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Uranium Purchases Report 1995

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Preface

This report is the fourth in a series of annual publications by the Energy Information Administration required by the *Energy Policy Act of 1992* (EPACT 1992), Public Law 102–486 (October 24, 1992), Subtitle B, 42 USC § 2296b–4 Section 1015 of P.L. 102–486, which provides 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. "*

This information is required to be made available to the Congress annually. Data reported by domestic nuclear utility companies in their responses to the 1994 through 1995 "Uranium Industry Annual Survey," Form EIA–858, Schedule B, "Uranium Marketing Activities," are provided in response to the requirements in the EPACT 1992.

Information published in this report are U.S. utility purchases of uranium and enrichment services by origin country and seller. The appendix contains an explanation of Form EIA–858 survey methodologies with emphasis on the processing of Schedule B data. Also, this report contains a glossary of terms and additional purchase information.

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Uranium Purchases by U.S. Utilities

During 1995, the owners and operators of U.S. civilian nuclear electric generating units took delivery of 43.4 million pounds U_3O_8 equivalent (U_3O_8e) from suppliers (Table 1). The 33 firms that supplied the uranium to the utilities are shown in the following list. Seventeen of the 33 firms (designated with an asterisk) made deliveries under new purchase contracts in 1995.

Uranium Sellers to U.S. Utilities

British Nuclear Fuel Ltd. (BNFL)*
Cameco Corporation*
China Nuclear Energy Industry Corp. (CNEIC)
COGEMA, Inc.
COGEMA Mining, Inc. (Total Minerals Corp.)
Converdyn*
Energy Fuels Exploration Company
Energy Fuels Corporation
Energy Resources of Australia
Everest Exploration, Inc.
Geomex Minerals, Inc.*
Global Nuclear Supply Service Ltd.*
Malapai Resources Company
Nuexco Trading Corporation
Nuclear Fuels Corporation of South Africa*
NUKEM, Inc.*
NYNCO Trading Limited*
Olympic Dam Corporation*
Pathfinder Mines Corporation
Power Resources, Inc.*
Rio Algom Mining Corporation*
Rio Grande/Nuclear Fuels
RTZ Minerals Services Limited
Sheep Mountain Partners
Siemens Nuclear Power Corporation
The Uranium Exchange Company*
U.S. Energy Corporation
UG U.S.A., Inc.*
Uranerz Exploration & Mining Ltd.*
Uranerz U.S.A., Inc.*
Urangesellschaft Mbh
Uranium Resources, Inc.*
Wolfco Trading Inc.*

Of the 43.4 million pounds delivered to U.S. utilities in 1995, natural uranium (U_3O_8 and UF_6) accounted for 98 percent and enriched uranium accounted for 2 percent (Table 1). The average price for the total deliveries was $11.25 per pound. The primary origin for the uranium delivered to U.S. utilities was Canada, followed by uranium from Russia and the United States. Foreign purchases accounted for 21.1 million pounds or 49 percent of total deliveries to utilities, compared with 41 percent in 1994 (Table 2). The domestic– and foreign–origin uranium that was purchased from U.S.–based companies are reported as domestic purchases.

Enrichment Services Purchased by U.S. Utilities

The amount of separative work units (SWU) purchased by U.S. utilities under enrichment service contracts that were delivered in 1995 was 9.5 million SWU (Table 3). The 8 firms that were reported as the sellers of enrichment services for these SWU deliveries in 1995 are shown in the following list.

Enrichment Service Sellers to U.S. Utilities

COGEMA, Inc.
Global Nuclear Supply Service, Ltd.
Nuexco Trading Corporation
NUKEM, Inc.
UG U.S.A., Inc.
United States Enrichment Corporation (USEC)
Urenco
Wolfco Trading, Inc.

Seventy–one percent of the enrichment was conducted at U.S. enrichment plants under United States Enrichment Corporation operation. The remaining enrichment for U.S. utilities was performed in France, Germany, the Netherlands, Russia, and the United Kingdom (Table 3).

Uranium Enrichment Feed

In 1995, enrichment feed deliveries by U.S. utilities totaled 44.3 million pounds U_3O_8e shipped to both domestic and foreign enrichment suppliers, 18 percent above the 1994 level (Table 4). Deliveries consisted of 21 percent of U.S.–origin and 79 percent of foreign–origin uranium. Utility enrichment feed deliveries to U.S. enrichers in 1995 totaled 33.9 million pounds (77 percent of total deliveries). Feed deliveries to non–U.S. enrichers in 1995 totaled 10.4 million pounds (Table 4).

