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## CONTRACTOR REPORT

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# Spent Fuel Transportation in the United States: Commercial Spent Fuel Shipments Through December 1984

Nuclear Assurance Corporation  
5720 Peachtree Parkway  
Norcross, GA 30092

Prepared by Sandia National Laboratories Albuquerque, New Mexico 87185  
and Livermore California 94550 for the United States Department of Energy  
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SPENT FUEL TRANSPORTATION IN THE UNITED STATES:  
COMMERCIAL SPENT FUEL SHIPMENTS THROUGH DECEMBER 1984

Prepared By  
Nuclear Assurance Corporation  
Norcross, Georgia

March 1986

ABSTRACT

This report lists the transportation shipments of light water reactor (LWR) spent nuclear fuel from U.S. commercial nuclear power plants that have occurred from 1964 through December 31, 1984.

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## SUMMARY

As of December 31, 1984, more than 4,500 commercial spent nuclear fuel assemblies had been shipped either by road or by rail to off-site storage locations within the United States. An additional 1,656 spent-fuel assemblies have been transferred between storage pools located on the same site. Of all the nuclear utilities in the U.S., Commonwealth Edison has the most experience in shipping spent fuel. It has shipped more fuel to Nuclear Fuel Services' (NFS) West Valley plant in New York State and General Electric's Midwest Storage Facility (GE-MSF) in Morris, Illinois, than any other utility. Based on current utility operating plans and commercial operation dates of new reactors to come on line, more than 85,000 assemblies will be available for shipping by the end of 1990.

Spent-fuel shipping activity began to increase in 1983. The activity continued at a faster pace in 1984 (this activity level is expected to continue to 1985) because of requirements for removal of the fuel in storage at West Valley, New York, and its return to its owners. In addition to the West Valley shipments, 109 fuel assemblies have been returned to Point Beach from the General Electric Midwest Storage Facility, Morris, Illinois. Also, a current shipping program is under way between Monticello reactor and the GE Morris facility that has already resulted in the shipment of 216 fuel assemblies by rail. Combined, these shipments involve more than 1,100 fuel assemblies and shipments, including both truck and rail transport.

With a national nuclear waste policy act in place, the future shipments of spent nuclear fuel will depend in part on how this act is implemented. According to the act, all at-reactor storage alternatives must be assessed and utility storage systems implemented, if possible, before the government will provide for interim storage capacity. Transshipment is one alternative that is being utilized and will likely

increase in the future where the need arises. A monitored retrievable storage (MRS) system, if approved and implemented by the Department of Energy (DOE), will involve large transport requirements for the movement of spent fuel from the plants to storage. This eventuality, however, is not expected to occur until the late 1990s.

## INTRODUCTION

This report has been prepared to provide updated transportation information on light water reactor (LWR) spent fuel in the United States. Historical data are presented on the quantities of spent fuel shipped from individual reactors on an annual basis and their shipping destinations. Specifically, a tabulation is provided for each spent-fuel shipment that lists utility and plant of origin, destination and number of spent-fuel assemblies shipped. For all annual shipping campaigns between 1980 and 1984, the actual numbers of spent-fuel shipments are defined. The shipments are tabulated by year, and the mode of shipment and the casks utilized in shipment are included. The data consist of the current spent-fuel inventories at each of the operating reactors as of December 31, 1984.

This report presents historical data on all commercial spent-fuel transportation shipments that have occurred in the United States through December 31, 1984.

### The Decommissioning West Valley Reprocessing Facility

A sizable number of spent-fuel shipments are being made or have been made from the Nuclear Fuel Services West Valley facility. The decommissioning of this facility requires that all of the spent fuel currently in storage at the site be removed. Lacking alternative storage options, the utilities which have fuel stored at West Valley are shipping it back to their spent-fuel pools. In addition, Nuclear Fuel Services has developed a cooperative program with the DOE for cask storage of that portion of the spent fuel for which title to the spent fuel has passed from the originating utility to NFS. Table 1 provides data on the spent-fuel shipping activity anticipated in connection with this operation.

