

HOPE CREEK GENERATING STATION
OPERATING LICENSE NO. NPF-57

MONITORING OF LNG AND LPG SHIPPING AND
CONSTRUCTION ACTIVITIES ON THE DELAWARE RIVER
FINAL REPORT

Prepared in Response to Amendment No. 5
Construction Permit No. CPPR-120

Public Service Electric and Gas Company
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1.0 SUMMARY

On November 4, 1974, the Atomic Energy Commission issued a Construction Permit (CP) for the construction of the Hope Creek Generating Station in Salem County, New Jersey.

The Hope Creek site is located on the Delaware River estuary near the southern end of an artificial peninsula known as Artificial Island.

Amendment No. 5 to the Construction Permit requires PSE&G to monitor activities related to the shipment of liquefied natural gas (LNG) and liquefied petroleum gas (LPG) on the Delaware River. This monitoring included shipping rates of liquefied flammable gases and various types of construction activity. The chemicals classified as liquefied flammable gases are propane, butane, butadiene, vinyl chloride and liquefied natural gas.

Monitoring results show that total shipping of liquefied flammable gas has decreased from the level anticipated during the construction permit stage and remains below the acceptable upper limit of probability established by the NRC that Hope Creek Generating Station will be affected by a flammable vapor cloud. In addition, no new or proposed construction which could have an effect on the probability calculations has apparently been authorized.

2.0 INTRODUCTION

Amendment No. 5 to CPPR-120 was initiated due to concerns that a flammable vapor cloud could reach the Hope Creek Generating Station in the event of a waterborne transportation accident and affect the safe operation of the Hope Creek facility. As stated in the Hope Creek SER, the initial safety evaluation determined that the projected maximum value of 420 ship transits per year would not present a hazard to the safety of the Hope Creek facility and estimated a total probability of flammable gas clouds at Artificial Island of 1.6×10^{-7} per year based on this level of shipping.

Amendment No. 5 requires monitoring to ensure that this probability is not exceeded. Activities of interest are those which might result in an increased rate of shipping or which could cause an increased probability of accident occurrence.

An increase in the shipping rate may occur when an existing facility increases its importation rate or constructs new storage or refining facilities. PSE&G has monitored these events by keeping in touch with local authorities, contacting those refineries and import terminals on the Delaware River which are capable of receiving liquid fuel and by reviewing the monthly "Public Notices" issued by the Department of the Army - Philadelphia District, Corps of Engineers."

Although there is currently no LNG shipping on the Delaware River, there have been proposals in the past to initiate such shipping. All have either been withdrawn or rejected by the Federal Energy Regulatory Commission (FERC). Consequently, there are currently no outstanding proposals for an LNG facility that could possibly affect the Hope Creek Generating Station. PSE&G is continuously monitoring the applications received by FERC relating to LNG terminals.

Other types of construction activities on the Delaware River may also result in an increased risk to the Hope Creek Generating Station. It has been estimated (PSE&G, Dockets 50-354 and 50-355 before the NRC, exhibits 9, 10, 11) that a flammable vapor cloud which forms as a result of an accidental spill of a liquid fuel on water could travel up to 12 miles. Therefore, PSE&G monitored for construction of potential river obstacles or rammable objects within a distance of 12 miles up or downstream of Hope Creek. Currently, with the exception of one high voltage transmission tower and a submerged shipwreck, there are no rammable objects in the vicinity of the shipping channel near Hope Creek.

The calculation of the probability of a flammable cloud reaching Hope Creek was made on a biannual basis. It was last calculated for the calendar year 1983 and reported in our submission dated April 19, 1985. Our February 6, 1986 submission also considered possible changes in this probability.

The probability calculation is based on a series of conditional probabilities. These probabilities involve the expected number of accidents per mile of river transit, the probability that a spill will result given that an accident has occurred, the probability that a vapor cloud will form given that there has been a spill, and the meteorological factor.

The NRC has established guidelines for the acceptable upper limit of the probability that the Hope Creek Generating Station will be affected by a flammable vapor cloud formed as a result of an accident on the river. In an estimate in which the factors are determined based on conservative approximations, the number of incidents cannot exceed 10^{-6} per year.

