
Highway Route Controlled Quantity Shipment Routing Reports—An Overview*

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INTRODUCTION

United States Department of Transportation (DOT) regulations require a postnotification report from the shipper for all shipments of radioactive materials categorized as a Highway Route Controlled Quantity. These postnotification reports, filed in compliance with 49 CFR 172.203(d), have been compiled by the DOT in a database known as the Radioactive Materials Routing Report (RAMRT) since 1982. The data were sorted by each of its elements to establish historical records and trends of Highway Route Controlled Quantity shipments from 1982 through 1987. Approximately 1520 records in the RAMRT database were compiled for this analysis.

Approximately half of the shipments reported for the study period were from the U.S. Department of Energy (DOE) and its contractors, with the others being commercial movements. Two DOE installations, EG&G Idaho and Oak Ridge, accounted for nearly half of the DOE activities. Similarly, almost half of the commercial movements were reported by two vendors, Nuclear Assurance Corporation and Transnuclear, Incorporated. Spent fuel from power and research reactors accounted for approximately half of all shipments.

DISCUSSION

The DOT rulemaking of January 19, 1982, 49 CFR 173.22, required that shippers of "Large Quantities" of radioactive materials submit a copy of the route used within 90 days following the shipment. Shipments in this category are made in Type B accident-resistant containers and include spent reactor fuel from both research and power reactors. On July 1, 1983, the DOT established new

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criteria for classifying radionuclides based on A_1/A_2 values and replaced the term "Large Quantity" with "Highway Route Controlled Quantity." The net effect of this change was to reduce the number of shipments reported to the DOT by eliminating most radiopharmaceuticals and some waste shipments from the postnotification reporting requirements. Uniform application of the modified requirements would have reduced the total number of shipments reported in 1982 and 1983 by approximately 27%.

The DOT Radioactive Materials Routing (RAMRT) database contains seven data elements and an assigned DOT identification number for each shipment of Highway Route Controlled Quantity of radioactive (RAM) material. These are:

1. RAM ID Number--radioactive material shipment identification number,
2. Company--shipper or agent name,
3. Carrier--carrier name,
4. Shipped From--name and location of owner or facility,
5. Shipped To--name and location of consignee,
6. Shipment Date--date shipment was made,
7. Material Shipped--type and quantity of material shipped, and
8. Shipment Route--sequential listing of the route taken.

A typical RAMRT data entry is illustrated in Figure 1.

Postnotification reports are currently received from three sources: (1) the shippers, (2) the U.S. Nuclear Regulatory Commission (NRC), who submit the data from their route approval reports, and (3) the DOE, who assemble their data and periodically submit reports to the DOT. In May, 1988, the DOT published a change to the postnotification rule; the carrier, and not the shipper, will be responsible for the submission of the report for Highway Route Controlled Quantities of radioactive material.

Approximately 1520 shipment records from February 1982 through December 1987 were examined. Figure 2 illustrates the total by year of these records. The data contained in each of the data fields for each record were examined and adjusted where necessary to compile the summary data discussed below. This effort did not change the reported information but rather ensured consistency in reporting. An example of this was the reported destination, such as Idaho National Engineering Laboratory: locations reported included the INEL, Idaho Falls, ID; the INEL, Scoville, ID; EG&G Idaho, Scoville, ID; and Westinghouse Electric, Scoville, ID. Similar reporting inconsistencies were noted for each of the data fields. Where necessary, shippers and/or carriers were contacted for clarification and a modified data set was created for use on a personal computer.

Key data elements summarized in this effort include the shippers, carriers, origins, destinations, material types, and routes taken. Shippers are categorized as NRC shippers, or those who are governed by the regulations of the DOT as well as the NRC; and DOE shippers, equivalently governed by the regulations and orders of the DOT and the DOE. NRC shippers transport materials owned or possessed by NRC licensees, while DOE shippers transport materials covered under the Atomic Energy Act. Major shippers are summarized in Figures 3 and 4.

The relationship between the major NRC shippers is illustrated in Figure 3. Three of these companies, Nuclear Assurance Company (NAC), Transnuclear, Incorporated, and Edlow International Company, do not own, possess or directly use RAM, but make shipping arrangements for NRC licensee clients and handle most of the international shipments into and out of the United States. A majority of the remainder of the shippers transport RAM directly.

