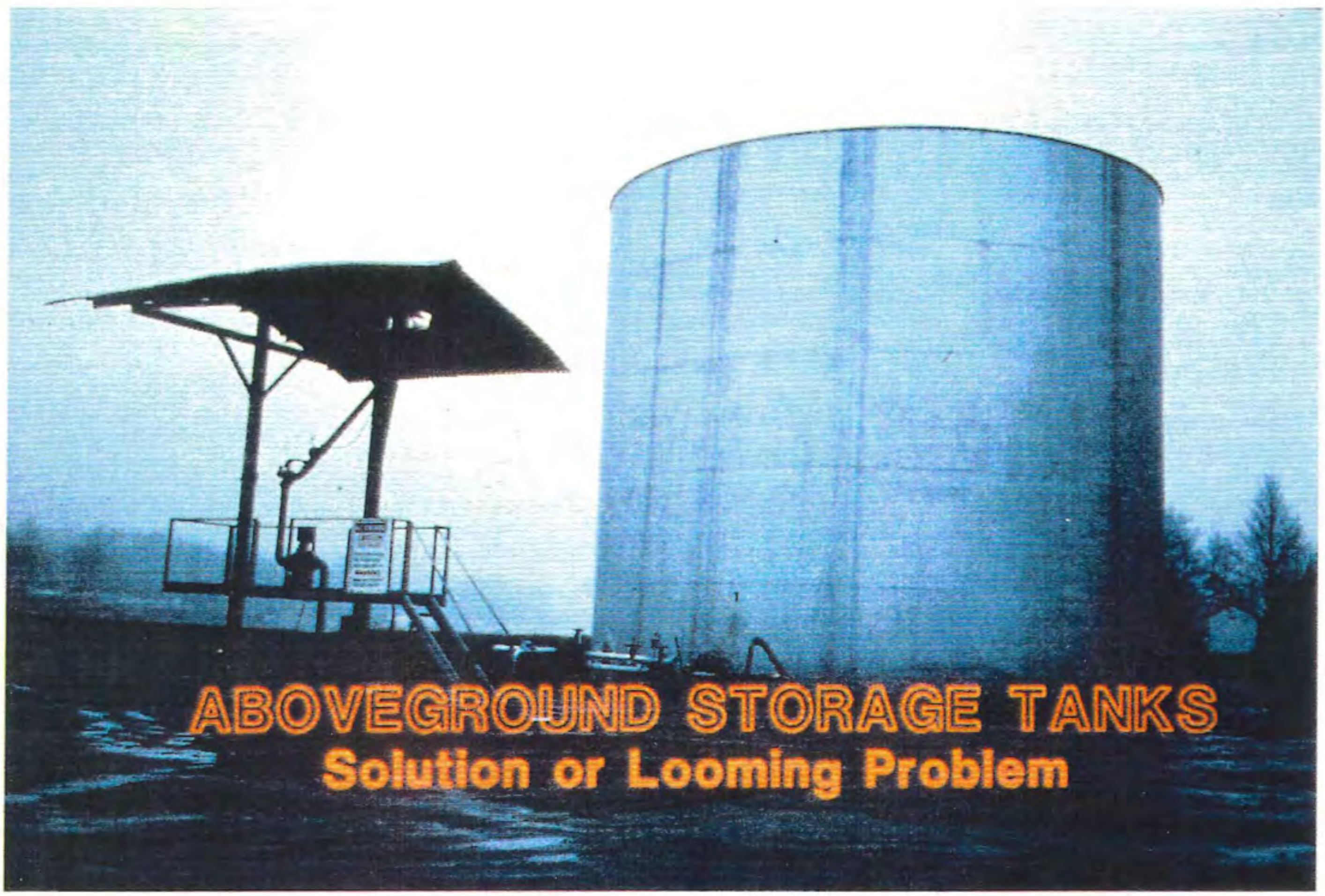
ABOVEGROUND STORAGE TANKS
Solution or Looming Problem

Study of Aboveground Storage of Petroleum and Hazardous Substances in Maine

Final Report

Prepared for:
State of Maine
Department of Environmental Protection
Bureau of Oil and Hazardous Materials Control
Augusta, Maine

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VOLUME II

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1.0 INTRODUCTION

The Maine Department of Environmental Protection (DEP) was requested by the Maine legislature in 1987 to conduct a study of aboveground facilities for the storage of petroleum and hazardous substances. In October of 1988, the DEP contracted with E. C. Jordan Co. (Jordan) to conduct this study. This document is the final report presenting the results of this study.

The three primary objectives of this study are:

- To assess the existing and potential threats to Maine's groundwater and surface water resources from aboveground oil and hazardous substance storage facilities.

- To develop basic standards for the siting, design, operation and closure of aboveground storage facilities.

- To assess the need for additional State regulations to minimize any threat from aboveground oil and hazardous substance storage facilities to the water resources of Maine.

The long term goal of this study is to assist the DEP and the Maine legislature in evaluating the need to regulate aboveground storage facilities, and if regulations are deemed necessary, to identify standards which should be considered in order to protect ground and surface water resources.

The study is limited in scope to those facilities which have a single tank larger than 660 gallons or an aggregate storage capacity in excess of 1320 gallons. For the purposes of this study, an aboveground facility is defined as a storage system where more than 90% of the volume, including associated piping, is above the surface of the ground. Any facility with less than 660 gallons of aboveground storage capacity is not included in this study.

The study was divided into eight tasks:

Task 1: Inventory Maine's population of aboveground storage facilities.
Task 2: Determine the extent and potential threat of contamination of surface and groundwater from aboveground storage facilities.
Task 3: Summarize the existing standards for aboveground petroleum and hazardous substance storage facilities.
Task 4: Summarize the regulations applicable to aboveground petroleum and hazardous substance storage facilities.
Task 5: Develop minimum facility standards.
Task 6: Assess the overall adequacy of Maine's aboveground petroleum and hazardous substance storage facilities.
Task 7: Prepare a draft final report, including a slide presentation.
Task 8: Prepare a final report.

Tasks 1 through 6 are described in a set of six technical memoranda which have been submitted individually to the DEP and are appended to this report as a separate volume of of appendices. This report will summarize the findings and conclusions of the preceding seven tasks, and will present recommendations on the need for additional state controls governing the siting, design, operation and closure of aboveground oil and hazardous substance storage facilities.

2.0 TASK 1: INVENTORY OF MAINE'S POPULATION OF ABOVEGROUND STORAGE FACILITIES

The goals of Task 1 were to:

- o Compile as accurate an inventory as possible of the current active population of aboveground facilities in Maine storing petroleum and hazardous substances
- o Create a database using commercially available software (D-Base III) to manage the information compiled in the inventory process.

2.1 Data Sources

The following potential data sources were investigated in searching for existing data on characteristics of Maine's aboveground facility population:

- o State Fire Marshal's Office
- o Maine DEP, Oil Bureau
- o Maine DEP, Land Bureau
- o Maine DEP, Air Quality Bureau
- o DHS, Bureau of Health
- o Maine Emergency Management Agency (MEMA)
- o Maine Oil and Solid Fuel Board
- o U.S. EPA, Region I
- o Office of Energy Resources
- o Survey of Local Maine Fire Chiefs
- o Survey of Members of Maine Oil Dealers Association (MODA)

The results of Jordan's investigation of these eleven potential data sources are summarized in Tables 2-1 and 2-2. Of these eleven sources, five were found to have information which could be incorporated into the data base:

- o **Maine Oil Dealers' Survey:** 260 questionnaires were mailed out and 83 returned for a 32 percent response rate. The survey totals reported 82 facilities with a total of 333 tanks.
- o **Maine Fire Chiefs' Survey:** 407 questionnaires were mailed out and 89 returned for a 22 percent response rate. The survey totals reported 164 facilities with a total of 620 tanks.
- o **State Fire Marshal:** 574 facilities with a total of 1,086 tanks(1946-1988); 299 facilities with a total of 589 tanks (1984-1988)
- o **Maine Emergency Management Agency:** 49 facilities with a minimum total of 184 tanks (42 facilities reported the storage of petroleum and hazardous substances; 7 facilities reported only the storage of petroleum. The data include a minimum of 134 chemical tanks and 50 petroleum tanks).
- o **Maine DEP, Licensed Marine Oil Terminals:** 31 terminals with a total of 291 tanks

Jordan's complete database consists of records on approximately 865 petroleum and 42 hazardous materials storage facilities across the state and approximately 1,618 petroleum tanks, 134 hazardous materials tanks (at a minimum), and 265

TABLE 2-1
SUMMARY OF REVIEW OF DATA SOURCES

Agency	Contact	Type of Information	No. of Records Facilities/Tanks	Time Frame	How Useful
State Fire Marshal Augusta, ME	Steve Dodge	Aboveground storage tank registrations and permits	574/1086	1946 to 12/31/88 (permits first issued in 1974)	High
Maine DEP Oil Bureau Augusta, ME	Rick Kaselis Ann LaPoint	License applications and inspection reports of marine oil terminals	31/291	Currently Licensed Marine Oil Terminals (Files dated 1984-1988)	High
Maine DEP Land Bureau Augusta, ME	Bill Thompson	Site Location Law permits	N/A	1984 to present (AIS Database)	Low
Maine DEP Air Bureau Augusta, ME	Ron Severance Jerry Bernier Rick Dawson	Database covers aboveground facilities with fixed roofs storing petroleum product in volumes greater than 39,000 gallons	12/226	Current data-base as of April 1989	Moderate
DHS, Bureau of Health Augusta, ME	Jean Scudder (Consultant) David Sait (DEP)	Database of contaminated wells in Maine	N/A	Early 1980's to present	Low

SUMMARY OF REIVEW OF DATA SOURCES
TABLE 2-1 (CONTINUED)

Agency	Contact	Type of Information	No. of Records Facilities/Tanks	Time Frame	How Useful
Maine Emergency Management Agency (MEMA) Augusta, ME	Mike Pomerleau	SARA Title III reports filed by facilities that process, manufacture or otherwise use a certain volume of toxic chemicals	49/184*	SARA Title III reports filed 7/88	High
Maine Oil & Solid Fuel Board Augusta, ME	Marianne Campbell	Reports filed by field inspectors investigating reports of unlicensed oil burner technicians, furnaces not built to code, and other practices that do not comply with this licensing Board's Regulations	N/A	N/A	Low
USEPA Region I Boston, MA	David Tordoff	o Aboveground oil storage facility inspection tally sheets	181	1975-1988	Moderate
		o SPCC Plan Inspection Reports	178	1975-1988	
		o List of aboveground storage facilities with 1,000,000 gallons of total storage	47	late 1970s - early 1980's	Moderate
Survey of local Fire Chiefs in Maine	George Seel (DEP) Marcel Moreau (Jordan)	Questionnaire response from local Fire Chiefs listing tank owner, facility and location, product, volume and number of tanks.	164/620	survey conducted 1/89 to 3/89	High

* Because of the way the SARA Title III reports are structured, this number represents the number of different chemicals stored at the 49 facilities, not the number of individual tanks.

