

HOPE CREEK GENERATING STATION

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

Docket No. 50-354

December 1983

M P83 120/01 1-df

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## 1. 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 includes 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.

The results of this study show that the shipping activity of interest has decreased slightly, and that no new or proposed construction which could have an effect on the probability calculations has apparently been authorized.

## 2. INTRODUCTION

The 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 would occur either should an existing facility increase its importation rate or because of the construction of a new storage or refining facility. 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 fuels and by reviewing the "Public Notices" issued by the Department of the Army - "U.S. Corps of Engineers."

Although there is currently no LNG shipping on the river, there have been proposals 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 All have either been withdrawn or rejected by the Federal Energy Regulatory Commission (FERC).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 on the Delaware River could also result in 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, any spill occurring within a distance of 12 miles up or downstream of the nuclear facility has to be analyzed to determine if it presents a potential hazard to the plant. Currently, with the exception of Tower 97,\* there are no rammable objects in the vicinity of the shipping channel near Hope Creek. However, in the future, docks, jetties, moorings, piles, or other potential obstructions could be constructed in the river. Therefore, PSE&G is monitoring construction activity of this type.

The calculation of the probability of a flammable cloud reaching the Hope Creek plant is made from 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 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.

\*Electrical Transmission Line Tower

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3. YEARLY REPORT - 1982  
(YR-4)

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### 3.1 Total Number of Ships Per Year

The total number of ships passing by the nuclear plant in 1982 and carrying each of the designated chemicals was developed by Poten & Partners, Inc., a shipping consultant. The data was derived from U.S. Coast Guard Records, Import and Export Records, and the U.S. Army Corps of Engineers. The list presented in Table 1 specifies the discharge date, quantity, product, vessel, origin and, where possible, the importer. This information is summarized in Table 2, and graphically presented on Figures 1 through 5.

Also, the shipments of vinyl chloride have ceased. This is due to the fact that the manufacturing facility, located in Puerto Rico, from which the vinyl chloride was being imported, went out of business.

### 3.2 Construction Activity

The construction activity along the Delaware River was monitored through the review of "Public Notices" issued by the U.S. Army Corps. of Engineers, by contacting various facilities located upstream of the plant (see Table 3 and Figure 6) and the Federal Energy Regulatory Commission, which is responsible for reviewing and approving any proposals for construction of LNG terminals.

Liquefied Gas Cargos Transiting the Delaware River - 1982

<u>DISCHARGE DATE</u>	<u>QUANTITY (METRIC TONS)</u>	<u>PRODUCT</u>	<u>VESSEL</u>	<u>ORIGIN</u>	<u>IMPORTER</u>
<u>January</u>					
9	14,669	Butane	Faraday	Saudi Arabia	
<u>February</u>					
2	2,427	Butadiene	Bow Elm	United Kingdom	
8	13,054	Butane	Mundogas Europe	Saudi Arabia	
<u>March</u>					
22	11,521	Butane	Lord Kelvin	Venezuela	Warren
30	3,400	Butadiene	Luigi Casale	United Kingdom	Exxon Chemical
<u>April</u>					
28	7,205	Butane	Fernwave	Algeria	MBK
<u>May</u>					
20	5,488	Butane	Danian Gas	Libya	Naftomar
25	2,900	Butadiene	Pascal	United Kingdom	Exxon Chemical
<u>June</u>					
15	2,155	Butane	Svend Maersk	France	Warren
15	2,200	Butadiene	Svend Maersk	France	
<u>July</u>					
7	3,158	Butadiene	Deltagas	United Kingdom	Exxon Chemical
<u>August</u>					
<u>September</u>					
<u>October</u>					
<u>November</u>					
24	3,525	Butadiene	Epsilongas	United Kingdom	Exxon Chemical
<u>December</u>					
11	8,932	Butane	Susan Maersk	Australia	Warren
21	8,961	Butane	Wiltshire	Netherlands	Warren

Table 2 Summary of Liquid Gas Ships

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						
	1984						
	1985						
	1986						
	1987						
	1988						
	1989						
	1990						
	1991						
	1992						
	1993						
	1994						
	1995						
	1996						
	1997						
	1998						
	1999						
	2000						
	2001						
	2002						
	2003						
	2004						
	2005						

