9,728	40,073	26,096	7,496	33,592
United States	7,786	1,390	9,176	8,306	700	9,006	6,195	515	6,710
Total	33,901	10,393	44,294	38,651	10,428	49,079	32,291	8,011	40,302

W=Data withheld to avoid disclosure.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1995-1997).

Table 24. Shipments of Uranium by U.S. Utilities to Domestic and Foreign Enrichment Suppliers, 1998-2007
(Thousand Pounds U₃O₈ Equivalent)

Year of Shipment	Amount to be Shipped		Change from 1996 to 1997	
	As of December 31, 1996	As of December 31, 1997	Annual	Cumulative
1998	49,724	40,540	-9,184	-9,184
1999	42,438	46,038	3,600	-5,584
2000	50,132	47,970	-2,162	-7,746
2001	39,980	47,858	7,878	132
2002	39,425	45,029	5,604	5,736
2003	35,469	50,410	14,941	20,677
2004	38,481	46,238	7,757	28,434
2005	32,601	45,025	12,424	40,858
2006	34,424	47,385	12,961	53,819
2007	NR	46,290	—	—

NR=Not reported. — = Not applicable.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1996-1997).

Table 25. U.S. Utility Purchases of Enrichment Services by Country and Delivery Year, 1994-1997
(Thousand Separative Work Units (SWU))

Actual Deliveries	1994	1995	1996	1997
Country where Enrichment Service was performed:				
China	237	0	W	W
France	549	867	1,507	734
Germany	W	W	W	W
Netherlands	W	W	167	0
Russia	421	1,108	1,073	1,765
United Kingdom	W	460	278	119
Foreign Total	1,676	2,800	3,154	2,865
United States	7,521	6,741	8,004	6,013
Total	9,197	9,540	11,159	8,878

W=Data withheld to avoid disclosure.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1994-1997).

Table 26. U.S. Utility Purchases of Enrichment Services by Contract Type in Delivery Year, 1997
(Thousand Separative Work Units (SWU))

Enrichment Service Contract Type	U.S. Enrichment	Foreign Enrichment	Total
Spot	175	114	289
Short-term	0	0	0
Medium-term	765	719	1,484
Long-term	5,073	2,032	7,105
Total	6,013	2,865	8,878

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1997).

Table 27. Uranium in Fuel Assemblies Loaded into U.S. Commercial Nuclear Power Reactors by Year, 1994-1997
(Thousand Pounds U₃O₈ Equivalent)

Origin of Uranium	1994	1995	1996	1997 ^P
Domestic-Origin Uranium	9,302	11,146	8,820	11,609
Foreign-Origin Uranium	31,098	39,972	37,330	37,069
Total	40,400	51,118	46,151	48,677

P = Preliminary data. Final 1996 fuel assembly data reported in the 1997 survey.

Notes: Includes only unirradiated uranium in new fuel assemblies loaded into reactors during the year. Does not include uranium removed from reactors that subsequently will be reloaded. Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1995-1997).

Table 28. Foreign Purchases of Uranium by U.S. Suppliers and U.S. Utilities by Delivery Year, 1994-1997

(Thousand Pounds U₃O₈ Equivalent; Dollars per Pound U₃O₈ Equivalent)

Actual Deliveries	1994	1995	1996	1997
U.S. Suppliers:				
Foreign Purchases	21,082	20,162	21,746	20,425
Weighted-Average Price	7.78	8.96	11.78	10.61
U.S. Utilities:				
Foreign Purchases	15,536	21,139	23,676	22,545
Weighted-Average Price	10.53	11.39	14.41	12.89
U.S. Suppliers and U.S. Utilities:				
Foreign Purchases	36,618	41,301	45,422	42,970
Weighted-Average Price	8.95	10.20	13.15	11.81

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1994-1997).

Table 29. U.S. Broker and Trader Purchases of Uranium by Origin, Supplier, and Delivery Year, 1994-1997

(Thousand Pounds U₃O₈ Equivalent; Dollars per Pound U₃O₈ Equivalent)

Actual Deliveries	1994	1995	1996	1997
Received by U.S. Brokers and Traders of U.S.-Origin Uranium:				
Purchases	4,792	3,356	4,725	3,162
Weighted-Average Price	9.75	11.51	13.90	12.78
Received by U.S. Brokers and Traders of Foreign-Origin Uranium:				
Purchases	26,011	19,593	20,529	16,501
Weighted-Average Price	8.02	9.20	12.32	10.66
Total Received by U.S. Brokers and Traders:				
Purchases	30,803	22,949	25,254	19,663
Weighted-Average Price	8.29	9.53	12.61	11.00
Received by U.S. Brokers and Traders from Foreign Suppliers:				
Purchases	22,328	18,311	17,816	15,703
Weighted-Average Price	7.87	9.02	11.78	10.71

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1994-1997).

Table 30. Foreign Sales of Uranium from U.S. Suppliers and U.S. Utilities by Origin and Delivery Year, 1994-1997

(Thousand Pounds U₃O₈ Equivalent; Dollars per Pound U₃O₈ Equivalent)

Actual Deliveries for Foreign Suppliers and Foreign Utilities	1994	1995	1996	1997
U.S.-Origin Uranium:				
Foreign Sales	5,941	4,713	4,962	6,472
Weighted-Average Price	18.41	17.34	17.22	14.81
Foreign-Origin Uranium:				
Foreign Sales	11,799	5,123	6,542	10,517
Weighted-Average Price	7.78	9.94	11.91	10.90
Total:				
Foreign Sales	17,740	9,836	11,504	16,989
Weighted-Average Price	11.34	13.48	14.20	12.39
From U.S. Producers, U.S. Utilities, and other U.S. Suppliers:				
Foreign Sales	4,930	4,342	5,539	8,584
Weighted-Average Price	20.09	18.11	15.69	13.05
From U.S. Brokers and Traders:				
Foreign Sales	12,810	5,494	5,965	8,405
Weighted-Average Price	7.98	9.83	12.82	11.72

Note: "other U.S. Suppliers" are U.S. converters, enrichers, and fabricators.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1994-1997).

Table 31. Inventories of Natural and Enriched Uranium as of End of Year, 1994-1997

(Thousand Pounds U₃O₈ Equivalent)

Type of Uranium Inventory	Inventories at the End of the Year			
	1994	1995	1996	1997 ^P
U.S. Utility Inventories	65,410	58,730	66,089	63,936
Natural Uranium	42,417	41,227	42,194	45,874
Enriched Uranium ^a	22,993	17,504	23,895	18,061
U.S. Supplier Inventories	21,469	13,740	13,949	11,908
Natural Uranium	17,413	13,218	12,969	10,257
Enriched Uranium ^a	4,056	521	980	1,652
Total Commercial Inventories	86,879	72,470	80,038	75,844
DOE-Owned and USEC-Held Inventories^b ...	85,210	110,797	108,491	102,929
Natural Uranium	57,176	81,987	83,211	76,542
Enriched Uranium	28,034	28,810	25,280	26,388

^aIncludes amounts reported as inventories of enriched UF₆ at enrichment suppliers.

^bAmounts reported as inventories by U.S. Department of Energy (DOE) and the United States Enrichment Corporation (USEC).

P=Preliminary data. Final 1996 inventory data reported in the 1997 survey.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1995-1997).

Table 32. Commercial Uranium Inventories by Type and Location at End of Year, 1995-1997
(Thousand Pounds U₃O₈ Equivalent)

Material Type and Location	U.S. Utilities			U.S. Suppliers			U.S. Utilities and U.S. Suppliers		
	1995	1996	1997 ^P	1995	1996	1997 ^P	1995	1996	1997 ^P
U₃O₈ on hand, in off-site storage, or at conversion plants	23,536	25,472	25,747	11,308	11,597	9,383	34,844	37,069	35,130
Natural UF₆	17,690	16,721	20,127	1,910	1,372	874	19,601	18,094	21,001
on hand, in private off-site storage, or at conversion plants	W	W	W	W	W	W	5,422	3,665	3,184
delivered to enrichment plants under usage agreements	W	W	W	W	W	W	6,102	9,364	10,217
at enrichment suppliers	7,056	4,217	7,151	1,020	848	449	8,076	5,065	7,600
Enriched UF₆	17,504	23,895	18,061	521	980	1,652	18,025	24,875	19,713
at enrichment suppliers	W	W	W	W	W	W	2,007	1,080	428
on hand, and/or in private storage	W	W	W	W	W	W	8,286	14,026	11,544
as fabricated fuel not inserted into a reactor, on hand, and/or in private storage	7,733	9,769	7,741	0	0	0	7,733	9,769	7,741
Total Commercial Inventories	58,730	66,089	63,936	13,740	13,949	11,908	72,470	80,038	75,844

P = Preliminary data. Final 1996 inventory data reported in the 1997 survey. W = Data withheld to avoid disclosure.
Note: Totals may not equal sum of components because of independent rounding.
Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1996-1997).

Table 33. Commercial Uranium Inventories by Type and Owner at End of Year, 1995-1997
(Thousand Pounds U₃O₈ Equivalent)

U.S. Firms	U ₃ O ₈			Natural and Enriched UF ₆			Total		
	1995	1996	1997 ^P	1995	1996	1997 ^P	1995	1996	1997 ^P
Brokers and Traders	5,404	W	3,085	1,405	W	678	6,808	5,213	3,762
Converter and Fabricators	0	W	0	1,027	W	1,848	1,027	1,517	1,848
Producers	5,904	7,219	6,298	0	0	0	5,904	7,219	6,298
Utilities	23,536	25,472	25,747	35,194	40,617	38,188	58,730	66,089	63,936
Total Commercial Inventories	34,844	37,069	35,130	37,626	42,969	40,714	72,470	80,038	75,844

P = Preliminary data. Final 1996 inventory data reported in the 1997 survey. W = Data withheld to avoid disclosure.
Note: Totals may not equal sum of components because of independent rounding.
Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1996-1997).