SUMMARY OF REVIEW OF DATA SOURCES
TABLE 2-1 (CONTINUED)

Agency	Contact	Type of Information	No. of Records Facilities/Tanks	Time Frame	How Useful
Survey of Members of Maine Oil Dealers Association (MODA)	Gene Guilford Floyd Rutherford MODA	Questionnaire response from MODA members listing tank owner, facility and location, number, product and volume of tanks.	82/333	survey conducted 1/89 to 3/89	High

TABLE 2-2
CONTENTS OF RECORDS OF DATA SOURCES REVIEWED

Source	Facility Street Address	Location Town	Owner Info. (Street Address/ Town)	Tank Type	Product	Capacity	Year Registered or Age	Design
State Fire Marshal	usually	yes	usually	no	usually	usually	yes	no
Maine DEP Oil Bureau	yes	yes	yes	no	yes	yes	no	no
Maine DEP Land Bureau	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Maine DEP Air Quality Bureau	usually	yes	usually	no	yes	no	no	no
DHS Bureau of Health	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Maine Emergency Management Agency (MEMA)	yes	yes	yes	no	yes	no	no	no
Maine Oil & Solid Fuel Board	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
USEPA Region I SPCC Plan Inspection Reports	yes	yes	no	no	no	no	no	no
Survey of Maine Fire Chiefs	yes	yes	yes	no	yes	yes	no	no
Survey of Members of Maine Oil Dealers Association (MODA)	yes	yes	yes	no	yes	yes	no	no

tanks whose contents are either unknown or could not be classed as oils or hazardous substances.

2.2 Limitations of the Data Base

The following limitations should be kept in mind when considering the information contained in the data base:

- o The information from all data sources was accepted at face value. No field verification was attempted.

- o Because the Fire Marshal records are not updated to reflect changes in facility use or whether facilities are still active, the 1946 through 1983 records were not used to profile the active tank population. This was an arbitrary cut off date but represents half of the Fire Marshal data.

- o Although response to the mail surveys was quite good, many questionnaires were not returned and survey numbers are incomplete. The completeness and level of detail among the responses was also variable.

- o Because of the multiple data sources for petroleum facilities, some facilities appear in the data base more than once. It is estimated that eight percent of the entries may be duplicated entries.

- o The MEMA data do not include facilities which manufacture or process less than 75,000 pounds, or use less than 10,000 pounds of hazardous substances per year.

- o There is no information in any data source concerning oil supply tanks connected to heating plants.

2.3 Profile of Aboveground Hazardous Substance Storage Facilities

- o Black, green and white liquors which are hazardous liquids associated with the papermaking industry, are by far the hazardous substances stored in greatest quantity in the state, totaling 205 million pounds. These liquids are stored in only 10 locations. Refer to Table 2-3, Figures 2-1 and 2-2 for further details.

- o Acids, caustics and chlorine occur routinely in the MEMA records, but in relatively small quantities, totaling only about 20 million pounds at 28 facilities. Ammonia is stored at 14 facilities totaling 1.4 million pounds. Refer to Table 2-3, Figures 2-1 and 2-2 for further details.

- o There are an additional 80 hazardous substances totaling 86 million pounds stored at facilities in the state. Refer to Table 2-3, Figures 2-1 and 2-2 for further details.

- o All of the hazardous substance storage facilities currently listed in the MEMA data base were classed as industrial facilities.

TABLE 2-3

SUMMARY OF TANK INVENTORY DATA

PETROLEUM	TOTALS (1) No.	(2) Vol.	(2) Average Volume	INDUSTRIAL (1) No.	(2) Vol.	(2) Average Volume	DISTRIBUTORS (1) No.	(2) Vol.	(2) Average Volume	RETAIL (1) No.	(2) Vol.	(2) Average Volume	COMMERCIAL (1) No.	(2) Vol.	(2) Average Volume	UNCLASSIFIED (1) No.	(2) Vol.	(2) Average Volume
#1 FUEL OIL	207	25,475,327	123,069	23	224,811	9,774	96	23,501,829	244,811	31	230,856	7,447	34	1,243,681	36,579	23	274,150	11,920
#2 FUEL OIL	389	138,080,890	354,964	30	2,170,210	72,340	220	121,918,825	554,176	26	389,255	14,971	82	13,087,000	159,598	31	515,600	16,632
#3 FUEL OIL	1	3,000	3,000	0	0	-	0	0	-	0	0	-	0	0	-	1	3,000	3,000
#4 FUEL OIL	1	10,000	10,000	0	0	-	0	0	-	0	0	-	1	10,000	10,000	0	0	-
#5 FUEL OIL	2	40,000	20,000	0	0	-	0	0	-	0	0	-	2	40,000	20,000	0	0	-
#6 FUEL OIL	53	168,072,924	3,171,187	28	69,425,220	2,479,472	19	76,361,704	4,019,037	0	0	-	6	22,286,000	3,714,333	0	0	-
CRUDE OIL	24	160,826,000	6,701,083	1	50,000	50,000	23	160,776,000	6,990,261	0	0	-	0	0	-	0	0	-
DIESEL	262	34,686,661	132,392	55	13,359,001	242,891	43	17,011,090	395,607	34	129,476	3,808	93	1,920,744	20,653	37	2,266,350	61,253
GAS	521	102,998,346	197,694	13	242,975	18,690	162	100,323,751	619,282	144	578,300	4,016	106	1,334,845	12,593	96	518,475	5,401
AVIATION FUEL	20	61,288,480	3,064,424	6	20,160,000	3,360,000	5	11,493,480	2,298,696	0	0	-	9	29,635,000	3,292,778	0	0	-
LUBE OIL	32	889,800	27,806	3	10,300	3,433	5	245,000	49,000	6	7,500	1,250	7	26,500	3,786	11	600,500	54,591
WASTE OIL	33	2,065,225	62,583	1	1,000	1,000	6	16,850	2,808	7	2,875	411	19	2,044,500	107,605	0	0	-
OTHER OIL	73	4,812,792	65,929	18	164,992	9,166	21	1,413,600	67,314	1	3,000	3,000	30	3,229,700	107,657	3	1,500	500
TOTAL OILS	1,618	699,249,445		178	105,808,509		600	513,062,129		249	1,341,262		389	74,857,970		202	4,179,575	

HAZARDOUS SUBSTANCES	TOTALS (3) No.	(4) Vol.	(4) Average Volume	INDUSTRIAL (3) No.	(4) Vol.	(4) Average Volume	DISTRIBUTORS (3) No.	(4) Vol.	(4) Average Volume	RETAIL (3) No.	(4) Vol.	(4) Average Volume	COMMERCIAL (3) No.	(4) Vol.	(4) Average Volume	UNCLASSIFIED (3) No.	(4) Vol.	(4) Average Volume
ACIDS	16	8,144,000	509,000	16	8,144,000	509,000	0	0	-	0	0	-	0	0	-	0	0	-
AMMONIA	14	1,363,175	97,370	14	1,363,175	97,370	0	0	-	0	0	-	0	0	-	0	0	-
BENZENE	2	100	50	0	0	-	2	100	50	0	0	-	0	0	-	0	0	-
BLACK LIQUOR	7	55,000,000	7,857,143	7	55,000,000	7,857,143	0	0	-	0	0	-	0	0	-	0	0	-
CAUSTIC	5	7,050,000	1,410,000	5	7,050,000	1,410,000	0	0	-	0	0	-	0	0	-	0	0	-
CHLORINE	7	5,113,000	730,429	7	5,113,000	730,429	0	0	-	0	0	-	0	0	-	0	0	-
GREEN LIQUOR	2	100,000,000	50,000,000	2	100,000,000	50,000,000	0	0	-	0	0	-	0	0	-	0	0	-
WHITE LIQUOR	1	50,000,000	50,000,000	1	50,000,000	50,000,000	0	0	-	0	0	-	0	0	-	0	0	-
OTHER CHEMICAL	80	86,114,621	1,076,433	79	86,109,621	1,089,995	1	5,000	5,000	0	0	-	0	0	-	0	0	-
TOTAL HAZARDOUS SUBSTANCES	134	312,784,896	2,334,216	131	312,779,796	2,387,632	3	5,100	1,700	0	0	-	0	0	-	0	0	-
		(5)			(5)			(5)			(5)			(5)			(5)	
MISC.	42	19,447,488	463,035	16	2,368,500	148,031	11	16,770,588	1,524,599	3	5,000	1,667	11	302,000	27,455	1	1,400	1,400
BLANK	223	31,863,508	142,886	33	235,014	7,122	93	30,665,044	329,732	15	70,000	4,667	52	653,350	12,564	30	240,100	8,003

Legend:
(1) Number of Tanks Storing Product
(2) Gallons
(3) Minimum Number of Tanks Storing Product
(4) Pounds
(5) Mixed Units (gallons and pounds)

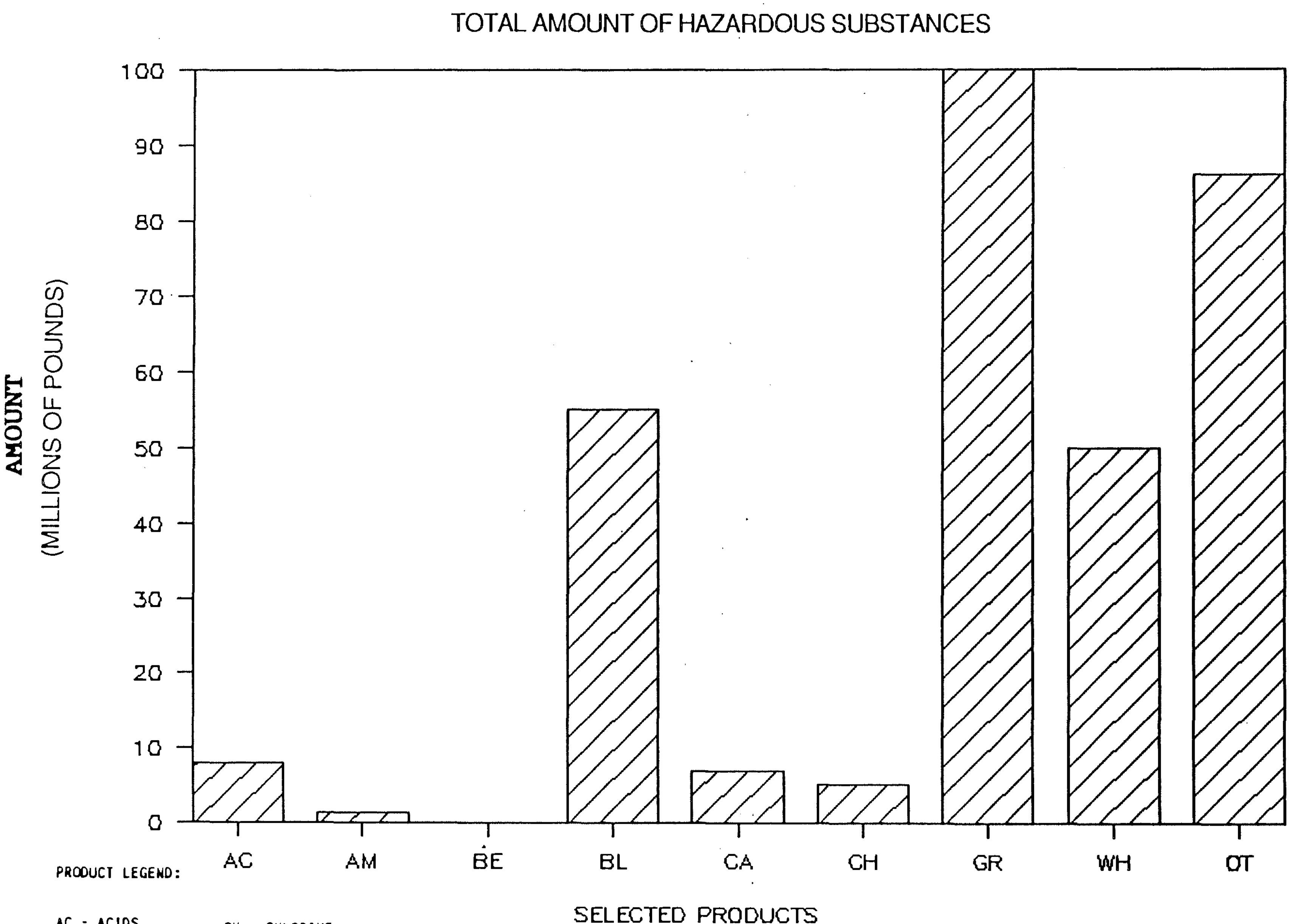
Data Sources:
State Fire Marshal (1984-1988)
Fire Chief Survey
Maine Oil Dealers Association (MODA) Survey
Marine Oil Terminals
Maine Emergency Management Agency (MEMA)

Figure 2-1: Profile of amounts of hazardous substances stored as reported to MEMA.