Table 2 - Continued Summary of Liquid Gas Ships

Total Number of Ships							
	Year	Propane	Butane	Butadiene	Vinyl Chloride	LNG	Total
	2001						
	2002						
	2003						
	2004						
	2005						
	2006						
	2007						
	2008						
	2009						
	2010						
	2011						
	2012						
	2013						
	2014						
	2015						
	2016						
	2017						
	2018						
	2019						
	2020						
	2021						
	2022						
	2023						
	2024						
	2025						
	2026						
	2027						
	2028						
	2029						
	2030						

The focus of our review of construction activity was on the following:

- a. Have any LNG or LPG facilities been licensed on the Delaware River?
- b. Have any new docking facilities been authorized which might result in an increase in transportation of propane, butane, butadiene, or vinyl chloride?
3. Has the construction of any rammable objects in or near the shipping channel in the 24 mile catchment distance near Hope Creek been proposed or authorized?

An ongoing activity, which has no impact on the nuclear power plant, is the dredging of the river in front of Artificial Island, on which the plant is located. This activity is sponsored by Public Service Electric and Gas.

### 3.3 Conclusions

Based on our review of "Public Notices" issued by the U.S. Army Corps of Engineers, responses to inquiry letters sent to the facilities listed in Table 3, and Federal Energy Regulatory Commission notices, we conclude that no new or proposed construction which would have an effect on the calculation of the probability of a flammable fuel vapor cloud reaching the Hope Creek Nuclear Generating Station has apparently been authorized.

Table 3

Mailing address of LPG Facilities located on the Delaware River

Atlantic Richfield Company  
Box 7709  
Philadelphia, PA 19101  
(215) 339-2632

British Petroleum Oil Company  
Marcus Hook, PA 19061  
(215) 494-3600

British Petroleum Oil Company  
Paulsboro, NJ 08066  
(609) 423-4000

Cities Services Company  
Box 300  
Tulsa, Oklahoma 74102  
(918) 586-2211

Getty Oil Company  
Delaware City, Delaware 19706

Gulf Oil Company  
Girard Point, Pa. 19145  
(215) 389-3500

Mantua Chemicals Terminal, Inc.  
Crown Point Road  
Thorofare, New Jersey 08086  
(609) 423-5400