TABLE 1

West Valley Spent Fuel Shipping Summary

<u>Number of Fuel Assemblies</u>	<u>Destination</u>	<u>Shipment Mode</u>	<u>Current Status</u>
205	Dresden	Truck	Completed in 1984*
114	Point Beach	Truck	Completed in 1984
224	Oyster Creek	Truck	Completed in 1985
81	R. E. Ginna	Truck	Planned
125	DOE (Idaho Falls)	Rail	Planned

---

\* Except for one failed assembly

---

The effect of these return shipments is to reduce the already-limited at-reactor fuel storage capacity at the utility sites.

Historical Spent-Fuel Shipments

A presentation of the LWR spent-fuel shipments that have taken place from 1964 through December 31, 1984, is shown in Table 2. These shipments are summarized in Table 3 and Figure 1.

TABLE 2

**Historical Spent-Fuel Shipments  
Through December 31, 1984**

<u>ORIGIN,</u> <u>-----</u>	<u>DESTINATION</u> <u>-----</u>	<u>NUMBER</u> <u>ASSEMBLIES</u> <u>-----</u>	<u>SHIPMENT</u> <u>DATE</u> <u>-----</u>	<u>NUMBER OF</u> <u>SHIPMENTS</u> <u>-----</u>	<u>SHIPMENT</u> <u>MODE</u> <u>-----</u>	<u>CASK TYPE</u> <u>-----</u>
BALTIMORE GAS AND ELECTRIC						
CALVERT CLIFFS	BATELLE CO	RODS†,**	1981	1	TRUCK	NAC-1/NFS-4
BATELLE CO	CALVERT CLIFFS	RODS†,**	1984	1	TRUCK	NLI-1/2
CAROLINA POWER AND LIGHT						
ROBINSON 2	INEL	1	1975	1	TRUCK	NAC-1/NFS-4
ROBINSON 2	BRUNSWICK1	42	1977	††	RAIL	IF-300
ROBINSON 2	BRUNSWICK1	112	1978	††	RAIL	IF-300
BRUNSWICK2	BRUNSWICK1	144	1978	††	RAIL	IF-300
ROBINSON 2	BRUNSWICK2	105	1979	††	RAIL	IF-300
ROBINSON 2	BRUNSWICK1	6	1980	1	RAIL	IF-300
ROBINSON 2	BRUNSWICK2	26	1980	4	RAIL	IF-300
ROBINSON 2	BRUNSWICK2	13	1981	2	RAIL	IF-300
BRUNSWICK2	BATELLE CO	8 RODS**	1981	1	TRUCK	NLI-1/2
COMMONWEALTH EDISON						
DRESDEN 1	SAVANNAH RIVER	8	1964	††	RAIL	*
DRESDEN 1	GE-VALLECITOS	1	1964	1	TRUCK	IF-100
DRESDEN 1	NFS	370	1965-1967	††	RAIL	IF-300
DRESDEN 1	NFS	111	1966	††	RAIL	IF-300
DRESDEN 1	NFS	202	1968-1969	††	RAIL	IF-300
DRESDEN 1	NFS	120	1973	††	TRUCK	NAC-1/NFS-4
DRESDEN 1	NFS	86	1974	††	TRUCK	NAC-1/NFS-4
DRESDEN 2	MSF	64	1975	††	RAIL	IF-300
DRESDEN 2	MSF	324	1976	††	RAIL	IF-300
DRESDEN 2	BATELLE CO	1	1976	1	TRUCK	NAC-1/NFS-4
DRESDEN 2	MSF	365	1977	††	RAIL	IF-300
DRESDEN 1	INEL	2	1978	2	TRUCK	NAC-1/NFS-4
ZION 1	BATELLE CO	1	1982	1	TRUCK	NLI-1/2
BATELLE CO	ZION 1	1 † RODS	1983	1	TRUCK	NLI-1/2
ZION 1	BATELLE CO	1	1983	1	TRUCK	NLI-1/2
NFS	DRESDEN 2/3	14	1983	2	TRUCK	TN-9
NFS	DRESDEN 2/3	191	1984	29	TRUCK	TN-9
BATELLE CO	ZION 1	1	1984	1	TRUCK	NLI-1/2

MSF, General Electric - Midwest Storage Facility  
 INEL, Idaho National Engineering Laboratory  
 NFS, Nuclear Fuel Services, West Valley, NY  
 PNL, Batelle, Pacific Northwest Laboratories  
 EMAD, Nevada Test Site

\* Cask type unknown  
 † Unknown number of rods shipped  
 \*\* Shipment of rods not equal to an assembly  
 †† Multiple shipments prior to 1980 were not covered in this contract