This information is derived entirely from MEMA data. The MEMA information does not describe individual tank capacity but rather the maximum daily amount stored of a given chemical. Because the first submittal of SARA Title III reports applied only to companies using, processing, or manufacturing chemicals in large quantities, this figure represents only a portion of the hazardous substances stored in the state. Refer to Sections 2.6 and 4.4 of the Task 1 Technical Memorandum in Volume II of this report for further description of the MEMA data.

The white, black and green liquors, all associated with the papermaking process, make up the greatest amount of individual product stored. The large amount of chemicals in the "other" category indicates that the hazardous substances are difficult to categorize.

INVENTORY OF ACTIVE ABOVEGROUND TANKS



PRODUCT LEGEND:

AC - ACIDS
AM - AMMONIA
BE - BENZENE
BL - BLACK LIQUOR
CA - CAUSTIC
CH - CHLORINE
GR - GREEN LIQUOR
WH - WHITE LIQUOR
OT - OTHER HAZARDOUS SUBSTANCES

FIGURE 2-1

DATA SOURCE: Maine Emergency Management Agency (MEMA)

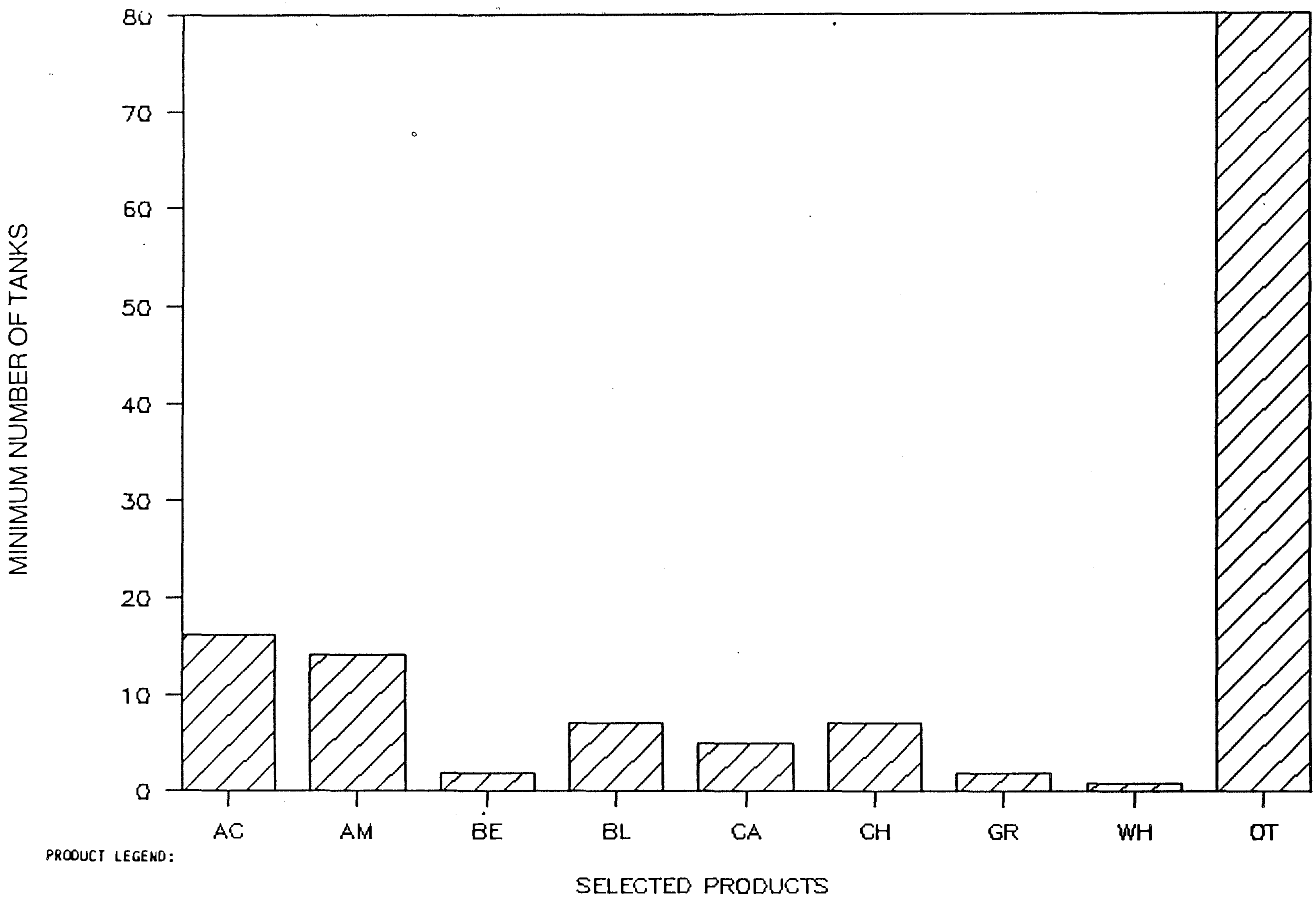
Figure 2-2: Profile of numbers of tanks storing hazardous substances as reported to MEMA.

In order to generate this figure, it was assumed that each facility reporting a chemical substance was storing that material in a single tank. This assumption was necessary because of the nature of the MEMA data and results in a very conservative estimate of the number of tanks.

Comparing Figures 2-1 and 2-2, it is clear that there is a wide variety of "Other" substances being stored in a relatively large number of locations. Although the white, black, and green liquor storage facilities are few in number, they contain large quantities of these materials.

INVENTORY OF ACTIVE ABOVEGROUND TANKS

MINIMUM NUMBER OF TANKS STORING HAZARDOUS SUBSTANCES



PRODUCT LEGEND:

AC - ACIDS
AM - AMMONIA
BE - BENZENE
BL - BLACK LIQUOR
CA - CAUSTIC
CH - CHLORINE
GR - GREEN LIQUOR
WH - WHITE LIQUOR
OT - OTHER HAZARDOUS SUBSTANCES

FIGURE 2-2

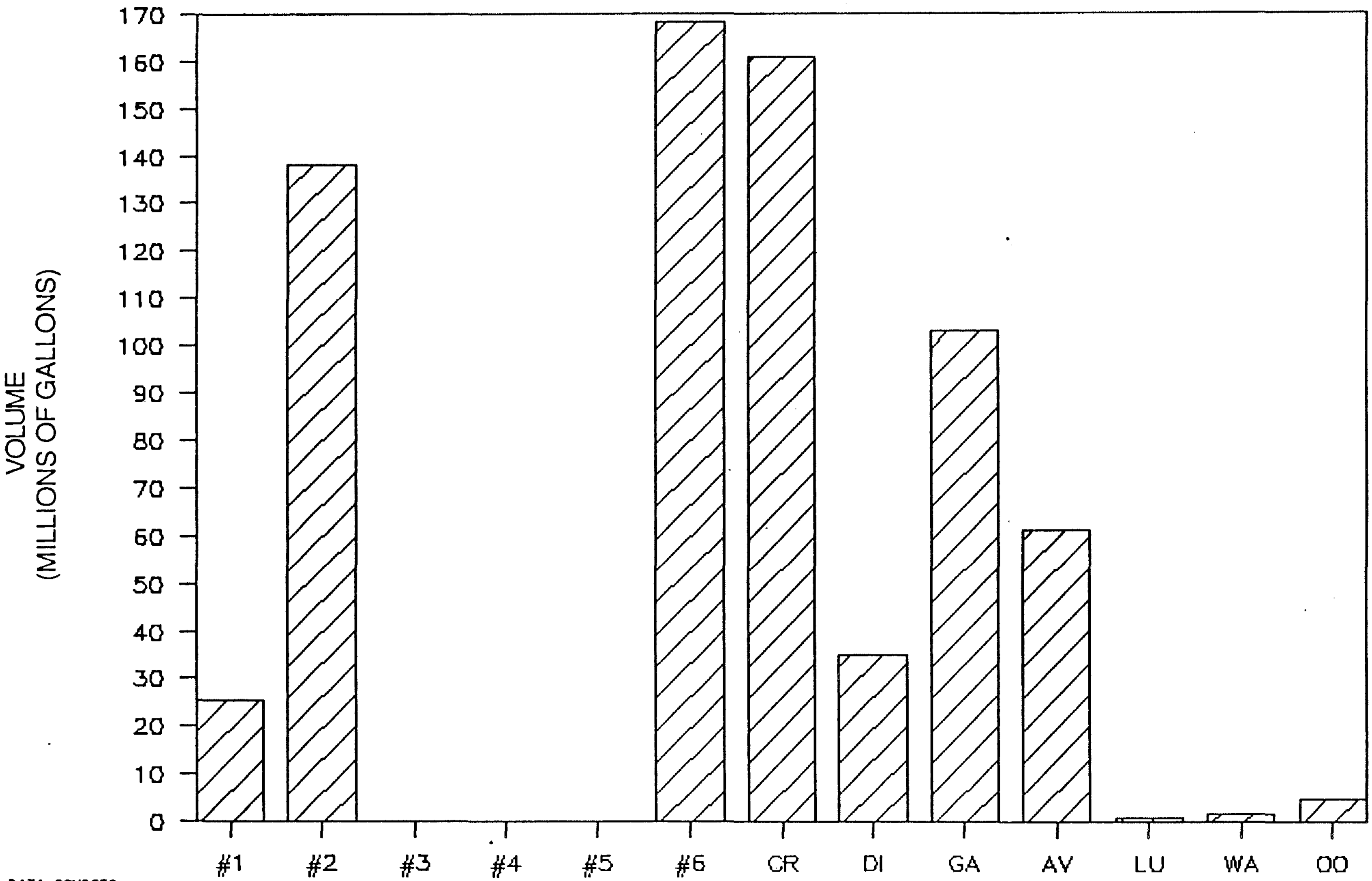
DATA SOURCE: Maine Emergency Management Agency (MEMA)

FIGURE 2-3: **Profile of volume of petroleum storage capacity by product type.**

The largest storage capacities are for No. 6, crude, and No. 2, in descending order, followed by gasoline and aviation fuel.

