

NWPO-TN--008-90

STATE OF NEVADA
AGENCY FOR NUCLEAR PROJECTS/
NUCLEAR WASTE PROJECT OFFICE

DE91 011015

NWPO-TN-008-90

COMMERCIAL SPENT NUCLEAR FUEL SHIPMENTS
IN THE UNITED STATES, 1964 - 1987

by

NUCLEAR ASSURANCE CORPORATION
NORCROSS, GEORGIA

December, 1990

DIVISION *Diggs*

CC *Petrie / Lorenz*

CC *Grassmeyer*

CC *Barton / Fisher*

CC *Coburn / Wilson*

CC *Feilly / Volek*

CC *Andrews / Jappan*

CC *Hertz / Johnson*

CC *Blanchard / Robison*

REC'D IN YMP *Brookman*
4-9-91

The Nevada Agency for Nuclear Projects/Nuclear Waste Project Office (NWPO) was created by the Nevada Legislature to oversee federal high-level nuclear waste activities in the State. Since 1985, it has dealt largely with the U.S. Department of Energy's (DOE) siting of a high-level nuclear waste repository at Yucca Mountain in southern Nevada. As part of its oversight role, NWPO has contracted for studies designed to assess the transportation impacts of a repository.

This study was funded by DOE grant number DE-FG08-85-NV10461.

MASTER

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

Table of Contents

<u>Section</u>	<u>Page</u>
I Introduction	1
II Table 1 — Historical Spent Fuel Shipments	3
III Table 2 — Summary of Historical Spent Fuel Shipments by Destination.....	11
IV Potential Spent Fuel Shipments — Commercial Reactors.....	13

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

Introduction

This report provides an overview of U.S. commercial light-water reactor spent-fuel shipments that have occurred from January, 1964 through December, 1987. A summary analysis was performed on these historical shipments, showing the amount of fuel that has been shipped to research facilities, reprocessing plants, away-from-reactor (AFR) storage sites, and other reactors. Also presented in this report is a listing of potential spent-fuel shipments to and/or from commercial nuclear plants.

Information on historical spent-fuel shipments was obtained from publications, utility and industry sources, and the transportation experience of NAC. This information has been compiled to show:

- Utility
- Origin of shipment (reactor)
- Destination of shipment
- Quantity of spent-fuel assemblies shipped and the actual number of shipments made
- Year(s) of shipment
- Mode of shipment
- Cask(s) utilized in shipment

Table 1 provides the detailed listing of historical spent-fuel shipments. Table 2 is a summary of these shipments grouped by destination. Section IV discusses utility plans for future spent-fuel shipments.

Table 1
Historical Spent-Fuel Shipments
Through December 31, 1987

Origin	Destination	Number Assemblies	Shipment Date	Number of Shipments	Shipment Mode	Cask Type
Arkansas Power and Light						
ANO 1	B&W-Lynchburg	6 rods	1987	1	Truck	NLI-1/2
Baltimore Gas and Electric						
Calvert Cliffs	Battelle Co.	rodst,**	1981	1	Truck	NAC-1/NFS-4
Battelle Co.	Calvert Cliffs	rodst,**	1984	1	Truck	NLI-1/2
Calvert Cliffs	PNL	rodst,**	1985	1	Truck	NLI-1/2
Carolina Power and Light						
Robinson 2	INEL	1	1975	1	Truck	NAC-1/NFS-4
Robinson 2	Brunswick 1	42	1977	6***	Rail	IF-300
Robinson 2	Brunswick 1	112	1978	16	Rail	IF-300
Brunswick 2	Brunswick 1	144	1978	††	Rail	IF-300
Robinson 2	Brunswick 2	105	1979	15	Rail	IF-300
Robinson 2	Brunswick 1	6	1980	1	Rail	IF-300
Robinson 2	Brunswick 2	26	1980	4	Rail	IF-300
Robinson 2	Brunswick 2	13	1981	2	Rail	IF-300
Brunswick 2	Battelle Co.	8 rods**	1981	1	Truck	NLI-1/2
Robinson 2	AECL†	10 rods	1986	1	Truck	NLI-1/2
Commonwealth Edison						
Dresden 1	Savannah River	8	1964	1	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	52	Truck	NAC-1/NFS-4
Dresden 1	NFS	86	1974		Truck	NAC-1/NFS-4

AECL = Atomic Energy of Canada, Ltd.