Figure 4 depicts the relationship between the major DOE shippers for the six-year period. EG&G Idaho, Incorporated (together with INEL) was the most active DOE shipper with 204 shipments, followed by a combination of organizations located in Oak Ridge, Tennessee, including Oak Ridge National Laboratory (61 shipments), Union Carbide (22), and Martin Marietta Energy Systems (58) for a total of 141 shipments. Argonne National Laboratory, Argonne, IL, was the third most active shipper with 116 shipments.

Table 1 summarizes the motor carrier statistics from the DOT database. Common carriers, identified by an asterisk, transported approximately 90% of the total, with private carriers responsible for the remainder. A decrease in carrier activity can be noted for more recent years. In 1982, 22 carriers reported activity, while only 4-6 were active in 1986 and 1987. Some of this reduction is due to the reporting criteria change (July 1983) from "Large Quantity" to "Highway Route Controlled Quantity" shipments. Over the period analyzed, approximately 70% of the total number of shipments were handled by only one carrier, Tri-State Motor Transit Company of Joplin, MO.

Figure 5 shows the distribution of the five most active shipment origins. Two of these, West Valley, NY, and Morris, IL, are origins for domestic spent power reactor fuel, and a third, Portsmouth, VA, is the most frequently used port of entry for shipments of spent research reactor fuel from overseas. Spent power reactor fuel was temporarily stored in both the West Valley and Morris locations and has subsequently been returned to the respective owners to permit decommissioning of the facilities.

The most active destination points included in the database are summarized in Figure 6. The most active DOE-operated receiving facilities were the Idaho National Engineering Laboratory in Scoville, ID, the Savannah River Plant near Aiken, SC, and the Hanford Reservation near Richland, WA. The most frequent commercially-operated facilities were the Point Beach nuclear power plant in Two Rivers, WI, and the R. E. Ginna power plant in Ontario, NY. These locations received approximately 50% of the total shipments over the study period.

The total number of reported shipping destinations declined after 1983 due to the change in reporting requirements discussed previously.

The data entry most difficult to analyze was the type of material shipped. This entry is extracted from the shipping papers submitted with the postnotification report. The requirements for reporting the material shipped are found in 49 CFR 172.203(d). The exact nature of the material shipped was found, in some cases, to be inconsistently reported. The records may indicate a long list of radionuclides followed by the curie content, the notation "spent fuel", or simply by the term "mixed fission products." From the data, four frequently shipped types of material are: (1) Cobalt 60; (2) mixed fission products of high curie content; (3) power reactor spent fuel; and (4) research reactor spent fuel. The remaining types of material were classified as "other." These data are summarized in Figure 7.

The shipment routes taken largely follow the Interstate Highway system, consistent with the requirements of 49 CFR Part 173.22 and 177.825, as anticipated. A total of 1206 shipments, representing approximately 80% of the total number of records, were surveyed. These records were selected on the basis of shipment frequency and do not include shipments that were judged to pertain only to "Large Quantity" amounts for the years 1982 and 1983. This set consists of a total of 48 distinct routes. Where incomplete sections of the Interstate Highway system forced a rerouting or detour, these data were not separated; however, each of the 48 routes followed the same pathways for all shipments, except for one rerouting from Surry, VA, to Scoville, ID. This pattern would confirm that the Interstate Highway System routes, recommended in HM-164, are still functioning as the major path for Highway Route Controlled Quantities of radioactive materials.

CONCLUSIONS

Efforts to further analyze these data and update this work are presently underway. Efforts will be concentrated on data quality assurance activities, checking the reports filed with the DOT and formulation of a specialized database summarizing the postnotification reports, RAMPOST, to be placed on TRANSNET (Cashwell, 1989). Historical shipment patterns may then be analyzed by using any of the data fields compiled. Historical and anticipated routes will be compared to validate routing methods employed for environmental analyses conducted using TRANSNET.