3.0 YEARLY REPORT

3.1 Total Number of Ships Per Year

An estimate of the total number of ships passing the Hope Creek Generating Station during the period March 1985 through April 11, 1986 and carrying each of the designated cargoes is shown on Tables 1 and 2. Table 1 shows the liquid flammable gases imported into the Ports of Philadelphia and Table 2 shows those exported. This data is also graphically depicted in the figures appearing at the end of this report. The data were obtained from the Delaware River Port Authority through a computer database of shipping manifests. Tables 1 and 2 also present the load/discharge date, quantity, product, vessel, origin/destination and, where possible, the importer/exporter. Data for January and February 1985 were not available from this database.

As indicated in Table 3, the total number of ships of liquefied flammable gas passing Hope Creek has generally decreased since monitoring began in 1977. The slight increase in number of ships shown for 1985-86 is due to the extra 3½ months included in the total.

3.2 Construction Activity

The construction activity along the Delaware River was monitored through the review of monthly "Public Notices" issued by the Department of the Army, Philadelphia District Corps of Engineers, and by contacting various facilities located upstream of the plant. The facilities listed in Table 4 were last contacted in late 1985 and either had no plans to increase the capacity of their off-loading facilities or did not plan to construct receiving facilities for liquefied flammable gases.

3.3 Conclusions

PSE&G has monitored existing and planned construction, and waterborne shipment of liquefied natural gas (LNG) and liquefied petroleum gas (LPG) on the Delaware River since 1977. No major liquefied flammable gas facilities have been constructed, nor are planned for the Delaware River. In no year did the number of ship transits even approach the projected maximum value of 420 ship transits per year that was determined not to present a hazard to the safety of the Hope Creek facility in the initial safety evaluation and in the Hope Creek Safety Evaluation Report (SER).

As indicated in Table 3, there have been no shipments of liquefied natural gas (LNG) past the site during the study years 1977-1986. Also, no vinyl chloride has been shipped past Hope Creek since 1978.

The NRC staff determined at the construction permit stage of review and again in the SER, that the total probability of propane, butane, LPG, and LPG flammable gas clouds at Artificial Island was 1.6×10^{-7} per year. Using 30 as the nine year average total number of liquefied flammable gas shipments per year (Table 3), the revised probability is 4.69×10^{-9} per year.

Therefore, as previously concluded by the NRC staff, the probability of waterborne transportation accidents causing radiological consequences in excess of the guidelines of 10CFR100 remains within the acceptance criteria of SRP Section 2.2.3.

Construction Permit CPPR-120 for Hope Creek Generating Station was converted into Operating License No. NPF-57 on April 11, 1986. With the conversion of the construction permit into an operating license, the monitoring and reporting requirements of Amendment No. 5 expire. Thus, this is the final report on LNG and LPG shipping and construction activities on the Delaware River.

TABLE 1 - LIQUEFIED FLAMMABLE GAS SHIPMENTS ON DELAWARE RIVER
MARCH 1985 - APRIL 11, 1986
IMPORT CARGOS

<u>Discharge Date</u>	<u>Quantity (STONS)</u>	<u>Product</u>	<u>Vessel</u>	<u>Origin</u>	<u>Importer</u>
3/26/85	6,122	Butadiene	Simon	Netherlands	-
4/18/85	1,857	Butadiene	Alessandro Volta	Belgium	-
5/17/85	19,968	Butane	Lincolnshire	Saudia Arabia	Sun Transport
6/1/85	2,314	Butadiene	Luigi Casale	Spain	-
6/9/85	3,309	Butadiene	Igloo Moss	United Kingdom	-
6/10/85	2,313	Butadiene	Sally Maersk	Spain	-
6/19/85	1,864	Butadiene	Sofie Maersk	Spain	-
7/16/85	4,248	Butadiene	Susan Maersk	Spain	-
8/5/85	2,315	Butadiene	Olga Maersk	Spain	-
9/6/85	2,326	Butadiene	Hermion	Netherlands	Texaco
9/22/85	7,603	Butane	Lincolnshire	United Kingdom	Chevron
9/30/85	2,970	Butadiene	Gas Mariner	Netherlands	-
10/25/85	2,327	Butadiene	Epsilongas	Netherlands	-
10/31/85	9,680	Butane	Mundogas Pacific	United Kingdom	-
12/5/85	1,774	Butane	Concordia Fjord	France	Total Intl.
12/20/85	2,314	Butadiene	Inge Maersk	Spain	Keer Maurer

TABLE 1 - (CONT.)