TABLE 2 (Continued)

Historical Spent-Fuel Shipments  
Through December 31, 1984

<u>ORIGIN</u>	<u>DESTINATION</u>	<u>NUMBER ASSEMBLIES</u>	<u>SHIPMENT DATE</u>	<u>NUMBER OF SHIPMENTS</u>	<u>SHIPMENT MODE</u>	<u>CASK TYPE</u>
CONNECTICUT YANKEE APC						
HADDAM NECK	MSF	65	1972	††	TRUCK	1F-200
HADDAM NECK	MSF	6	1974	††	TRUCK	1F-200
HADDAM NECK	BATELLE CO	3	1980	3	TRUCK	NAC-1/NFS-4
CONSOLIDATED EDISON						
INDIAN POINT 1	NFS	124	1966	††	TRUCK	1F-200
INDIAN POINT 1	NFS	80	1969	††	TRUCK	1F-200
INDIAN POINT 1	NFS	40	1970	††	TRUCK	1F-200
CONSUMERS POWER COMPANY						
BIG ROCK	NFS	142	1970	††	RAIL	M-100
BIG ROCK	NFS	45	1971	††	RAIL	M-100
BIG ROCK	NFS	72	1973	††	RAIL	M-100
BIG ROCK	NFS	13	1974	††	RAIL	M-100
DAIRYLAND						
LACROSSE	SAVANNAH RIVER	1	1970	1	TRUCK	*
LACROSSE	MSF	8	1979	8	TRUCK	NAC-1/NFS-4
MSF	LACROSSE	8	1981	4	TRUCK	NAC-1/NFS-4

TABLE 2 (Continued)

Historical Spent-Fuel Shipments  
Through December 31, 1984

ORIGIN	DESTINATION	NUMBER ASSEMBLIES	SHIPMENT DATE	NUMBER OF SHIPMENTS	SHIPMENT MODE	CASK TYPE
<b>DUKE POWER COMPANY</b>						
OCONEE 1	B&W-LYNCHBURG	1	1975	1	TRUCK	NAC-1/NFS-4
B&W-LYNCHBURG	OCONEE 3	1	1975	1	TRUCK	NAC-1/NFS-4
OCONEE 1	B&W-LYNCHBURG	1	1976	1	TRUCK	NAC-1/NFS-4
B&W-LYNCHBURG	OCONEE 3	1	1976	1	TRUCK	NAC-1/NFS-4
OCONEE 1	OCONEE 3	134	1976-1978	134	TRUCK	NAC-1/NFS-4
OCONEE 2	OCONEE 3	36	1977	36	TRUCK	NAC-1/NFS-4
OCONEE 3	OCONEE 2	12	1977	12	TRUCK	NAC-1/NFS-4
OCONEE 1	B&W-LYNCHBURG	3	1978	3	TRUCK	NAC-1/NFS-4
OCONEE 1	CRYSTAL RIVER 3	4	1978	4	TRUCK	NAC-1/NFS-4
B&W LYNCHBURG	OCONEE 3	3	1978	3	TRUCK	NAC-1/NFS-4
OCONEE 2	OCONEE 3	53	1978-1979	53	TRUCK	NAC-1/NFS-4
OCONEE 1	OCONEE 3	44	1979	44	TRUCK	NAC-1/NFS-4
OCONEE 3	OCONEE 1	1	1980	1	TRUCK	NAC-1/NFS-4
OCONEE 1	B&W LYNCHBURG	2	1980	2	TRUCK	NAC-1/NFS-4
B&W LYNCHBURG	OCONEE 3	1	1980	1	TRUCK	NAC-1/NFS-4
OCONEE 3	OCONEE 1 & 2	52	1981	52	TRUCK	NAC-1/NFS-4
OCONEE 3	MCGUIRE 1	13	1982	13	TRUCK	NLI-1/2
OCONEE 3	OCONEE 1 & 2	284	1982	284	TRUCK	NAC-1/NFS-4
OCONEE 3	MCGUIRE 1	4	1983	4	TRUCK	NLI-1/2
OCONEE 3	OCONEE 1 & 2	201	1983	201	TRUCK	NAC-1/NFS-4
<b>FLORIDA POWER AND LIGHT</b>						
TURKEY POINT 3	TURKEY POINT 4	57	1976	57	*	NLI-1/2
TURKEY POINT 4	TURKEY POINT 3	189	1976-1977	189	*	NLI-1/2
TURKEY POINT 3	BATELLE CO	5	1978	5	TRUCK	NAC-1/NFS-4
TURKEY POINT 3	TURKEY POINT 4	272	1977-1978	272	*	NAC-1&NLI-1/2
TURKEY POINT 3	EMAD	8	1979	8	TRUCK	NLI-1/2
TURKEY POINT 3	EMAD+	5	1979	5	TRUCK	NLI-1/2
TURKEY POINT 4	TURKEY POINT 3	168	1981	168	*	NAC-1/NFS-4
TURKEY POINT 3	TURKEY POINT 4	1	1981	1	*	NAC-1/NFS-4
TURKEY POINT 3	TURKEY POINT 4	2	1983	2	*	NAC-1/NFS-4
TURKEY POINT 4	TURKEY POINT 3	2	1983	2	*	NAC-1/NFS-4
TURKEY POINT 4	TURKEY POINT 3	4	1983	4	*	NAC-1/NFS-4