B&W-Lynchburg = Babcock & Wilcox, Lynchburg, VA

Battelle Co. = Battelle, Columbus, OH

C-E = Combustion Engineering

EMAD = Nevada Test Site

GE-Vallecitos = General Electric, California Research Facility

INEL = Idaho National Engineering Laboratory

MSF = General Electric - Midwest Storage Facility at Morris, IL

NFS = Nuclear Fuel Services, West Valley, NY

PNL = Battelle, Pacific Northwest Laboratories

* Cask type unknown

** Shipment of rods not equal to an assembly

*** NAC assumption

† Unknown number of rods shipped

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

‡ First shipped to INEL then to AECL

Table 1 (continued)
Historical Spent-Fuel Shipments
Through December 31, 1987

Origin	Destination	Number Assemblies	Shipment Date	Number of Shipments	Shipment Mode	Cask Type
Commonwealth Edison (continued)						
Dresden 2	MSF	64	1975	4	Rail	IF-300
Dresden 2	MSF	324	1976	21	Rail	IF-300
Dresden 2	Battelle 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	Battelle Co.	1	1982	1	Truck	NLI-1/2
Battelle Co.	Zion 1	1 + rods	1983	1	Truck	NLI-1/2
Zion 1	Battelle 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
Battelle Co.	Zion 1	1	1984	1	Truck	NLI-1/2
NFS	Dresden 2/3	1	1985	1	Truck	NLI-1/2
Quad Cities	B&W-Lynchburg	3	1986	3	Truck	NLI-1/2
B&W-Lynchburg	Quad Cities	3	1987	*	*	*
Connecticut Yankee APC						
Haddam Neck	MSF	65	1972	65	Truck	IF-200
Haddam Neck	MSF	6	1974	6	Truck	IF-200
Haddam Neck	Battelle Co.	3	1980	3	Truck	NAC-1/NFS-4
Battelle Co.	Haddam Neck	2	1982	2	Truck	TN-8L
Haddam Neck	MSF	7	1987-1988	7	Truck	IF-200
Consolidated Edison						
Indian Point 1	NFS	124	1966	124	Truck	IF-200
Indian Point 1	NFS	80	1969	80	Truck	IF-200
Indian Point 1	NFS	40	1970	40	Truck	IF-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	9	Rail	M-100
Big Rock	NFS	13	1974	2	Rail	M-100

* Number of shipments, shipment mode, and cask type is not known

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

Table 1 (continued)

Historical Spent-Fuel Shipments
Through December 31, 1987

Origin	Destination	Number Assemblies	Shipment Date	Number of Shipments	Shipment Mode	Cask Type
Dairyland						
Lacrosse	Savannah River	1	1970	1	Truck	NAC-1/NFS-4
Lacrosse	MSF	8	1979	8	Truck	NAC-1/NFS-4
MSF	Lacrosse	8	1981	4	Truck	NAC-1/NFS-4
Duke Power Company						
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
Oconee	McGuire 1	6	1984-1985**	6**	Truck	NLI-1/2
Oconee 1, 2 & 3*	Oconee 1, 2 & 3*	294	1984-1985**	294**	Truck	NAC-1/NFS-4
Oconee 2	McGuire 2	21	1985	21**	Truck	NLI-1/2
Oconee 1, 2 & 3*	Oconee 1, 2 & 3*	81	1986	81	Truck	NAC-1/NFS-4
Oconee 1, 2 & 3*	Oconee 1, 2 & 3*	1	1987	1	Truck	NAC-1/NFS-4
Oconee 2	McGuire 2**	4	1986	†	Truck	TN-8
Oconee 1	McGuire 2	21	1986	†	Truck	TN-8
Oconee 2	McGuire 2	75	1986	†	Truck	TN-8