<u>Discharge Date</u>	<u>Quantity (STONS)</u>	<u>Product</u>	<u>Vessel</u>	<u>Origin</u>	<u>Importer</u>
12/21/85	9,566	Butane	Gazana	United Kingdom	Avant Petrol.
12/26/85	2,239	Butadiene	Igloo Moss	United Kingdom	ICI Americas
12/26/85	41,977	Butane	Gas Enterprise	Saudia Arabia	P.B.Gas Intl.
12/30/85	6,235	Butane	Susan Maersk	United Kingdom	Mundogas
1/2/86	2,551	Butadiene	Osco Cecilia	Netherlands	-
1/3/86	46,398	Butane	Golar Frost	Saudia Arabia	Sun Intl.
1/16/86	2,887	Butadiene	Svend Maersk	Spain	ICI Americas
2/3/86	9,450	Butane	Gazana	United Kingdom	Tranogas & Petrochem
2/16/86	2,274	Butadiene	Olga Maersk	Spain	Keer Maurer
2/16/86	2,309	Butadiene	Olga Maersk	Spain	-
2/25/86	2,777	Butane	Mundogas Europe	United Kingdom	-
2/25/86	11,581	Butane	Mundogas Europe	United Kingdom	Mundogas
4/8/86	20	Butane	Nyhavn	United Kingdom	Mundogas

TABLE 2 - LIQUEFIED FLAMMABLE GAS SHIPMENTS ON DELAWARE RIVER
MARCH 1985 - APRIL 11, 1986
EXPORT CARGOS

<u>Load Date</u>	<u>Quantity (STONS)</u>	<u>Product</u>	<u>Vessel</u>	<u>Destination</u>	<u>Exporter</u>
3/22/85	1	Propane	Nurnberg Express	Germany	Scott Environmental
4/2/85	774	Propane	Simon Gas	Canada	Tropigas
5/9/85	8,816	Propane	Oluf Maersk	Sweden	-
6/6/85	705	Propane	Fred Billups	Bermuda	Tropigas
6/23/85	881	Propane	Fred Billups	Bermuda	Tropigas
9/9/85	755	Propane	Caribbean Venture	Bahamas	Tropigas
9/9/85	950	Propane	Caribbean Venture	Bermuda	Tropigas
9/12/85	1	Propane	Brussel	United Kingdom	STP
3/7/86	111	Propane	Fred Billups	Jamaica	Tropigas
3/7/86	1527	Propane	Fred Billups	Bahamas	Tropigas

TABLE 3. LIQUEFIED FLAMMABLE GAS SHIPMENTS ON DELAWARE RIVER,
1/1/77 THROUGH 4/11/86

Total Number of Ships						
Year	Propane	Butane	Butadiene	Vinyl Chloride	LNG	Total
1977	1	10	10	25	0	46
1978	5	10	1	25	0	41
1979	1	10	13	0	0	24
1980	2	9	12	0	0	23
1981	3	8	6	0	0	17
1982	0	8	6	0	0	14
1983	9	4	19	0	0	32
1984	8	8	16	0	0	32
1985-1986	10	11	17	0	0	38
TOTAL	0	78	100	50	0	228

NOTE: 1985-1986 data includes March 1985 through April 11, 1986 only

TABLE 4
LPG FACILITIES ON THE DELAWARE RIVER

1. Atlantic Petroleum Company (Formerly ARCO Marine)
Foot of Island Road
Philadelphia, PA 19153

Robert Ryan, Pipeline Supervisor
(215)365-6688

Future Correspondence:
Atlantic Refinery and Marketing Corporation
Centre Square East
1500 Market Street
Philadelphia, PA 19102

Attention: Traffic and LPG Coordinator
2. British Petroleum Oil Company
P.O. Box 428
Marcus Hook, PA 19061

Robert S. Yurko, Operations Superintendant
(215)494-3600
3. British Petroleum Oil Company
P.O. Box 71
Paulsboro, NJ 08066

Houston Johnson, Terminal Manager
(609)423-4000
4. Chevron Oil Company (Formerly Gulf Oil Company)
Girard Point, PA 19145