INVENTORY OF ACTIVE ABOVEGROUND TANKS

TOTAL VOLUME OF PETROLEUM



SELECTED PRODUCTS

FIGURE 2-3

DATA SOURCES:

State Fire Marshal (1984-1988)
Fire Chief Survey
Maine Oil Dealers Association Survey
Marine Oil Terminals

PRODUCT LEGEND:

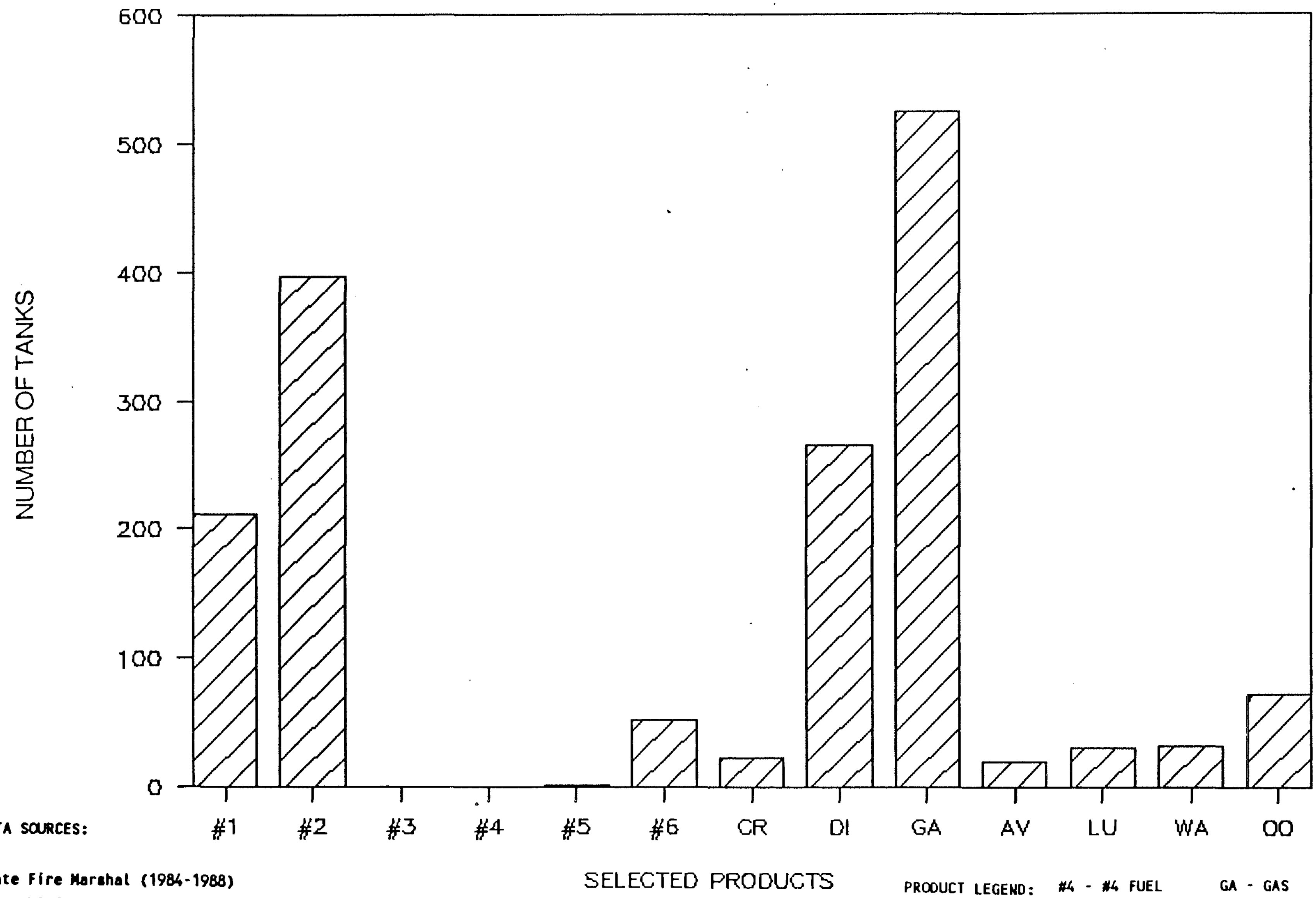
#1 - #1 FUEL
#2 - #2 FUEL
#3 - #3 FUEL
#4 - #4 FUEL
#5 - #5 FUEL
#6 - #6 FUEL
CR - CRUDE OIL
DI - DIESEL
GA - GAS
AV - AVIATION FUEL
LU - LUBE OIL
WA - WASTE OIL
OO - OTHER PETROLEUM

Figure 2-4: Profile of numbers of tanks storing petroleum by product type.

There are more tanks storing gasoline than any other product type. Comparing this figure with Figure 2-3, although the volume of #6 oil, crude oil and aviation fuel stored is large, there are relatively few tanks storing these products. In contrast, there are many diesel tanks even though the volume of product stored is relatively small. As indicated by the small volume of "Other Petroleum", the product types listed here include most of what is being stored aboveground.

INVENTORY OF ACTIVE ABOVEGROUND TANKS

NUMBER OF TANKS STORING PETROLEUM



DATA SOURCES:

State Fire Marshal (1984-1988)
Fire Chief Survey
Maine Oil Dealers Association Survey
Marine Oil Terminals

PRODUCT LEGEND:

#1 - #1 FUEL
#2 - #2 FUEL
#3 - #3 FUEL
#4 - #4 FUEL
#5 - #5 FUEL
#6 - #6 FUEL
CR - CRUDE OIL
DI - DIESEL
GA - GAS
AV - AVIATION FUEL
LU - LUBE OIL
WA - WASTE OIL
OO - OTHER PETROLEUM

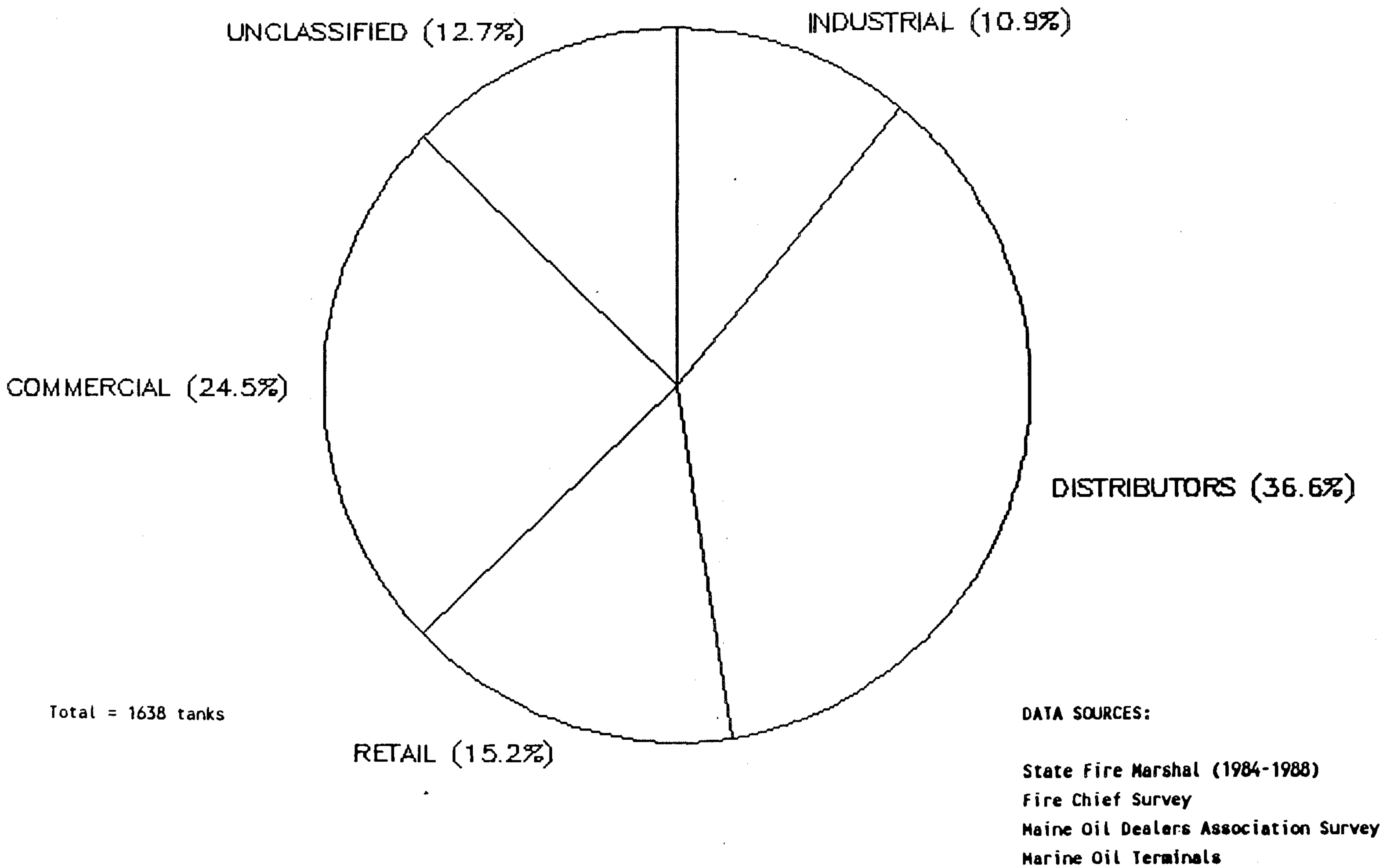
FIGURE 2-4

Figure 2-5: Distribution of petroleum storage tanks in the active data base by use.