Appendix A

Survey Methodology

Survey Methodology

Survey Design

The 14th comprehensive survey of the U.S. uranium industry was conducted in 1998 by the Energy Information Administration (EIA) using the “Uranium Industry Annual Survey,” Form EIA-858. EIA collected data from all companies involved in the U.S. uranium industry, mailing the survey form to these firms in December 1997. The data reported in this publication were developed from the 1997 survey and predecessor databases.

EIA asked respondents to the “Uranium Industry Annual Survey” to provide data current to the end of 1997 about the following:

Uranium raw materials activities, including: land holdings, exploration and development activities, uranium-bearing properties and reserves, uranium mines, uranium processing facilities, and uranium industry employment in the raw materials sector

Uranium marketing activities, including contracts, contract prices and delivery schedules, uranium inventories, enrichment feed deliveries, unfilled market requirements, uranium used in fuel assemblies, and purchases of enrichment services.

The data collected on Form EIA-858 are subject to various sources of error. These sources are: (1) coverage (the list of respondents might not be complete or, on the other hand, there might be double counting); (2) non-response (all units that are surveyed might not respond or not provide all the information requested); (3) respondents (respondents might commit errors in reporting the data); (4) processing (the data collection agency might omit or incorrectly transcribe a submission); (5) concept (the data collection elements might not measure the items they were intended to measure); and (6) adjustments (errors might be made in estimating values for missing data). Because the “Uranium Industry Annual Survey” is not a sample survey, the estimates shown in this report are not subject to sampling error.¹ Although it is not possible to present estimates of nonsampling error, precautionary steps were taken at each stage of the survey design to minimize the possible occurrence of these errors. The steps are described below, with the error they were designed to minimize shown in parenthesis.

Survey Universe and Frame (Coverage Errors)

The survey universe includes all companies involved in the U.S. uranium industry. The universe includes all firms meeting one or more of the following criteria: (1) are controllers or were controllers during any portion of 1997, or are identified in EIA records as the most recent controllers of uranium properties, mines, mills, or plant; (2) involved as controllers of uranium exploration and development ventures in the United States; (3) incurred uranium exploration expenditures in 1997 or plan such expenditures in 1998; (4) hold uranium reserves; (5) control uranium mining properties; (6) control commercial uranium extraction operations; and (7) purchase, sell, held, or own domestic- or foreign-origin uranium; offered uranium enrichment services; imported or exported uranium; and (utilities only) purchased uranium enrichment services from an enrichment supplier.

The respondent list used for the Form EIA-858 survey was developed from a frame of all establishments known to meet the selection criteria. The frame of potential respondents was compiled from previous surveys and from information in the public domain. The frame was intended to cover the following: all utilities owning nuclear-fueled generating stations; uranium converters, enrichers, and fuel fabricators; uranium traders and brokers; large and small companies actively engaged in exploration, development, or extraction in the U.S. uranium industry; and companies holding all large properties with uranium reserves. Companies meeting these criteria include: those involved in exploration, development, mining, milling, and trading of uranium; landowners; uranium converters, enrichers, and fabricators; and utilities with whole or partial ownership in operating or planned nuclear electric power plants.

Survey Procedures (Nonresponse)

The survey forms were sent via first class mail to ensure their receipt only by the proper respondent organization. If the U.S. Postal Service was unable to deliver the survey form, the corrected address was obtained where possible. In a few instances, businesses that had reported in earlier

¹Sampling error is a measure of the variation that occurs by chance because a sample rather than a complete enumeration of units is surveyed.

surveys were no longer operating. All known companies currently conducting business in the U.S. uranium industry were contacted during this survey.

Form EIA-858, "Uranium Industry Annual Survey," requests data about many areas of company operations. The scope of the questions is necessarily broad, and self-reporting of company-specific data is required.

Cooperation from industry on the 1997 survey was good. About 48 percent of respondents replied to the form within the specified deadline. Those that had not responded by the due date (March 1st for Schedules A and B) were telephoned to encourage submission of the forms, and those calls resulted in the submission of most of the remaining forms. Subsequently, telephone calls were made to obtain forms not yet submitted. In a few instances, company data were collected through telephone conversations.

Data Editing, Analysis, and Processing (Respondent and Processing Errors)

The survey forms are logged in and reviewed by agency personnel prior to data entry into the Uranium Industry Annual System, an automated database containing all current and historical data from each company's submissions. The database is maintained on the EIA computer facility in Washington, DC. After entry into the database, a copy of each part of the Form EIA-858 was distributed to the Analysis and Systems Division analyst responsible for that part. The submissions were checked for internal consistency, and the reported data were compared with previous collections of similar data. After reviewing these submissions, the analyst consulted with the reporting company, as needed, to resolve data problems and to confirm any corrections of the data.

Data areas that were reviewed and the corrections that were made differed from company to company. Most represented different interpretations of the data item definitions. No data in the database were changed without first consulting with the reporting company. Computer edits were also used to identify keypunch errors, out-of-range values, and unlikely data combinations. These also were either corrected to represent the data reported on the submissions or were changed only after confirming the corrected values by telephone conversations with company representatives. Data coding and entry errors were eliminated by proofing data after entry. All changes to reported data are documented.

Response Rates

For the 1997 Form EIA-858 survey, Schedule A, "Uranium Raw Materials Activities," was mailed to 46 firms and Schedule B, "Uranium Marketing Activities," was mailed to 87 firms. Response statistics are shown in Table A1. Overall, 100 percent of the firms responded to EIA with the data as requested for the survey sections as applicable to individual firms.

Table A1. Response Statistics for the 1997 Uranium Industry Annual Survey

Response Status	Schedule	
	A	B
Survey Schedules Mailed Out	46	87
Data Provided	42	80
Reported as Not Applicable	4	7

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1997).

Missing Data

Some omissions of data were identified during the prescreening and editing of the data. Most omitted data elements fell into two categories: particular data were unknown or inadvertent omissions. EIA contacted respondents to obtain omitted data or to verify that they could not be reported. Only confirmed company-reported data are contained in the database and included in this report.

Data Revisions

The Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Information Administration, has adopted the following policy for review and correction (revision) of data it collects and publishes. The policy covers revisions to prior published data. This new policy was initially implemented with the publication of the *Uranium Industry Annual 1992*.

1. Annual survey data are published either as *preliminary* or *final* when they first appear in a data report. Data released as *preliminary* will be identified as such. When necessary, preliminary data will be revised and declared to be *final* at the next publication of that data.

2. Monthly and quarterly survey data are published initially as *preliminary* data. They will be revised only after the completion of the data collection cycle for the full 12-month survey period. Revisions will not be made to monthly or quarterly data prior to this time.

3. The magnitude of historical data revisions experienced will be included in each data report to inform the reader about the accuracy of the data presented.

4. Revisions to data published as *final* will be made only in the event that newly available information would result in a change to published data of more than 1 percent at the national level. Revisions for changes of lesser magnitudes will be made at the discretion of the Office Director.

All data, except for uranium inventory data and uranium fuel assembly data, are published as final. Data on uranium inventories and fuel assemblies for the survey year are published as preliminary because survey respondents are requested to make changes to their prior year data, if necessary, when reporting data for the current survey year.

Nondisclosure of Data

To protect the confidentiality of individual respondents' data, a policy was implemented to ensure that the reporting of survey data in this publication would not associate those data with a particular company. This is in compliance with EIA Standard No. 88-05-06, "Nondisclosure of Company Identifiable Data in Aggregate Cells." In tables where the nonzero value of a cell is composed of data from fewer than three companies or if a single company dominates a table-cell value so that the publication of the value would lead to identification of a company's data, then the EIA classifies the cell value as "sensitive," and the cell value is withheld ("W") from publication. Within a table with a sensitive cell value, selected values in other cells of the table are also withheld, as necessary, so that the sensitive cell value cannot be computed using the values in published cells. A sensitive table-cell value can be reported, if each company whose data contribute to the sensitivity, gives permission to publish the value and if the company believes that publishing it would not harm the company's competitive position. This is the only exception to the application of EIA Standard No. 88-05-06 in this report.

Appendix B

**Resources
and Reserves**

Appendix B

Resources and Reserves

This section discusses the methodologies used to estimate the U.S. uranium resources. Three classes of resources are estimated: Reserves, Estimated Additional Resources (EAR), and Speculative Resources (SR). EAR and SR categories are undiscovered potential.

A diagram showing a comparison of nomenclatural schemes used by the EIA and DOE's predecessor agencies for reporting estimates of U.S. uranium resources since 1974 is provided in Figure B1.

Appraisal of Potential Resources

The appraisal of the National potential resources of uranium, which comprise the Estimated Additional Resources (EAR) and Speculative Resources (SR) categories, is based on extensive data collected under the uranium resource appraisal program of DOE and its predecessor agencies. These data include: chemical assays of core samples; data from geochemical surveys of groundwater, stream water and sediment; aerial radiometric surveys; limited selective drilling to fill voids in subsurface information; and geological studies of field areas throughout the United States.