E. E. Schoeberlein, Refinery Manager
(215)339-7233
5. Chevron Oil Company (Formerly Gulf Oil Products
Company)
Philadelphia Refinery
P.O. Box 7408
Philadelphia, PA 19101

Rudy Koziol, Operations Coordinator
(215)339-7450
6. CITGO Petroleum Corporation
P.O. Box 171
Pennsauken, NJ 08110

Ray Smith, Terminal Manager
(609)963-8470

7. Coastal Eagle Point Oil Company (Formerly Texaco Oil Co.)
Eagle Point Facility
Box 1000
Westville, NJ 08093

George Orescan, Plant Manager
(609)845-8000
8. Mantua Chemical Terminal Corporation
Crown Point Road
Thorofare, NJ 08086

George Gagloff, Facility Manager
(609)423-5400
9. Mobil Oil Company
Paulsboro, NJ 08066

Dale E. Choate, Refinery Manager
(609)423-1040
10. Sun Oil Company
Marcus Hook, PA 19061

Charles Phillips, Superindendant - Transfer & Shipping
(215)447-1000
11. Texaco Oil Company (Formerly Getty Oil Company)
Delaware City, DE 19706

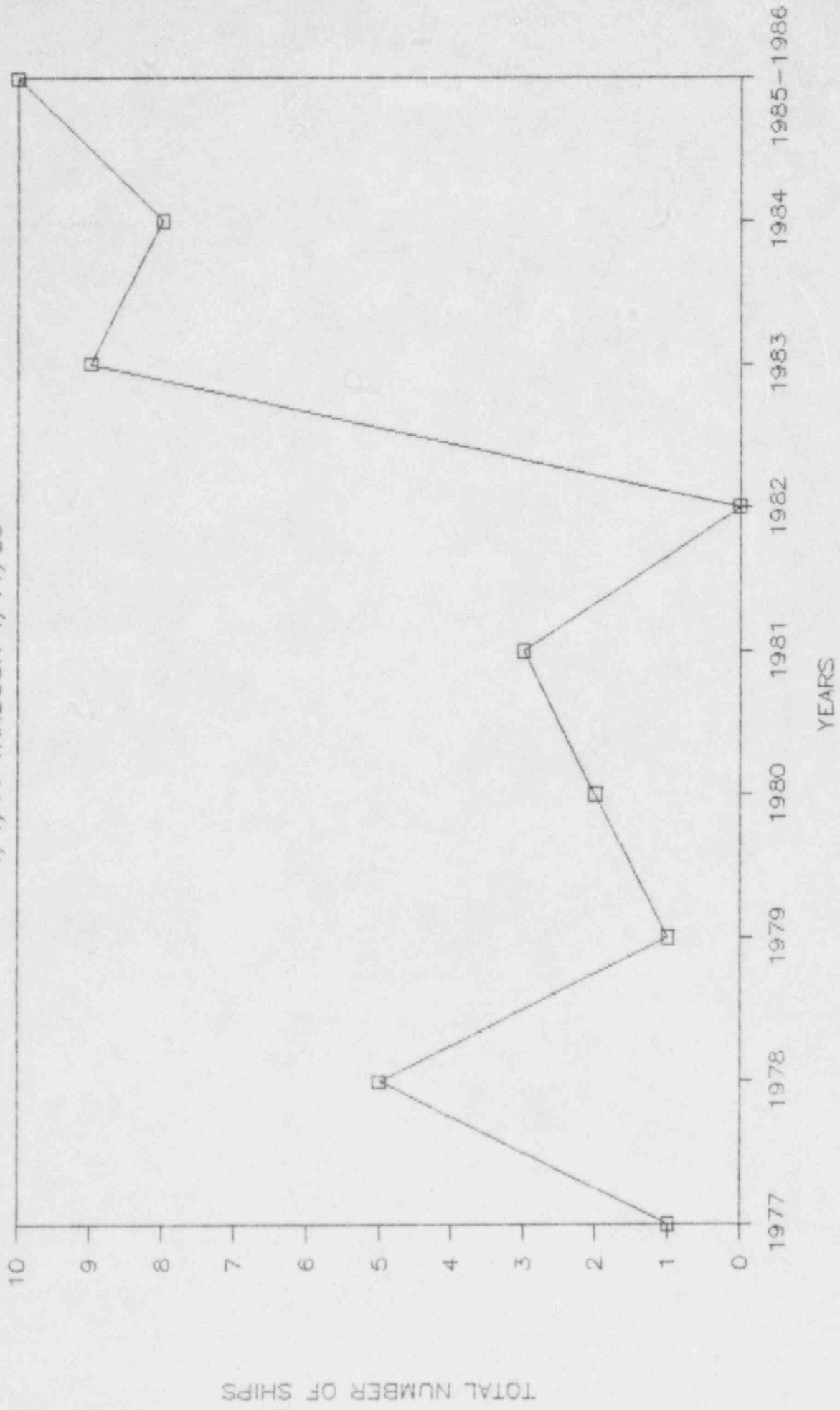
R. G. Soehlke, Refinery Manager
(302)834-6200