Facilities were categorized as follows:

- Industrial - manufacturing, i.e. chemical and pulp and paper
- Commercial - fleet fueling, heating
- Retail - motor fuel for sale to the public
- Distributor - in the oil marketing business
- Unclassified - not easily identifiable (probably includes residential and small commercial and retail)

DISTRIBUTION OF ACTIVE PETROLEUM TANKS BY USE



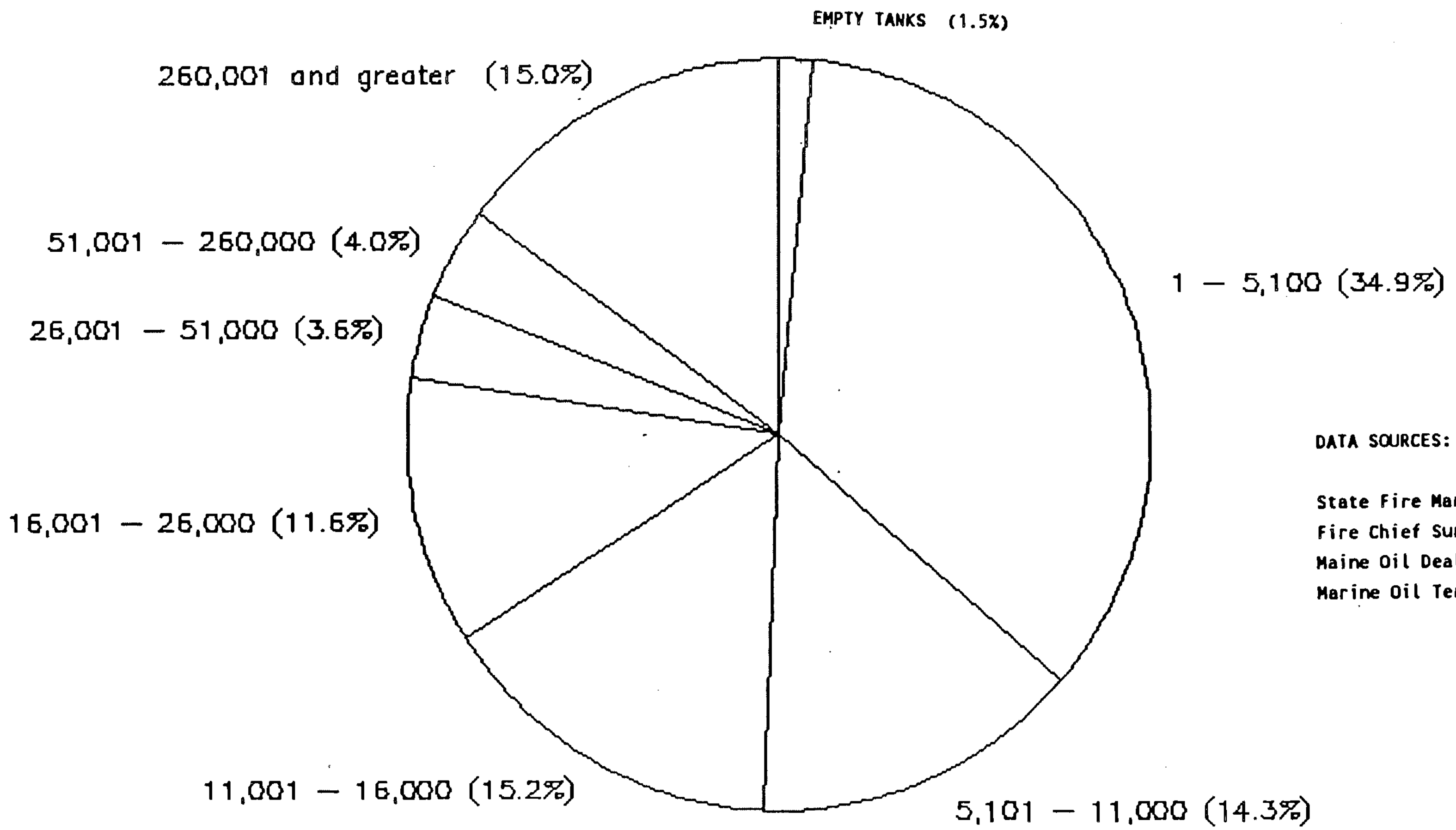
Total = 1618 tanks

FIGURE 2-5

FIGURE 2-6: **Size distribution of petroleum tanks in the active data base.**

About 50% of the population consists of tanks of less than 11,000 gallons capacity. These are primarily retail, commercial and smaller industrial tanks. About 35% of the tanks are between 11,000 and 260,000 gallons in size, representing the larger storage tanks at bulk plants. Only 15% of the population consists of tanks larger than 250,000 gallons. These are primarily the marine terminal tanks. 1.5% of the tanks were listed in the data sources as having zero capacity. We have assumed that these are empty tanks of unknown capacity.

SIZE DISTRIBUTION OF ACTIVE TANKS
PETROLEUM ONLY



DATA SOURCES:

State Fire Marshal (1984-1988)
Fire Chief Survey
Maine Oil Dealers Association Survey
Marine Oil Terminals

Volume in Gallons
Total = 1618 tanks

FIGURE 2-6

2.4 Profile of Aboveground Petroleum Storage Facilities

- Petroleum products with the largest storage capacities are #6 fuel oil (168 million gallons), crude oil (161 million gallons), #2 fuel oil (138 million gallons), gasoline (103 million gallons), aviation fuel (61 million gallons), diesel (35 million gallons), and #1 fuel oil (25 million gallons). Refer to Table 2-3 and Figure 2-3 for further details.

- Gasoline has by far the largest number of storage tanks with 521 tanks in the data base. This if followed by #2 fuel oil (389 tanks), diesel (262), #1 fuel oil (207), #6 fuel oil (53), crude oil (24) and aviation fuel (20). Refer to Table 2-3 and Figure 2-4 for further details.

- The largest percentage of petroleum tanks are associated with the oil marketing business (37%), followed by commercial (25%), retail (15%), unclassified (13%), and industrial (11%). Although aboveground retail facilities have only recently come on the scene, they already represent 15% of the tank population. Refer to Figure 2-5 for further details.

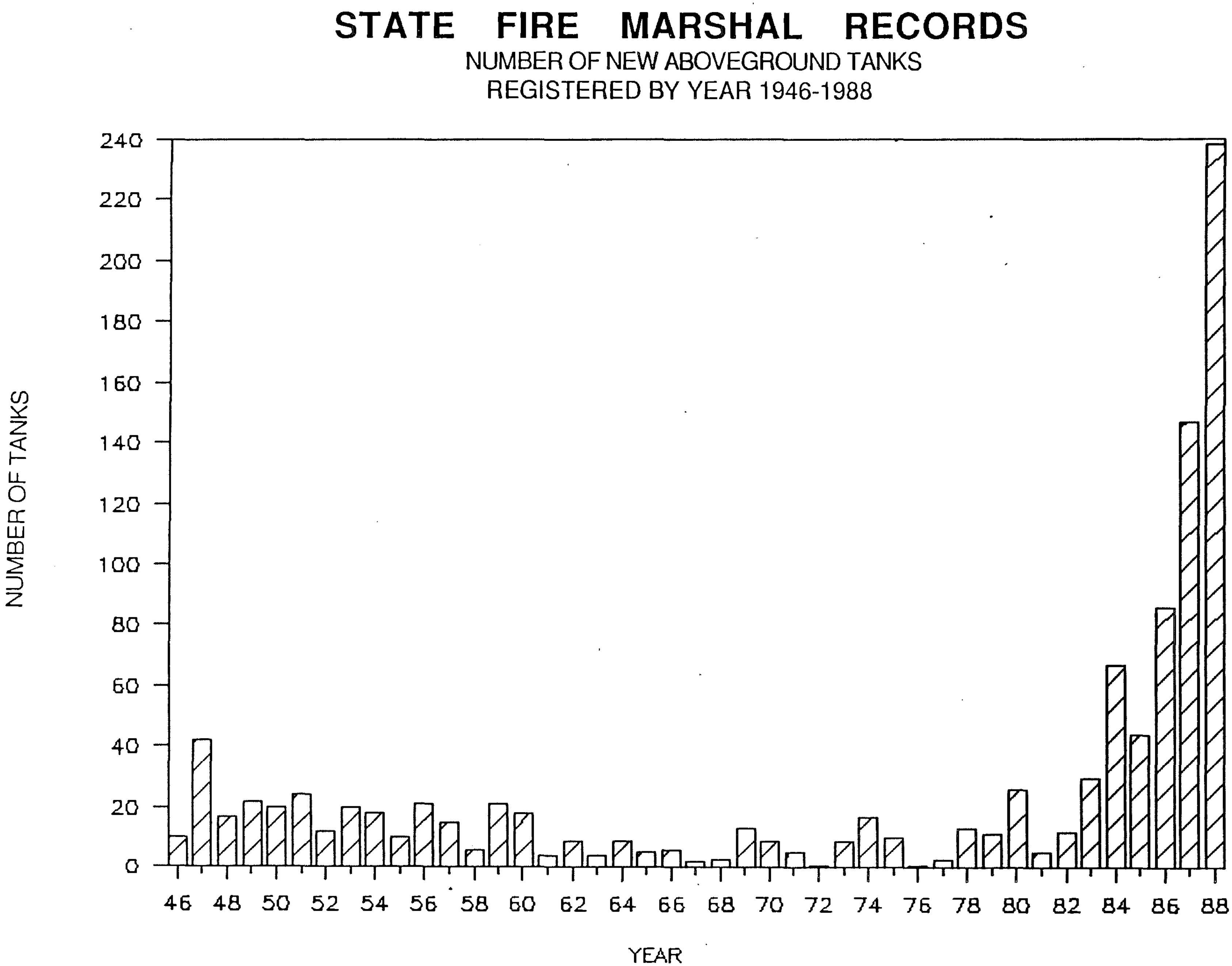
- Approximately 50% of the aboveground tank population is less than 11,000 gallons in size. Another 25% is between 11 and 26,000 gallons. Only 8% of the tanks are between 26,000 and 260,000, while 15% are greater than 260,000. Thus the majority of the state's petroleum storage tanks are relatively small volume storage systems. Refer to Figure 2-6 for further details.

2.5 Historical Trends in the Data Base

As is graphically evident from Figure 2.7, there has been a tremendous increase in the last five years in the number of aboveground storage facilities registered with the Fire Marshal's Office. As many tanks were registered in the period 1984-88 as in the previous 38 years of Fire Marshal records. DEP personnnel believe that most of this increase appears to be in reaction to the recent underground storage tank regulations. There has been a very marked increase in the number of aboveground gasoline storage facilities, including over 100 retail facilities.

2.6 Conclusions

Existing data sources were utilized to the fullest extent possible in order to create a reasonable profile of the state's aboveground storage facilities for petroleum and hazardous substances. The hazardous substance data will become more complete with time as facilities which use smaller amounts of hazardous substances come under the SARA Title III reporting requirements. No information is currently being gathered, however, regarding the nature or size of the hazardous substance storage tanks themselves. The petroleum storage facility data will remain incomplete and nebulous unless some type of continuing registration/notification program is undertaken.



DATA SOURCE: State Fire Marshal 1946-1988

FIGURE 2-7

3.0 TASK 2: DETERMINATION OF THE EXTENT AND POTENTIAL THREAT OF CONTAMINATION OF SURFACE AND GROUNDWATER FROM ABOVEGROUND STORAGE FACILITIES

The specific objectives of Task 2 were to:

- o Provide an estimate of the potential threat to water resources from aboveground storage facilities.
- o Derive preliminary descriptive statistics on the nature of reported spills in the state, including causes and volume of spills.
- o Provide some quantitative measure of the presence of contamination associated with aboveground storage facilities.

3.1 Potential Threat to Water Resources

The intended approach to assessing the threat to water resources was to compare the aboveground storage facility locations with water resource information. By determining the proximity of storage facilities and water resources to one another, some measure of the threat posed by the storage facilities would be gained.

This approach proved not to be useful in assessing the risk of contamination to the State's water resources because of the limited geographic information on the aboveground storage facilities. The lack of precise geographic locations for the facilities prohibited plotting them on the water resource maps with any degree of accuracy, thus a determination of their proximity to wells, aquifers, rivers and streams, and other water resources could not be calculated. Due to these limitations which surfaced during our investigation, we were unable to complete an assessment of the threat to water resources from aboveground storage facilities.