Estimates of potential resources are based on data developed under the DOE National Uranium Resource Evaluation (NURE) program and under a Memorandum of Understanding signed in 1984 between EIA and the U.S. Geological Survey of the Department of Interior. Annual updating of the estimates by EIA was discontinued after 1994. Therefore, 1997 potential resources are the same as those reported for the previous year. Estimates of uranium resources in the EAR and SR classes for 1988 through 1997 are shown in Table B1. Resource quantities of EAR and SR are summarized for principal resource regions (Figure B2) and forward-cost categories in Table B2.

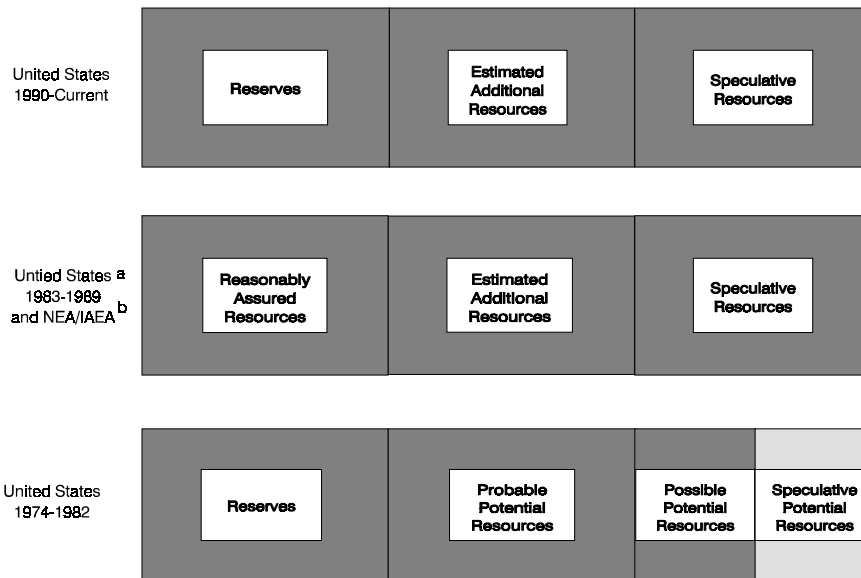
Estimation of Reserves

Uranium reserves are the estimated quantities of uranium that occur in known deposits of such grade, quantity, configuration, and depth that they can be recovered under current regulations at or below a specified cost with state-of-the-art mining and processing technology. Estimates reserves are based on direct radiometric and chemical measurements in drill hole samples. Ore grades and thickness, spacial relationships, depths, mining and reclamation methods, haulage distance, and amenability of ore within specific forward-cost levels are considered in the evaluation. Uranium reserves estimated by the DOE have been adjusted for appropriate mining dilution and mill recovery.

The costs used to categorize uranium reserves are forward costs (see Glossary) in current (year of estimate) dollars that would be incurred in producing the uranium. The costs include power and fuel, labor, materials, royalties, severance and ad valorem taxes, insurance, and applicable administrative costs. Previous expenditures (sunk costs) for such items as exploration and land acquisition are excluded. Also excluded are income taxes, profit, and the cost of money. The forward-cost categories are independent of the market price at which the uranium might be sold.

The current uranium reserves estimates are based on a combination of EIA-held historical property data, company-reported data, and independent reserve estimates. The estimates of national uranium reserves are based on currently available data for domestic deposits and on adjustments for depletion and erosion of specific cost category reserves due to production of ore from individual properties. Current and historical estimates of reserves since 1988 are shown in Table B3. Reserves estimates for each forward-cost category are summarized for major States in Table B4.

Figure B1. Comparison of Historical and Current U.S. and NEA/IAEA Classification Nomenclature for Uranium Resources



^aThis nomenclature was adopted in 1983 by the U.S. Department of Energy and was patterned after the Nuclear Energy Agency/International Atomic Energy Agency Standard.

The classifications shown for the United States prior to 1983 and after 1989 and the NEA/IAEA are not strictly comparable, because the criteria used in the individual systems are not identical. Precise correlations are not possible, particularly for the less assured resources. Nonetheless, based on the principal criterion of geological assurance of existence, this figure presents a reasonable approximation of uranium resources classification comparability.

^bNEA/IAEA: Nuclear Energy Agency/International Atomic Energy Agency.

Note: The NEA/IAEA separates the Estimated Additional Resources (EAR) into Categories I and II based primarily on geological inference. Categories I and II of EAR are not utilized for estimates of resources in the United States.

Source: Prepared by the Energy Information Administration, Office of Coal, Nuclear, Electric and Alternate Fuels.

Figure B2. Uranium Resource Regions of the United States



Source: U.S. Department of Energy, *An Assessment Report on Uranium in the United States of America*, GJO-111(80) (Grand Junction, Colorado, October 1980).

Table B1. U.S. Potential Uranium Resources by Forward-Cost Category and Resource Class, 1988-1997
(Million Pounds U₃O₈)

Year	Forward-Cost Category					
	\$30 per pound		\$50 per pound		\$100 per pound	
	EAR ^a	SR ^b	EAR ^a	SR ^b	EAR ^a	SR ^b
1988	1,300	1,000	2,300	2,000	3,800	3,200
1989	2,300	1,400	3,400	2,300	5,000	3,500
1990	2,200	1,300	3,400	2,200	4,900	3,500
1991	2,200	1,400	3,400	2,300	4,900	3,600
1992	2,200	1,300	3,400	2,300	4,900	3,500
1993	2,200	1,330	3,340	2,250	4,880	3,510
1994	2,180	1,310	3,310	2,230	4,850	3,480
1995 ^c	2,180	1,310	3,310	2,230	4,850	3,480
1996 ^c	2,180	1,310	3,310	2,230	4,850	3,480
1997 ^c	2,180	1,310	3,310	2,230	4,850	3,480

^aEAR = Estimated Additional Resources.

^bSR = Speculative Resources.

^cAnnual updating of the estimates by the Energy Information Administration was suspended after 1994. Therefore, potential resources after 1994 are the same as those reported for the previous year.

Notes: Values shown are the mean values for the distribution of estimates for each forward-cost category: 1988-1992- rounded to the nearest 100 million pounds U₃O₈; 1993-1997- rounded to the nearest 10 million pounds U₃O₈. Estimates of uranium that could be recovered as a byproduct of other commodities are not included. Resource values in forward-cost categories are cumulative: that is, the quantity at each level of forward cost includes all resources at the lower cost in that category.

Sources: **1988**-Estimates based on uranium resources data developed under the DOE National Uranium Resource Evaluation (NURE) program, 1974-1983, using methodology described in *An Assessment Report on Uranium in the United States of America* (October 1980) in U.S. Department of Energy, *Uranium Industry Seminar* (October 1980); and under U. S. Geological Survey (USGS) Uranium Resource Assessment Project. **1989-1994**-Estimates based on uranium resources data developed under the NURE program and USGS Uranium Resource Assessment Project using methodology described in *Uranium Resource Assessment by the Geological Survey: Methodology and Plan to Update the National Resource Base*, U.S. Geological Survey Circular 994 (1987).

Table B2. U.S. Potential Uranium Resources by Forward-Cost Category and Resource Region, 1997
(Million Pounds U₃O₈)

Resource Region	Forward-Cost Category					
	\$30 per pound		\$50 per pound		\$100 per pound	
	EAR ^a	SR ^b	EAR ^a	SR ^b	EAR ^a	SR ^b
Colorado Plateau	1,330	480	1,900	770	2,540	1,210
Wyoming Basins	160	80	340	160	660	250
Coastal Plain	370	130	490	180	600	230
Northern Rockies	30	110	60	200	170	300
Colorado and Southern Rockies	140	90	180	140	220	190
Basin and Range	50	90	160	170	390	320
Other Regions ^c	110	330	180	610	270	990
Total	2,180	1,310	3,310	2,230	4,850	3,480

^aEAR = Estimated Additional Resources.

^bSR = Speculative Resources.

^cIncludes Appalachian Highlands, Great Plains, Pacific Coast and Sierra Nevada, Central Lowlands, and Columbia Plateau regions and Alaska.

Notes: Values shown are the mean values for the distribution of estimates for each forward-cost category, rounded to the nearest 10 million pounds U₃O₈. Estimates of uranium that could be recovered as a byproduct of other commodities are not included. Resource values in forward-cost categories are cumulative: that is, the quantity at each level of forward cost includes all resources at the lower cost in that category.

Sources: Prepared by the Energy Information Administration, Office of Coal, Nuclear, Electric and Alternate Fuels, based on uranium resources data developed under DOE *National Uranium Resource Evaluation (NURE) program* and the USGS Uranium Resource Assessment project, using methodology described in *Uranium Resource Assessment by the Geological Survey: Methodology and Plan to Update the National Resource Base*, U.S. Geological Survey Circular 994 (1987).

Table B3. U.S. Uranium Reserves by Forward-Cost Category, 1988-1997
(Million Pounds U₃O₈)

Year	\$30 per pound	\$50 per pound	\$100 per pound
1988	289	981	1,560
1989	277	962	1,537
1990	265	926	1,511
1991	304	975	1,542
1992	295	959	1,523
1993	292	952	1,511
1994	294	953	1,501
1995	290	947	1,493
1996	285	939	1,480
1997	281	931	1,466

Note: Uranium reserves that could be recovered as a byproduct of phosphate and copper mining are not included in these reserves. Reserves values in forward-cost categories are cumulative; that is, the quantity at each level of forward cost includes all reserves at the lower costs.