Mobil Oil Company  
Paulsboro, New Jersey 08066  
(609) 423-1307

Table 3 - continued

Sun Oil Company  
Marcus Hook, Pa. 19061  
(215) 447-1244

Texaco Oil Company  
Eagle Point, New Jersey 08093  
(609) 845-8000

FIGURE 1  
NUMBER OF SHIPS  
TRANSPORTING  
PROPANE

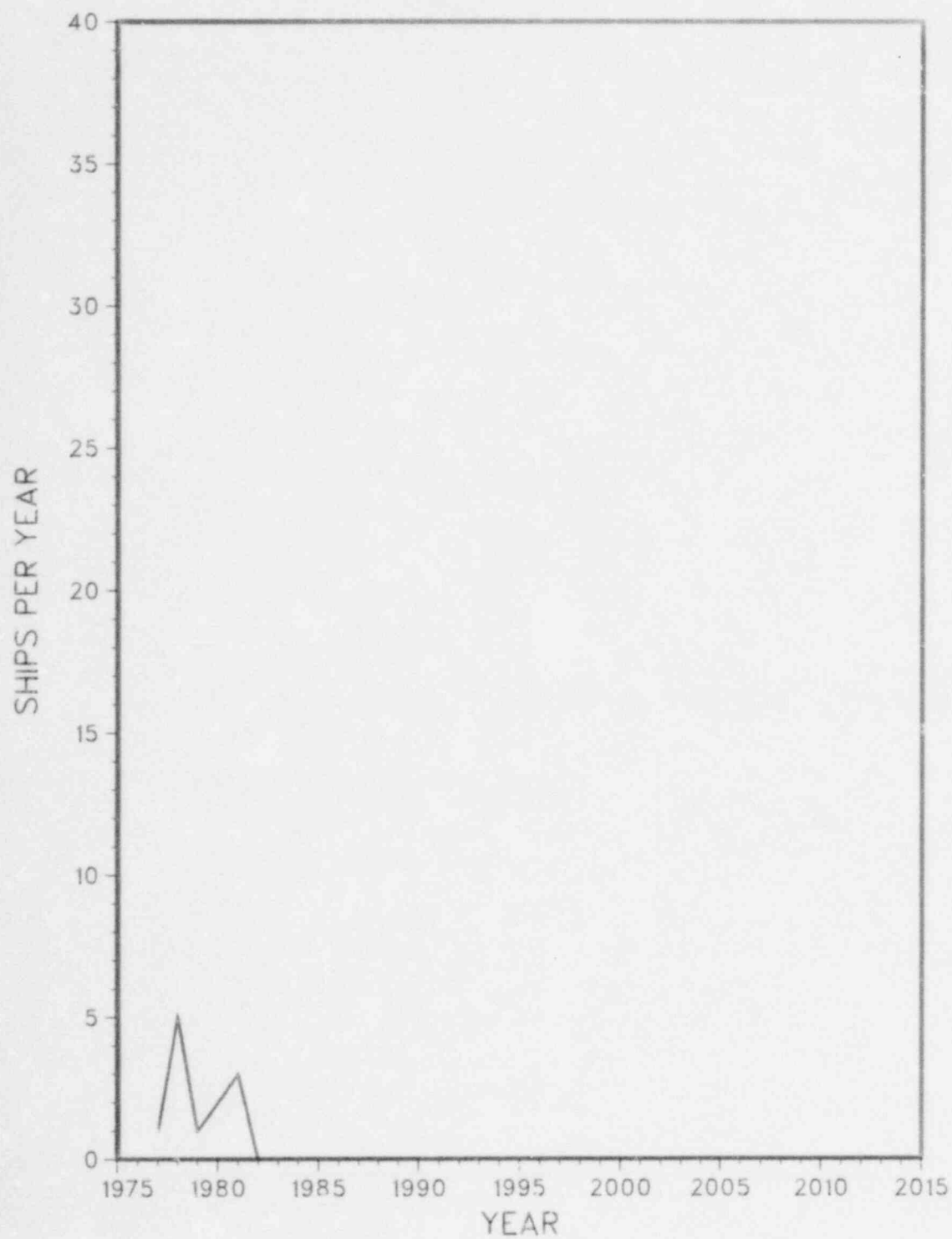


FIGURE 2  
NUMBER OF SHIPS  