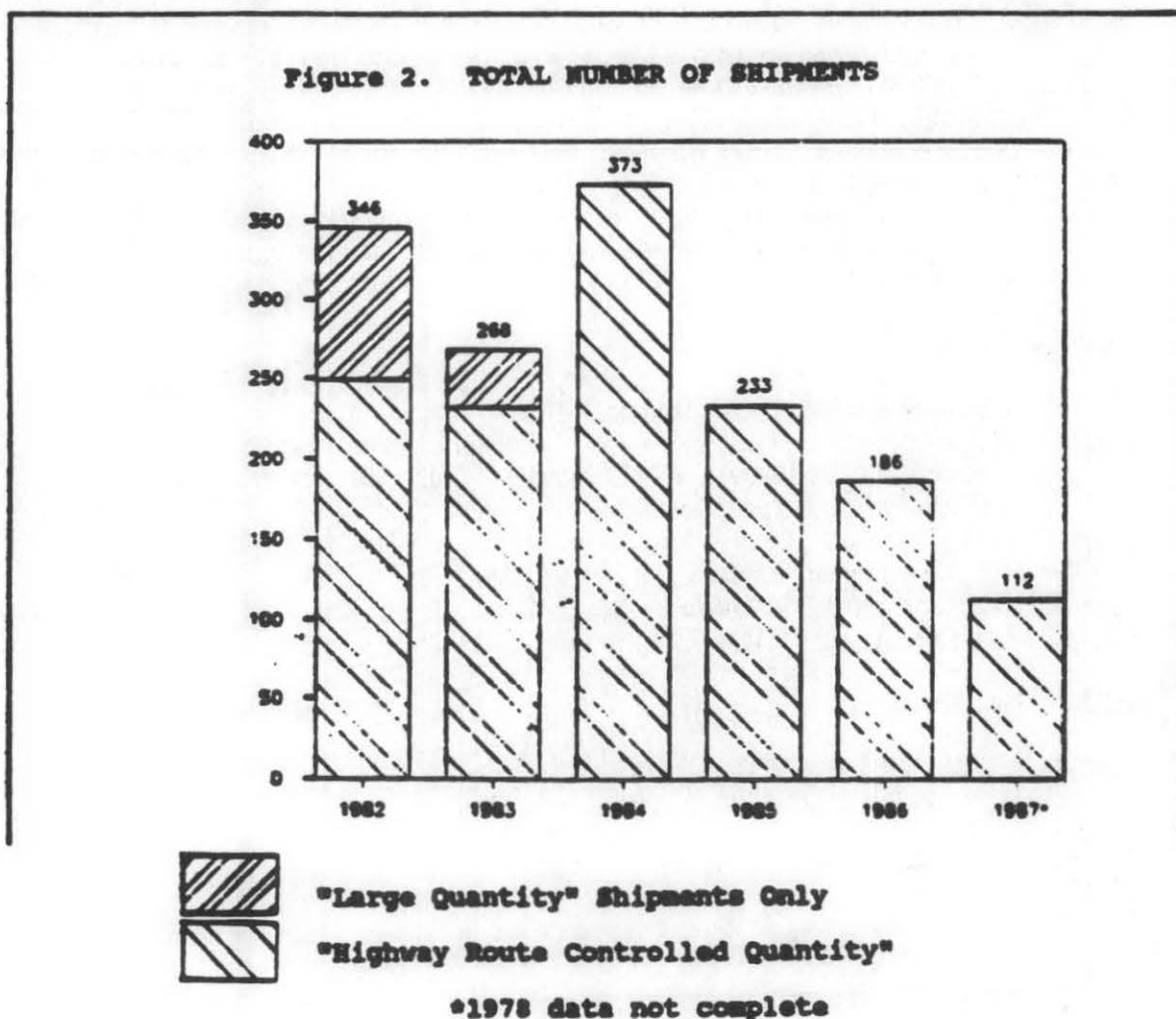
REFERENCES

- Cashwell, J.W., TRANSNET--Access to Transportation Models and Databases, SAND89-0982C, TTC-0882, Albuquerque, NM, Sandia National Laboratories, June, 1989.

COMPANY: DOE/WESTINGHOUSE ELEC. RAM ID NUMBER: 1540
 CARRIER: TRI-STATE MOTOR TRANSIT
 SHIPPED FROM: WESTINGHOUSE ELECTRIC
 SCOVILLE, ID
 SHIPPED TO : WESTINGHOUSE ELECTRIC
 WEST HIFFLIN, PA
 SHIPMENT DATE : 07/19/1984
 MATERIAL SHIPPED:
 MF-181, MF-P, NI-63, PU-239, PU-241, FISSILE EXEMPT, SOLID, METAL OXIDE,
 860 CURIES