Source: Estimated by the Energy Information Administration, Office of Coal, Nuclear, Electric and Alternated Fuels, based on U.S. Department of Energy, Grand Junction Projects Office data files and Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1988-1997).

Table B4. Forward-Cost Uranium Reserves by State, 1997

State(s)	\$30 per pound			\$50 per pound		
	Ore (million tons)	Grade ^a (percent U ₃ O ₈)	U ₃ O ₈ (million pounds)	Ore (million tons)	Grade ^a (percent U ₃ O ₈)	U ₃ O ₈ (million pounds)
New Mexico	15	0.279	84	111	0.157	350
Wyoming	44	0.130	116	245	0.078	381
Arizona, Colorado, Utah	7	0.292	42	45	0.132	119
Texas	5	0.084	8	19	0.066	26
Other ^b	8	0.202	32	26	0.108	56
Total	79	0.177	281	446	0.104	931

^aWeighted average percent U₃O₈ per ton of ore.

^bIncludes California, Idaho, Nebraska, Nevada, North Dakota, Oregon, South Dakota, and Washington.

Notes: Uranium reserves that could be recovered as a byproduct of phosphate and copper mining are not included in this table. Reserves values in forward-cost categories are cumulative: that is, the quantity at each level of forward-cost includes all reserves at the lower costs. Totals may not equal sum of components because of independent rounding.

Sources: Estimated by Energy Information Administration, Office of Coal, Nuclear, Electric and Alternate Fuels, based on industry conferences, U.S. Department of Energy, Grand Junction Projects Office data files, and Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1997).

Appendix C

**Respondents to
the Uranium
Industry Annual
Survey**

Appendix C

Respondents to the Uranium Industry Annual Survey

Respondents to the Energy Information Administration's (EIA) 1997 Form EIA-858, "Uranium Industry Annual Survey," are listed alphabetically in Table C1. For each respondent, an industry-activity code is shown. The activity code broadly describes the respondent's major indus-

try activity from Form EIA-858. Included in the listing are respondents that stated that no part of the Form EIA-858 was applicable to their operations as of the end of the survey year. The footnote at the end of Table C1 provides an explanation for the activity codes.

Table C1. Respondents to the 1997 Uranium Industry Annual Survey

Company Name	Industry Activity Code ^a	Company Name	Industry Activity Code ^a
Alabama Power Co. (Southern Nuclear)	UTL	Everest Exploration, Inc.	UPH
Anaconda Uranium Corporation	UPH	Florida Power Corporation	UTL
Arizona Public Service Company	UTL	Florida Power & Light	UTL
Aspen Exploration Corporation	UPH	Framatome Cogema Fuels	FAB
B. B. Brooks Company	UPH	General Electric Company	FAB
Baltimore Gas & Electric	UTL	Geomex Minerals, Inc.	UPH
Boston Edison Company	UTL	Georgia Power Co. (Southern Nuclear)	UTL
Cameco Resources (U.S.) Inc.	UPH	GPU Nuclear, Inc.	UTL
Carolina Power & Light	UTL	William H. B. Graves	UPH
Centerior Energy Corporation	UTL	Green Mountain Mining Venture	UPH
Cobb Resources Corporation	UPH	Hanson Exploration, Inc.	UPH
COGEMA, Inc.	BRO	Homestake Mining Company	UPH
COGEMA Mining Inc. (Total Minerals Corp.)	MLG	Houston Lighting and Power Co.	UTL
Combustion Engineering, Inc.	FAB	IES Utilities, Inc. - Duane Arnold Energy Center	UTL
Commonwealth Edison	UTL	Illinois Power Company	UTL
Consolidated Edison Co. of NY, Inc.	UTL	IMC - Agrico Company	MLG
Consumers Energy/Palisades Nuclear Plant	UTL	Indiana Michigan Power	UTL
ConverDyn	CON	Intercontinental Energy Corporation	UPH
Cotter Corporation	UPH	International Uranium (USA) Corporation	MLG
Crow Butte Resources, Inc.	MLG	Maine Yankee Atomic Power Co.	UTL
Cycle Resources Investment Corp.	BRO	Malapai Resources Company	MLG
Dawn Mining Company	UPH	Marquez Development Corporation	UPH
Detroit Edison	UTL	Mesa, Inc.	UPH
Duke Power Company	UTL	Mining Unlimited, Inc.	UPH
Duquesne Light Company	UTL	Nebraska Public Power District	UTL
Enserch Processing, Inc.	UPH	New York Power Authority	UTL
Entergy Operations, Inc.	UTL	New York Nuclear Corp. /NYNCO Trading	BRO

Table C1. Respondents to the 1997 Uranium Industry Annual Survey (Continued)

Company Name	Industry Activity Code^a	Company Name	Industry Activity Code^a
Niagara Mohawk Power Corporation	UTL	Simons Associates	UPH
North Atlantic Energy Service Corp.	UTL	South Carolina Electric & Gas	UTL
Northeast Utilities Service Co.	UTL	Southern California Edison Company	UTL
Northern States Power Company	UTL	Strathmore Resources	UPH
Nuclear Fuel Resources, Inc.	TRA	Tennessee Valley Authority	UTL
Nuexco Trading Corporation	TRA	Texas Utilities Electric Company	UTL
Nukem, Inc.	TRA	UG U.S.A., Inc.	TRA
NZU, Inc.	UPH	Umetco Minerals Company	UPH
Office of Nuclear Energy (DOE)	ENR	Union Electric Company	UTL
Ohio Edison Co. and Pennsylvania Power	UTL	United Nuclear Corporation	UPH
Omaha Public Power District	UTL	United States Enrichment Corporation	ENR
Pacific Gas & Electric Company	UTL	Uranerz USA, Inc.	UPH
Pathfinder Mines Corp. (C/O COGEMA Inc.)	UPH	The Uranium Exchange Company	TRA
PECO Energy Company	UTL	Uranium King Corporation	UPH
Pennsylvania Power & Light Company	UTL	Uranium Resources Incorporated	MLG
Petrotomics Company (C/O Texaco, Inc)	UPH	USX Corporation, Texas Uranium Operations	UPH
Power Resources, Inc.	MLG	U.S. Energy Corp. (Plateau Resources, Ltd)	UPH
Public Service Electric & Gas	UTL	Vermont Yankee Nuclear Power Corp.	UTL
Rio Algom Mining Corp.	MLG	Virginia Electric and Power Co.	UTL
Rio Grande Resources Corp.	UPH	Washington Public Power Supply System	UTL
Riverside Public Utility Dept.	UTL	Western Nuclear, Inc.	UPH
RME Partners, L. P.	UPH	Westinghouse Electric Corporation, CNFD	FAB
Rochester Gas & Electric Corporation	UTL	Wisconsin Electric Power Company	UTL
San Diego Gas & Electric	UTL	Wisconsin Public Service Corporation	UTL
San Rafael Energy, Inc.	UPH	WM Mining Company	BRO
Section 2 Joint Venture-Continental Materials	UPH	Wold Nuclear Company, John S. Wold d/b/a	UPH
Sheep Mountain Partners	UPH	Wolf Creek Nuclear Operating Corporation	UTL
Siemens Power Corporation - Nuclear Div.	FAB	Yellow Stone Fuels Corp.	UPH

^aBRO = Uranium brokerage company; CON = Uranium conversion service supplier; ENR = Uranium enrichment service supplier; FAB = Uranium fuel fabrication service supplier; MLG = Uranium milling/processing company (can involve ownership of a uranium property); TRA = Uranium trading company; UPH = Uranium property holder (can include activities related to uranium exploration, reserves, reclamation, and/or mining); UTL = Nuclear electric utility company.

Source: Prepared by the Energy Information Administration, Office of Coal, Nuclear, Electric and Alternate Fuels, based on information reported on the Form EIA-858 "Uranium Industry Annual Survey" (1997).

Appendix D

**Form EIA-858:
Uranium Industry
Annual Survey**

Appendix E

**U.S. Customary Units
of Measurement,
International System
of Units (SI), and
Selected Data Tables
in SI Metric Units**

Appendix E

U.S. Customary Units of Measurement, International System of Units (SI), and Selected Data Tables in SI Metric Units

Standard Factors for interconversion between U.S. customary units and the International System of Units (SI) are shown in Table E1. These factors are provided as a coherent and consistent set of units for the convenience

of the reader in making conversions between U.S. and metric units of measure for data published in this report. Conversion factors are provided only for the U.S. units of measurement quoted in this report.

Table E1. Conversion Factors for U.S. Customary Units and SI Metric Units of Measurement

To convert from:	To:	Multiply by: ^a
Area		
acre	meter ² (m ²)	4,046.9*
Length		
foot (ft)	meter (m)	0.304 801
yard (yd)	meter (m)	0.914 4*
Mass		
pound—avoirdupois (lb avdp)	kilogram (kg)	0.453 592
pound—avoirdupois U ₃ O ₈ ^b	kilogram U	0.384 647
ton, short (2,000 lb)	metric ton (t)	0.907 185

^aAn asterisk after the last digit indicates that the conversion factor is exact and that all subsequent digits are zero. All other conversion factors are rounded to six digits after the decimal.

^bThe factor of 1 pound U₃O₈ = 0.848 002 pounds U was used in this conversion.