* Specific unit(s) not known

** NAC assumption

† Number of shipments is not known

Table 1 (continued)
Historical Spent-Fuel Shipments
Through December 31, 1987

Origin	Destination	Number Assemblies	Shipment Date	Number of Shipments	Shipment Mode	Cask Type
Duke Power Company (continued)						
Oconee 1 & 2	McGuire 2	45	1986	15	Truck	TN-8
Oconee	McGuire 1	12	1986	12	Truck	NLI-1/2
Oconee 1 & 2	McGuire 2	74	1987	58	Truck	TN-8
Florida Power and Light						
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	Battelle 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
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	Battelle Co.	rods	1981	1	Truck	NAC-1/NFS-4
NFS	Oyster Creek 1	224	1985	32	Truck	TN-9
Maine Yankee						
Maine Yankee	C-E	7 rods	1974	1	Truck	NAC-1/NFS-4
Maine Yankee	Battelle Co.	30 rods	1974	1	Truck	NAC-1/NFS-4

* Cask transfer between adjacent pools using crane

† First shipped to Battelle Columbus Laboratories then to EMAD

‡ NAC estimate based on historical cask use information

Table 1 (continued)
Historical Spent-Fuel Shipments
Through December 31, 1987

Origin	Destination	Number Assemblies	Shipment Date	Number of Shipments	Shipment Mode	Cask Type
Nebraska Public Power District						
Cooper	MSF	54	1984	1*	Rail	IF-300
Cooper	MSF	36	1985	**	Rail	IF-300
Cooper	MSF	378	1986	**	Rail	IF-300
Cooper	PNL†	2	1986	2	Truck	NLI-1/2
Cooper	MSF	360	1987-1988	**	Rail	IF-300
Omaha Public Power District						
Fort Calhoun	Battelle Co.	23 rods	1982	1	Truck	NLI-1/2
Battelle Co.	Fort Calhoun	23 rods	1983	1	Truck	NLI-1/2
Fort Calhoun	Battelle Co.	1	1985	1	Truck	NLI-1/2
Battelle Co.	Fort Calhoun	1	1986	1	‡	‡
Northern States Power Co.						
Monticello	Battelle Co.	rods	1981	1	Truck	NAC-1/NFS-4
Monticello	Battelle Co.	1	1983	1	Truck	NLI-1/2
Monticello	MSF	72	1984	29	Rail	IF-300
Monticello	MSF	612	1985		Rail	IF-300
Monticello	MSF	144	1986		Rail	IF-300
Monticello	MSF	230	1987		Rail	IF-300
Pacific Gas and Electric						
Humboldt Bay	NFS	262	1969-1971	15	Rail	NFS-100
Humboldt Bay	NFS	8	1971		Truck	TN-8L
Philadelphia Electric						
Peach Bottom 2	GE-Vallecitos	5 rods	1976	††	Truck	Vandenburgh
Peach Bottom 2	INEL	2	1977	1	Truck	NLI-1/2
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
NFS	R.E. Ginna	36	1985	46	Truck	NLI-1/2
NFS	R.E. Ginna	45	1986	45	Truck	NLI-1/2

* Three casks

** Number of shipments is not known

† First shipped to MSF then to PNL

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

‡ Shipment mode and cask type are unknown

Table 1 (continued)
Historical Spent-Fuel Shipments
Through December 31, 1987

Origin	Destination	Number Assemblies	Shipment Date	Number of Shipments	Shipment Mode	Cask Type
Southern California Edison						
San Onofre 1	MSF	74	1972-1973	74	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	Battelle Co.	1	1983	1	Truck	NLI-1/2
Surry	INEL	45	1985	*	Truck	TN-8L
Surry	INEL	24	1986	*	Truck	TN-8L
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	NFS	76	1975	76	Truck	NAC-1/NFS-4
Point Beach 2	Battelle 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
Point Beach 1	PNL	3	1985	3	Truck	NLI-1/2
Yankee Atomic Power Co.						
Yankee 1	NFS	74	1965	††	Rail	WECX-300
Yankee 1	NFS	39	1965-1966	††	Rail	WECX-300
Yankee 1	NFS	37	1965-1967	††	Rail	WECX-300
Yankee 1	NFS	32	1966	††	Rail	WECX-300