TABLE 2 (Continued)

Historical Spent-Fuel Shipments  
Through December 31, 1984

ORIGIN	DESTINATION	NUMBER ASSEMBLIES	SHIPMENT DATE	NUMBER OF SHIPMENTS	SHIPMENT MODE	CASK TYPE
GPU NUCLEAR						
OYSTER CREEK 1	NFS	24	1973+	12	TRUCK	NAC-1/NFS-4
OYSTER CREEK 1	NFS	136	1974+	68	TRUCK	NAC-1/NFS-4
OYSTER CREEK 1	NFS	64	1975+	32	TRUCK	NAC-1/NFS-4
OYSTER CREEK 1	BATELLE CO	RODS	1981	1	TRUCK	NAC-1/NFS-4
NEBRASKA PUBLIC POWER DISTRICT COOPER	MSF	54	1984	1**	RAIL	IF-300
OMAHA PUBLIC POWER DISTRICT						
FORT CALHOUN	BATELLE CO	23 RODS	1982	1	TRUCK	NLI-1/2
BATELLE CO	FORT CALHOUN	21 RODS	1983	1	TRUCK	NLI-1/2
NORTHERN STATES POWER CO.						
MONTICELLO	BATELLE CO	RODS	1981	1	TRUCK	NAC-1/NFS-4
MONTICELLO	BATELLE CO	1	1983	1	TRUCK	NLI-1/2
PACIFIC GAS AND ELECTRIC HUMBOLDT BAY	NFS	270	1969-1971	15	RAIL	NFS-100
PHILADELPHIA ELECTRIC						
PEACH BOTTOM 2	INEL	2	1977	††	TRUCK	*
PEACH BOTTOM 2	GE-VALLECITOS	5 RODS	1976	††	TRUCK	*
ROCHESTER GAS AND ELECTRIC						
R.E.GINNA	NFS	12	1973	12	TRUCK	NAC-1/NFS-4
R.E.GINNA	NFS	61	1974	61	TRUCK	NAC-1/NFS-4
R.E.GINNA	NFS	48	1976	48	TRUCK	NAC-1/NFS-4

+ NAC estimate based on historical cask use information

\* Cask type unknown

†† Multiple shipments prior to 1980 were not covered in this contract

\*\* Three casks

TABLE 2 (Continued)