Source: Table E1 is patterned after Table 3, "Conversion Factors for SI Metric Units and U.S. Customary Units of Measurement," in S.M. Long and A.M. Orellana, "The Metric System," in *Suggestions to Authors of the Reports of the United States Geological Survey*, Sixth Edition, U.S. Government Printing Office (Washington, DC, 1978) pp. 192-196.

Forward Cost and Average Price Conversions

The forward-cost categories of \$US80 through \$US130 per pound U shown on Table E3 to report uranium reserves quantities were converted from units of “\$ per pound U₃O₈” to “\$ per kilogram U” by multiplying by the standard factor of 2.6 and rounding the results to the nearest multiple of \$US10.

Selected Tables Converted to SI Metric Values

Sixteen principal tables of data from the Uranium Industry Annual 1997 (UIA) converted to equivalent metric values are shown on the following pages. The crosswalk given below shows the correlation between the tables of metric values and their corresponding tables in U.S. customary units in the main body of the UIA.

Appendix E Table Number	UIA Chapter and Table Number
E2	Chapter 1, Table 1
E3	Chapter 1, Table 3
E4	Chapter 1, Table 4
E5	Chapter 1, Table 5
E6	Chapter 2, Table 10
E7	Chapter 2, Table 11
E8	Chapter 2, Table 12
E9	Chapter 2, Table 14
E10	Chapter 2, Table 19
E11	Chapter 2, Table 21
E12	Chapter 2, Table 22
E13	Chapter 2, Table 27
E14	Chapter 2, Table 28
E15	Chapter 2, Table 29
E16	Chapter 2, Table 30
E17	Chapter 2, Table 31

Table E2. U.S. Uranium Land and Surface Drilling Activities, 1988-1997

Year	Land Exploration		Surface Drilling Exploration			Surface Drilling Development			Surface Drilling Exploration and Development		
	Square Meters Acquired during Year (millions)	Square Meters Held at End of Year (millions)	Number of Holes	Meters (thousand)	Cost ^a (thousand dollars)	Number of Holes	Meters (thousand)	Cost ^a (thousand dollars)	Number of Holes	Meters (thousand)	Cost ^a (thousand dollars)
1988	364	6,880	2,029	390	6,440	3,176	527	3,260	5,205	917	9,700
1989	113	6,188	2,087	436	5,820	1,753	244	3,120	3,840	680	8,940
1990	154	4,893	1,507	265	3,210	1,908	247	5,950	3,415	512	9,160
1991	130	4,290	1,624	297	2,832	1,573	265	8,114	3,197	561	10,946
1992	344	3,189	935	171	1,267	833	153	1,162	1,768	324	2,429
1993	263	1,841	355	68	983	1,665	270	4,754	2,020	338	5,737
1994	36	1,315	519	104	736	477	96	383	996	200	1,119
1995	28	1,048	584	122	790	1,728	289	1,799	2,312	411	2,589
1996	146	1,166	1,118	269	1,602	3,577	659	5,549	4,695	928	7,150
1997	2,226	3,399	1,935	405	3,544	5,858	1,083	16,448	7,793	1,488	19,992

^aCosts for 1988 through 1990 were rounded to the nearest \$10 thousand.

Note: Totals may not equal sum of components because of independent rounding.

Sources: Energy Information Administration: **1988-1996-Uranium Industry Annual 1996** (April 1997). **1997-Form EIA-858, "Uranium Industry Annual Survey"** (1997).

Table E3. Forward-Cost Uranium Reserves by Mining Method, 1997

Mining Method	Forward-Cost Category					
	\$80 per kilogram			\$130 per kilogram		
	Ore (million metric tons)	Grade ^a (percent U)	Uranium (thousand metric tons)	Ore (million metric tons)	Grade ^a (percent U)	Uranium (thousand metric tons)
Underground	23	0.232	53	129	0.138	179
Openpit	9	0.118	11	148	0.067	99
In Situ Leaching	39	0.111	44	114	0.065	75
Other ^b	< 1	0.224	< 1	14	0.042	6
Total	72	0.150	108	405	0.088	358

^aWeighted average percent U per metric ton of ore.

^bIncludes heap leach, mine water, and low grade stockpiles.

Notes: Uranium reserves that could be recovered as a byproduct of phosphate and copper mining are not included in this table. Reserves values in forward-cost categories are cumulative: That is, the quantity at each level of forward-cost includes all reserves at the lower costs. Totals may not equal sum of components because of independent rounding.

Sources: Estimated by Energy Information Administration, Office of Coal, Nuclear, Electric and Alternate Fuels, based on industry conferences, U.S. Department of Energy, Grand Junction Projects Office data files, and Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1997).

Table E4. U.S. Uranium Mine Production and Number of Mines and Sources, 1988-1997

Mining Method	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Underground (metric tons U)	2,100	2,000	W	W	W	0	0	0	W	W
Openpit (metric tons U)	W	W	724	972	W	0	0	0	0	0
In Situ Leaching (metric tons U)	W	W	W	W	W	W	942	1,297	1,684	1,571
Other ^a (metric tons U)	1,600	1,700	1,537	1,021	379	789	30	60	125	241
Total Mine Production (metric tons U)	3,700	3,700	2,260	1,993	379	789	972	1,357	1,810	1,812
Number of Mines Operated										
Underground	17	19	27	6	4	0	0	0	1	1
Openpit	4	2	2	2	1	0	0	0	0	0
In Situ Leaching	11	9	7	6	4	5	5	5	6	7
Other Sources ^b	0	2	3	1	8	7	7	7	6	6
Total Mines and Sources	32	32	39	15	17	12	12	12	13	14

^aFor 1988 and 1989, "Other" includes production from openpit, in situ leach, heap leach, mine water, and water-treatment plant solutions. Production quantities were rounded to the nearest 100 metric tons. For 1990 and 1991, "Other" includes production from underground, in situ leach, heap leach (1990), mine water, water treatment plant solutions (1990), and restoration. For 1992, "Other" includes production from underground, openpit, and in situ leach mines and uranium bearing water from mine workings, tailings ponds, and restoration. For 1993, the "Other" includes production from in situ leach mines and uranium bearing water from mine workings and restoration. For 1994 and 1995, "Other" includes production from uranium bearing water from mine workings and restoration. For 1996 and 1997, "Other" includes production from an underground mine and uranium bearing water from mine workings and restoration.

^bOther Sources includes, in various years, heap leach, mine water, mill site cleanup and mill tailings, well field restoration, and low-grade stockpiles as sources of uranium.

W=Data withheld to avoid disclosure. The data are included in the total for "Other."

Notes: Totals may not equal sum of components because of independent rounding. Table does not include byproduct production and sources.

Sources: Energy Information Administration: **1988-1996-Uranium Industry Annual 1996** (April 1997); **1997-Form EIA-858, "Uranium Industry Annual Survey"** (1997).

Table E5. U.S. Uranium Concentrate Processing Operations, 1988-1997

Processing Operations	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Ore Fed to Process ^a (thousand metric tons)	1,101	1,120	655	580	232	0	0	151	40	0
Percent U ^b	0.244	0.274	0.248	0.168	0.194	—	—	0.441	0.424	—
Contained U (metric tons)										
In Ore	2,692	3,068	1,626	973	451	0	0	669	171	0
Other Feed Materials ^c	195	165	187	69	70	16	30	63	157	350
Total Mill Feed (metric tons U)	2,887	3,233	1,812	1,042	520	16	30	732	328	350
In-Process Inventory Change (metric tons U)	52	- 90	- 94	- 47	- 10	4	9	60	- 53	20
Concentrate Produced at Mills (metric tons U)										
Theoretical ^d	2,834	3,323	1,906	1,089	530	12	21	671	381	330
Actual	2,706	3,144	1,788	1,003	523	12	18	621	331	302
Recovery as Percent of Mill Feed	95.5	94.6	93.8	92.2	98.7	—	—	92.6	86.8	91.2
Tailings and Unaccountable (metric tons U)	129	179	118	85	7	0	3	50	50	29
Other Processing^e (metric tons U)	2,345	2,178	1,630	2,056	1,649	1,167	1,272	1,703	2,101	1,869
Total Uranium Concentrate Production (metric tons U)	5,050	5,322	3,418	3,059	2,171	1,178	1,289	2,324	2,431	2,171
Total Concentrate Shipped From Mills and Plants (metric tons U)	4,920	5,696	4,984	3,245	2,636	1,298	2,431	2,116	2,301	2,237

^aUranium ore "fed to process" in any year can include: ore mined and shipped to a mill during the same year, ore that was mined during a prior year and later shipped from mine-site stockpiles, and/or ore obtained from drawdowns of stockpiles maintained at a mill site.

^bWeighted average percent U per metric ton of ore.

^cIncludes for various years uranium from low-grade ore, mill cleanup, mine water, tailings water, heap leaching, solution mining, and waste stream, except as footnoted below.

^dAt 100-percent recovery. This equals total mill feed minus in-process inventory change.

^eU₃O₈ concentrate production from in situ leaching and as a byproduct of phosphate processing. The total for 1988 includes U₃O₈ recovered from reclamation and mine water at some mills that did not report processing of uranium ore for that year.

— = Not applicable.

Note: Totals may not equal sum of components because of independent rounding.

Sources: Energy Information Administration: **1988-1996-Uranium Industry Annual 1996** (April 1997); **1997-Form EIA-858, "Uranium Industry Annual Survey"** (1997).

