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Report to the Committee on Governmental Affairs, U.S. Senate

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NUCLEAR NONPROLIFERATION

Information on Nuclear Exports Controlled by U.S.-EURATOM Agreement

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Resources, Community, and
Economic Development Division

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The Honorable William V. Roth, Jr.
Chairman
The Honorable John Glenn
Ranking Minority Member
Committee on Governmental Affairs
United States Senate

The Agreement for Cooperation Between the United States of America and the European Atomic Energy Community Concerning Peaceful Uses of Atomic Energy (U.S.-EURATOM agreement) expires on December 31, 1995. The U.S.-EURATOM agreement controls the exports of certain nuclear materials—specifically, enriched uranium, natural and depleted uranium with specific nuclear uses, plutonium, thorium, and nuclear reactors and their major components and parts—between the United States and 15 western European countries.[1] If a new agreement is not concluded before the expiration date, the export of these U.S. nuclear materials and components to EURATOM would be prohibited. In addition, the expiration of the U.S.-EURATOM agreement would also prohibit Japan from transferring U.S.-origin nuclear materials to EURATOM because U.S.-origin nuclear materials cannot be transferred to countries that do not have in place an agreement for cooperation with the United States.

This report responds to your request for information on (1) the amount of U.S. nuclear exports to EURATOM and Japan and U.S.-origin nuclear materials transferred from Japan to EURATOM, (2) the value of U.S. nuclear exports to EURATOM and Japan, and (3) the nuclear industry's views on the potential impact on nuclear commerce with EURATOM and Japan if the U.S.-EURATOM agreement is not renewed.

Results in Brief

From 1980 through 1994, the United States exported about 32.6 million kilograms (kgs) and about 11 million kgs of nuclear materials to EURATOM and Japan, respectively, and Japan transferred about 4.7 million kgs of U.S.-origin nuclear materials to EURATOM. Depleted, natural, and enriched uranium constituted the largest amounts of nuclear materials exported to EURATOM and Japan. Depleted uranium is very dense and can be used in

[1]EURATOM is composed of 15 countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom. These countries are treated as a single entity for the purposes of trade in and the transfer of nuclear materials to the United States. Because Austria, Finland, and Sweden joined EURATOM in 1995, they are not included in the data on nuclear exports presented in this report.

high-impact projectiles and as a shielding material against radiation. Both natural and enriched uranium are used for fuel in nuclear power reactors. Enriched uranium constituted the largest amount—totaling about 4.5 million kgs—of U.S.-origin nuclear material transferred from Japan to EURATOM during 1980 through 1994. Japan also transferred a total of 37,187 kgs of U.S.-origin plutonium to EURATOM during this period. According to a Nuclear Regulatory Commission (NRC) official, no nuclear power reactors were exported to EURATOM or Japan from 1980 through 1994. However, NRC issued licenses for the export of four major reactor components for use in research and nuclear power reactors to EURATOM in 1986, 1991, and 1992. The United States has also exported nuclear reactor equipment and components to Japan annually from 1980 through 1994 under NRC's general licenses.

The U.S. Department of Commerce has valued U.S. nuclear materials exported from 1989 through August 1994 at about $1.1 billion for EURATOM countries and about $4 billion for Japan. For fiscal years 1989 through 1993, the value of U.S. enrichment services charged to EURATOM and Japan was $168 million and $1.6 billion, respectively. According to U.S. nuclear industry officials, technical and engineering services related to exported nuclear materials, such as uranium mining, enrichment, and fuel fabrication, should be factored into the value of U.S. nuclear exports.

According to United States Enrichment Corporation officials, if the U.S.-EURATOM agreement expires, the future of the Corporation's uranium enrichment services could be seriously affected. Corporation officials estimated that contracts with EURATOM worth approximately $160 million would terminate and that other contracts worth about $470 million would be in jeopardy if the agreement expires. Furthermore, another $1.8 billion in potential new contracts with EURATOM and Japan could be lost.

Background

EURATOM, a group of 15 western European countries in the European Union, was established in 1957 to promote and facilitate the growth of nuclear industries through the research and development of nuclear energy in the Union, to ensure a supply of nuclear materials, and to foster progress in the peaceful uses of nuclear energy. Figure 1 shows EURATOM's 15 member countries.

Figure 1: Map of EURATOM Member Countries

The U.S.-EURATOM agreement was signed in 1958. According to a State Department official, the agreement has served as the basis for substantial and historic peaceful nuclear cooperation and trade between the United States and the EURATOM countries for nearly 40 years. Negotiations are currently under way to try to secure a new U.S.-EURATOM agreement before the present agreement expires at the end of 1995. According to a State Department official, if a new agreement is not concluded prior to the expiration date, significant nuclear commerce between the two parties must be suspended. According to a Department of Energy (DOE) official, the existing U.S.-EURATOM agreement prohibits the EURATOM countries from using U.S.-origin nuclear materials or equipment for nuclear weapons or for other military purposes, and it requires that EURATOM safeguards or controls be applied to U.S.-origin materials in a EURATOM country. These safeguards are augmented by full-scope International Atomic Energy Agency safeguards in the EURATOM states that do not have nuclear weapons. The EURATOM nations are required to obtain U.S. consent before transferring U.S.-origin nuclear materials or equipment to a third party outside of the European Union. However, the agreement does not contain any other U.S. consent rights and therefore differs significantly from other U.S. nuclear cooperation agreements, which contain U.S. consent rights over the use (including reprocessing) of U.S.-origin nuclear materials.

Quantities of U.S. Nuclear Materials Exported to EURATOM and Japan From 1980-94

The largest amount of U.S. nuclear materials exported to EURATOM and Japan during the last 15 years was made up of depleted, natural, and enriched uranium. Table 1 shows the total amount of U.S. nuclear materials exported to EURATOM from 1980 through 1994 that are controlled by the agreement. Table 2 summarizes the total amount of nuclear materials exported to Japan during the same period. (App. I contains detailed information on U.S. exports to EURATOM and Japan.)

Table 1: Summary of U.S. Nuclear Materials Exported to EURATOM, 1980-94

In kilograms

Nuclear material	Quantity
Depleted uranium	14,649,985.000
Natural uranium	11,886,101.000
Enriched uranium	6,049,307.000
Thorium	3,188.000
Uranium-233	0.062
Plutonium	32.800
Plutonium-242	0.094
Plutonium-238	0.099

Table 2: Summary of U.S. Nuclear Materials Exported to Japan, 1980-94

In kilograms

Nuclear material	Quantity
Enriched uranium	10,031,810.000
Natural uranium	917,621.000
Depleted uranium	7,937.000
Thorium	2,705.000
Uranium-233	0.056
Plutonium	2.420
Plutonium-242	0.007
Plutonium-238	0.019

Quantities of U.S.-Origin Nuclear Materials Transferred From Japan to EURATOM From 1980-94

Japan uses enriched and natural uranium as fuel for nuclear power reactors. The used or spent fuel is transferred to EURATOM for reprocessing, which chemically separates the depleted uranium and plutonium. Enriched uranium, totaling 4,542,383 kgs, constituted the largest amount of U.S.-origin nuclear materials transferred from Japan to EURATOM. From 1980 through 1994, Japan transferred to EURATOM between 115,651 kgs and 404,935 kgs annually of enriched uranium. Japan also exported about 37,187 kgs of plutonium to EURATOM during this period. Table 3 summarizes the total amount of U.S.-origin nuclear materials Japan transferred to EURATOM during the period. (App. I contains information on the amount of U.S.-origin nuclear materials Japan transferred to EURATOM annually during this period.)

Table 3: Summary of U.S.-Origin Nuclear Materials Transferred From Japan to EURATOM, 1980-94

In kilograms

Nuclear material	Quantity
Enriched uranium	4,542,383.000
Depleted uranium	98,178.000
Plutonium	37,187.000

Exports of Reactors and Reactor Components

According to NRC officials, no nuclear power reactors were exported to EURATOM or Japan from 1980 through 1994. However, NRC issued licenses for the export of four major reactor components for use in research and nuclear power reactors to EURATOM in 1986, 1991, and 1992. In addition, nuclear reactor equipment and components have been exported by the United States to Japan annually between 1980 and 1994 under NRC's general licenses.

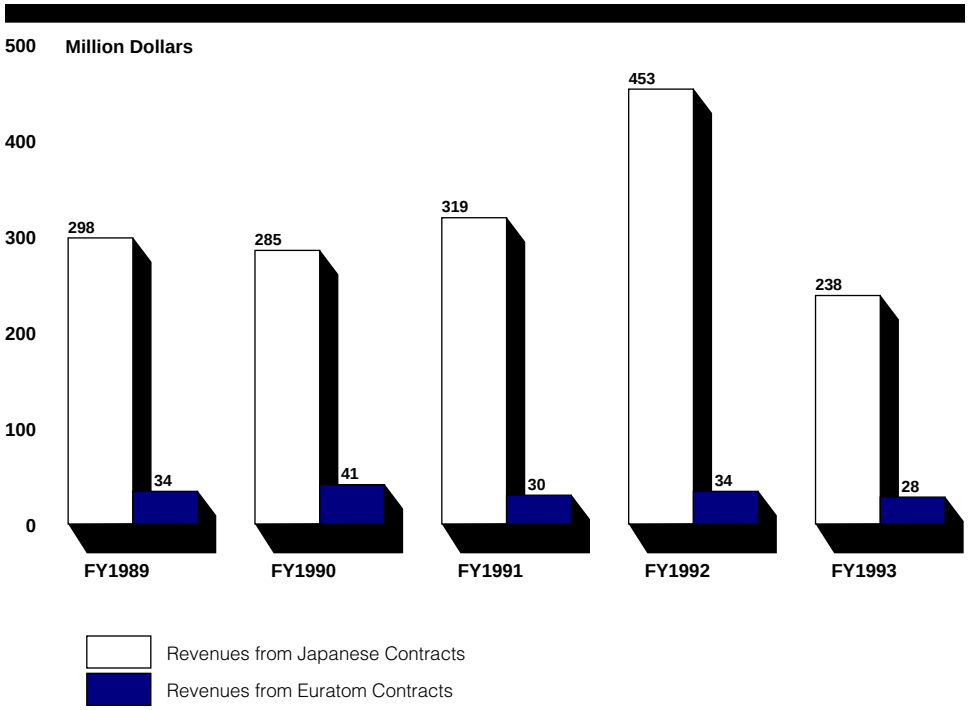
Dollar Value of U.S. Nuclear Exports to EURATOM and Japan From 1989 Through August 1994

We obtained the dollar values of the uranium and plutonium exports from the Department of Commerce's National Trade Data Base. However, this data base excludes the cost of loading the merchandise aboard the exporting carrier and also excludes freight, insurance, and any other charges or transportation costs beyond the port of exportation. The reliability of the data also depends on the accuracy of reporting by shippers on their export declarations. According to the Department of Commerce's data base, the dollar value of U.S. exports to EURATOM countries of uranium (natural, enriched, and depleted) and plutonium in 1989 through August 1994 was about $1.1 billion. The value of these U.S. exports to Japan for the same period was about $4 billion. (App. II contains detailed information on the dollar value of U.S. exports to EURATOM and Japan.)

U.S. Uranium Enrichment Services

According to U.S. nuclear industry officials, the services related to exported nuclear materials, such as uranium mining, enrichment, and fuel fabrication, should be factored into the value of U.S. nuclear exports. In the past, DOE provided uranium enrichment services to EURATOM and Japan. In 1993, uranium enrichment services were transferred to the U.S. Enrichment Corporation (USEC), a government-owned corporation, which was created to operate the U.S.-owned uranium enrichment plants and to market enrichment services. We contacted DOE and USEC to obtain the amount billed to EURATOM and Japan for enrichment services from 1989 through 1994. According to information from DOE, EURATOM was billed a total of $167,527,507 for enrichment services in fiscal years 1989 through 1993. Japan was billed a total of $1,593,567,205 for the same period. DOE's billings under EURATOM and Japanese contracts, by fiscal year (FY), are shown in figure 2.