SHIPMENT ROUTE : ID 26 ID I-15 UT I-15 UT I-84 UT I-80 WY I-80
 NE I-80 IA I-80 IL I-80 IN I-80 OH I-80 OH I-76
 PA I-76 PA I-79 PA I-179 PA 31

Figure 1. Typical RAMRT Data Form



TOTAL NUMBER OF NRC SHIPMENTS (810)
MAJOR SHIPPERS FOR ALL YEARS 1982-1987

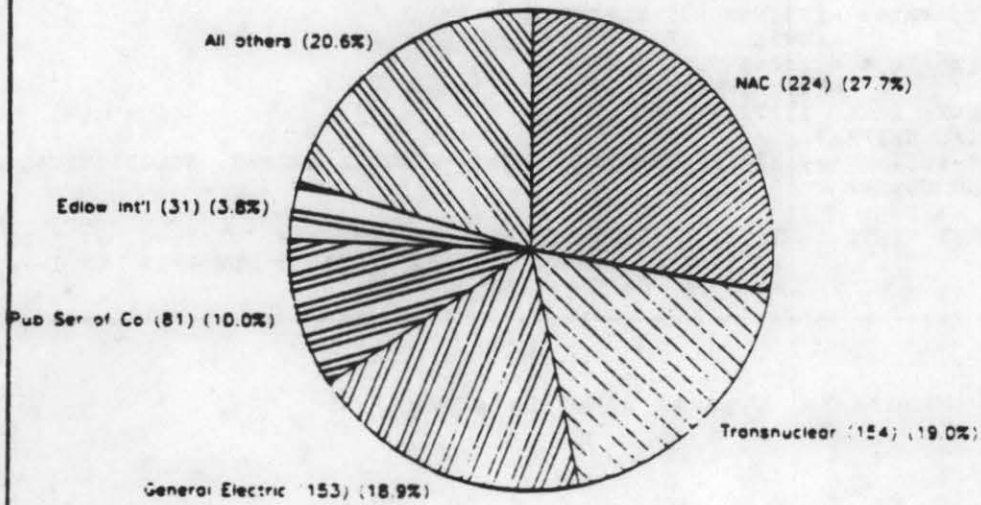


Figure 3: Major NRC Shippers of Highway Route Controlled Quantities of Radioactive Material.