Table E6. U.S. Utility Contracted Uranium by Supplier, Transaction Type, and Delivery Year, 1994-1997
(Metric Tons U Equivalent; Dollars per Kilogram U Equivalent)

Actual Deliveries	1994	1995	1996	1997
Received by U.S. Utilities from U.S. Producers:				
Purchases of U.S.-Origin and Foreign-Origin Uranium	2,093	2,034	2,218	2,205
Weighted-Average Price	35.68	38.59	36.91	35.35
Received by U.S. Utilities from U.S. Brokers and Traders:				
Purchases of U.S.-Origin and Foreign-Origin Uranium	5,879	6,232	5,124	3,804
Weighted-Average Price	24.29	25.56	34.73	32.01
Received by U.S. Utilities from other U.S. Utilities:				
Purchases	0	0	0	W
Weighted-Average Price	—	—	—	W
Received by U.S. Utilities from other U.S. Suppliers:				
Purchases of U.S.-Origin and Foreign-Origin Uranium	420	216	725	W
Weighted-Average Price	20.90	32.56	38.95	W
Received by U.S. Utilities from Foreign Suppliers:				
Purchases of U.S.-Origin and Foreign-Origin Uranium	6,332	8,227	10,139	8,986
Weighted-Average Price	27.11	29.63	37.57	33.56
Total Received by U.S. Utilities:				
Purchases of U.S.-Origin and Foreign-Origin Uranium	14,725	16,709	18,206	16,140
Weighted-Average Price	27.03	29.24	36.71	33.49

— = Not applicable.

W=Data withheld to avoid disclosure.

Notes: "Other U.S. Suppliers" are U.S. converters, enrichers, and fabricators. Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1994-1997).

Table E7. U.S. Utility Contracted Uranium by Origin, Transaction Type and Delivery Year, 1994-1997
(Metric Tons U Equivalent; Dollars per Kilogram U Equivalent)

Actual Deliveries	1994	1995	1996	1997
Received by U.S. Utilities of U.S.-Origin Uranium:				
Purchases	2,969	2,018	3,192	3,105
Weighted-Average Price	31.39	36.93	38.01	34.73
Received by U.S. Utilities of Foreign-Origin Uranium:				
Purchases	11,756	14,692	15,014	13,035
Weighted-Average Price	25.92	28.18	36.45	33.23
Total:				
Purchases	14,725	16,709	18,206	16,140
Weighted-Average Price	27.03	29.24	36.71	33.49

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1994-1997).

Table E8. U.S. Utility Purchases of Uranium by Origin Country and Delivery Year, 1995-1997
(Metric Tons U Equivalent; Dollars per Kilogram U Equivalent)

Origin Country	Actual Deliveries in 1995		Actual Deliveries in 1996		Actual Deliveries in 1997	
	Purchases	Weighted-Average Price	Purchases	Weighted-Average Price	Purchases	Weighted-Average Price
All Purchases:						
Australia	1,711	28.54	1,753	38.10	1,674	34.09
Canada	6,462	30.74	7,344	37.30	6,429	33.21
China	113	29.87	143	39.79	89	45.82
France	W	W	W	W	0	—
Gabon	W	W	W	W	W	W
Germany	W	W	372	35.21	W	W
Kazakhstan	1,191	23.36	575	38.04	744	33.10
Kyrgyzstan	W	W	0	—	W	W
Mongolia	W	W	W	W	W	W
Namibia	204	25.68	W	W	298	38.04
Netherlands	W	W	W	W	0	—
Niger	W	W	W	W	0	—
Russia	2,116	24.57	2,090	32.99	1,382	32.84
Slovakia	0	—	W	W	0	—
South Africa	385	32.68	643	34.75	990	29.96
Spain	W	W	0	—	0	—
Tajikistan	W	W	W	W	0	—
Ukraine	W	W	381	35.33	W	W
United Kingdom	W	W	0	—	0	—
Uzbekistan	1,498	22.37	1,332	35.11	1,060	34.30
Total Foreign	14,692	28.18	15,014	36.45	13,035	33.23
United States	2,018	36.93	3,192	38.01	3,105	34.73
Total Purchases	16,709	29.24	18,206	36.71	16,140	33.49
Domestic Purchases:						
Australia	897	27.66	310	40.21	270	32.80
Canada	895	34.29	1,283	35.07	1,548	32.13
China	W	W	143	39.79	W	W
France	0	—	W	W	0	—
Gabon	0	—	W	W	0	—
Germany	W	W	W	W	W	W
Kazakhstan	677	21.57	98	37.74	200	32.52
Kyrgyzstan	W	W	0	—	0	—
Mongolia	W	W	W	W	0	—
Namibia	W	W	W	W	W	W
Netherlands	0	—	W	W	0	—
Niger	0	—	W	W	0	—
Russia	1,452	24.61	1,673	33.29	938	33.13
Slovakia	0	—	W	W	0	—
South Africa	W	W	345	33.00	333	28.12
Tajikistan	W	W	0	—	0	—
Ukraine	W	W	381	35.33	0	—
United Kingdom	W	W	0	—	0	—
Uzbekistan	W	W	W	W	883	34.28
United States	2,018	36.93	3,192	38.01	3,105	34.73
Total Domestic Purchases	8,578	28.89	9,100	35.91	7,468	33.46
Foreign Purchases:						
Australia	814	29.50	1,443	37.65	1,404	34.34
Canada	5,567	30.17	6,061	37.76	4,880	33.56
China	W	W	0	—	W	W
France	W	W	0	—	0	—
Gabon	W	W	W	W	W	W
Germany	0	—	W	W	0	—
Kazakhstan	514	25.73	477	38.11	544	33.31
Kyrgyzstan	0	—	0	—	W	W
Mongolia	0	—	0	—	W	W
Namibia	W	W	0	—	287	38.46
Netherlands	W	W	0	—	0	—
Niger	W	W	0	—	0	—
Russia	663	24.49	417	31.77	445	32.24
South Africa	W	W	298	36.77	657	30.90
Spain	W	W	0	—	0	—
Tajikistan	W	W	W	W	0	—
Ukraine	0	—	0	—	W	W
Uzbekistan	W	W	W	W	177	34.45
Total Foreign Purchase	8,131	29.61	9,107	37.47	8,672	33.52

W=Data withheld to avoid disclosure. — = Not applicable.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1995-1997).

Table E9. Average Price and Quantity for Purchases of Uranium by U.S. Utilities by Pricing Mechanisms and Delivery Year, 1995-1997
(Dollars per Kilogram U Equivalent; Metric Tons U Equivalent)

Pricing Mechanisms	Domestic Purchases			Foreign Purchases			Total Purchases		
	1995	1996	1997	1995	1996	1997	1995	1996	1997
Contract-Specified Pricing									
Weighted-Average Price	27.50	34.83	34.65	33.69	36.33	36.95	29.02	35.23	35.48
Quantity with Reported Price	6,564	6,407	5,035	2,148	2,303	2,827	8,712	8,710	7,862
Market-Related Pricing									
No Floor Type									
Weighted-Average Price	26.48	35.52	29.12	28.22	38.35	32.35	27.86	37.56	31.29
Quantity with Reported Price	815	849	722	3,184	2,181	1,467	3,999	3,030	2,189
Floor Type									
Weighted-Average Price	46.42	41.93	37.76	28.19	38.06	31.09	30.69	38.78	31.73
Quantity with Reported Price	263	865	272	1,651	3,756	2,532	1,913	4,622	2,804
Market Related Total									
Weighted-Average Price	31.34	38.76	31.48	28.21	38.16	31.55	28.78	38.30	31.54
Quantity with Reported Price	1,078	1,714	994	4,835	5,937	3,999	5,912	7,651	4,993
Contract Specified and Market Related Total									
Weighted-Average Price	28.04	35.66	34.13	29.89	37.65	33.79	28.92	36.66	33.95
Quantity with Reported Price	7,642	8,121	6,030	6,982	8,240	6,826	14,624	16,362	12,855
Spot-Market Pricing									
Weighted-Average Price	23.59	38.74	28.69	26.68	37.08	32.21	25.74	37.98	30.68
Quantity with Reported Price	288	650	960	656	549	1,250	944	1,199	2,210
Other Pricing^a									
Weighted-Average Price	41.27	41.28	36.63	29.47	33.52	33.15	36.18	34.36	33.98
Quantity with Reported Price	649	38	185	492	317	597	1,141	356	782
All Pricing Mechanisms									
Weighted-Average Price	28.89	35.91	33.46	29.61	37.47	33.52	29.24	36.71	33.49
Quantity with Reported Price	8,578	8,810	7,175	8,131	9,107	8,672	16,709	17,916	15,847

^aCategory used to report pricing mechanisms that are different from the other categories.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1995-1997).

Table E10. U.S. Utility Contracted Purchases of Uranium from Suppliers, in Effect at the End of 1997, by Delivery Year, 1998-2007
(Metric Tons U Equivalent)

Year of Delivery	Purchases from U.S. Suppliers		Purchases from Foreign Suppliers		Purchases from All Suppliers	
	Firm Deliveries	Optional Deliveries	Firm Deliveries	Optional Deliveries	Firm Deliveries	Optional Deliveries
1998	6,393	561	7,978	1,069	14,371	1,631
1999	5,139	715	7,781	1,377	12,920	2,092
2000	4,033	677	7,721	1,389	11,754	2,066
2001	3,144	930	4,463	1,357	7,608	2,287
2002	2,103	589	3,717	1,259	5,820	1,848
2003	1,244	1,072	1,337	944	2,581	2,016
2004	884	651	681	1,208	1,564	1,859
2005	190	328	245	999	435	1,327
2006	0	289	162	346	162	635
2007	0	0	0	308	0	308
Total	23,130	5,812	34,085	10,256	57,215	16,068

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1997).