3.2 Number of Reported Spills and Investigations

Jordan identified a total of 174 incidents pertaining to aboveground storage of petroleum and hazardous substances at 120 different facility locations from the spill reports filed by DEP response personnel between 1979 and 1987. These incidents covered 158 oil spills and investigations and 16 hazardous material spills and investigations.

This figure of 174 incidents should be viewed as a minimum number of spills which occurred during this time for several reasons including:

- o Not all of the spill reports Jordan examined contained complete information enabling the clear identification of a spill being related to an aboveground storage facility.
- o Many spill reports were not present in the file at the time of Jordan's investigation. The missing reports were either under review by the DEP or had been misplaced or lost.
- o It is unlikely that all spill incidents which have occurred have been reported to the DEP.

3.3 Reported Geographic Distribution

The geographic distribution of the reported spill incidents by the DEP regional office that responded to the incident is shown in Table 3-1. The geographic distribution of spill incidents by town is a better indicator of the extent of the situation. The 174 reported spills occurred in a total of 70 different towns and cities; the majority of the incidents appear to be concentrated in the southern half of the state.

3.4 Type of Product Reported Discharged

The distribution of spills by product type reported from 1979 to 1987 is shown in Figure 3-1. As is depicted, No. 2 fuel oil is the dominant product which was spilled (44% of all spills), followed by No. 6 fuel oil (14%), gasoline (13%), chemical (9%), kerosene (7%), diesel fuel (7%), jet fuel (5%), and waste oil (1%).

3.5 Reported Causes of Spills

A listing of the causes of spills from oil and hazardous material aboveground storage facilities along with the percentage of spills attributable to each is shown in Figure 3-2.

3.6 Estimated Amount of Product Spilled, Recovered, and Lost to the Environment

The values given in this section are taken from the spill report estimates. These figures give a rough idea of how much product was spilled, recovered, and lost to the environment; however, these figures must be viewed as educated guesses only because not all spills are reported. In those instances where spills are reported, not all of the aboveground facilities have an accurate method for determining the volume spilled, and the volume of product recovered is an estimate by the DEP response person and/or the responsible party. Given these limitations, the numbers given here, even though shown to the gallon, are approximations only.

The total approximate amount of product spilled in the 155 of the 174 reported incidents (for which the quantity of product spilled was estimated) totalled 618,037 gallons. Nineteen of the spill incidents did not include an estimate of the volume discharged. The estimated amount recovered was 530,608 gallons which represents 86% of the total reported spilled. Given the estimated volume spilled and estimated volume recovered, the resulting estimated volume which has been lost to the environment for the 155 spills documented was approximately 87,429 gallons, representing 14% of the total volume spilled.

Figures 3-3 and 3-4 display the distribution of the 155 incidents by estimated spill volume. Fifty percent of the spills involved a discharge of less than 300 gallons, less than 1,000 gallons were spilled in 66% of the incidents, and 94% of the spills discharged less than 10,000 gallons.

3.7 Reported Surface or Groundwater Affected

Jordan reviewed the DEP spill reports to estimate the impacts on surface and groundwater resources from known contamination due to spills from aboveground

TABLE 3-1

GEOGRAPHIC DISTRIBUTION OF REPORTED SPILLS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
AUGUSTA, MAINE

REGIONAL OFFICE	NUMBER OF SPILLS	PERCENTAGE OF TOTAL SPILLS
PORTLAND	73	42%
BANGOR	70	40%
AUGUSTA	28	16%
PRESQUE ISLE	3	2%