1/22/86

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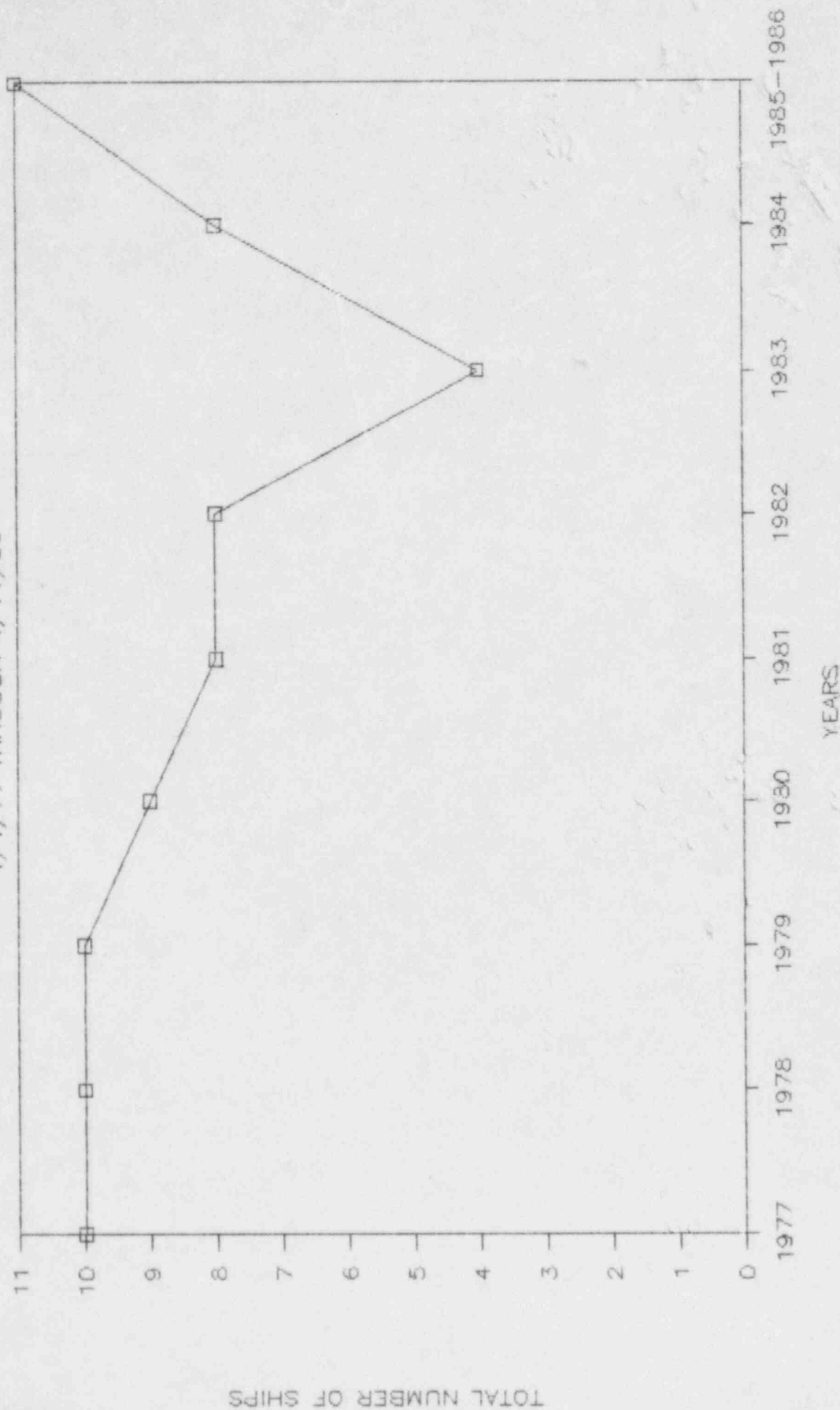
PROPANE SHIPMENTS ON DELAWARE RIVER.