* Number of shipments is not known

† First shipped to Battelle Columbus Laboratories then to EMAD

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

‡ First shipped to NFS then to PNL

Table 1 (continued)

Historical Spent-Fuel Shipments
Through December 31, 1987

Origin	Destination	Number Assemblies	Shipment Date	Number of Shipments	Shipment Mode	Cask Type
Yankee Atomic Power Co. (continued)						
Yankee 1	NFS	39	1967	++	Rail	WECX-300
Yankee 1	NFS	36	1968	++	Rail	WECX-300
Yankee 1	NFS	32	1969-1970	++	Rail	WECX-300
Yankee 1	NFS	35	1971	++	Rail	WECX-300
Yankee 1	Westinghouse Waltz Mill, Pa	8	1971	++	Truck	Vandenburgh
Yankee 1	NFS*	8	1971	++	Truck	Vandenburgh
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
Battelle Co.	EMAD	3	1979	++	Truck	NAC-1/NFS-4

* First shipped to Westinghouse then to NFS

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

Table 2
Summary of Historical Spent-Fuel Shipments
1964-1987

Origin	Destination	Number of Assemblies
Utility	AFR Storage	2,738 ¹
Utility	Other reactors ²	2,615
Utility	Reprocessor	2,470
Utility	Research	63 + rods ³
AFR Storage	Research	2
AFR Storage	Utility	117
Research	AFR Storage	1 + 16 rods
Research	Reprocessor	8
Research	Utility	14 + rods ³
Reprocessor	Research	6
Reprocessor	Utility	625

1. Figure does not include 360 assemblies from Cooper and 7 assemblies from Haddam Neck that were shipped to Morris in 1987-1988. The number of assemblies for 1987 from these reactors is not known.
2. Includes on-site and off-site transfers.
3. Total number of rods is not known.

Potential Spent-Fuel Shipments To and/or From Commercial Reactors

Arkansas Power & Light

The utility plans to ship rods from one ANO-2 fuel assembly in 1989 to B&W or to the AECL research facility at Chalk River.

Carolina Power & Light

CP&L plans to use the storage pools at its Shearon Harris site for storing spent fuel from the Robinson and Brunswick units. Transshipments will be made as necessary, using utility-owned casks. The Robinson site is licensed for, and has already begun, dry storage in concrete bunkers.

Duke Power

In 1988 there were 10 transshipments of Oconee fuel to McGuire: 9 shipments of 25 assemblies using the TN-8 cask and 1 shipment of 4 rods in the NLI-1/2 cask. A shipment of 8 rods from the Oconee site to B&W is planned for the future.

Georgia Power

The utility plans to ship rods from the Hatch plant to B&W in 1990.

Philadelphia Electric

PECO plans to ship rods from Limerick to B&W in 1989.

Southern California Edison

One hundred forty assemblies from unit 1 at San Onofre were transshipped to units 2 and 3 in 1988-1989.

Virginia Power

The utility is licensed to ship up to 500 assemblies from Surry to the North Anna site, but Virginia Power has postponed its plans for transshipment because of opposition by local residents.

Big Rock Point and Ginna fuel at West Valley

There are 165 assemblies remaining in the spent-fuel pool at the NFS facility. Of this quantity, 125 were shipped from Big Rock Point and 40 from R.E. Ginna. All of this fuel is owned by NFS. There are 2 TN casks on site which could be used for the planned transport to INEL, but firm plans for these shipments have not been established.