FIGURE 3-1

NUMBER OF REPORTED SPILLS BY PRODUCT

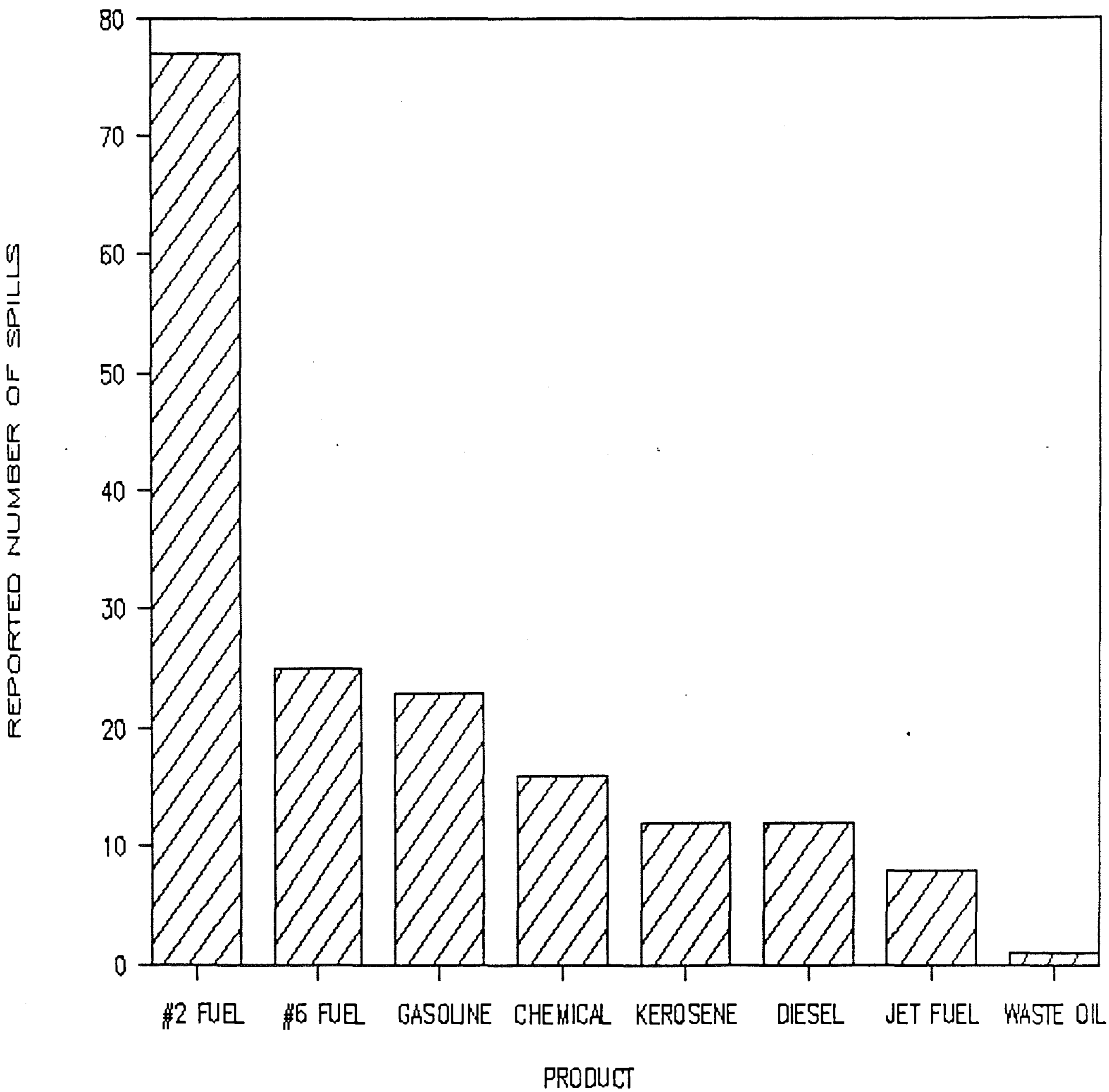


FIGURE 3-2

DISTRIBUTION OF REPORTED SPILLS BY CAUSE

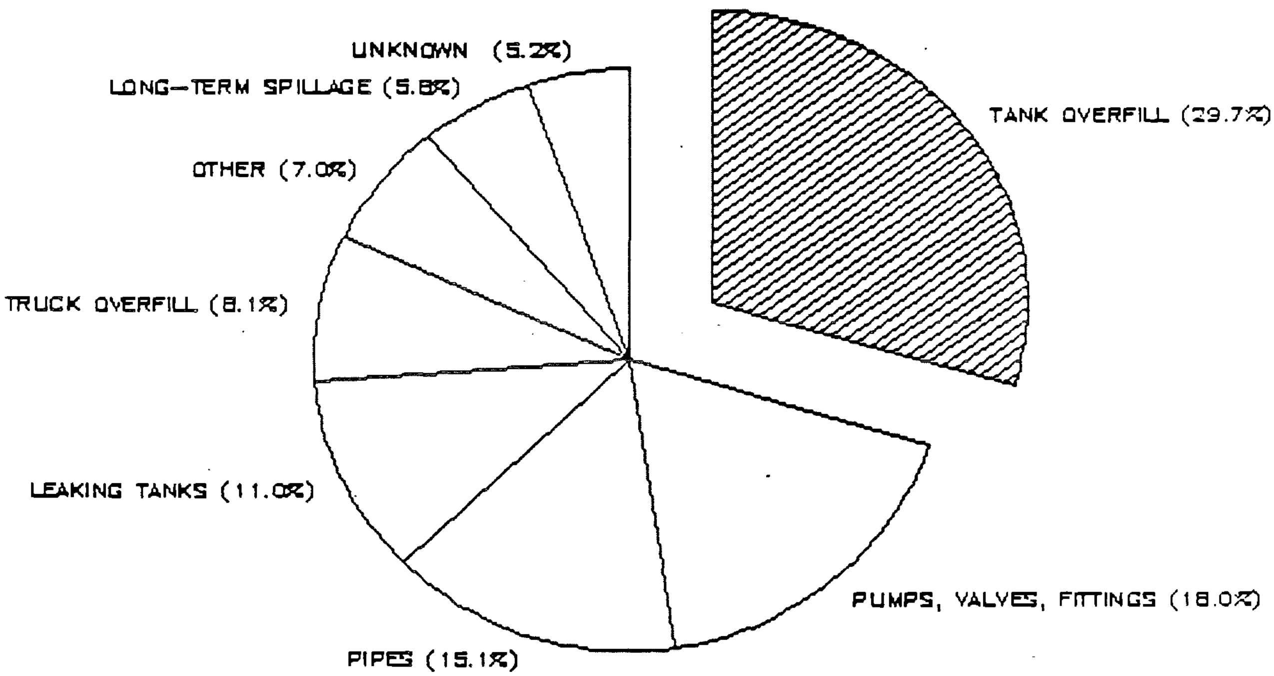


FIGURE 3-3

ESTIMATED VOLUME OF ALL REPORTED SPILLS

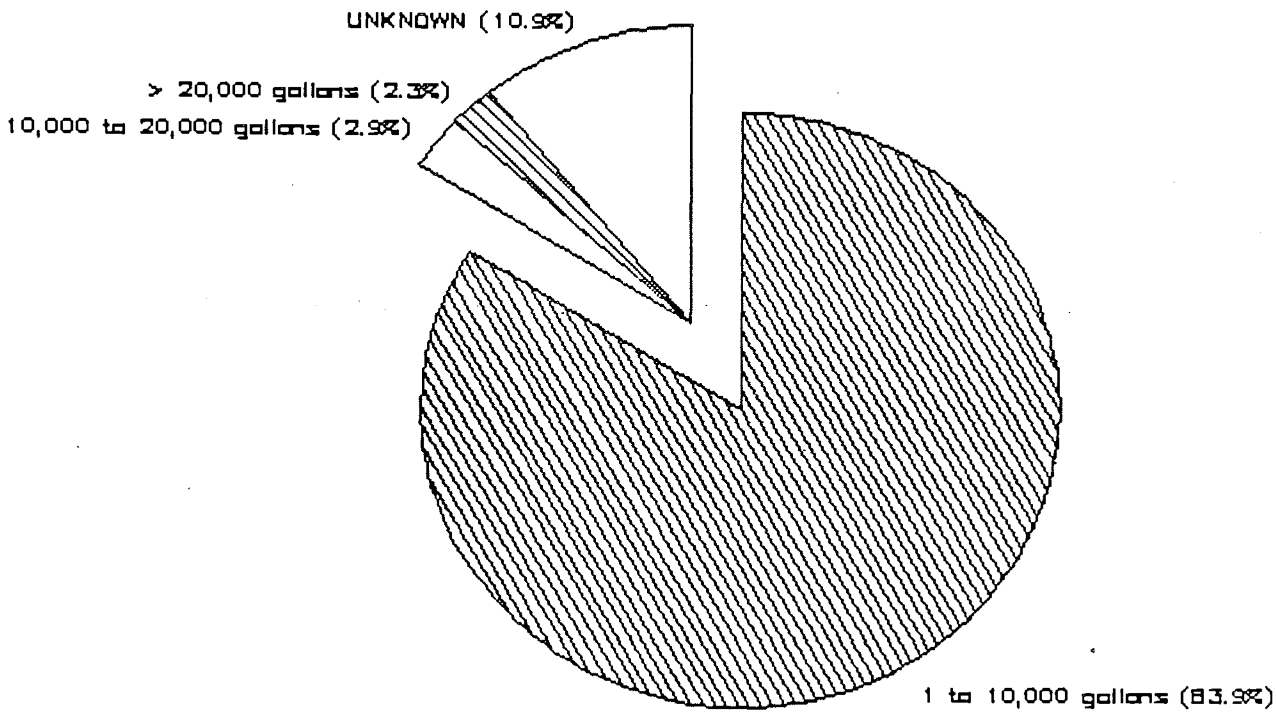
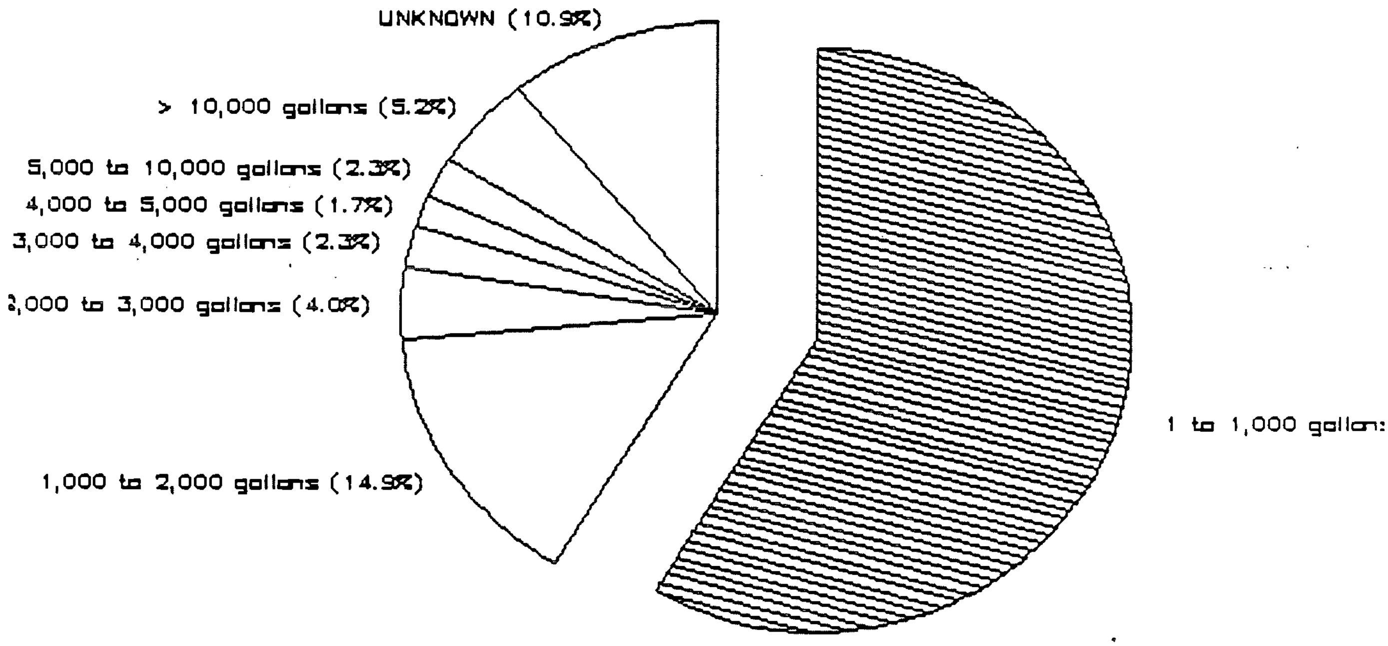


FIGURE 3-4

ESTIMATED VOLUME OF REPORTED SPILLS

OF LESS THAN 10,000 GALLONS



storage facilities. Of the 174 spills Jordan identified, 59 were reported to have impacted surface or groundwater. Of these 59 spills, only one incident was reported to have impacted a drinking water supply. A private well in Richmond located adjacent to a bulk heating oil storage facility was contaminated in 1983.

The total volume of the 59 spills affecting surface or groundwater was estimated to be 517,520 gallons, of which 86 % was reportedly recovered leaving an estimated 71,501 gallons lost to surface water or groundwater.

3.8 Conclusions

- A significant number of spills and leaks do occur at aboveground storage facilities, and a significant volume of product is lost to the environment.

- Spills discussed in this document represent a minimum number because not all spills are reported.

- Few documented cases of well contamination have occurred to date. It is not known to what extent water resources which are not presently being utilized have been affected by spills and leaks from aboveground storage systems.

- The potential threat posed to water resources cannot be determined because of inability to correlate identified water resources with existing aboveground storage facilities due to lack of accurate geographic location data for the facilities.

4.0 TASK 3: SUMMARY OF EXISTING STANDARDS FOR ABOVEGROUND PETROLEUM AND HAZARDOUS SUBSTANCE STORAGE FACILITIES

This task consisted of a review of the national codes and standards applicable to aboveground storage of petroleum and hazardous substances. The codes and standards which were reviewed are listed in Table 4-1. The general areas of applicablility of each code are listed in Table 4-2. Refer to the Task 3 Technical Memorandum in Volume II of this report for detailed summaries of these codes and standards.

It is important to note that these codes and standards do not contain:

- o facility operating procedures,
- o construction standards for rebuilt tanks,
- o facility closure procedures, or
- o in service inspection or other leak monitoring procedures.

There is no code or standard specifically intended for non-flammable or non-combustible hazardous substances.

TABLE 4-1

LIST OF STORAGE TANK CODES AND STANDARDS REVIEWED

ORGANIZATION	TITLE	DATE	ABBREVIATION IN TABLE 4-2
American Petroleum Institute (API)	API Standard 620, Recommended Rules for Design and Construction of Large, Welded, Low-Pressure Storage Tanks, Seventh Edition and Revision 1, April 1985	April 1985	API 620
American Petroleum Institute	API Standard 650, Welded Steel Tanks for Oil Storage, Eighth Edition, 1988	November 1988	API 650
American Petroleum Institute	Guide for Inspection of Refinery Equipment, Chapters I-XVII	Dates vary with Chapter	API Inspection Guide
American Society of Mechanical Engineers (ASME)	ASME Code for Pressure Piping, B31, Chemical and Petroleum Refinery Piping, ANSI/ASME B31.3, 1987 Edition	1987	ANSI B31.3
American Society of Mechanical Engineers	Welded Aluminum-Alloy Storage Tanks, ASME/ANSI B96.1-1986	1986	ANSI B96.1
American Society of Mechanical Engineers	ASME Boiler and Pressure Vessel Code, Section VIII, Rules for Construction of Pressure Vessels, Division 1 and Division 2	1986	ASME Sec. VIII
National Fire Protection Association (NFPA)	Flammable and Combustible Liquids Code, NFPA 30, 1987 Edition	1987	NFPA 30

TABLE 4-1 (CONTINUED)

LIST OF STORAGE TANK CODES AND STANDARDS REVIEWED

ORGANIZATION	TITLE	DATE	ABBREVIATION IN TABLE 4-2
National Fire Protection Association	Automotive and Marine Service Station Codes, NFPA 30A, 1987 Edition	1987	NFPA 30A
National Fire Protection Association	Installation of Oil Burning Equipment, NFPA 31, 1987 Edition	1987	NFPA 31
Underwriters Laboratories (UL)	Steel Underground Tanks for Flammable and Combustible Liquids, Eighth Edition, ANSI/UL 58-1985	April 15, 1986	UL 58
Underwriters Laboratories	Steel Aboveground Tanks for Flammable and Combustible Liquids, Sixth Edition, ANSI/UL 142-1987	September 15, 1987	UL 142

Table 4-2: Generalized Contents of Storage Tank Codes and Standards Reviewed

	Piping Code	Pressure Vessel Code	STORAGE TANK CODES AND STANDARDS									
Key Areas/Questions Covered By Code or Standard	ANSI B31.3	ASME Section VIII	API 650 Ver. 8	API 620	NFPA 30A	NFPA 31	DEP Oil Terminal License Regs	API Inspection Guide	UL 58	UL 142	NFPA 30	ANSI B96.1
Material Specifications or Requirements	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Welding Specifications or Requirements	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	No	Yes
Preservice Testing Requirements	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Vents, Valves, Pipes, and Fittings	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	No	Yes	Yes
Siting Requirements	No	No	No	No	No	No	No	Yes	No	No	Yes	No
In-service Leak Detection Guidance	No	No	No	No	No	No	No	Yes	No	No	Yes	No
Inspection and Testing of Rebuilt Tanks	No	No	No	No	No	No	No	No	No	No	No	No
Closure of Tanks or Facilities	No	No	No	No	No	No	No	Yes	No	No	Yes	No
Diking	No	No	No	No	No	Yes	Yes	No	No	No	Yes	No

5.0 TASK 4: SUMMARY OF REGULATIONS APPLICABLE TO ABOVEGROUND PETROLEUM AND HAZARDOUS SUBSTANCE STORAGE FACILITIES IN MAINE

This task consisted of a review of existing State of Maine, Maine local government, and Federal regulations applicable to aboveground oil and hazardous substance storage facilities. This task included:

- A comparison of the current DEP and Fire Marshal regulations. The study found little overlap between the two programs because the DEP focus is very narrow (marine oil terminals only) while the Fire Marshal is concerned with storage volumes of greater than 60 gallons. A tabular comparison of the two programs is contained in Table 1 of the Task 4 Technical Memorandum contained in Volume II of this report.