Table E11. Anticipated Uranium Market Requirements of U.S. Utilities, 1998-2007, as of December 31, 1997
(Metric Tons U Equivalent)

Year	Quantity of Uranium Under Purchase Contracts	Unfilled Requirements	Anticipated Market Requirements	Enrichment Feed Deliveries
1998	16,002	869	16,870	15,594
1999	15,012	1,992	17,004	17,708
2000	13,820	5,643	19,464	18,452
2001	9,894	8,641	18,535	18,408
2002	7,668	10,736	18,404	17,320
2003	4,596	15,959	20,555	19,390
2004	3,423	16,139	19,563	17,785
2005	1,762	16,276	18,038	17,319
2006	797	17,854	18,651	18,226
2007	308	17,451	17,759	17,805
Total	73,283	111,560	184,843	178,008

Note: Totals may not equal sum of components because of independent rounding.
Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1997).

Table E12. U.S. Utility Deliveries of Uranium Feed by Enrichment Country and Delivery Year, 1995-1997
(Metric Tons U Equivalent)

Enrichment Plant Location	Actual Deliveries in 1995			Actual Deliveries in 1996			Actual Deliveries in 1997		
	U.S.- Origin	Foreign- Origin	Total	U.S.- Origin	Foreign- Origin	Total	U.S.- Origin	Foreign- Origin	Total
China	0	0	0	0	0	0	0	0	0
France	W	W	1,847	145	2,318	2,463	W	W	1,153
Germany	W	W	335	W	W	W	0	W	W
Netherlands	W	W	366	W	W	W	0	0	0
Russia	322	721	1,043	95	594	689	W	W	1,110
United Kingdom	0	407	407	W	W	230	W	W	W
Foreign Total	535	3,463	3,998	269	3,742	4,011	198	2,883	3,081
United States	2,995	10,045	13,040	3,195	11,672	14,867	2,383	10,038	12,421
Total	3,530	13,508	17,038	3,464	15,414	18,878	2,581	12,921	15,502

W=Data withheld to avoid disclosure.
Note: Totals may not equal sum of components because of independent rounding.
Sources: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1995-1997).

Table E13. Uranium in Fuel Assemblies Loaded into U.S. Commercial Nuclear Power Reactors by Year, 1994-1997
(Metric Tons U Equivalent)

Origin of Uranium	1994	1995	1996	1997 ^P
Domestic-Origin Uranium	3,578	4,287	3,393	4,465
Foreign-Origin Uranium	11,962	15,375	14,359	14,258
Total	15,540	19,662	17,752	18,724

P = Preliminary data. Final 1996 fuel assembly data reported in the 1997 survey.
Notes: Includes only unirradiated uranium in new fuel assemblies loaded into reactors during the year. Does not include uranium removed from reactors that subsequently will be reloaded. Totals may not equal sum of components because of independent rounding.
Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1995-1997).

Table E14. Foreign Purchases of Uranium by U.S. Suppliers and U.S. Utilities by Delivery Year, 1994-1997
(Metric Tons U Equivalent; Dollars per Kilograms U Equivalent)

Actual Deliveries	1994	1995	1996	1997
U.S. Suppliers:				
Foreign Purchases	8,109	7,755	8,365	7,856
Weighted-Average Price	20.23	23.29	30.62	27.58
U.S. Utilities:				
Foreign Purchases	5,976	8,131	9,107	8,672
Weighted-Average Price	27.38	29.61	37.47	33.52
U.S. Suppliers and U.S. Utilities:				
Foreign Purchases	14,085	15,886	17,471	16,528
Weighted-Average Price	23.27	26.52	34.19	30.69

Note: Totals may not equal sum of components because of independent rounding.
Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1994-1997).

Table E15. U.S. Broker and Trader Purchases of Uranium by Origin, Supplier, and Delivery Year, 1994-1997
(Metric Tons U Equivalent; Dollars per Kilogram U Equivalent)

Actual Deliveries	1994	1995	1996	1997
Received by U.S. Brokers and Traders of U.S.-Origin Uranium:				
Purchases	1,843	1,291	1,817	1,216
Weighted-Average Price	25.35	29.91	36.15	33.23
Received by U.S. Brokers and Traders of Foreign-Origin Uranium:				
Purchases	10,005	7,536	7,896	6,347
Weighted-Average Price	20.86	23.91	32.02	27.71
Total Received by U.S. Brokers and Traders:				
Purchases	11,848	8,827	9,714	7,563
Weighted-Average Price	21.56	24.79	32.79	28.60
Received by U.S. Brokers and Traders from Foreign Suppliers:				
Purchases	8,588	7,043	6,853	6,040
Weighted-Average Price	20.46	23.46	30.62	27.84

Note: Totals may not equal sum of components because of independent rounding.
Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1994-1997).

Table E16. Foreign Sales of Uranium from U.S. Suppliers and U.S. Utilities by Origin and Delivery Year, 1994-1997
(Metric Tons U Equivalent; Dollars per Kilogram U Equivalent)

Actual Deliveries to Foreign Suppliers and Foreign Utilities	1994	1995	1996	1997
U.S.-Origin Uranium:				
Foreign Sales	2,285	1,813	1,909	2,489
Weighted-Average Price	47.86	45.07	44.76	38.51
Foreign-Origin Uranium:				
Foreign Sales	4,538	1,971	2,516	4,045
Weighted-Average Price	20.24	25.84	30.98	28.35
Total:				
Foreign Sales	6,824	3,783	4,425	6,535
Weighted-Average Price	29.49	35.06	36.92	32.22
From U.S. Producers, U.S. Utilities, and other U.S. Suppliers:				
Foreign Sales	1,896	1,670	2,131	3,302
Weighted-Average Price	52.23	47.09	40.80	33.94
From U.S. Brokers and Traders:				
Foreign Sales	4,927	2,113	2,294	3,233
Weighted-Average Price	20.73	25.55	33.32	30.46

Notes: "other U.S. Suppliers" are U.S. converters, enrichers, and fabricators. Totals may not equal sum of components because of independent rounding.
Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1994-1997).

Table E17. Inventories of Natural and Enriched Uranium as of End of Year, 1994-1997
(Metric Tons U Equivalent)

Type of Uranium Inventory	Inventories at the End of the Year			
	1994	1995	1996	1997 ^P
U.S. Utility Inventories	25,160	22,590	25,421	24,593
Natural Uranium	16,316	15,858	16,230	17,645
Enriched Uranium ^a	8,844	6,733	9,191	6,947
U.S. Supplier Inventories	8,258	5,285	5,365	4,580
Natural Uranium	6,698	5,084	4,989	3,945
Enriched Uranium ^a	1,560	201	377	635
Total Commercial Inventories	33,418	27,875	30,786	29,173
DOE-Owned and USEC-Held Inventories^b ...	32,776	42,618	41,731	39,591
Natural Uranium	21,993	31,536	32,007	29,442
Enriched Uranium	10,783	11,081	9,724	10,150

^aIncludes amounts reported as inventories of enriched UF₆ at enrichment suppliers.

^bIncludes amounts reported as inventories by U.S. Department of Energy (DOE) and the United States Enrichment Corporation (USEC).

P = Preliminary data. Final 1996 inventory data reported in the 1997 survey

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Form EIA-858, "Uranium Industry Annual Survey" (1995-1997).

Glossary

Glossary

Contract-specified price: The delivery price determined when a contract is signed. It can be a fixed price or a base price escalated according to a given formula.

Conventional mill (uranium): A facility engineered and built principally for processing of uraniferous ore materials mined from the earth and the recovery, by chemical treatment in the mill's circuits, of uranium and/or other valued coproduct components from the processed ore.

Cost model for undiscovered resources: A computerized algorithm that uses the uranium endowment estimated for a given geological area and selected industry economic indexes to develop random variables that describe the undiscovered resources ultimately expected to be discovered in that area at chosen forward-cost categories.

Cutoff grade: The lowest grade, in percent U_3O_8 , of uranium ore at a minimum specified thickness that can be mined at specified cost.

Development drilling: Drilling done to determine more precisely size, grade, and configuration of an ore deposit subsequent to the time the determination is made that the deposit can be commercially developed.

Domestic: Domestic means within the 50 States, District of Columbia, Puerto Rico, the Virgin Islands, Guam, and other U.S. Possessions. The word "domestic" is used also in conjunction with data and information that are compiled to characterize a particular segment or aspect of the uranium industry in the United States.

Domestic purchase: A uranium purchase from a firm located in the United States.

Domestic sale: A uranium sale to a firm located in the United States.

Domestic uranium industry: Collectively, those businesses (whether U.S. or foreign-based) that operate under the laws and regulations pertaining to the conduct of commerce within the United States and its territories

and possessions and that engage in activities within the United States, its territories, and possessions specifically directed toward uranium exploration, development, mining, and milling; marketing of uranium materials; enrichment; fabrication; or acquisition and management of uranium materials for use in commercial nuclear power plants.

Enriched uranium: Uranium in which the ^{235}U isotope concentration has been increased to greater than the 0.711 percent ^{235}U (by weight) present in natural uranium.

Enrichment feed deliveries: Uranium that is shipped under contract to a supplier of enrichment services for use in preparing enriched uranium product to a specified ^{235}U concentration and that ultimately will be used as fuel in a nuclear reactor.