Historical Spent-Fuel Shipments  
Through December 31, 1984

ORIGIN	DESTINATION	NUMBER ASSEMBLIES	SHIPMENT DATE	NUMBER OF SHIPMENTS	SHIPMENT MODE	CASK TYPE
SOUTHERN CALIFORNIA EDISON						
SAN ONOFRE 1	MSF	74	1972-1973	††	TRUCK	IF-100
SAN ONOFRE 1	MSF	21	1975	††	TRUCK	IF-100
SAN ONOFRE 1	MSF	55	1976	55	TRUCK	NAC-1/NFS-4
SAN ONOFRE 1	MSF	85	1977	85	TRUCK	NAC-1/NFS-4
SAN ONOFRE 1	MSF	19	1978	19	TRUCK	NAC-1/NFS-4
SAN ONOFRE 1	MSF	16	1980	16	TRUCK	NAC-1/NFS-4
VIRGINIA ELECTRIC POWER CO. SURRY						
	BATELLE CO	1	1983	1	TRUCK	NLI-1/2
WISCONSIN ELECTRIC POWER CO.						
POINT BEACH 1	NFS	44	1974	44	TRUCK	NAC-1/NFS-4
POINT BEACH 1	MSF	14	1975	14	TRUCK	NAC-1/NFS-4
POINT BEACH 2	MSF	20	1975	20	TRUCK	NAC-1/NFS-4
POINT BEACH 1	MSF	76	1975	76	TRUCK	NAC-1/NFS-4
POINT BEACH 2	BATELLE CO	1 + 16 RODS	1976	2	TRUCK	NAC-1/NFS-4
POINT BEACH 2	MSF	38	1976	38	TRUCK	NAC-1/NFS-4
POINT BEACH 2	MSF+	1 + 16 RODS	1976	2	TRUCK	NAC-1/NFS-4
POINT BEACH 2	MSF	36	1977	36	TRUCK	NAC-1/NFS-4
POINT BEACH 1	PNL††	6	1978	6	TRUCK	NAC-1/NFS-4
MSF	POINT BEACH 1	60	1983	60	TRUCK	NLI-1/2
NFS	POINT BEACH 1	13	1983	13	TRUCK	NLI-1/2
NFS	POINT BEACH 1	101	1984	101	TRUCK	NLI-1/2
MSF	POINT BEACH 1	49	1984	49	TRUCK	NLI-1/2
YANKEE ATOMIC POWER CO.						
YANKEE ROWE	NFS	74	1965	††	RAIL	WECX-300
YANKEE ROWE	NFS	39	1965-1966	††	RAIL	WECX-300
YANKEE ROWE	NFS	37	1965-1967	††	RAIL	WECX-300
YANKEE ROWE	NFS	32	1966	††	RAIL	WECX-300
YANKEE ROWE	NFS	39	1967	††	RAIL	WECX-300

+ First shipped to Batelle Columbus Laboratories then to EMAD

†† First shipped to NFS then to PNL

†† Multiple shipments prior to 1980 were not covered in this contract

TABLE 2 (Continued)

Historical Spent-Fuel Shipments  
Through December 31, 1984

<u>ORIGIN</u>	<u>DESTINATION</u>	<u>NUMBER ASSEMBLIES</u>	<u>SHIPMENT DATE</u>	<u>NUMBER OF SHIPMENTS</u>	<u>SHIPMENT MODE</u>	<u>CASK TYPE</u>
YANKEE ATOMIC POWER CO. (continued)						
YANKEE ROWE	NFS	36	1968	††	RAIL	WECX-300
YANKEE ROWE	NFS	32	1969-1970	††	RAIL	WECX-300
YANKEE ROWE	NFS	35	1971	††	RAIL	WECX-300
YANKEE ROWE	WESTINGHOUSE WALTZ MILL, PA	8	1971	††	TRUCK	VANDENBURGH
YANKEE ROWE	NFS+	8	1971	††	TRUCK	VANDENBURGH
BATTELLE CO	EMAD	3	1979	††	TRUCK	NAC-1/NFS-4
BATTELLE CO	EMAD	1	1978	1	TRUCK	NAC-1/NFS-4
B&W-LYNCHBURG	BATTELLE CO	RODS	1978	1	TRUCK	NAC-1/NFS-4
BATTELLE CO	B&W-LYNCHBURG	RODS	1978	1	TRUCK	NAC-1/NFS-4

†† Multiple shipments prior to 1980 were not covered in this contract  
+ First shipped to Westinghouse then to NFS