TRANSPORTING  
BUTANE

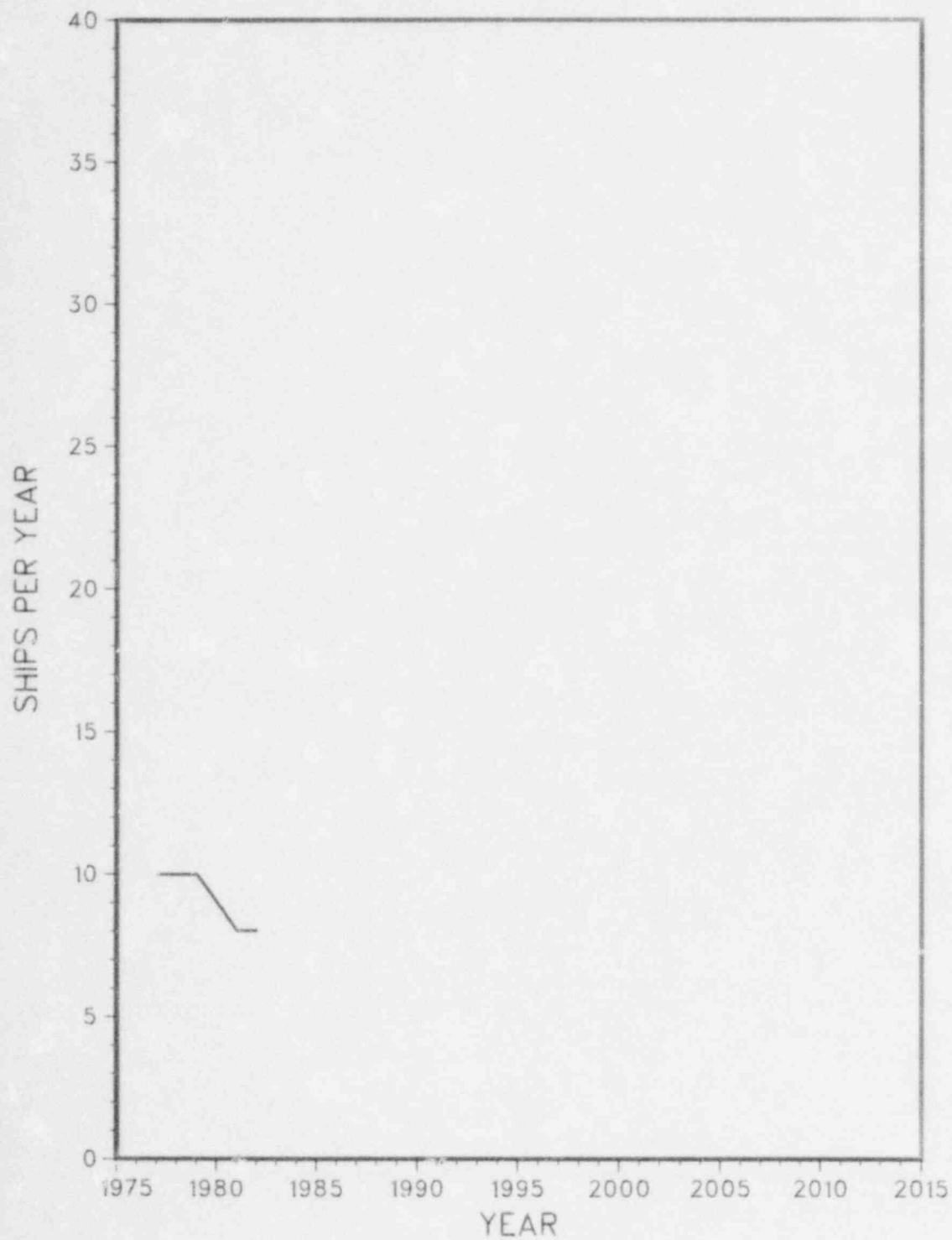


FIGURE 3  
NUMBER OF SHIPS  
TRANSPORTING  
BUTADIENE

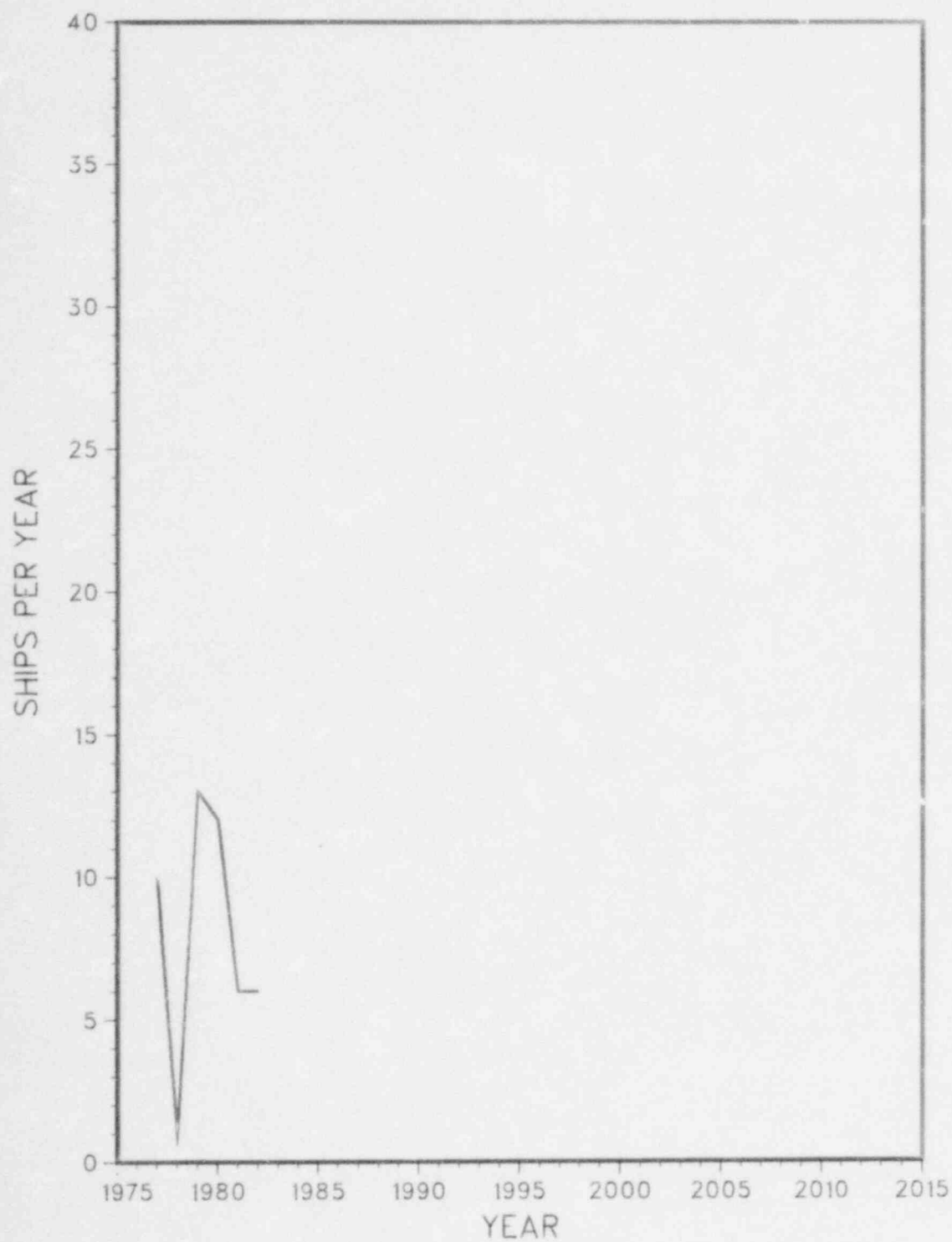