Figure 2: DOE's Revenues for Uranium Enrichment Services for FYs 1989-93



Note: DOE's uranium enrichment services were transferred to USEC after FY 1993.

Source: DOE's Oak Ridge Operations Office.

The amounts billed by DOE included the cost of enriching the uranium delivered to the enrichment plant and of packaging and handling the services at the enrichment plant. The enriched uranium is delivered to the customer at the enrichment plant, but its cost does not include any subsequent services, such as fabricating reactor fuel assemblies. According to USEC, the amount billed under Japanese contracts for the period from 1989 through 1994 was $350 million to $400 million per year.

U.S. Nuclear Industry's Views on Potential Impact of Nonrenewal of Agreement on Nuclear Commerce With EURATOM and Japan

Industry representatives anticipate that if the U.S.-EURATOM agreement is allowed to expire, EURATOM and Japan would turn to other suppliers of nuclear products and services outside the United States. U.S. participation in the European nuclear markets would be greatly reduced. In addition, because Japan also exports U.S.-origin spent fuel to EURATOM for reprocessing, Japan would be less likely to purchase uranium fuel sources from the United States in the future. The absence of a U.S.-EURATOM agreement would prohibit Japan from transferring this U.S.-origin spent fuel for reprocessing in any EURATOM country.

Furthermore, these industry representatives point out that part of nuclear commerce includes relationships with the customers and the guarantee of reliable supply and services to them. A break in any of these ties, such as a failure to renew the U.S.-EURATOM agreement, would weaken the U.S. nuclear industry substantially, because the industry needs both its domestic and foreign markets. U.S. nuclear industry representatives stated that the nuclear industry is a market industry that can exist only in a global environment.

According to USEC officials, if the U.S.-EURATOM agreement for cooperation expires, USEC's future enrichment services would be seriously affected. Specifically, existing contracts with EURATOM, worth approximately $160 million, could be terminated. Other contracts, valued at approximately $470 million, would be in jeopardy. Another $1.8 billion in potential new business from EURATOM and Japan might be lost. According to a nuclear industry representative, the U.S. share of the European nuclear industry market currently is about $100 million and may reach $300 million annually after the year 2000. In addition, Japan currently is the largest single foreign purchaser from U.S. suppliers of nuclear power systems equipment, materials, and services. In the next 5 years, according to industry officials, anticipated U.S. participation in construction, equipment, start-up services, spare parts, and fuel for 10 nuclear power plants in Japan is expected to amount to about $500 million to $800 million annually throughout the plants' lives.

Agency Comments

During May 1995, we provided drafts of this report to officials in NRC and the Departments of Commerce, Energy, and State to obtain their comments on the facts presented in this report. In general, these officials agreed with the facts presented in the draft report. NRC officials, including the Director, Division of Nonproliferation, Exports, and Multilateral Relations, Office of International Programs, made several editorial

suggestions to improve the clarity of the information and noted that they had some questions about the Department of Commerce's National Trade Data Bank information presented in table II.8 in appendix II. In particular, NRC officials stated that they were puzzled by the reported plutonium sales to some of the listed countries, especially Denmark, Greece, and Portugal. According to the NRC officials, these countries have very small nuclear research programs and no nuclear power programs; thus, they doubt that these countries have in fact imported plutonium from the United States. In addition, NRC stated that NRC's export licensing data base shows no licenses for exports to Greece or Portugal, one small (0.005 kg) plutonium export case for Denmark, and only three plutonium export cases for Spain. However, NRC noted that U.S.-supplied nuclear materials to any country within EURATOM can be freely transferred within EURATOM without prior notification to, or approval by, the United States. Thus, according to NRC, it is possible, although not considered likely, that U.S.-supplied plutonium has gone to the countries in question and has been reported to the Department of Commerce's National Trade Data Bank system without appearing in NRC's export licensing records. (The text of NRC's comments appears in app. III.)

In their review of the draft, Department of Commerce officials, including officials at the Bureau of Export Administration, acknowledged the differences in NRC's export licensing data base, DOE's data base, and the National Trade Data Bank's data. However, neither the Department of Commerce nor DOE has determined why these data bases differ. According to the Department of Commerce officials, they may, at a later date, examine why these differences exist. According to a DOE official, DOE is attempting to determine why the differences exist between the data bases. It was not within the scope of our review to determine why the various data bases differ. (The text of the Department of Commerce's comments appears in app. IV.)

DOE officials, including the Acting Director, Office of Nonproliferation and National Security, reviewed the draft and had no comments on the facts presented. DOE stated that it is confident that a new U.S.-EURATOM agreement will be achieved before the December 31, 1995, expiration of the current agreement. (The text of the Department of Energy's comments appears in app. V.) The State Department's Foreign Affairs Officer, Office of Nuclear Energy Affairs, Bureau of Political-Military Affairs, reviewed the draft and had no comments on the facts presented in the report. (The text of the Department of State's comments appears in app. VI.)

Scope and Methodology

To determine what nuclear commerce items are subject to export controls under the U.S.-EURATOM agreement, we interviewed officials in NRC's Office of International Programs, Division of Nonproliferation, Exports, and Multilateral Relations. We reviewed the export license requirements covered by 10 C.F.R. part 110. In addition, we obtained data on NRC's approved licenses for U.S. nuclear material exports to EURATOM and Japan for 1980 through 1994 (the period selected was judgmental) from NRC's Office of International Programs, Division of Nonproliferation, Exports, and Multilateral Relations.

To determine what data bases contain data on nuclear material exports, we interviewed officials at DOE's Energy Information Administration (EIA); the Program Manager for DOE's Nuclear Materials Management and Safeguards System (NMMSS), and NMMSS officials at the Oak Ridge Operations Office in Oak Ridge, Tennessee; officials at the Customs EXODUS Command Center; NRC officials in the Office of International Programs, Division of Nonproliferation, Exports, and Multilateral Relations; and U.S. nuclear industry representatives, including the Nuclear Energy Institute, General Electric, Energy Resources International, Inc., and Edlow International, Inc. On the basis of these discussions, we found that the best data available on U.S. nuclear exports are contained in the NMMSS data base, which accounts for U.S. nuclear material exports controlled under the U.S.-EURATOM agreement. The information on exported nuclear materials and U.S.-origin materials transferred from Japan to EURATOM in the NMMSS data base is collected from DOE and NRC forms. These forms are filled out by parties involved in the shipment of these materials. According to an NMMSS official, the data in the NMMSS data base reflect the amounts of nuclear materials that were actually exported or transferred from one country to another country.

To obtain the DOE/NMMSS export information, we worked with DOE/NMMSS staff at the Oak Ridge Operations Office in Oak Ridge, Tennessee, and NRC officials in the Office of International Programs, Division of Nonproliferation, Exports, and Multilateral Relations. However, we did not independently verify the accuracy of these data.

To determine the dollar value of uranium and plutonium exports to EURATOM countries and Japan, we obtained available data (1989-Aug. 1994) from the Department of Commerce's National Trade Data Bank. The accuracy of these data depends largely on the accuracy of the reporting by shippers in their export declarations. We did not independently verify the accuracy and completeness of the data. We

recognize that DOE's and the Department of Commerce's data show different quantities of nuclear material exports. Both DOE and Department of Commerce officials also acknowledge the differences in these data. However, it was not within the scope of this review to determine why the various data bases differ. According to a DOE official, DOE is attempting to determine why the two data bases differ. According to Department of Commerce officials, they may, at a later date, examine why these differences exist.

We interviewed nuclear industry officials, NRC officials, DOE/NMMSS staff, EIA officials, and officials from the State Department to obtain information on the nuclear commerce subject to the U.S.-EURATOM agreement. We also interviewed USEC officials to obtain available data (FYs 1989-93) on the value of enrichment services provided by DOE and USEC.

Our work was performed between September 1994 and May 1995 in accordance with generally accepted government auditing standards.

As arranged with your offices, unless you publicly announce its contents earlier, we plan no further distribution of this report until 15 days from the date of this letter. At that time, we will send copies to the Secretaries of Commerce, Energy, and State and to the Chairman, Nuclear Regulatory Commission. We will make copies available to others on request.

Please call me at (202) 512-3841 if you or your staff have any questions. Major contributors to this report are listed in appendix VI.

Victor S. Rezendes
Director, Energy and
Science Issues

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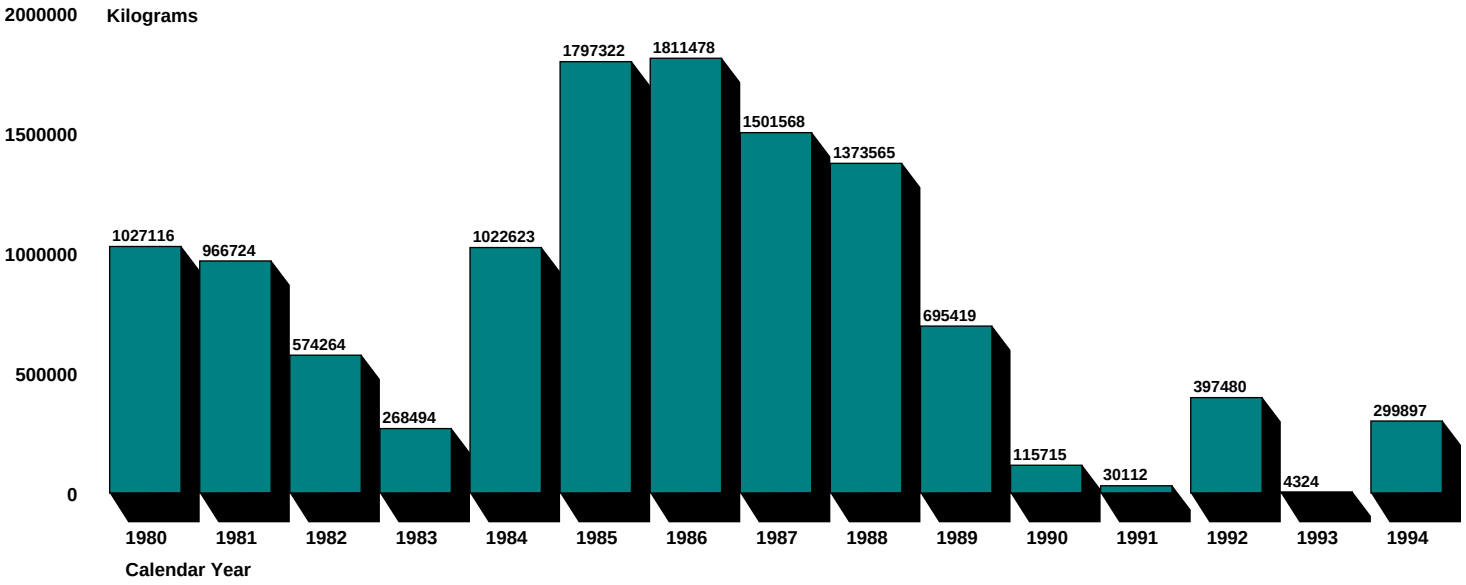
Abbreviations

DOE	Department of Energy
EIA	Energy Information Administration
EURATOM	European Atomic Energy Community
FY	fiscal year
HEU	highly enriched uranium
kgs	kilograms
LEU	low-enriched uranium
NMMSS	Nuclear Materials Management and Safeguards System
NRC	Nuclear Regulatory Commission
USEC	United States Enrichment Corporation