Table 1. U.S. Utility Purchases from Suppliers of Uranium by Origin Country and Delivery Year, 1994–1995
(Thousand Pounds U_3O_8 Equivalent, Dollars per Pound U_3O_8 Equivalent)

Material Type and Origin Country	Uranium Deliveries in 1994		Uranium Deliveries in 1995	
	Purchases	Weighted–Average Price	Purchases	Weighted–Average Price
Material Type:				
Natural U_3O_8	28,553	10.66	36,823	11.32
Natural UF_6	7,111	9.85	5,753	11.10
Enriched Uranium	2,617	9.00	865	9.29
Total Quantity	**38,281**	**10.40**	**43,441**	**11.25**
Country of Origin:				
Australia	2,812	9.88	4,448	10.98
Brazil	W	W	0	—
Canada	14,613	10.49	16,799	11.82
China	1,696	9.56	293	11.49
France	W	W	W	W
Gabon	W	W	W	W
Germany	W	W	W	W
Mongolia	W	W	W	W
Namibia	796	9.76	530	9.88
Netherlands	0	—	W	W
Niger	0	—	W	W
NIS[a] Total	**8,665**	**8.71**	**14,345**	**9.36**
Kazakhstan	2,777	8.94	3,097	8.99
Kyrgyzstan	W	W	W	W
Russia	1,779	8.81	5,500	9.45
Tajikistan	W	W	W	W
Ukraine	W	W	W	W
Uzbekistan	3,550	8.35	3,895	8.61
South Africa	1,106	9.64	1,002	12.57
Spain	0	—	W	W
United Kingdom	W	W	W	W
Foreign Total Quantity	**30,563**	**9.97**	**38,195**	**10.84**
United States	7,718	12.08	5,246	14.20
Total Quantity	**38,281**	**10.40**	**43,441**	**11.25**

[a]NIS = Newly Independent States.
W = Withheld to avoid disclosure of individual company data.
— = Not applicable.
Source: Energy Information Administration, Form EIA–858, "Uranium Industry Annual Survey" (1994–1995).

Table 2. Uranium Purchases by U.S. Utilities, 1994–1995
(Thousand Pounds U_3O_8 Equivalent, Dollars per Pound U_3O_8 Equivalent)

Category	Uranium Deliveries in 1994		Uranium Deliveries in 1995	
	Purchases	Weighted–Average Price	Purchases	Weighted–Average Price
Total	**38,281**	**10.40**	**43,441**	**11.25**
Domestic Purchases (Non–Imports)	**22,745**	**10.30**	**22,302**	**11.11**
By material type: Natural U_3O_8	15,150	10.63	18,806	11.05
Natural UF_6	5,498	9.75	3,496	11.44
Enriched Uranium	2,097	9.42	0	—
By origin country: Australia	1,297	9.52	2,333	10.64
Canada	4,622	10.06	2,326	13.19
China	1,616	9.42	W	W
France	W	W	0	—
Gabon	W	W	0	—
Germany	W	W	W	W
Mongolia	W	W	W	W
Namibia	425	9.26	W	W
NIS[a] Total	**5,327**	**8.38**	**11,107**	**9.26**
Kazakhstan	976	9.15	1,760	8.30
Kyrgyzstan	W	W	W	W
Russia	762	9.24	3,776	9.47
Tajikistan	W	W	W	W
Ukraine	0	—	W	W
Uzbekistan	3,223	7.95	W	W
South Africa	1,106	9.64	W	W
United Kingdom	W	W	W	W
United States	7,718	12.08	5,246	14.20
Foreign Purchases (Imports)	**15,536**	**10.53**	**21,139**	**11.39**
By material type: Natural U_3O_8	13,403	10.70	18,017	11.59
Natural UF_6	1,613	10.20	2,257	10.56
Enriched Uranium	520	7.30	865	9.29
By origin country: Australia	1,515	10.20	2,115	11.35
Brazil	W	W	0	—
Canada	9,991	10.69	14,473	11.60
China	80	12.43	W	W
France	0	—	W	W
Gabon	W	W	W	W
Namibia	371	10.34	W	W
Netherlands	0	—	W	W
Niger	0	—	W	W
NIS[a] Total	**3,338**	**9.23**	**3,238**	**9.71**
Kazakhstan	1,801	8.83	1,337	9.90
Kyrgyzstan	W	W	0	—
Russia	1,017	8.49	1,724	9.42
Tajikistan	0	—	W	W
Ukraine	W	W	0	—
Uzbekistan	327	12.25	W	W
South Africa	0	—	W	W
Spain	0	—	W	W

[a]NIS=Newly Independent States.
– = Not Applicable. W = Withheld to avoid disclosure of company identifiable data. Note: Totals may not equal sum of components because of independent rounding.
Source: Energy Information Administration, Form EIA–858, "Uranium Industry Annual Survey" (1994–1995).