FIGURE 4  
NUMBER OF SHIPS  
TRANSPORTING  
VINYL CHLORIDE

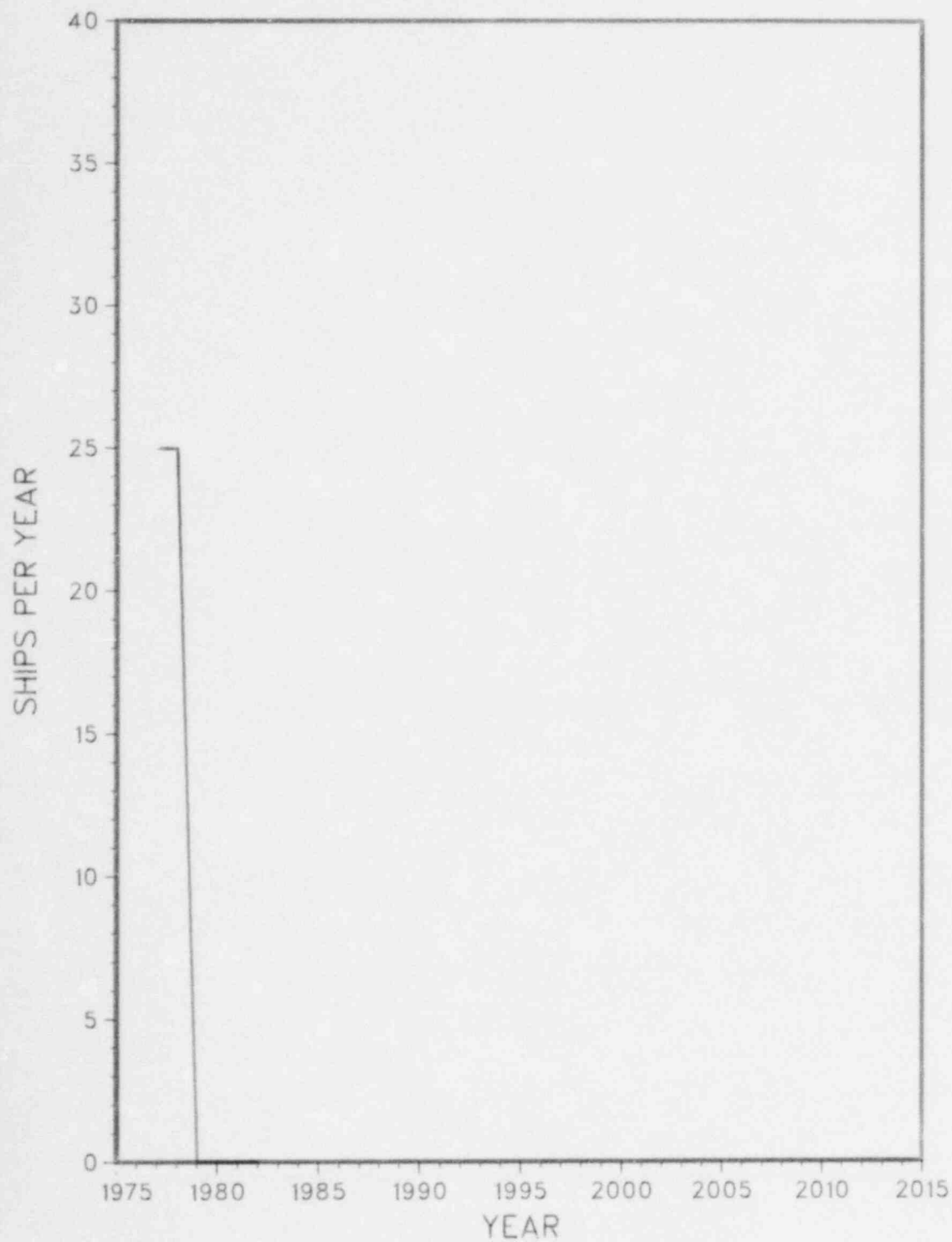


FIGURE 5  
NUMBER OF SHIPS  
TRANSPORTING  
LNG