U.S. Nuclear Material Exports to EURATOM and Japan

U.S. Exports to EURATOM

Figure I.1: U.S. Exports to EURATOM—Natural Uranium, 1980-94

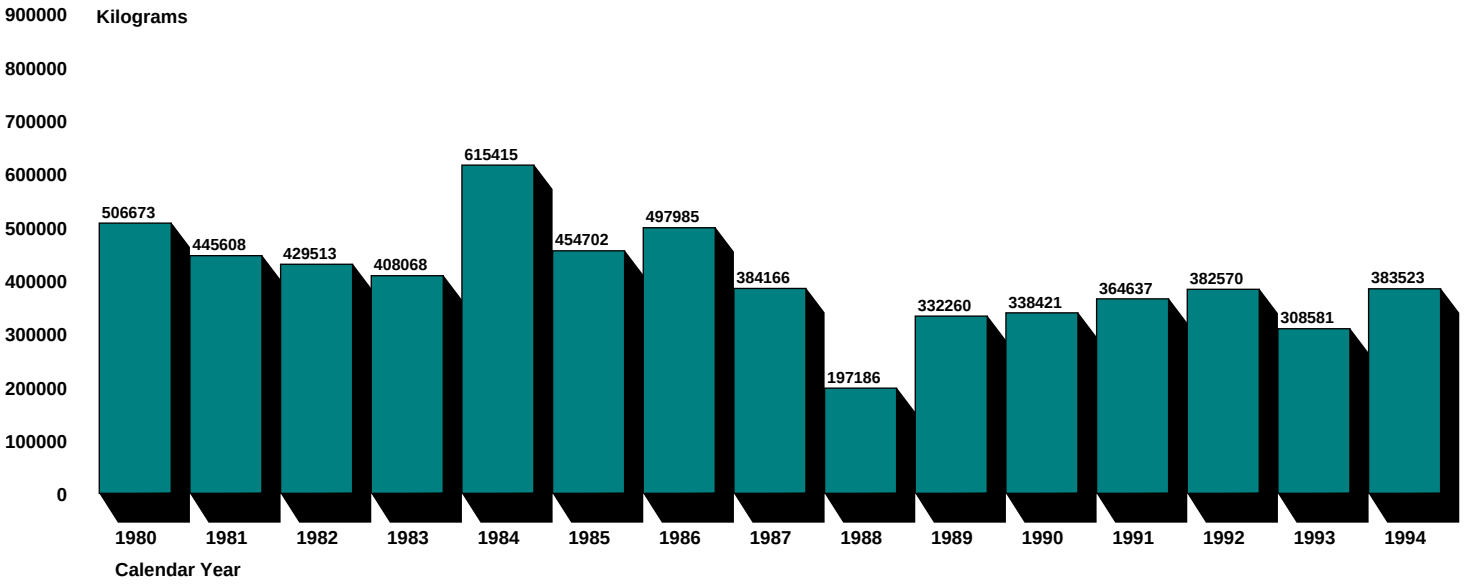


Note: Nuclear Materials Management and Safeguards System's (NMMSS) data are expressed by element weight.

Source: NMMSS, Department of Energy (DOE).

Figure I.1 shows that U.S. exports of natural uranium to EURATOM ranged from 4,324 kilograms (kgs) to 1,811,478 kgs annually during 1980 through 1994. The total amount of natural uranium exported was 11,886,101 kgs during this period. Natural uranium is used for fuel in some nuclear power reactors, but it is usually enriched or used for blending to produce low-enriched fuel.

Figure I.2: U.S. Exports to EURATOM—Enriched Uranium, 1980-94

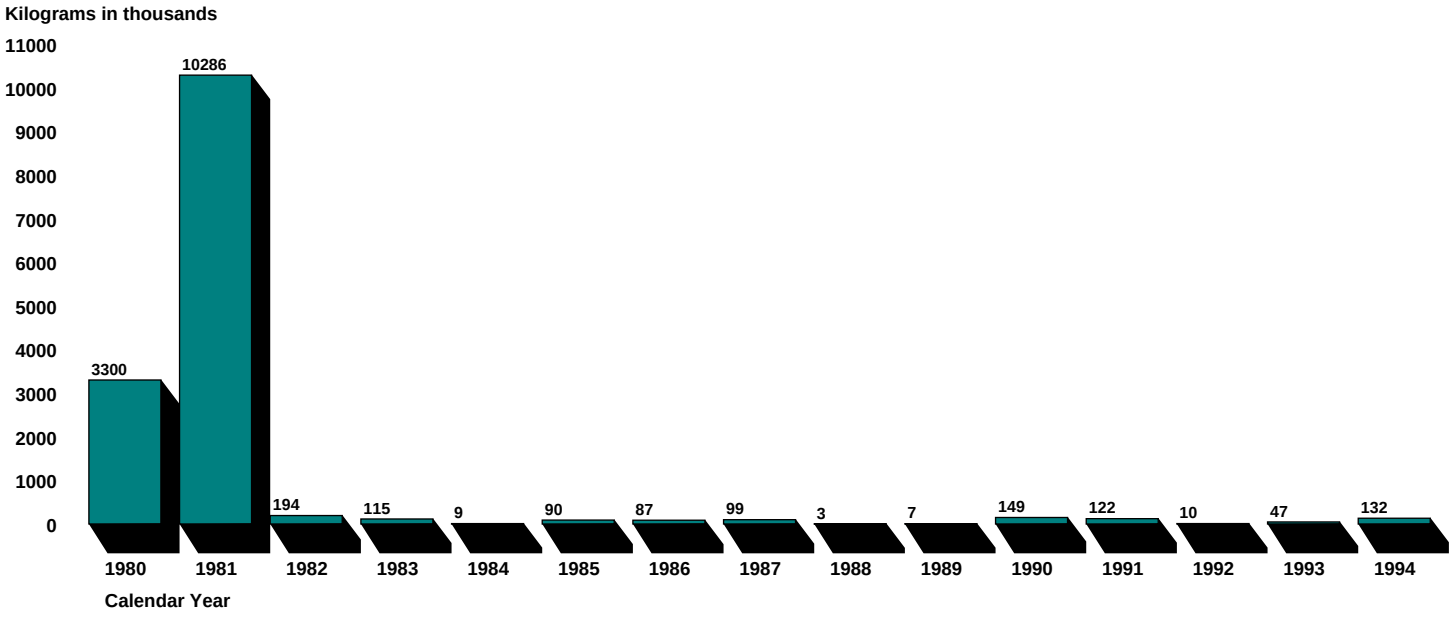


Notes:
1. Enriched uranium contains U-235.
2. NMMSS' data are expressed by element weight.

Source: NMMSS, DOE.

Figure I.2 shows that U.S. exports of enriched uranium to EURATOM ranged from 197,186 kgs to 615,415 kgs annually during 1980 through 1994. The total amount of enriched uranium exported was 6,049,307 kgs during this period. Enriched uranium contains 0.711 percent of the isotope uranium-235. Examples of enriched uranium's typical uses include fuel for commercial power reactors (low-enriched uranium) and research reactor fuel (highly enriched uranium).

Figure I.3: U.S. Exports to EURATOM—Depleted Uranium, 1980-94

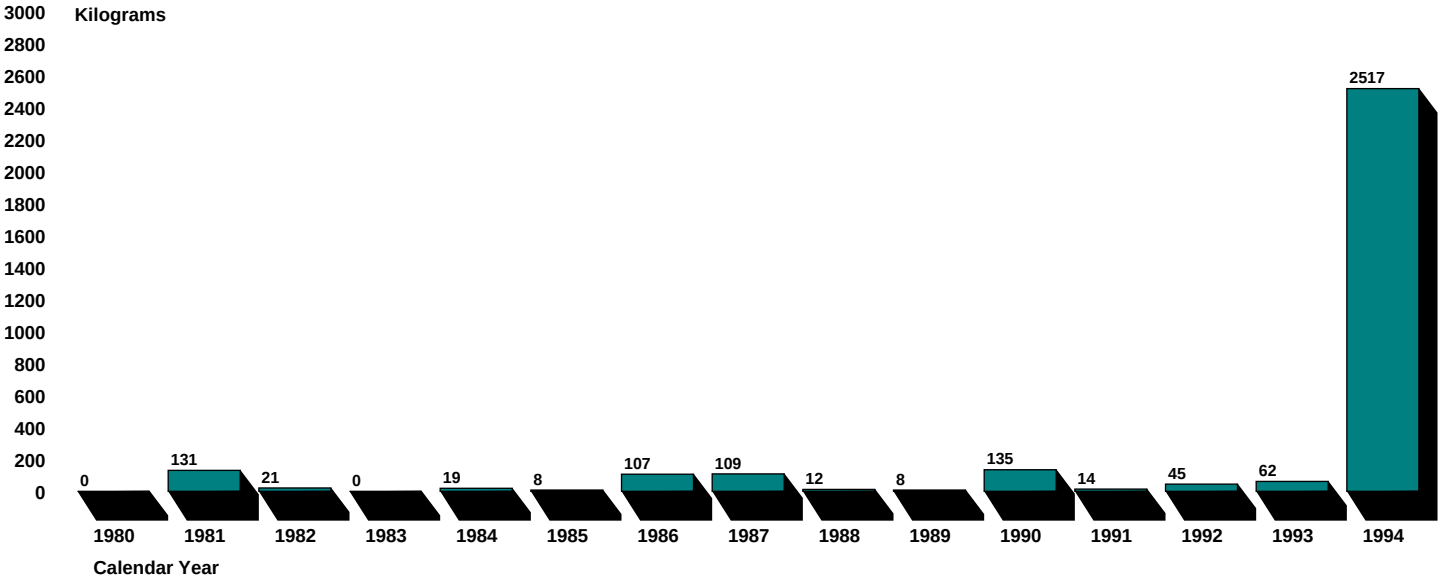


Note: Depleted uranium contains U-235.

Source: NMMSS, DOE.

Figure I.3 shows that U.S. exports to EURATOM of depleted uranium, with nuclear end use, ranged from 3,086 kgs to 10,286,236 kgs annually during 1980 through 1994. A total of 14,649,985 kgs were exported during this period. Depleted uranium also contains uranium-235 but contains less than 0.711 percent of this isotope. Depleted uranium is very dense and can be used in high-impact projectiles and as a shielding material against radiation.

Figure I.4: U.S. Exports to EURATOM—Thorium, 1980-94

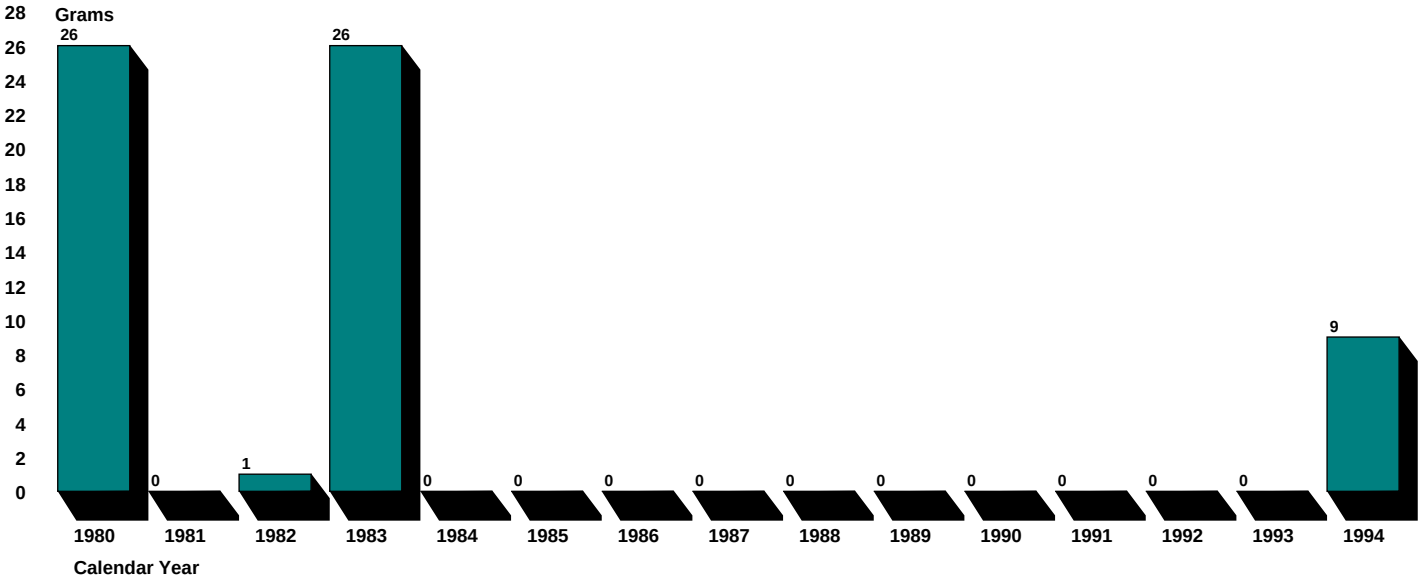


Note: NMMSS' data are expressed by element weight.