Table 3. U.S. Utility Purchases of Enrichment Services and Uranium Feed Deliveries to Enrichers by Origin Country, 1994–1995

Origin Country of Enrichment Services and Uranium Feed	Deliveries in 1994		Deliveries in 1995	
	Enrichment Services measured as Separative Work Units (thousand SWU)	**Enrichment Feed** (thousand pounds U_3O_8 equivalent)	**Enrichment Services measured as Separative Work Units** (thousand SWU)	**Enrichment Feed** (thousand pounds U_3O_8 equivalent)
Australia	–	2,880	–	3,300
Brazil	–	W	–	W
Canada	–	14,868	–	17,719
China	237[a]	1,429	0[a]	W
France	549[b]	W	867[b]	W
Gabon	–	W	–	218
Germany	W[c]	W	W[c]	365
Kazakhstan	–	3,470	–	2,469
Kyrgyzstan	–	W	–	W
Mongolia	–	W	–	W
Namibia	–	804	–	738
Netherlands	W[d]	0	W[d]	0
Russia	421[e]	1,764	1,108[e]	7,008
South Africa	0[f]	1,195	0[f]	709
Spain	–	W	–	W
Tajikistan	–	0	–	805
Ukraine	–	W	–	401
United Kingdom	W[g]	W	460[g]	W
Uzbekistan	–	715	–	514
Foreign Total Quantity	**1,676**	**29,086**	**2,800**	**35,118**
United States	7,521[h]	8,522	6,741[h]	9,176
Total Quantity	**9,197**	**37,608**	**9,540**	**44,294**

[a]CNEIC (China Nuclear Energy Industry Corp.) enrichment plant, Lanzhou Province, Peoples Republic of China.
[b]Eurodif enrichment plant, Georges Besse, France.
[c]Urenco enrichment plant, Gronau, Germany.
[d]Urenco enrichment plant, Almelo, Netherlands.
[e]Techsnabexport (Tenex) enrichment plants, Angarsk, Russia; Ekaterinburg, Russia; Krasnoyarsk, Russia; and Tomsk, Russia.
[f]AEC (Atomic Energy Corporation of South Africa, Ltd.) enrichment plant, Valindaba, South Africa.
[g]Urenco enrichment plant, Capenhurst, United Kingdom.
[h]USEC enrichment plants, Paducah, Kentucky and Portsmouth, Ohio.
– = Not Applicable. W = Withheld to avoid disclosure of company identifiable data.
Note: Totals may not equal sum of components because of independent rounding.
Source: Energy Information Administration, Form EIA–858, "Uranium Industry Annual Survey" (1994–1995).

Table 4. U.S. Utility Enrichment Feed Deliveries, 1994 – 1995
(Thousand Pounds U_3O_8 Equivalent)

Category		Uranium Feed Deliveries to Enrichment Plants	
		1994	1995
Enrichment Feed Deliveries (Total)[a]		**37,608**	**44,294**
To U.S. DOE/USEC (Total)[b]		**33,498**	**33,901**
U.S. Origin Uranium (Total)		**8,471**	**7,786**
Non–U.S. Origin Uranium (Total)		**25,027**	**26,115**
By origin country:	Australia	2,880	2,890
	Brazil	W	W
	Canada	13,870	15,533
	China	W	W
	France	W	W
	Gabon	W	W
	Germany	W	365
	Kazakhstan	2,041	W
	Mongolia	W	W
	Namibia	804	738
	Russia	992	1,936
	South Africa	W	W
	Spain	W	W
	Tajikistan	0	805
	Ukraine	0	W
	United Kingdom	W	W
	Uzbekistan	340	W
To Non–U.S. Enrichers (Total)[c]		**4,110**	**10,393**
U.S. Origin Uranium (Total)		**51**	**1,390**
Non – U.S. Origin Uranium (Total)		**4,059**	**9,003**
By origin country:	Australia	0	410
	Canada	998	2,186
	China	W	0
	Gabon	0	W
	Kazakhstan	1,429	W
	Kyrgyzstan	W	W
	Russia	772	5,072
	South Africa	W	W
	Ukraine	W	W
	Uzbekistan	375	W

[a]The total quantity of utility Enrichment Feed Deliveries shown for 1994 through 1995 represents, for each year, the sum of materials shipped for enrichment to United States Department of Energy (USDOE) and/or United States Enrichment Corporation (USEC), and to Non–U.S. Enrichers.
[b]The total quantity for 1994 through 1995 shipped to USDOE or USEC represents, for each year, the sum of U.S. Origin Uranium and Non–U.S. Origin Uranium.
[c]The total quantity for 1994 through 1995 shipped to Non–U.S. enrichers represents, for each year, the sum of U.S. Origin Uranium and Non–U.S. Origin Uranium.
W=Withheld to avoid disclosure of company identifiable data.