Enrichment services: (See Separative Work Units).

Exploration drilling: Drilling done in search of new mineral deposits, on extensions of known ore deposits, or at the location of a discovery up to the time when the company decides that sufficient ore reserves are present to justify commercial exploitation. Assessment drilling is reported as exploration drilling.

Fabricated fuel: Fuel assemblies composed of an array of fuel rods loaded with pellets of enriched uranium dioxide.

Floor price: A price specified in a market-price contract as the lowest purchase price of the uranium, even if the market price falls below the specified price. The floor price may be related to the seller's production costs.

Foreign purchase: A uranium purchase of foreign-origin uranium from a firm located outside of the United States.

Foreign sale: A uranium sale to a firm located outside the United States.

Forward cost: The operating and capital costs still to be incurred in the production of uranium from in-place reserves. By using forward costing, estimates of reserves for ore deposits in differing geological settings and status of development can be aggregated and reported for selected cost categories. Included are costs for labor, materials, power and fuel, royalties, payroll taxes, insurance, and applicable general and administrative costs. Excluded from forward cost estimates are prior expenditures, if any, incurred for property acquisition, exploration, mine development, and mill construction, as well as income taxes, profit, and the cost of money. Forward costs are neither the full costs of production nor the market price at which the uranium, when produced, might be sold.

Heap leach solutions: The separation, or dissolving-out, from mined rock of the soluble uranium constituents by the natural action of percolating a prepared chemical solution through mounded (heaped) rock material. The mounded material usually contains low grade mineralized material and/or waste rock produced from openpit or underground mines. The solutions are collected after percolation is completed and processed to recover the valued components.

In situ leach mining (ISL): The recovery, by chemical leaching, of the valuable components of an orebody without physical extraction of the ore from the ground. Also referred to as “solution mining.”

Long-term contract: One or more deliveries to occur after a period of at least 6 years following contract execution.

Market-related price: The prevailing price level in the market at a given time. It generally reflects a published spot price, is mutually agreed upon by the contracting parties, or is independently determined by an unbiased outside arbitrator.

Market-price contract: A contract in which the price of uranium is not specifically determined at the time the contract is signed but is based instead on the prevailing market price at the time of delivery. A market-price contract may include a floor price, that is, a lower limit on the eventual settled price. The floor price and the method of price escalation generally are determined when the contract is signed. The contract may also include a price ceiling or a discount from the agreed-upon market price reference.

Market-price settlement: The price paid for uranium delivery under a market-price contract. The price is commonly (but not always) determined at or sometime before delivery and may be related to a floor price, ceiling price, or discount.

Medium-term contract: One or more deliveries to occur over a period of 3 to 6 years following contract execution.

Milling of uranium: The processing of uranium from ore mined by conventional methods, such as underground or openpit, to separate the uranium from the undesired material in the ore.

National Uranium Resource Evaluation (NURE): A program begun by the U.S. Atomic Energy Commission (AEC) in 1974 to make a comprehensive evaluation of U.S. uranium resources and continued through 1983 by the AEC's successor agencies, the Energy Research and Development Administration (ERDA) and the Department of Energy (DOE). The NURE program included aerial radiometric and magnetic surveys, hydrogeochemical and stream sediment surveys, geologic drilling in selected areas, geophysical logging of selected boreholes, and geologic studies to identify and evaluate geologic environments favorable for uranium.

Nonconventional plant (uranium): A facility engineered and built principally for processing of uraniumiferous solutions that are produced during in situ leach mining, from heap leaching, or in the manufacture of other commodities, and the recovery, by chemical treatment in the plant's circuits, of uranium from the processed solutions.

Nuclear reactor: An apparatus in which a nuclear fission reaction, i.e., the splitting of atomic nuclei to release heat energy, can be initiated, controlled, and sustained at a specific rate. A reactor includes fuel (fissionable material), moderating materials to control the rate of fissioning, a heavy-walled pressure vessel to house reactor components, shielding to protect personnel, a system to conduct heat away from the reactor, and instrumentation for monitoring and controlling the reactor's systems.

Optional delivery commitment: A provision to allow the conditional purchase or sale of a specific quantity of material in addition to the firm quantity in the contract.

Processing of uranium: The recovery of uranium from solutions produced by nonconventional mining methods, i.e., in situ leach mining (ISL), a byproduct of copper or phosphate mining, or heap leaching.

Reclamation: Process of restoring surface environment to acceptable pre-existing conditions. Includes surface contouring, equipment removal, well plugging, revegetation, etc.

Restoration: The returning of all affected groundwater to its premining quality for its premining use by employing the best practical technology.

Separative Work Units (SWU): The standard measure of enrichment services. The effort expended in separating a mass F of feed of assay x_f into a mass P of product assay x_p and waste of mass W and assay x_w is expressed in terms of the number of separative work units needed, given by the expression $SWU = WV(x_w) + PV(x_p) - FV(x_f)$, where $V(x)$ is the "value function," defined as $V(x) = (1 - 2x) \ln((1 - x)/x)$.

Short-term contract: One or more deliveries to occur over a period of less than 3 years following contract execution.

Spot contract: A one-time delivery of the entire contract to occur within one year of contract execution.

Spot market: Buying and selling of uranium for immediate or very near-term delivery. It typically involves transactions for delivery of up to 500,000 pounds U_3O_8 within a year of contract execution.

Spot-market price: A transaction price concluded "on the spot," that is, on a one-time, prompt basis. The transaction usually involves only one specific quantity of product. This contrasts with a term-contract sale price, which obligates the seller to deliver a product at an agreed frequency and price over an extended period.

Unfilled requirements: Requirements not covered by usage of inventory or supply contracts in existence as of January 1 of the survey year.

Uranium: A heavy, naturally radioactive, metallic element (atomic number 92). Its two principally occurring isotopes

are ^{235}U and ^{238}U . The isotope ^{235}U is indispensable to the nuclear industry because it is the only isotope existing in nature to any appreciable extent that is fissionable by thermal neutrons. The isotope ^{238}U is also important because it absorbs neutrons to produce a radioactive isotope that subsequently decays to the isotope ^{239}Pu , which also is fissionable by thermal neutrons.

Uranium concentrate: A yellow or brown powder produced from naturally occurring uranium minerals as a result of milling uranium ore or processing uranium-bearing solutions. Synonymous with yellowcake, U_3O_8 , or uranium oxide.

Uranium deposit: A discrete concentration of uranium mineralization that is of possible economic interest.

Uranium endowment: The uranium that is estimated to occur in rock with a grade of at least 0.01 percent U_3O_8 . The estimate of the uranium endowment is made before consideration of economic availability and any associated uranium resources.

Uranium hexafluoride (UF_6): A white solid obtained by chemical treatment of U_3O_8 and which forms a vapor at temperatures above 56 degrees Centigrade. UF_6 is the form of uranium required for the enrichment process.

Uranium ore: Rock containing uranium mineralization in concentrations that can be mined economically, (typically 1 to 4 pounds of U_3O_8 per ton or 0.05 to 0.20 percent U_3O_8).

Uranium oxide: Uranium concentrate or yellowcake. Abbreviated as U_3O_8 .

Uranium property: A specific piece of land with uranium reserves that is held for the ultimate purpose of economically recovering the uranium. The land can be developed for production or undeveloped.

Uranium reserves: Estimated quantities of uranium in known mineral deposits of such size, grade, and configuration that the uranium could be recovered at or below a specified production cost with currently proven mining and processing technology and under current law and regulations. Reserves are based on direct radiometric and chemical measurements of drill holes and other types of sampling of the deposits. Mineral grades and thickness,

spatial relationships, depths below the surface, mining and reclamation methods, distances to milling facilities, and amenability of ores to processing are considered in the evaluation. The amount of uranium in ore that could be exploited within the chosen forward-cost levels are estimated in accordance with conventional engineering practices.

Uranium resources categories: Three categories of uranium resources are used to reflect differing levels of confidence in the resources reported. Reasonably assured resources (RAR), estimated additional resources (EAR), and speculative resources (SR) are described below.

Reasonably assured resources (RAR): The uranium that occurs in known mineral deposits of such size, grade, and configuration that it could be recovered within the given production cost ranges, with currently proven mining and processing technology. Estimates of tonnage and grade are based on specific sample data and measurements of the deposits and on knowledge of deposit characteristics. RAR correspond to DOE's uranium reserves category.

Estimated additional resources (EAR): The uranium in addition to RAR that is expected to occur, mostly on the basis of direct geological evidence, in extensions of well-explored deposits, little explored

deposits, and undiscovered deposits believed to exist along well-defined geological trends with known deposits, such that the uranium can subsequently be recovered within the given cost ranges. Estimates of tonnage and grade are based on available sampling data and on knowledge of the deposit characteristics, as determined in the best-known parts of the deposit or in similar deposits. EAR correspond to DOE's probable potential resources category.

Speculative resources (SR): Uranium in addition to EAR that is thought to exist, mostly on the basis of indirect evidence and geological extrapolations, in deposits discoverable with existing exploration techniques. The locations of deposits in this category can generally be specified only as being somewhere within given regions or geological trends. The estimates in this category are less reliable than estimates of RAR and EAR. The category of SR corresponds to DOE's possible potential resources plus speculative potential resources categories combined.

Usage Agreement: Contracts held by enrichment customers that allow feed material to be stored at the enrichment plant site in advance of need.

Yellowcake: (See uranium oxide).