Source: NMMSS, DOE.

Figure I.4 shows that U.S. exports of thorium to EURATOM ranged from 0 to 2,517 kgs annually during 1980 through 1994. A total of 3,188 kgs of thorium were exported during this period. According to a DOE official, thorium is used for research and development purposes.

Figure I.5: U.S. Exports to EURATOM—Uranium-233, 1980-94



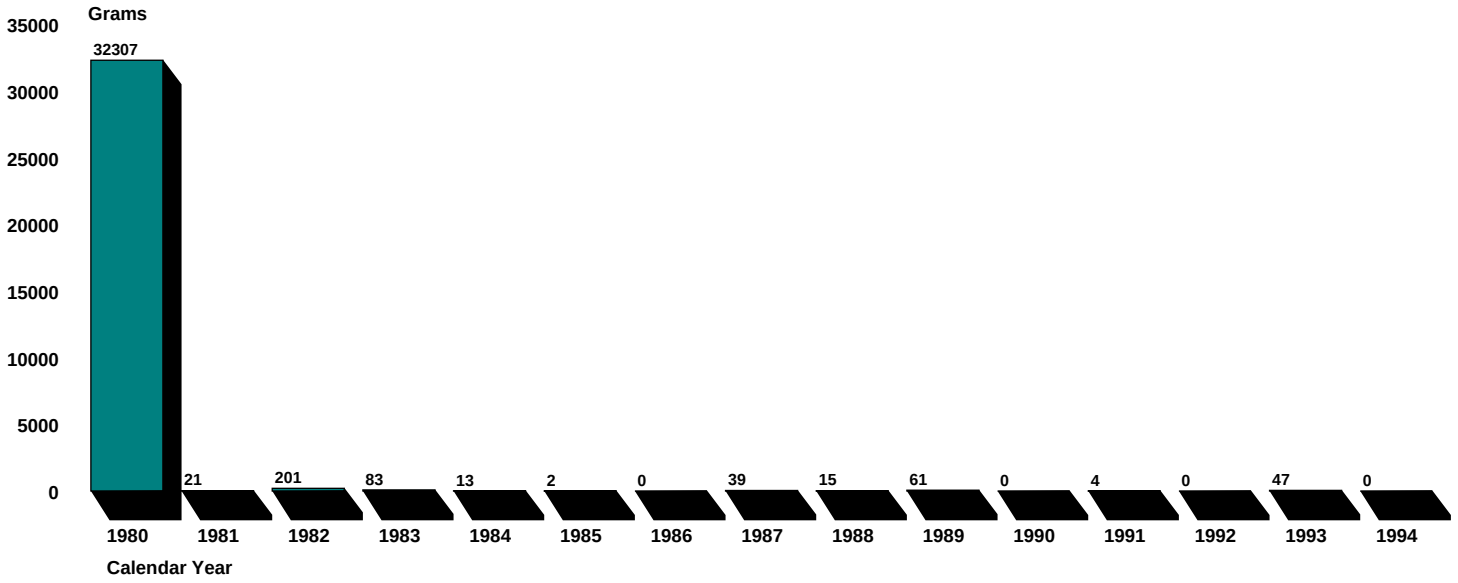
Notes:
1. NMMSS' data are expressed by element weight.
2. Uranium-233 is stated in grams because the quantities are too small to be expressed in kilograms.

Source: NMMSS, DOE.

Figure I.5 shows that U.S. exports of uranium-233 to EURATOM ranged from 0 to 26 grams annually during 1980 through 1994. A total of 62 grams of uranium-233 were exported during this period. According to the NRC, this uranium-233 was for use as standard samples in laboratory analyses and tests.

U.S. Exports of Plutonium to EURATOM

Figure I.6: U.S. Exports to EURATOM—Plutonium, 1980-94

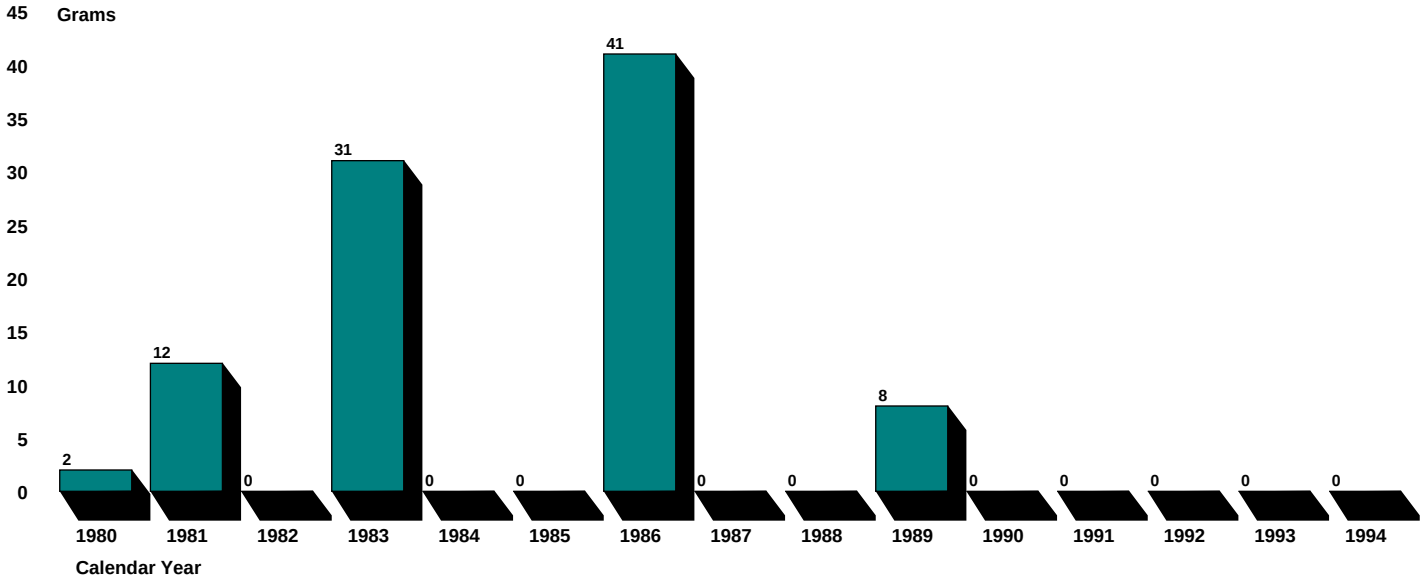


Note: Plutonium is stated in grams because the quantities are too small to be expressed in kilograms.

Source: NMMSS, DOE.

Figure I.6 shows that U.S. exports of plutonium to EURATOM ranged from 0 to 32,307 grams, or 32.3 kgs, annually during 1980 through 1994. A total of 32,793 grams, or 32.8 kgs, were exported during this period. According to DOE, the plutonium category in the NMMSS includes all plutonium that contains less than 20 percent of the plutonium-242 isotope. This category may also include the isotopes plutonium-239, –240 and –241. Plutonium in this category has research uses.

Figure I.7: U.S. Exports to EURATOM—Plutonium-242, 1980-94

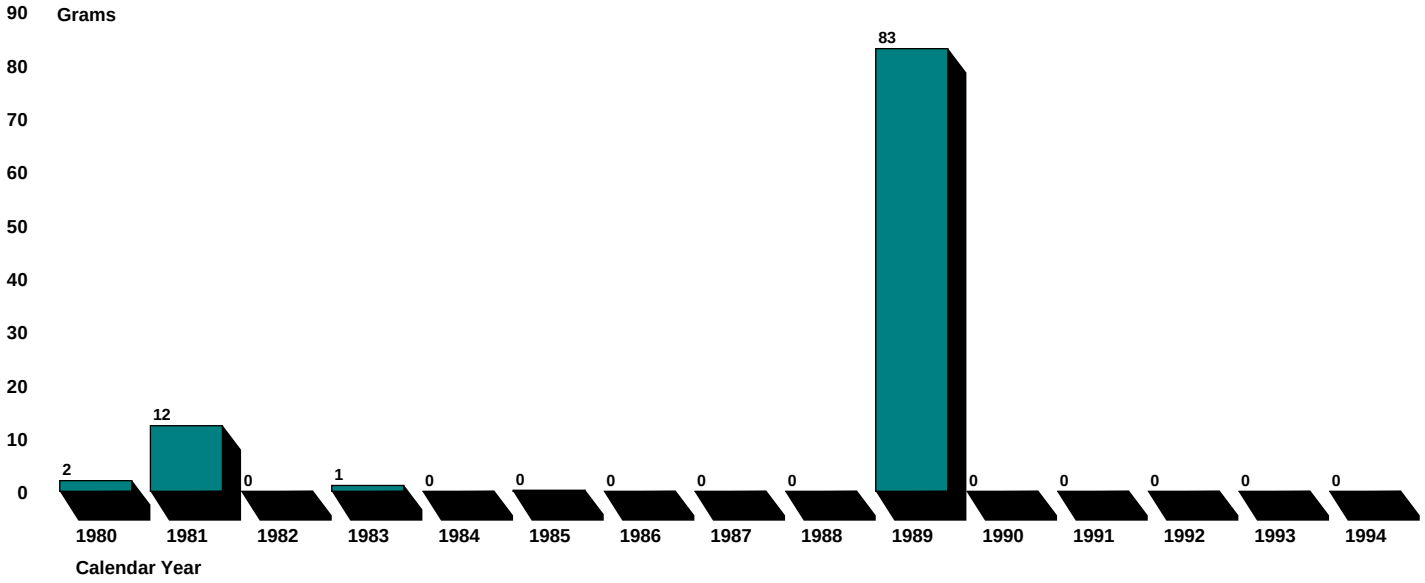


Notes:
1. NMMSS' data are expressed by element weight.
2. Plutonium that contains more than 20 percent of plutonium-242 is reported to NMMSS as plutonium-242.
3. Plutonium-242 is stated in grams because the quantities are too small to be expressed in kilograms.

Source: NMMSS, DOE.

Figure I.7 shows that U.S. exports of plutonium-242 to EURATOM ranged from 0 to 41 grams annually during 1980 through 1994. A total of 94 grams were exported during this period. This category includes all plutonium that has greater than 20 percent of plutonium-242. According to NRC, plutonium-242 is used for research purposes in calibrating equipment, such as mass spectrometers used in research institutes.

Figure I.8: U.S. Exports to EURATOM—Plutonium-238, 1980-94



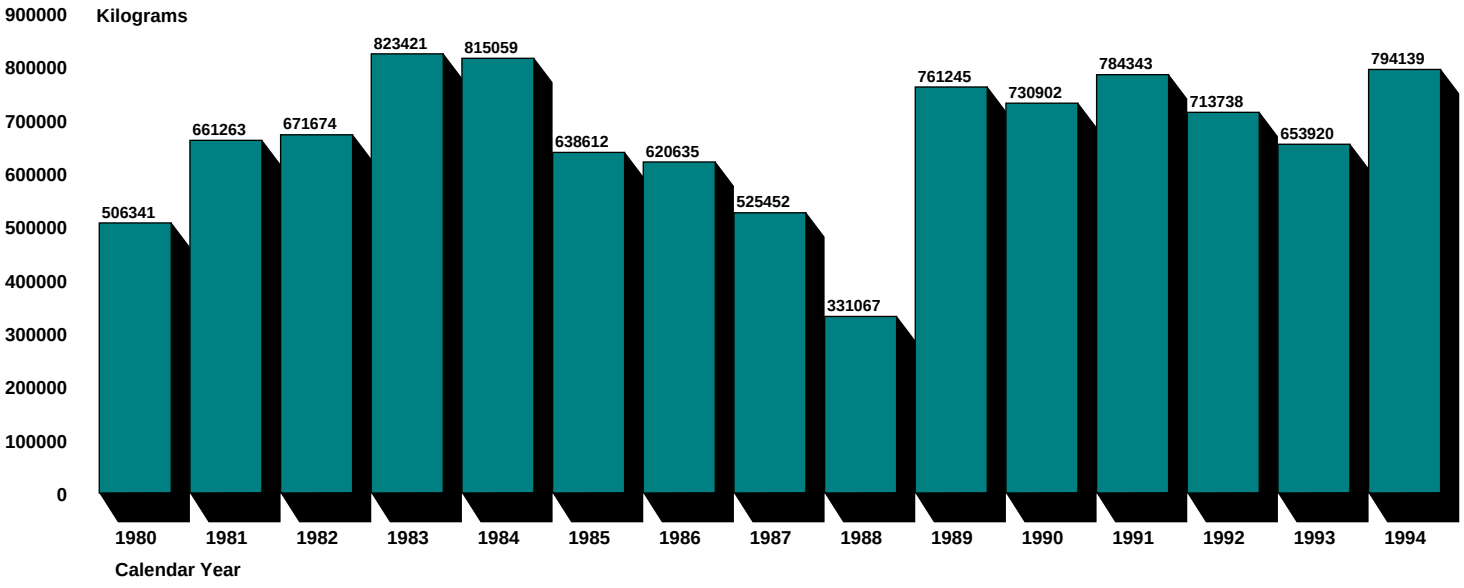
Notes:
1. NMMSS' data are expressed by element weight.
2. Plutonium-238 is stated in grams because the quantities are too small to be expressed in kilograms.