TABLE 2  
SPENT-FUEL SHIPMENT SUMMARY

Shipment Year	Assemblies					Number Shipped	Number of Shipments <sup>4</sup>
	Reprocessor/AFR		Transshipments		Research Facility		
	NFS	GE-MSF	On-Site	Off-Site			
1964	-	-	-	-	9	9	-
1965	231	-	-	-	-	231	-
1966	421	-	-	-	-	421	-
1967	174	-	-	-	-	174	-
1968	137	-	-	-	-	137	-
1969	287	-	-	-	-	287	-
1970	288	-	-	-	1	289	-
1971	178	-	-	-	-	178	-
1972	-	102	-	-	-	102	-
1973	228	46	-	-	-	274	-
1974	340	6	-	-	-	346	-
1975	140	119	-	-	2, (1)	262	-
1976	48	417	197	-	3, (2)	667	-
1977	-	486	323	42	2	853	-
1978	(6) <sup>3</sup>	19	351	116	15 + 2 <sup>1</sup> , (3)	509	-
1979	-	8	70	105	16	200	-
1980	-	16	1	32	5, (1)	55	28
1981	-	(8)	221	27	3 <sup>1</sup>	256	244
1982	-	-	284	13	1	298	298
1983	(26)	(60)	209	4	3, (1)	303	292
1984	(292)	(54, 149)	-	-	(1) + (1) <sup>1</sup>	396	181
TOTAL	2,147	1,156	1,656	339	48	6,247	1,044 <sup>2</sup>

1. These shipments contained rods only.
2. Shipments made January 1980 to December 31, 1984.
3. Assemblies returned to originator's designee or site shown in ( ).
4. Shipments from 1964 through 1979 not evaluated in this study.

## U.S. SPENT-FUEL SHIPMENT SUMMARY

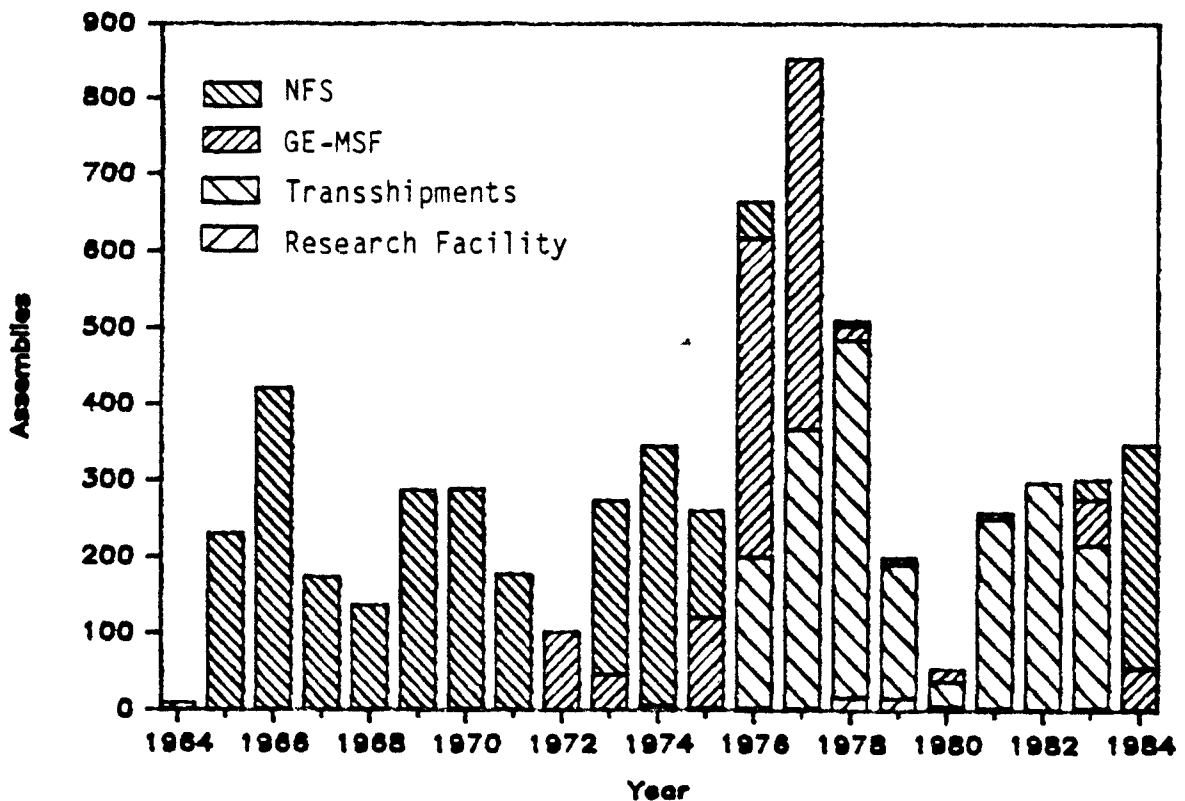


Figure 1. U.S. Spent Fuel Shipment Summary

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