1/1/77 THROUGH 4/11/86



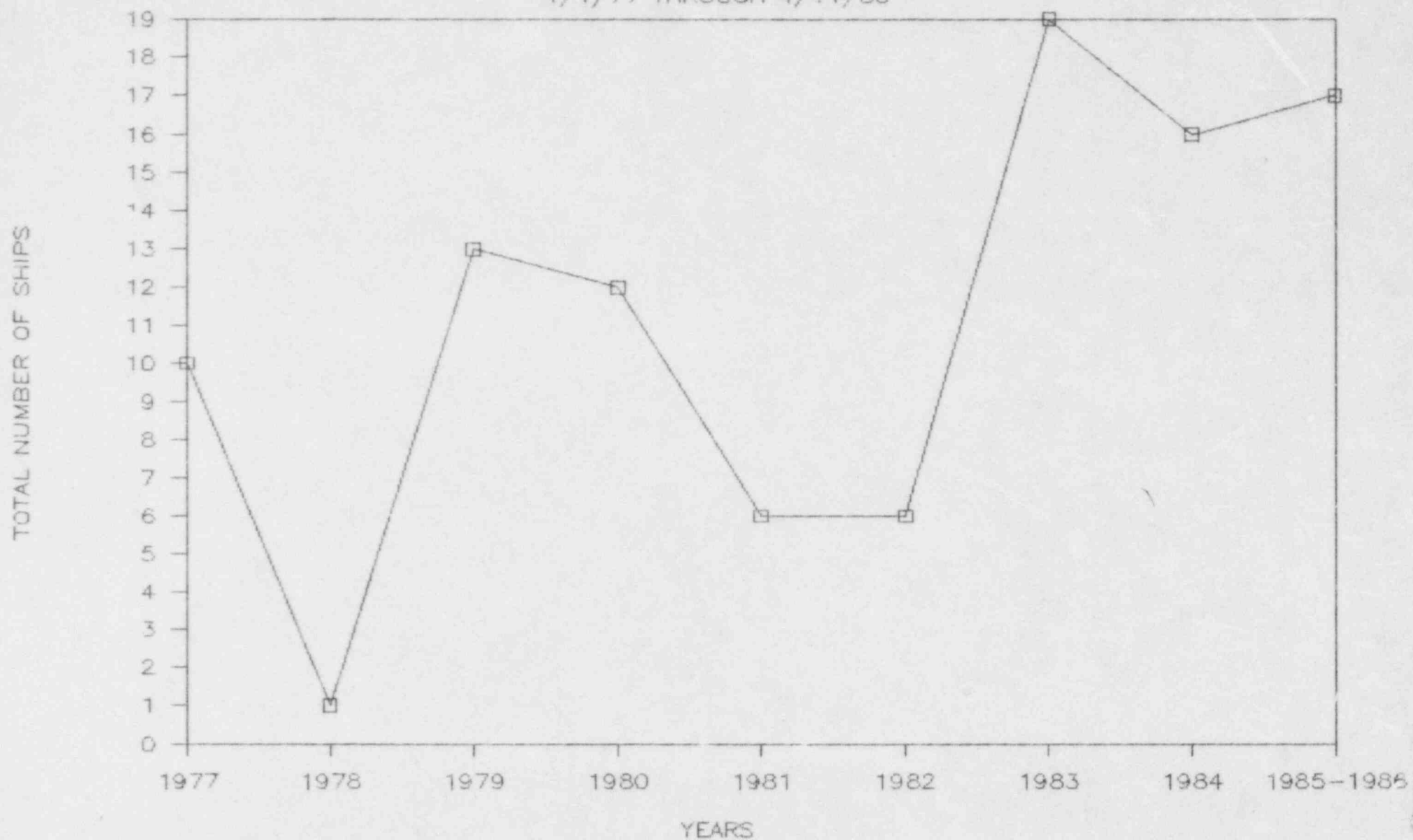
BUTANE SHIPMENTS ON DELAWARE RIVER,

1/1/77 THROUGH 4/11/86