Source: NMMSS, DOE.

Figure I.8 shows that U.S. exports of plutonium-238 to EURATOM ranged from 0 to 83 grams annually during 1980 through 1994. A total of 99 grams of plutonium-238 were exported during this period. According to DOE and NRC, plutonium-238 can be used for research and thermionic heating sources.

U.S. Exports to Japan

Figure I.9: U.S. Exports to Japan—Enriched Uranium, 1980-94

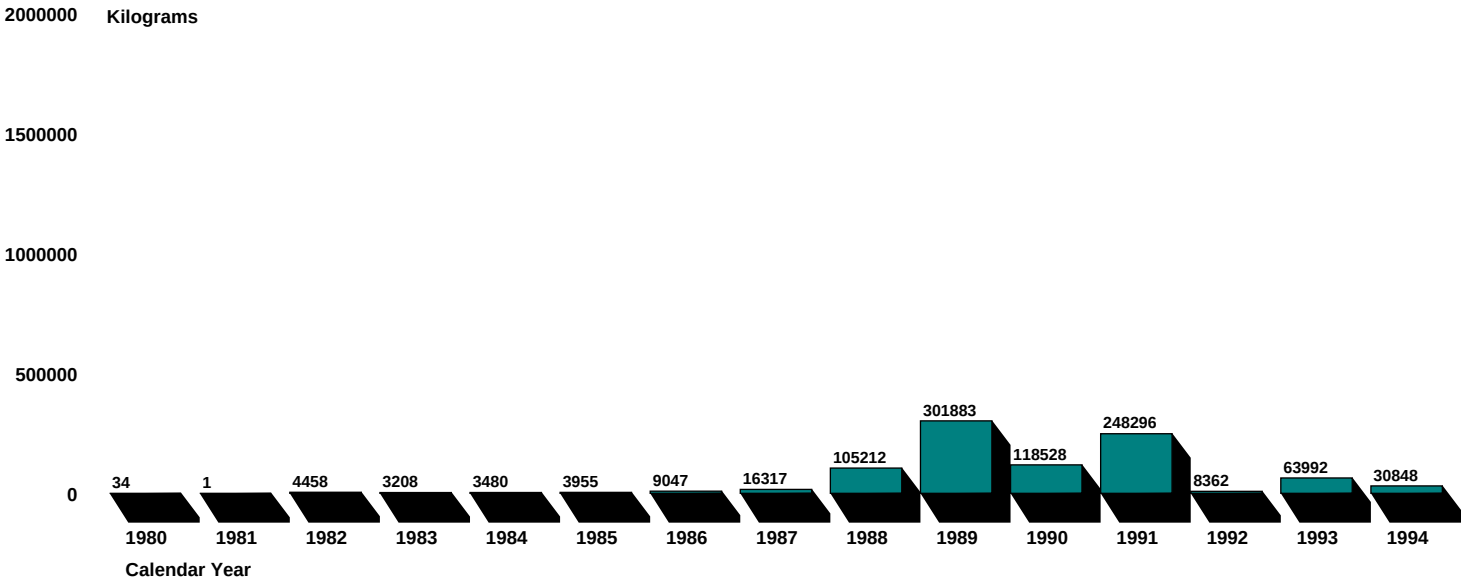


Note: NMMSS' data are expressed by element weight.

Source: NMMSS, DOE.

Figure I.9 shows that U.S. exports of enriched uranium to Japan ranged from 331,067 kgs to 823,421 kgs annually during 1980 through 1994. A total of 10,031,810 kgs were exported during this period.

Figure I.10: U.S. Exports to Japan—Natural Uranium, 1980-94

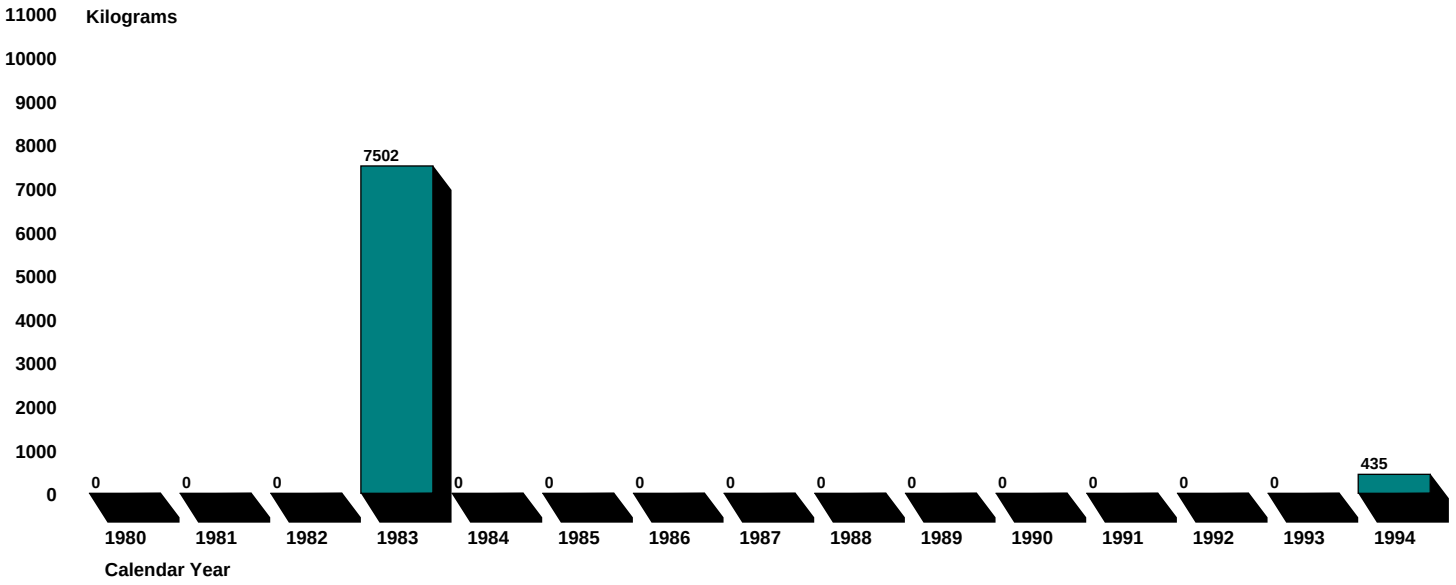


Note: NMMSS' data are expressed by element weight.

Source: NMMSS, DOE.

Figure I.10 shows that U.S. exports of natural uranium to Japan ranged from 1 kg to 301,883 kgs annually during 1980 through 1994. A total of 917,621 kilograms of natural uranium were exported during this period.

Figure I.11: U.S. Exports to Japan—Depleted Uranium, 1980-94

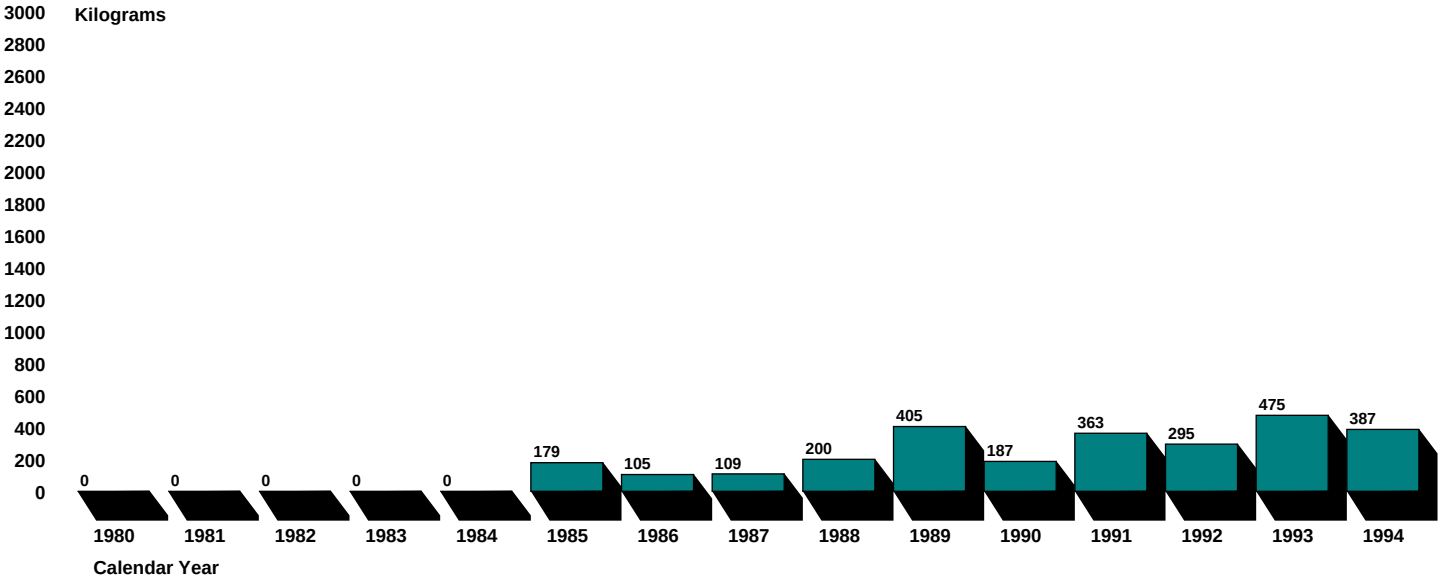


Note: NMMSS' data are expressed by element weight.

Source: NMMSS, DOE.

Figure I.11 shows that U.S. exports of depleted uranium to Japan ranged from 0 to 7,502 kgs annually during 1980 through 1994. A total of 7,937 kgs of depleted uranium were exported during this period.