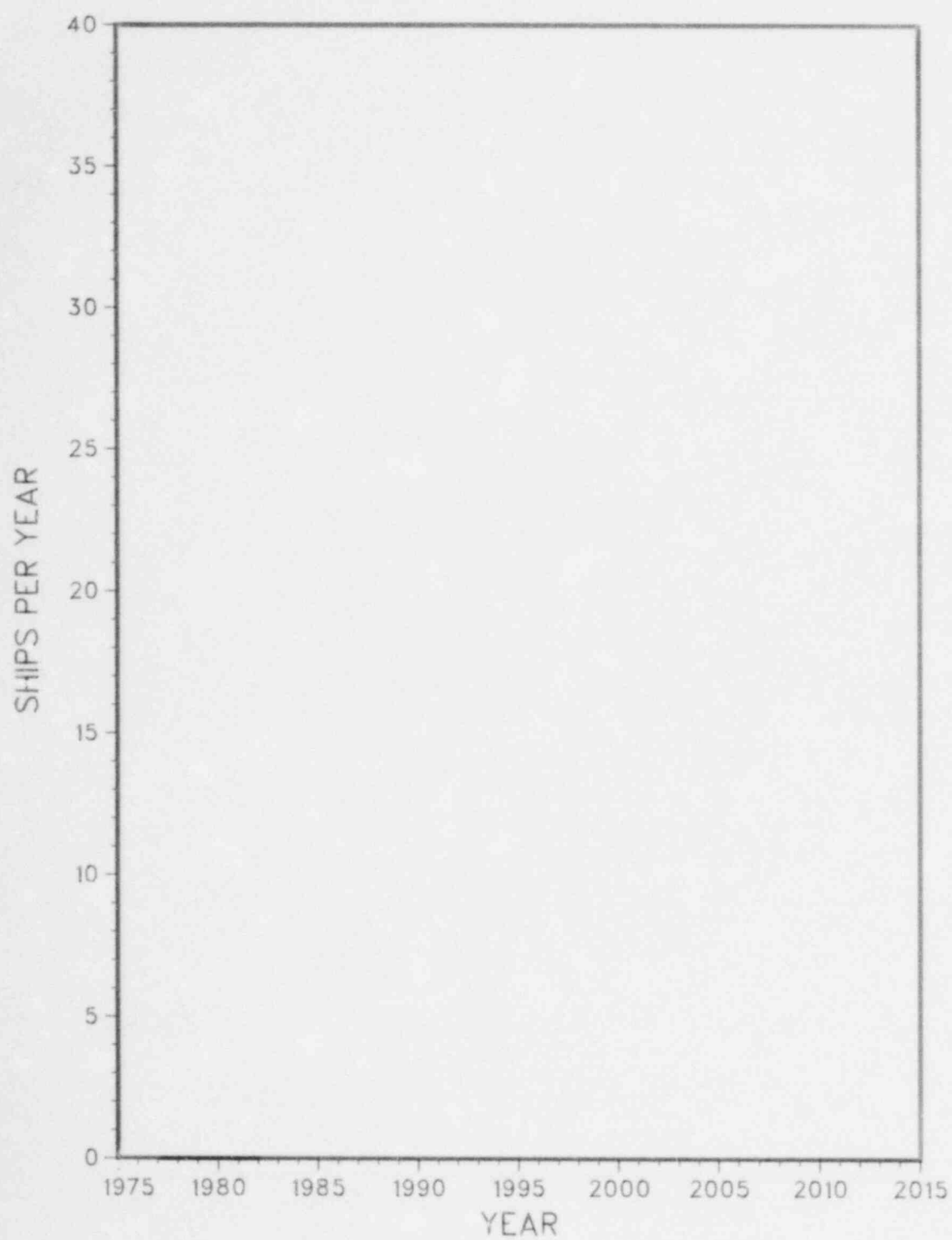
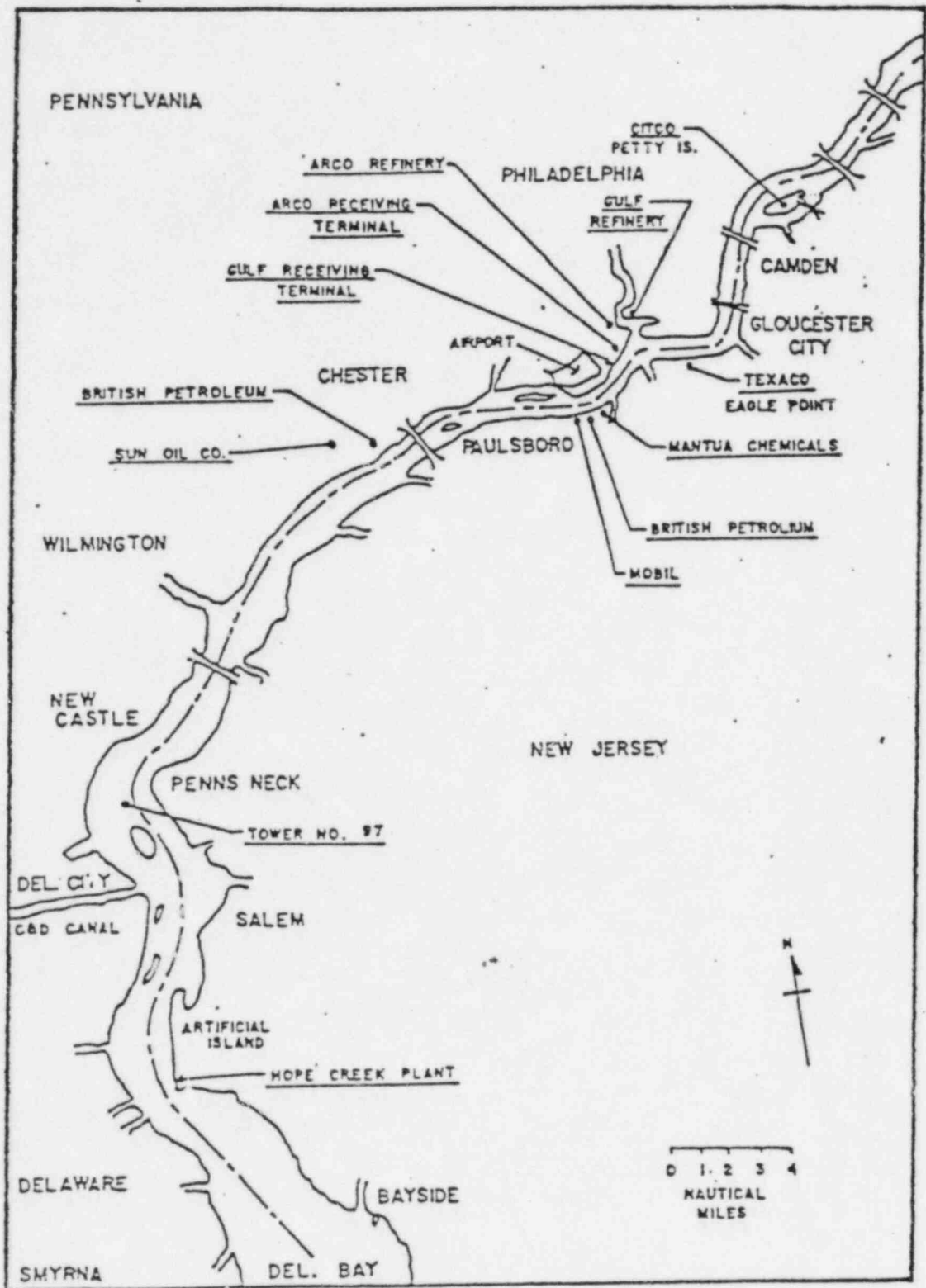


FIGURE 6



LOCATION OF MAJOR RECEIVING TERMINALS & REFINERIES &  
HOPE CREEK PLANT & TOWER NO. 97