TOTAL NUMBER OF DOE SHIPMENTS (706)
MAJOR SHIPPERS FOR ALL YEARS 1982-1987

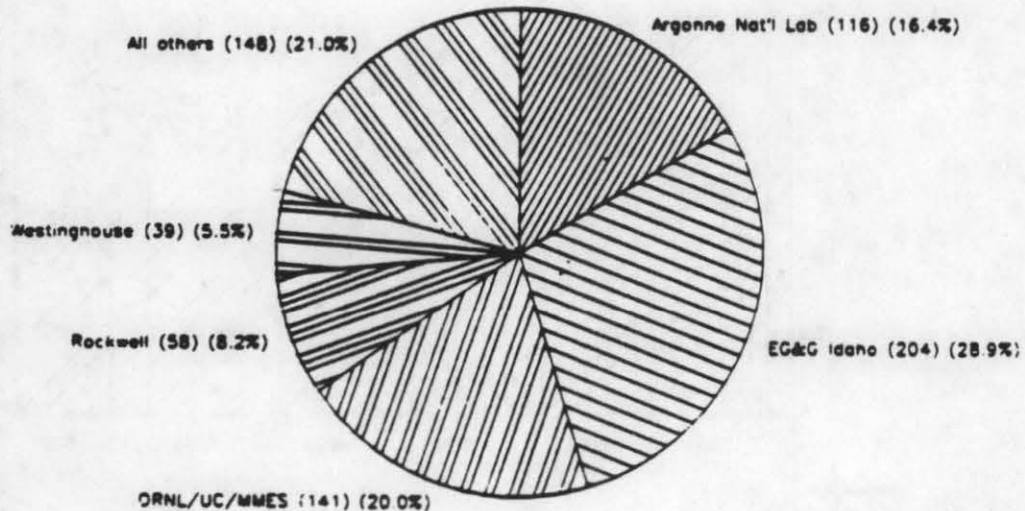
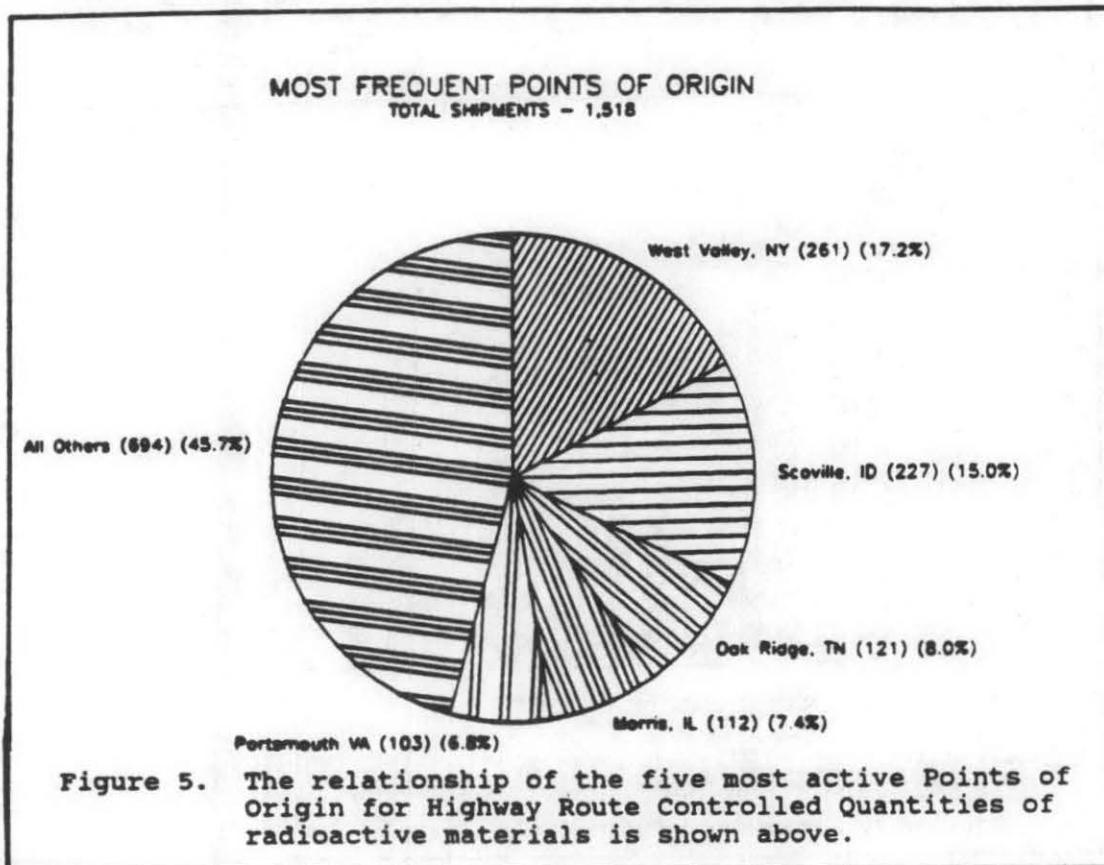


Figure 4. Major DOE Shippers of Highway Route Controlled Quantities of Radioactive Material.

**TABLE 3
CARRIER - SUMMARY
Number of Shipments**

Carrier:	1982	1983	1984	1985	1986	1987	TOTAL
*ABF Freight Systems	1						1
Advanced Medical Sys	3	5					8
Argonne Nat'l Lab				1		1	2
Chem Nuclear	11	23					34
*Con Freightways	1	1					2
*Emery Air Freight	27					2	29
*EMS Courier	1						1
*Flying Tigers	1						1
Fritz	1						1
Gamma	1						1
*Gresham				4			4
Hittman	6	8					14
*Home/McGil**	39	27	55	13	11	14	159
Lawrence Livermore NL		4	4				8
*Malslin	3						3
*Mason and Dixon	2						2
*Metler	14		8	18	25	9	74
*Midwestern	11	2	7				20
Neutron Products	59	31					90
*Pacific Interstate Exp	1			1			2
*Pilot Freight	1						1
*Roadway	2					3	5
Rockwell	3						3
*Ryder	14						14
*Tri-State Motor Trnst	144	167	299	196	148	83	1037
US Ecology					2		2
TOTALS	346	268	373	233	186	112	1518
*Common Carriers							
**Home became McGil Specialized Carriers in 1986							