Figure I.12: U.S. Exports to Japan—Thorium, 1980-94

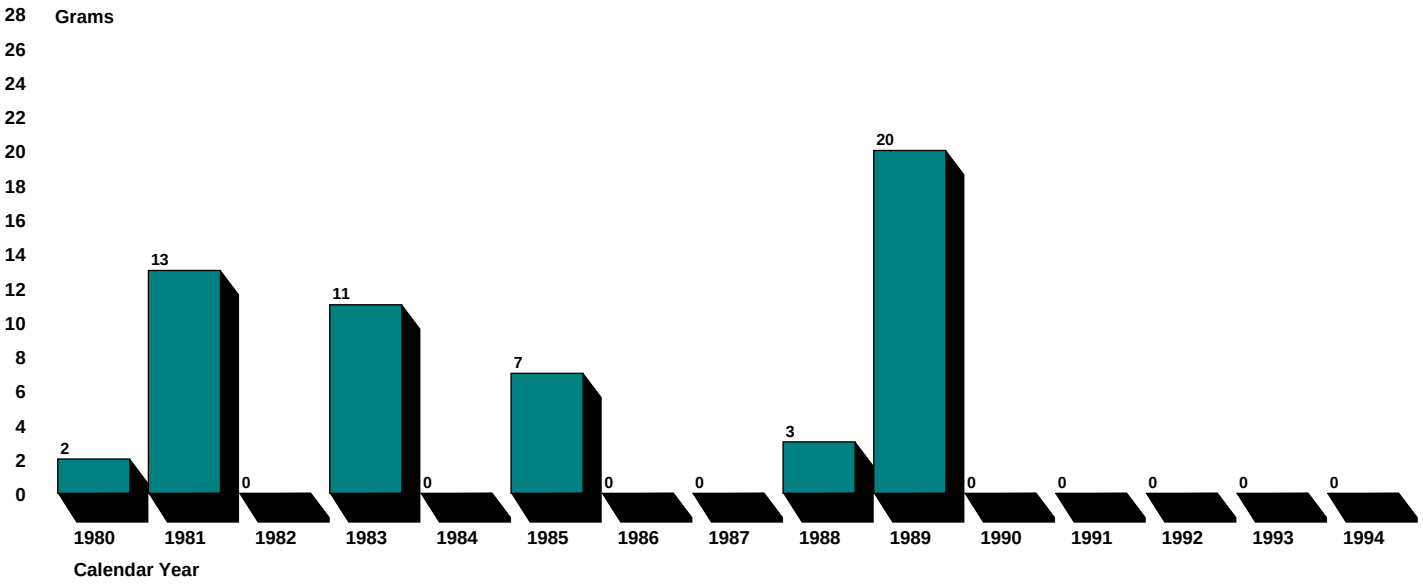


Note: NMMSS' data are expressed by element weight.

Source: NMMSS, DOE.

Figure I.12 shows that U.S. exports of thorium to Japan ranged from 0 to 475 kgs annually during 1980 through 1994. A total of 2,705 kgs were exported during this period.

Figure I.13: U.S. Exports to Japan—Uranium-233, 1980-94



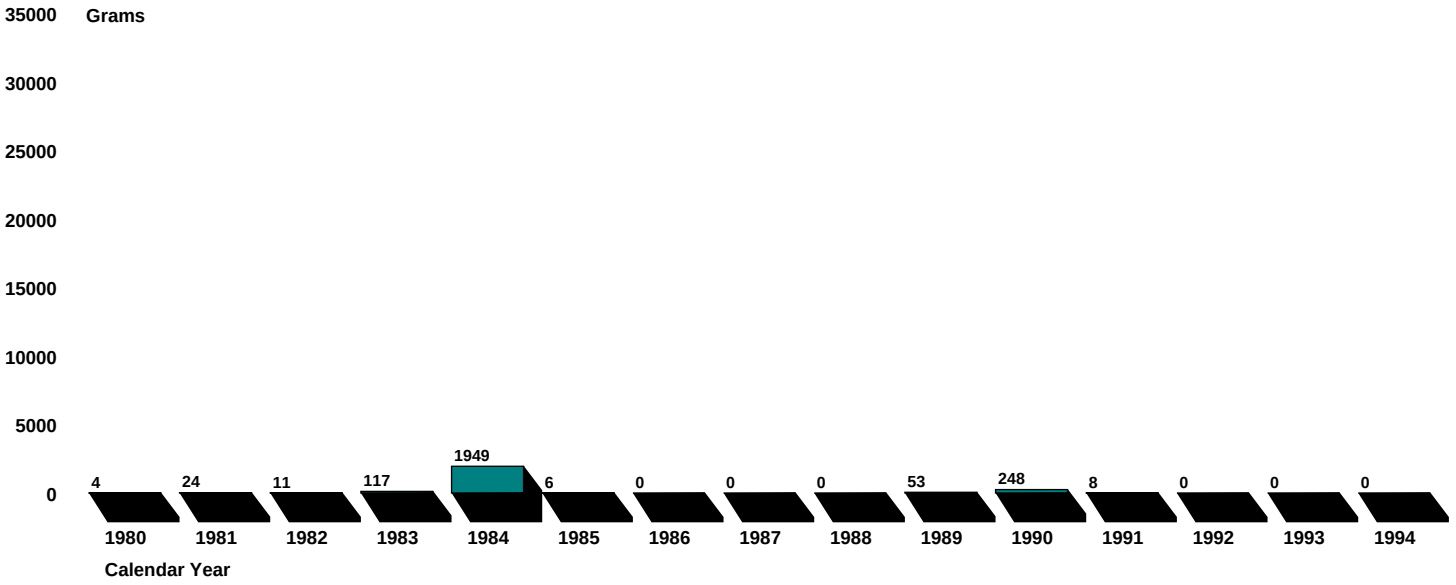
Notes:
1. NMMSS' data are expressed by element weight.
2. Uranium-233 is stated in grams because the quantities are too small to be expressed in kilograms.

Source: NMMSS, DOE.

Figure I.13 shows that U.S. exports of uranium-233 to Japan ranged from 0 to 20 grams annually during 1980 through 1994. A total of 56 grams were exported during this period.

U.S. Exports to Japan of Plutonium

Figure I.14: U.S. Exports to Japan—Plutonium, 1980-94

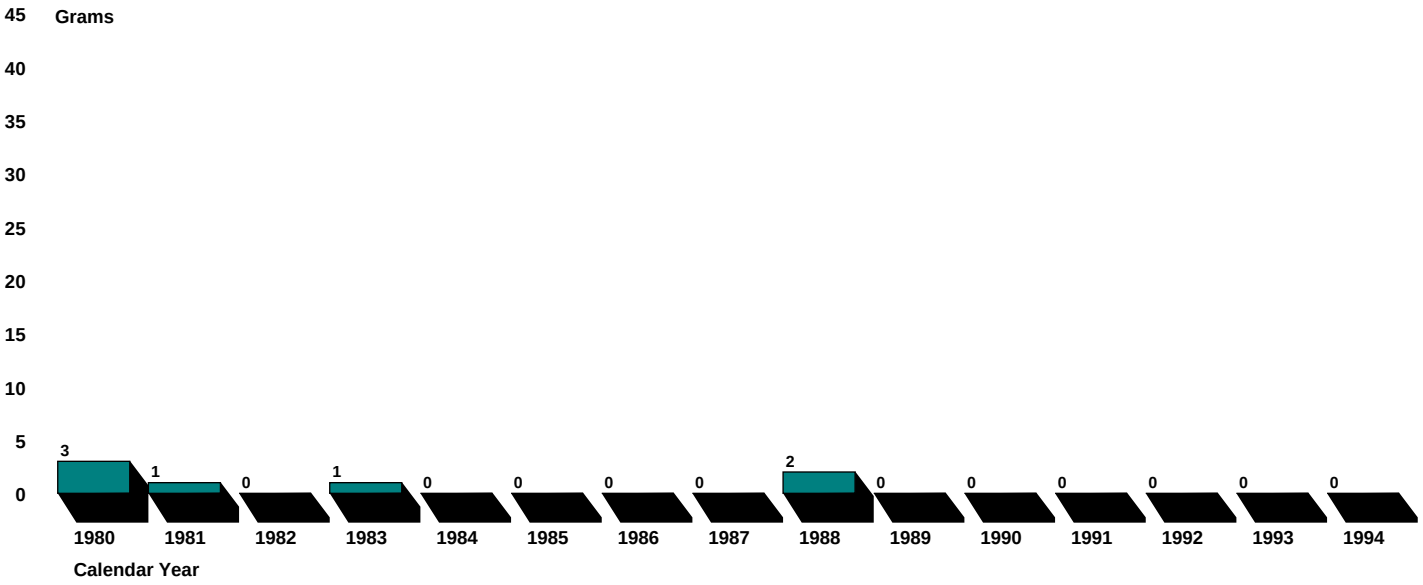


Notes:
1. NMMSS' data are expressed by element weight.
2. Plutonium is stated in grams because the quantities are too small to be expressed in kilograms.

Source: NMMSS, DOE.

Figure I.14 shows that U.S. exports of plutonium to Japan ranged from 0 to 1,949 grams, or 1.95 kgs, annually during 1980 through 1994. The total amount of plutonium exported during this period was 2,420 grams, or 2.42 kgs. These exports, like the exports to EURATOM, are used as laboratory standards and for research purposes, according to NRC.

Figure I.15: U.S. Exports to Japan—Plutonium-242, 1980-94

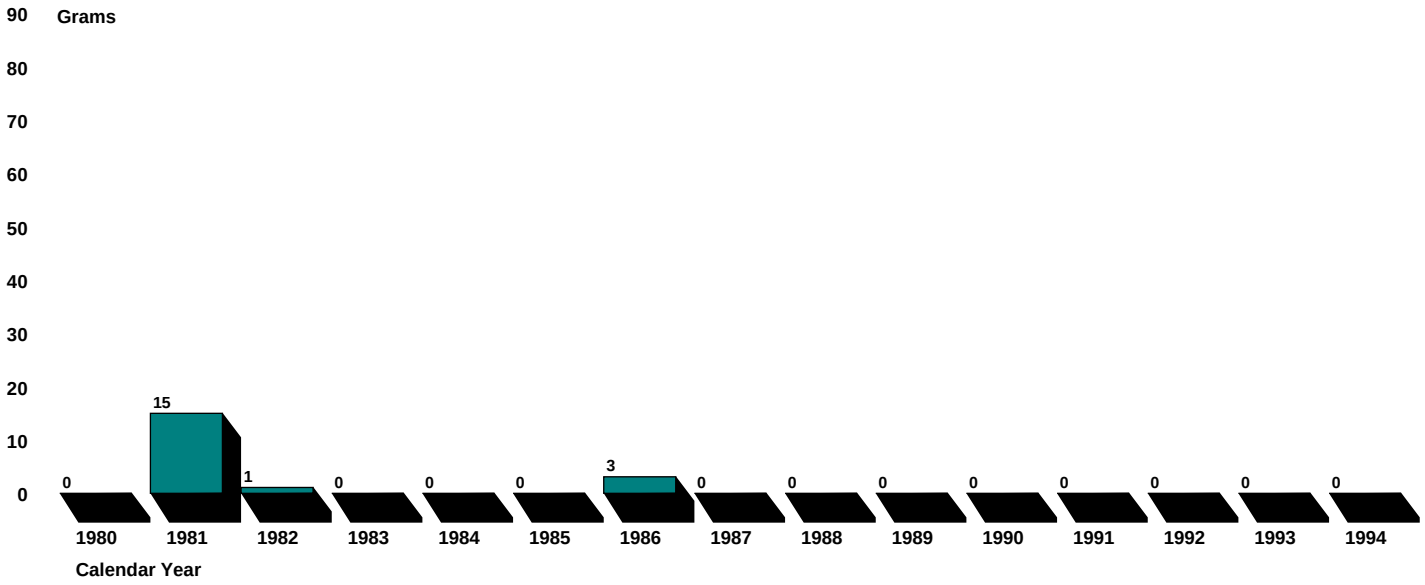


Notes:
1. NMMSS' data are expressed by element weight.
2. Plutonium-242 is stated in grams because the quantities are too small to be expressed in kilograms.

Source: NMMSS, DOE.

Figure I.15 shows that U.S. exports of plutonium-242 to Japan ranged from 0 to 3 grams annually, during 1980 through 1994. A total of 7 grams were exported during this period. Like EURATOM, Japan uses plutonium-242 as laboratory standards and for research purposes.