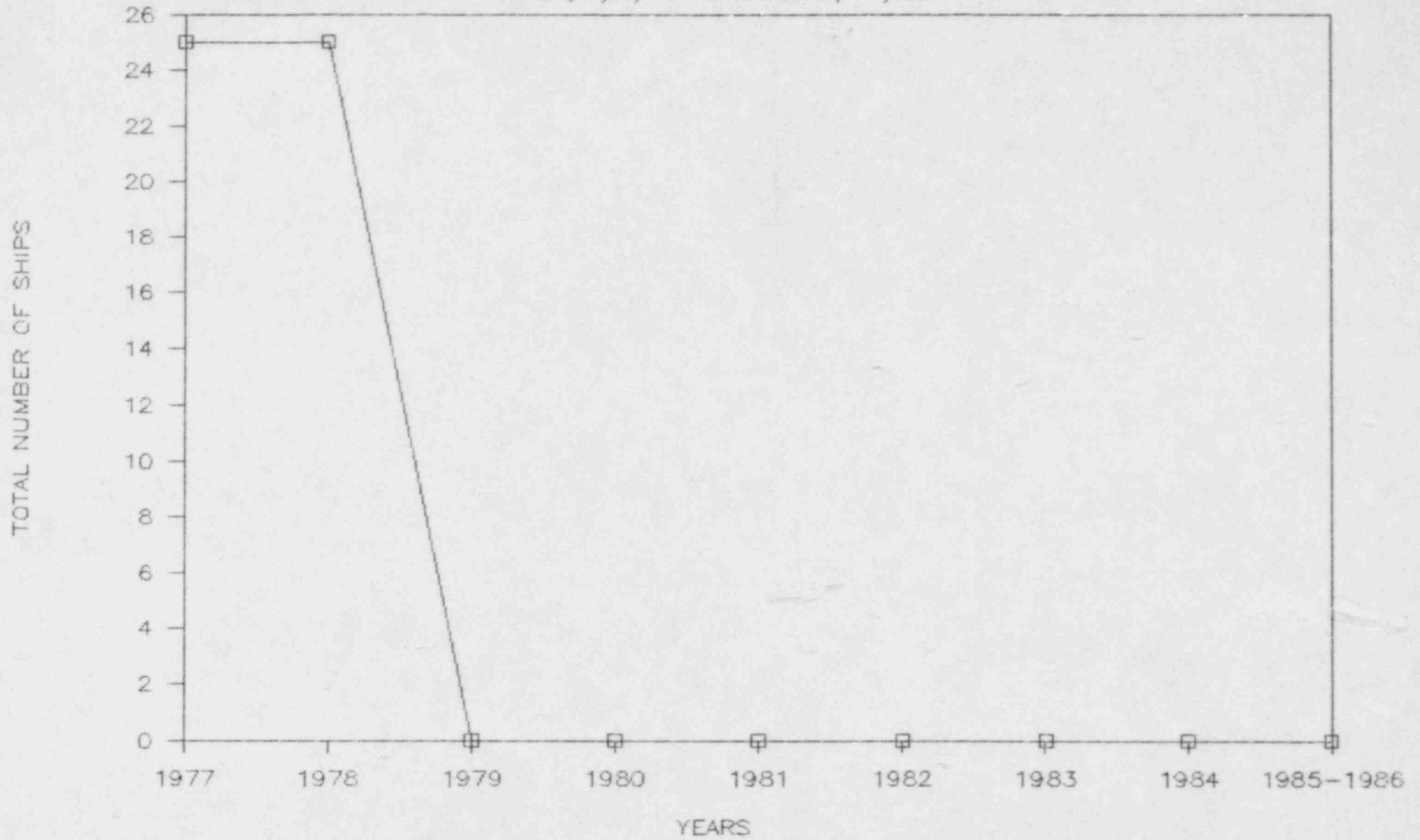
BUTADIENE SHIPMENTS ON DELAWARE RIVER,

1/1/77 THROUGH 4/11/86



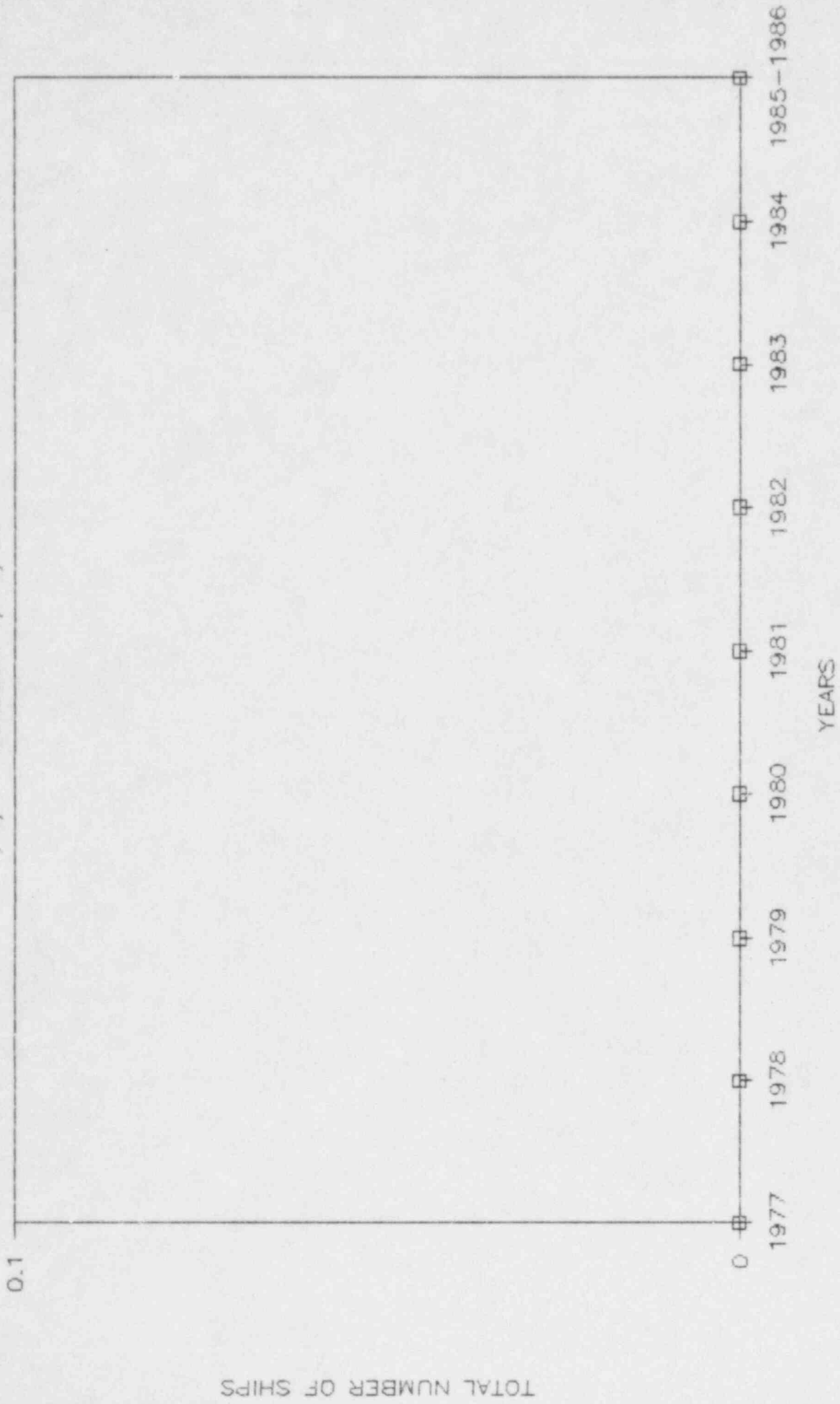
VINYL CHLORIDE SHIPMENTS ON DELAWARE

RIVER, 1/1/77 THROUGH 4/11/86



LNG SHIPMENTS ON DELAWARE RIVER,

1/1/77 THROUGH 4/11/86



TOTAL NUMBER OF SHIPS