Source: Energy Information Administration, Form EIA–858, "Uranium Industry Annual Survey" (1994–1995).

Appendix

Survey Methodology

Survey Design

Form EIA–858, "Uranium Industry Annual Survey," was used to collect information from all companies known or believed to have been involved in the U.S. uranium industry during 1995. Included in this survey are domestic utilities that own and/or operate nuclear power reactors. The 1995 survey form was mailed to respondents in December 1995, and was due back in March 1996. Respondents to the "Uranium Industry Annual Survey" were asked to provide data current to the end of 1995 about their Uranium Raw Materials Activities (Schedule A) and Uranium Marketing Activities (Schedule B).

In particular, Schedule B covers: uranium transaction parameters including name of the other party; type of transaction; uranium materials covered; origin for the uranium materials; conversion and enrichment services, delivery destination; importation and exportation; pricing mechanism; schedule of uranium deliveries with corresponding prices; uranium inventories; materials shipped for enrichment; projected enrichment feed deliveries; unfilled market requirements; and the amount of enrichment services and loaded fuel assemblies by U.S. utilities. Quantities of uranium reported are as equivalent U_3O_8 rounded to the nearest thousand pounds.

The data collected on Form EIA–858 are subject to several sources of error. These sources are: (1) *coverage* (the respondent frame might not be complete or, on the other hand, there might be double counting); (2) *nonresponse* (all units surveyed might not respond or might 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 a universe survey rather than a sample survey, sampling errors do not affect the data provided in this report. Although it is not possible to present estimates of non–sampling error, precautionary steps were taken at each stage of the survey design and operation to minimize the possible occurrence of these errors. These steps are described below, and the errors they were designed to minimize are named (in parenthesis).

Survey Universe/Frame (Coverage Errors)

The survey universe includes all nuclear utilities involved in the U.S. uranium industry. The criteria for responding to Schedule B are firms that during 1995: (1) held existing contracts covering the sale, purchase, exchange, loan, loan repayment, or custody of uranium or entered into similar new contracts; (2) held inventories of uranium in any form excluding reactor–inserted, fabricated fuel; (3) maintained a uranium–inventory policy; (4) made actual deliveries of uranium feed materials to any enrichment supplier; and/or (5) purchased enrichment services.

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. As it specifically relates to Schedule B, the frame was intended to cover the following: all utilities owning nuclear–fueled generating stations, fuel converters and fabricators, and utilities with whole or partial ownership in operating or planned uranium–fueled power plants.

Survey Procedures (Nonresponse)

The survey forms were sent by 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. All nuclear utilities currently conducting business in the U.S. uranium industry were contacted during this survey.

The Form EIA–858 is a self–administered questionnaire requesting data about many areas of company operations. The scope of the questions is necessarily broad, and self–reporting of company–specific data are required.

Cooperation from industry on the 1995 survey was good. A large number of respondents returned the completed form within the specified deadline. Those that had not responded by the due dates 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 some instances, company data were modified/collected through telephone conversations made to clarify items reported/omitted on their submissions.

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

The survey forms were logged in and reviewed by agency personnel prior to data entry into the Uranium Industry Annual System, an automated data base containing all current and historical data from each company's submission. The data base is maintained on the EIA computer facility in Washington, D.C. After entry into the data base, a copy of each Schedule B was distributed to the EIA's Analysis and Systems Division analyst for review and approval. The submissions were checked for internal consistency, and the reported data were compared with previous collections of similar data. After reviewing the 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 differing interpretations of the data item definitions. Computer edits were also used to identify keypunch errors, out–of–range values, and unlikely data combinations. These edits either were 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 data were documented.

Response Rates

Schedule B of Form EIA–858 was mailed to 87 firms. Overall, 100 percent of the firms responded to EIA with the data as requested for the survey sections as applicable to individual firms.

Missing Data

Omissions of data identified during the prescreening and editing of the data fell into two categories: (1) data that were withheld because of contractual constraints, or (2) because particular data were unknown. Respondents were contacted regarding omissions to verify that the data could not be reported. Only confirmed company data are contained in the data base and included in this report.

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 report would not associate those data with a particular company. This policy 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 reporting 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 the report. 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.

Glossary

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.

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 (SWU).

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

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.

Prices of Uranium: The quantity–weighted average of the prices paid for deliveries of uranium as reported on the Form EIA–858, "Uranium Industry Annual Survey," as purchases of either U_3O_8, natural UF_6, or enriched uranium.

Purchases of Uranium: The amount of uranium material that is delivered during a survey year as reported on the Form EIA–858, "Uranium Industry Annual Survey" (UIAS), as purchases of either U_3O_8, natural UF_6, or enriched UF_6. The amount of uranium material under other types of contracts reported on the UIAS, i.e., loans and exchanges, is excluded.

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

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.

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

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