Figure I.16: U.S. Exports to Japan—Plutonium-238, 1980-94



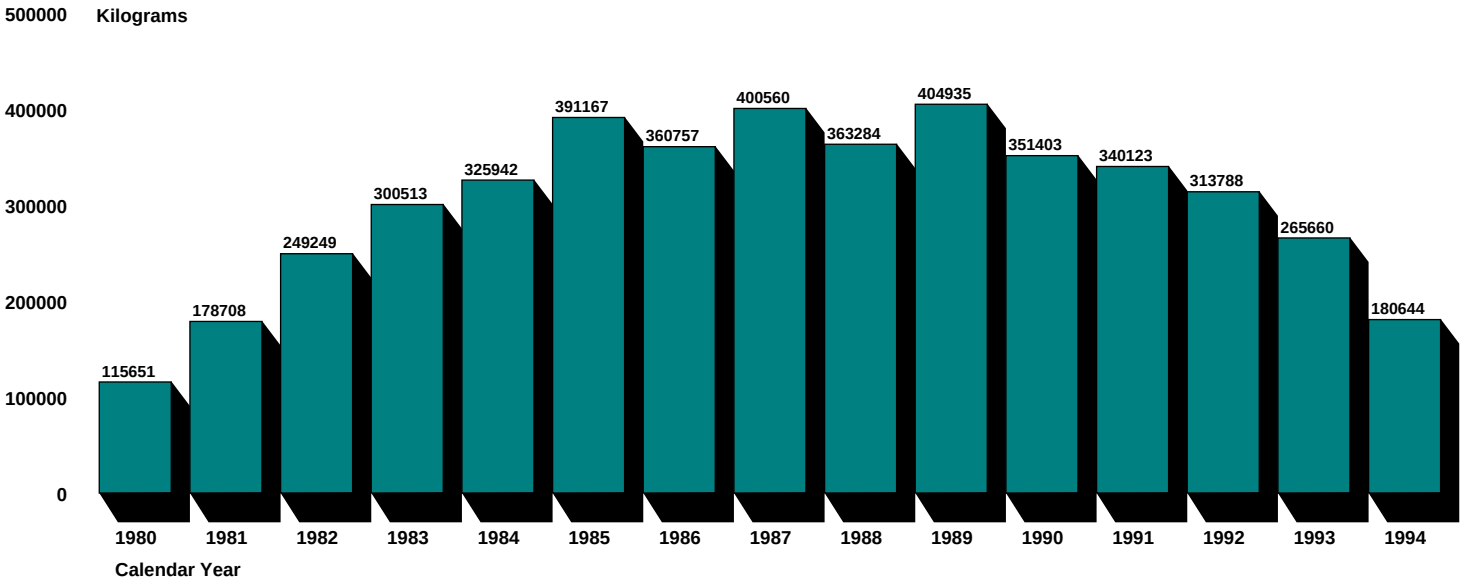
Notes:
1. NMMSS' data are expressed by element weight.
2. Plutonium-238 is stated in grams because the quantities are too small to be expressed in kilograms.

Source: NMMSS, DOE.

Figure I.16 shows that U.S. exports of plutonium-238 to Japan ranged from 0 to 15 grams annually during 1980 through 1994. A total of 19 grams were exported during this period.

U.S.-Origin Nuclear Material Transferred From Japan to EURATOM

Figure I.17: U.S.-Origin Enriched Uranium Exported From Japan to EURATOM, 1980-94

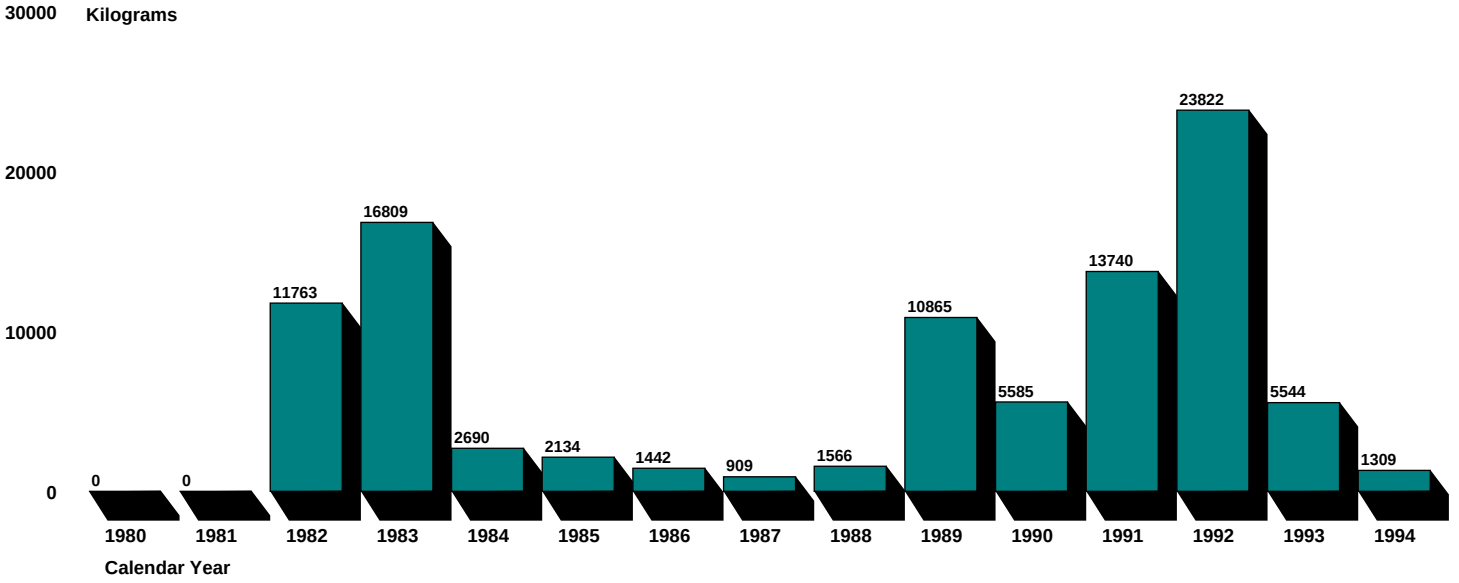


Note: NMMSS' data are expressed by element weight.

Source: NMMSS, DOE.

Figure I.17 shows that U.S.-origin enriched uranium transferred from Japan to EURATOM ranged from 115,651 kgs to 404,935 kgs annually during 1980 through 1994. Japan transferred a total of 4,542,383 kgs of U.S.-origin enriched uranium to EURATOM during this period.

Figure I.18: U.S.-Origin Depleted Uranium Exported From Japan to EURATOM, 1980-94

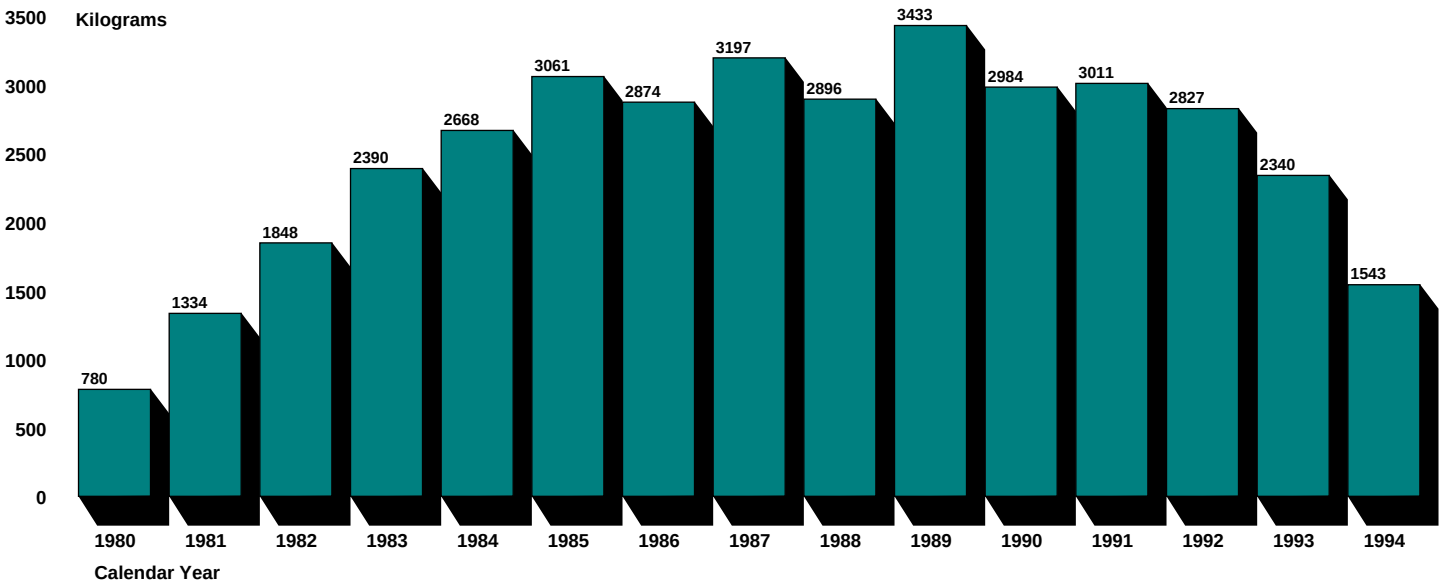


Note: NMMSS' data are expressed by element weight.

Source: NMMSS, DOE.

Figure I.18 shows that U.S.-origin depleted uranium transferred from Japan to EURATOM ranged from 0 to 23,822 kgs annually during 1980 through 1994. A total of 98,178 kgs were exported during this period.

Figure I.19: U.S.-Origin Plutonium Exported From Japan to EURATOM, 1980-94



Note: NMMSS' data are expressed by element weight.

Source: NMMSS, DOE.

Figure I.19 shows that U.S.-origin plutonium transferred from Japan to EURATOM ranged from 780 kgs to 3,433 kgs annually during 1980 through 1994. A total of 37,187 kgs were exported by Japan to EURATOM during this period.

Dollar Values and Amounts of U.S. Exports to EURATOM Countries and Japan

We obtained the dollar values for uranium and plutonium exports from the Department of Commerce's National Trade Data Bank. According to the Department of Commerce, the data bank was established by the Omnibus Trade and Competitiveness Act of 1988 to provide "reasonable public access" to an Export Promotion data system and an International Economic data system from 15 federal agencies. The export data bank contains statistics on the values of U.S. exports measured at the U.S. port of export. The value of a nuclear export item (material or component) is based on the transaction price, including inland freight, insurance, and the other charges incurred in placing the freight alongside the carrier at the U.S. port of export. The value excludes the cost of loading the merchandise aboard the exporting carrier and also excludes freight, insurance, and any other charges or transportation costs beyond the port of export. These statistics, however, do not always reflect the value as defined above, as exporters sometimes find it difficult to assign a value in accordance with this definition. The extent to which the statistics reflect this state depends largely on the accuracy of reporting by shippers on their export declarations.

We used information from the export data bank to identify the total value and quantities for the commodities uranium and plutonium shipped by the United States to EURATOM countries and Japan. The data bank information covered the period for calendar years 1989 through August 1994. Tables II.1 through II.11 show the dollar values and amounts of uranium and plutonium exports to EURATOM countries, and tables II.9 through II.11 show the U.S. dollar values and amounts of U.S. exports to Japan.

Table II.1: Dollar Values of U.S. Exports of Nuclear Materials to EURATOM, 1989-Aug.1994

Thousands of dollars

Material	1994	1993	1992	1991	1990	1989	Total
Natural uranium	$ 6,436	$ 10,473	$ 43,865	$ 7,176	$ 8,044	$ 53,546	$ 129,540
Enriched uranium	172,611	165,430	150,798	138,651	129,421	204,442	961,353
Depleted uranium	4,149	2,156	1,588	4,616	2,635	2,988	18,132
Plutonium	4,130	8,653	5,096	5,283	5,323	6,596	35,081
Total	**$187,326**	**$186,712**	**$201,347**	**$155,726**	**$145,423**	**$267,572**	**$1,144,106**

Source: National Trade Data Bank, Department of Commerce.

Table II.2: Dollar Values of U.S. Exports of Natural Uranium Metal, Compounds, and Ore to EURATOM Countries, 1989-Aug.1994

Thousands of dollars

Country	1994	1993	1992	1991	1990	1989	Total
Denmark	$ 4	$ 0	$ 0	$ 0	$ 0	$ 10	$ 14
France	0	6,000	20	1,529	5	24,154	31,708
Germany	0	51	50	31	180	0	312
Italy	0	0	0	0	0	2	2
Netherlands	0	4,176	522	554	75	67	5,394
Spain	0	0	5	3,397	0	0	3,402
United Kingdom	6,432	246	43,268	1,665	7,784	29,313	88,708
Total	**$6,436**	**$10,473**	**$43,865**	**$7,176**	**$8,044**	**$53,546**	**$129,540**

Source: National Trade Data Bank, Department of Commerce.