MOST FREQUENT DESTINATIONS
1,518 SHIPMENTS - 1982 THROUGH 1987

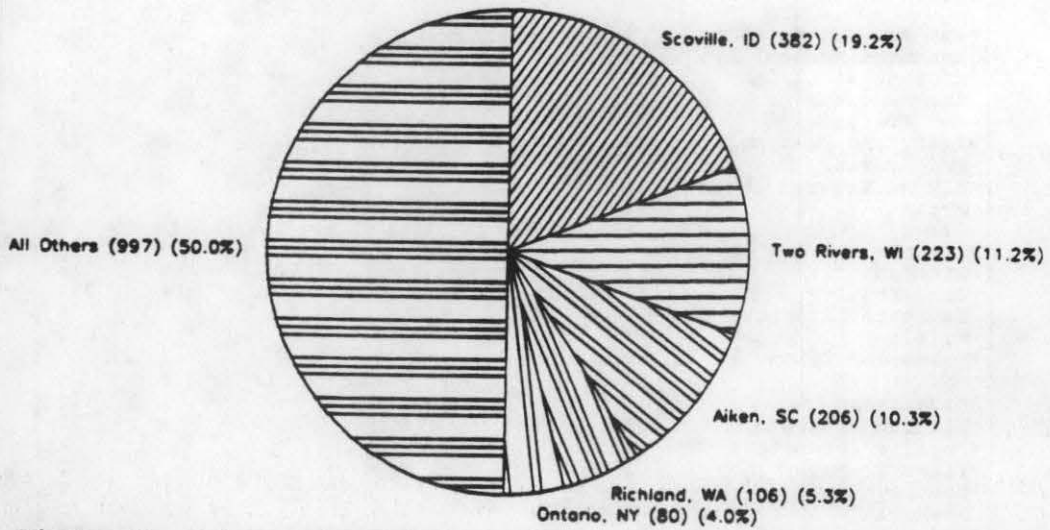


Figure 6. The relationship of the five most frequently used destinations for Highway Route Controlled Quantities of radioactive materials is shown above.

TYPES OF MATERIAL

ALL SHIPMENTS

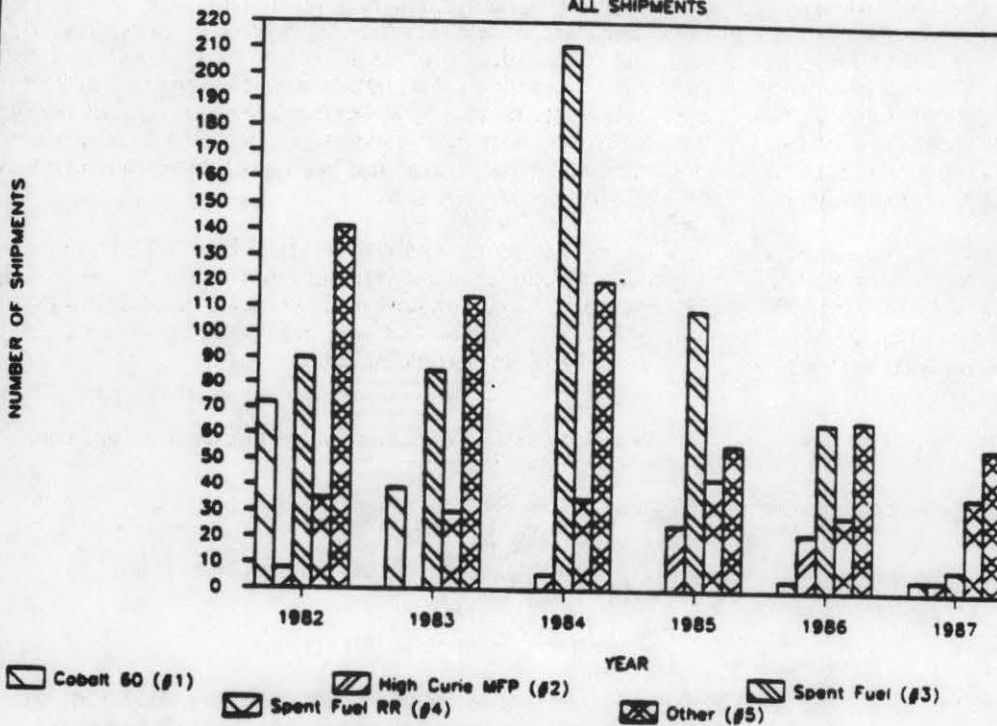


Figure 7. Summary of Materials Shipped, by Year.