Table II.3: Amounts of U.S. Exports of Natural Uranium Metal, Compounds, and Ore to EURATOM Countries, 1989-Aug.1994

In kilograms

Country	1994	1993	1992	1991	1990	1989	Total
Denmark	1	0	0	0	0	132	133
France	0	9,282	10	20,432	23	479,861	509,608
Germany	0	120	111	3,945	2,228	0	6,404
Italy	0	0	0	0	0	22	22
Netherlands	0	18,520	33,696	12,287	436	218	65,157
Spain	0	0	3	14,515	0	0	14,518
United Kingdom	184,752	1,329	496,727	61,816	165,520	362,764	1,272,908
Total	**184,753**	**29,251**	**530,547**	**112,995**	**168,207**	**842,997**	**1,868,750**

Source: National Trade Data Bank, Department of Commerce.

Table II.4: Dollar Values of U.S. Exports of Enriched Uranium Compounds to EURATOM Countries, 1989-Aug.1994

Thousands of dollars

Country	1994	1993	1992	1991	1990	1989	Total
Belgium	$ 0	$ 0	$ 0	$ 0	$ 6	$ 52	$ 58
Denmark	0	0	0	535	0	0	535
France	34,003	123	38,033	16,676	12,363	30,990	132,188
Germany	92,113	141,617	91,508	101,216	97,471	104,877	628,802
Ireland	0	21	0	0	0	0	21
Italy	0	7	10	0	0	0	17
Netherlands	0	0	0	0	1,649	13	1,662
Spain	20,905	13,953	1,965	4,750	858	2,303	44,734
United Kingdom	25,590	9,709	19,282	15,474	17,074	66,207	153,336
Total	**$172,611**	**$165,430**	**$150,798**	**$138,651**	**$129,421**	**$204,442**	**$961,353**

Source: National Trade Data Bank, Department of Commerce.

Table II.5: Amounts of U.S. Exports of Enriched Uranium Compounds to EURATOM Countries, 1989-Aug.1994

In kilograms

Country	1994	1993	1992	1991	1990	1989	Total
Belgium	0	0	0	0	29	974	1,003
Denmark	0	0	0	492	0	0	492
France	26,049	142	66,631	15,503	27,295	41,226	176,846
Germany	155,035	322,693	377,638	731,611	749,373	346,440	2,682,790
Ireland	0	14	0	0	0	0	14
Italy	0	1	46	0	0	0	47
Netherlands	0	0	0	0	10,869	39	10,908
Spain	47,588	24,057	35,930	190,234	55,358	24,471	377,638
United Kingdom	41,234	18,037	37,415	33,367	17,039	65,492	212,584
Total	**269,906**	**364,944**	**517,660**	**971,207**	**859,963**	**478,642**	**3,462,322**

Source: National Trade Data Bank, Department of Commerce.

Table II.6: Dollar Values of U.S. Exports of Depleted Uranium Compounds to EURATOM Countries, 1989-Aug.1994

Thousands of dollars

Country	1994	1993	1992	1991	1990	1989	Total
Belgium	$ 0	$ 0	$ 0	$ 20	$ 31	$ 0	$51
Denmark	0	0	0	0	0	6	6
France	2,116	542	0	0	5	0	2,663
Germany	210	0	0	448	1,286	0	1,944
Netherlands	7	0	0	0	0	0	7
United Kingdom	1,816	1,614	1,588	4,148	1,313	2,982	13,461
Total	**$4,149**	**$2,156**	**$1,588**	**$4,616**	**$2,635**	**$2,988**	**$18,132**

Source: National Trade Data Bank, Department of Commerce.

Table II.7: Amounts of U.S. Exports of Depleted Uranium Compounds to EURATOM Countries, 1989-Aug.1994

In kilograms

Country	1994	1993	1992	1991	1990	1989	Total
Belgium	0	0	0	41	1,144	0	1,185
Denmark	0	0	0	0	0	169	169
France	176,786	44,882	0	0	45	0	221,713
Germany	114	0	0	42,844	52,380	0	95,338
Netherlands	24	0	0	0	0	0	24
United Kingdom	23,602	24,664	29,535	98,668	14,768	47,389	238,626
Total	**200,526**	**69,546**	**29,535**	**141,553**	**68,337**	**47,558**	**557,055**

Source: National Trade Data Bank, Department of Commerce.

Table II.8: Dollar Values of U.S. Exports of Plutonium to EURATOM Countries, 1989-Aug. 1994

Thousands of dollars

Country	1994	1993	1992	1991	1990	1989	Total
Belgium	$ 359	$ 428	$ 468	$ 467	$ 402	$ 246	$ 2,370
Denmark	23	36	3	69	31	44	206
France	852	1,068	911	608	1,106	2,012	6,557
Germany	716	4,926	1,100	1,223	1,205	1,108	10,278
Greece	15	28	27	8	7	7	92
Ireland	0	0	0	0	0	6	6
Italy	651	905	1,295	1,443	1,043	1,135	6,472
Netherlands	133	280	211	256	340	511	1,731
Portugal	14	0	6	20	83	13	136
Spain	1,032	410	431	605	553	521	3,552
United Kingdom	335	572	644	584	553	993	3,681
Total	**$4,130**	**$8,653**	**$5,096**	**$5,283**	**$5,323**	**$6,596**	**$35,081**

Source: National Trade Data Bank, Department of Commerce.

Table II.9: Dollar Values of U.S. Exports of Uranium to Japan, 1989-Aug. 1994

Thousands of dollars

Calendar year	Natural uranium	Enriched uranium	Depleted uranium	Total
1994	$ 19	$ 410,484	$ 0	$ 410,503
1993	31,878	698,321	9	730,208
1992	59,110	654,987	0	714,097
1991	43,738	678,913	4	722,655
1990	7,377	598,390	359	606,126
1989	191,140	539,839	0	730,979
Total	**$333,262**	**$3,580,934**	**$372**	**$3,914,568**

Source: National Trade Data Bank, Department of Commerce.

Table II.10: Amounts of U.S. Exports of Uranium to Japan, 1989-Aug. 1994

In kilograms

Calendar year	Natural uranium	Enriched uranium	Depleted uranium	Total
1994	270	418,842	0	419,112
1993	164,139	776,424	22	940,585
1992	80,137	959,002	0	1,039,139
1991	127,914	927,724	12	1,055,650
1990	133,159	1,170,443	1,609	1,305,211
1989	359,530	795,574	0	1,155,104
Total	**865,149**	**5,048,009**	**1,643**	**5,914,801**

Source: National Trade Data Bank, Department of Commerce.

Table II.11: Dollar Values of U.S. Exports of Plutonium to Japan, 1989-Aug. 1994

Thousands of dollars

Calendar year	Amount
1994	$ 1,009
1993	1,128
1992	2,268
1991	1,732
1990	1,232
1989	3,006
Total	**$10,375**

Source: National Trade Data Bank, Department of Commerce.

Comments From the Nuclear Regulatory Commission

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

Mr. Gene Aloise
U.S. General Accounting Office
Suite 201
111 Massachusetts Ave NW
Washington, DC 20001

Dear Mr. Aloise:

We have reviewed the GAO draft report "Nuclear Materials: Information on Nuclear Exports Controlled by U.S.- EURATOM Agreement," as requested in your memorandum of May 16, 1995. In addition to the specific editorial changes marked on the report, we have two comments:

Now on p. 18.

Now on p. 39.

1. The graphs in the report are misleading in that similar bars are used to represent amounts varying from millions of kilograms to amounts as small as units of grams. We suggest that GAO more clearly emphasize the units being used on the Y axis on the charts, perhaps by using larger type (as was done on the chart on page 21).

2. Some information on the chart on page 42 is questionable. We are puzzled by the reported plutonium sales to some of the listed countries, especially Denmark, Greece and Portugal. These countries have very small nuclear research programs and no power programs, and we doubt they have in fact imported plutonium from the U.S. The NRC's export licensing data base shows no licenses for exports to Greece or Portugal, one small (0.005 kg) plutonium export case for Denmark, and only three plutonium export cases for Spain.[1] We suggest that the GAO seek confirmation from Commerce and DOE [or the DOE contractor which operates the Nuclear Materials Management and Safeguards System (NMMSS)] before including the chart in the report.

Sincerely,

James L. Blaha
Assistant for Operations
Office of the Executive Director
for Operations

Enclosure:
GAO/RCED-95-168 (Draft Report),
w/OIP annotations

[1] U.S.-supplied nuclear materials to any country within the European Atomic Energy Community (EURATOM) can be freely retransferred within EURATOM without prior notification to or approval by the U.S. Thus, it is possible, although not considered likely, that U.S.-supplied plutonium has gone to the countries in question and has been reported to Commerce's National Trade Data System without appearing in the NRC's export licensing records.

Comments From the Department of Commerce

THE SECRETARY OF COMMERCE
Washington, D.C. 20230

JUN - 5 1995

Mr. Victor S. Rezendes
Director, Energy Issues
General Accounting Office
Washington, D.C. 20548

Dear Mr. Rezendes:

Thank you for the opportunity to review and provide comments on your draft report entitled "Nuclear Materials: Information on Nuclear Exports Controlled by U.S.-EURATOM Agreement."

The Department of Commerce does not control the export of the items covered by this draft report. These items (uranium, thorium, plutonium, etc.) are licensed for export by the Nuclear Regulatory Commission.

The draft report notes an apparent difference between the amounts of nuclear material exports identified in the Department of Energy's database and the amounts identified in the Department of Commerce's National Trade Data Bank. GAO first made this alleged inconsistency known to us in this draft report. We are unable to comment on this in the short time you gave us to respond. We would be pleased to work with GAO on this issue, however.

If we may be of further assistance to you, please contact Ms. Rosemary Warren, Director, Office of Congressional and Public Affairs, Bureau of Export Administration, at (202) 482-0097.

Sincerely,

Ronald H. Brown

Comments From the Department of Energy

Department of Energy
Washington, DC 20585

May 18, 1995

Mr. Victor S. Rezendes
Director, Energy and Science Issues
Resources, Community, and
Economic Development Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Rezendes:

The Department of Energy appreciates the opportunity to review the draft General Accounting Office report GAO/RCED-95-168, "Nuclear Materials: Information on Nuclear Exports Controlled by U.S.-EURATOM Agreement." We have no comment on the facts of the report as they are portrayed. The Department is monitoring the Department of State's negotiations for a new European Atomic Energy Community Concerning Peaceful Uses of Atomic Energy (EURATOM agreement) and we are confident a new agreement will be achieved prior to the December 31, 1995 expiration of the current agreement.

Sincerely,

Kenneth E. Baker
Acting Director
Office of Nonproliferation
and National Security

Comments From the Department of State

United States Department of State

Washington, D.C. 20520

BUREAU OF POLITICAL-MILITARY AFFAIRS

June 2, 1995

Mr. Mario Zavala
U.S. General Accounting Office
111 Massachusetts Avenue N.W.
Suite 201
Washington, D.C. 20001

Dear Mr. Zavala:

Thank you for the opportunity to review GAO's draft report, "Nuclear Materials: Information on Nuclear Exports Controlled by U.S.-EURATOM Agreement" (GAO/RCED-95-168).

Department officials have read the draft report with interest. We do not have any specific comments on the report at this time.

Sincerely,

John A. Dooley
Office of Nuclear Energy Affairs

Major Contributors to This Report

Resources, Community, and Economic Development Division, Washington, D.C.

Bernice Steinhart, Associate Director, Energy and Science Issues
Gene Aloise, Assistant Director
Mary Alice A. Hayward, Evaluator-in-Charge
Thomas J. Flaherty, Senior Evaluator
Mario Zavala, Senior Evaluator
Duane G. Fitzgerald, Nuclear Engineer

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