- A survey of the cities/towns of: Bangor, Bridgton, Brunswick, Gray, Lewiston, Naples, North Berwick, Portland, Saco, Sanford, South Berwick, South Portland and Waldoboro. This survey revealed that most towns administer the Building Officials Code Administrator (BOCA) fire prevention code which incorporates the provisions of NFPA 30. The provisions of the BOCA code are listed in the Task 4 Technical Memorandum, while NFPA 30 is summarized in the Task 3 Memorandum. Both of these memoranda are included in Volume II of this report.

- A comprehensive survey of Federal and State of Maine programs related to petroleum and hazardous substance use. The programs compared included:

  - U.S. Environmental Protection Agency (EPA) Resource Conservation and Recovery Act (RCRA)
  - U.S. Department of Transportation (DOT) Coast Guard Oil Pollution Prevention
  - U.S. DOT Coast Guard Proposed Hazardous Substance Pollution Prevention
  - U.S. Department of Labor (DOL) Occupational Safety and Health Administration (OSHA)
  - U.S. Department of the Interior (DOI) Office of Pipeline Safety (OPS)
  - U.S. DOI Minerals Management Service (MMS)
  - U.S. EPA Underground Storage Tank Program (UST)
  - U.S. EPA Spill Prevention, Control and Countermeasures (SPCC)
  - Maine Oil Discharge and Pollution Control Regulations
  - Maine Rules and Regulations Relating to Gasoline and Other Flammable Liquids
  - Maine Regulations for Registration, Installation, Operation and Abandonment of Underground Oil Storage Facilities

These programs are compared in Table 3 of the Task 4 Technical Memorandum in Volume II of this report.

Except for the Federal and State underground storage tank programs, none of the above programs is specifically intended to protect ground water resources.

6.0 TASK 5: DEVELOPMENT OF MINIMUM ABOVEGROUND STORAGE FACILITY STANDARDS

The goal of Task 5 was to develop recommended minimum standards for facility siting, design, operation and closure, using existing codes, standards and regulations from other states as guidelines. Refer to Table 4-1 for a listing of the codes and standards reviewed, and Table 6-1 for a listing of the state regulations reviewed. The following are the minimum standards proposed by Jordan for Maine's aboveground storage facilities. The parentheses after each recommendation reference the national code or state regulation from which the standard is derived.

6.1 Facility Siting Recommended Minimum Standards

Jordan recommends the following minimum standards for the siting of new aboveground storage facilities:

- broaden the parameters of the Maine Site Location Law to include all proposed aboveground storage facilities. This would allow the DEP to review all proposed sites and require site-specific safeguards as needed depending upon the environmental sensitivity of a site (Maine);

- include siting provisions similar to the Maine UST siting requirements that mandate additional installation and monitoring requirements for new and replacement tanks which are located in sensitive geologic areas (Maine);

- adopt NFPA 30 (1987) to include up-to-date requirements with respect to distances from property lines and public ways, distances between tanks for safety, and updated standards for foundation design and structure that are not included in the current Maine regulations (NFPA 30); and,

- require special facility design and construction standards to prevent flood damage to facilities sited within the 100 year floodplain. (New Jersey, New York).

6.2 Facility Design Recommended Minimum Standards

Jordan recommends the following minimum standards for facility design:

6.2.1 Materials and Construction

- adoption of NFPA 30 (1987) to address up to date construction techniques and design features not included in the current Maine regulations. The design standards cited in the current Maine regulations are out of date with respect to the size of vents and the size of tanks allowed to have open vents. The most recent NFPA 30 code also contains new sections on ventilation of buildings, emergency drainage systems, and emergency venting design standards (NFPA 30);

- tanks that are removed and do not meet the standards for new tanks cannot be reinstalled (New York); and,

TABLE 6-1

STATE REGULATIONS REVIEWED

- Alaska Oil Pollution Control Law, Title 46, Water, Air, Energy, and Environmental Conservation, Chapter 4, Oil Pollution Control (oil treatment facilities which include onshore or offshore facilities of any kind which is used for the purpose of transferring, processing, refining, or storing oil with an effective storage capacity of 42,000 gallons or greater);

- Alaska Oil and Hazardous Substances Pollution Control Regulations, Alaska Administrative Code, Title 18, Environmental Conservation, Chapter 75 - Oil and Hazardous Substances Pollution Control Regulations (oil and hazardous substances treatment facilities which include onshore or offshore facilities of any kind which are used for the purpose of transferring, processing, refining, or storing oil with an effective storage capacity of 42,000 gallons or greater);

- Florida Pollution Spill Prevention and Control Act, Florida Statutes, Title 28 - Natural Resources; Conservation, Reclamation, and Use, Chapter 376 - Pollution Discharge Prevention and Removal (terminal facilities, meaning any waterfront or offshore facility of any kind other than vessels not owned or operated by such a facility used for the purpose of drilling for, pumping, storing, handling, transferring, processing, or refining pollutants such as petroleum, no storage amount specified);

- Florida Department of Environmental Regulation, Chapter 17-61, Stationary Tanks (oil facilities consisting of a stationary storage system or systems which have an individual storage capacity greater than 550 gallons but not aboveground storage tanks whose total combined storage capacity exceeds 500,000 gallons);

- Maine Oil Discharge Prevention and Pollution Control Act, Title 38, Chapter IIA, Discharge Prevention and Pollution Control (oil terminal facilities with capacities of 21,000 gallons or greater and engaged in transfers of oil to or from waters of the State);

- Maine Regulations for Registration, Installation, Operation, and Abandonment of Underground Oil Storage Facilities, Title 38, Chapter 691, Department of Environmental Protection (all oil stored in underground tanks except propane);

- Maryland Oil Pollution Control Regulations, Code of Maryland Regulations, Title 26, Department of Environment, Subtitle 10 - Water Resources Administration, Chapter 1 - Oil Pollution and Tank Management (oil storage facilites, no storage capacity cited);

TABLE 6-1 (cont.)

STATE REGULATIONS REVIEWED

- <u>Michigan Water Resources Commission General Rules</u>, Michigan Administrative Code, Department of Natural Resources, Water Resources Commission General Rules, Parts 1,3, 5, 9, and 21 (oil storage facilities that have storage capacity of 40,000 gallons or greater or any facility with less than 40,000 gallons as deemed necessary by the State);

- <u>New Jersey Rules on Discharge of Petroleum and Other Hazardous Substances</u>, New Jersey Administrative Code, Title 7, Chapter 1E - Discharge of Hazardous Substances (major facilites with a total above and below ground capacity of 400,000 gallons or greater - hazardous substances include petroleum and those substances designated as hazardous under the Clean Water Act as ammended in 1977);

- <u>New York Water Pollution Control Regulations</u>, Official Codes, Rules and Regulations of the State of New York, Chapter V, Subchapter D - Water Regulation, Part 608.610-614 (major facilities with a total above and below ground storage of 400,000 gallons or greater and petroleum storage facilities with a capacity of 1,100 gallons or greater);

- <u>Pennsylvania Water Resources Regulations</u>, Pennsylvania Code, Title 25 - Environmental Resources, Chapter 91 - General Provisions; Chapter 101 - Special Water Pollution Regulations (facilities that generate, store, treat, transport or dispose of hazardous substances);

- <u>Pennsylvania Senate Bill 280</u>, General Assembly of Pennsylvania, Provision for Regulation of storage tanks and Tank Facilities (oil storage facilities, all capacities); and,

- <u>South Dakota Water Pollution Law</u>, South Dakota Codified Laws, Title 34A - Environmental Protection, Chapter 2 - Water Pollution Control (stationary petroleum storage tank systems, no amount specified).

- tank strength be evidenced by the presence of an ASME code stamp, an API monogram, or the label of the UL on the tank. Such evidence must be described in the associated SPCC Plan (SPCC Task Force).

6.2.2 Leak Detection

- adoption of NFPA 30 (1987) to address tightness testing requirements for new facilities (NFPA 30);

- new and substantially modified tanks to be required to have equipment for monitoring between the tank and impermeable barrier (New York);

- new tanks and piping must be tightness tested prior to operation (NFPA 30, New York, SPCC Task Force);

- periodic testing of in-service tanks using hydrostatic or other liquid testing, pressure testing with air or inert gas, visual internal inspection, or a system of non-destructive shell-thickness testing (New Jersey, New York, SPCC Task Force);

- monthly inspection of all aspects of aboveground systems for leaks, cracks, or other irregularities (New York, Florida, Maryland); and,

- monthly inspection and testing of leak detection systems (Florida, New York, EPA UST regulations).

6.2.3 Leak Prevention

- installation of secondary containment structures consisting of impermeable dikes, liners, pads, ponds, impoundments and other structures capable of containing the product stored (New Jersey, New York, and Florida);

- substantially modified tanks to be underlain by an impermeable barrier (New York and Florida);

- existing tanks in contact with the soil if not underlain by an impermeable barrier, must meet one of the following requirements:

  - coat the interior bottom and at least 18 inches up the interior side walls with a glass fiber epoxy coating or other suitable material;

  - install a network of monitoring wells inside and outside the diked area to be sampled periodically (Florida);

- existing tanks elevated above the soil must have an impermeable barrier placed beneath them (Florida); and,

- new underground piping must be made of cathodically protected steel, FRP, or an equivalent material and must be equipped with a leak detection system (Florida).

6.2.4 Spill and Overfill Protection

- o broadening overfill requirements of NFPA 30 to include deliveries from tank vehicles as well as pipelines and barges (NFPA 30);
- o use of automatic high liquid level pump cutoff devices designed to stop flow at a predetermined level to prevent overfilling (NFPA 30, EPA UST regulations);
- o loading and unloading areas be designed to contain spills and be equipped with a secondary containment system such as curbing, trenching, and catchment basins, or drainage to a separator (New Jersey);
- o loading and unloading areas be paved or surfaced with an impermeable materials (New Jersey);
- o tank trucks in the process of loading or unloading be attended at all times (New Jersey, New York); and,
- o gauges showing the product level for each tank be accessible to the carrier and installed so it can be conveniently read (New York).

6.3 Facility Operation Recommended Minimum Standards

Jordan recommends the following minimum standards for facility operations.

6.3.1 Registration

- o registration of facilities prior to commencement of operation (as is currently done in Maine), registration of existing facilities, and re-registration every three years thereafter (Florida, New York, Pennsylvania-proposed);
- o update registration for substantially modified systems or ones that have changed ownership (Florida, New York); and,
- o notification of the State prior to closure of facilities or after tank testing results indicate a leak (Florida).

6.3.2 Inventory Control

- o inventory control practices for all new facilities (installation of metering devices would be required) and for those existing facilities equipped with metering devices (Florida).

6.3.3 Maintenance of Cathodic Protection and Leak Detection Systems

- o periodic inspections of cathodic protection systems (EPA UST regulations); and,
- o monthly monitoring of leak detection systems (Florida, New York, EPA UST regulations).

6.3.4 Inspections

- routine monthly inspection of all aspects of aboveground systems (Florida, Maryland, New York).

6.3.5 Recordkeeping

- recordkeeping requirements including: corrosion protection operational records, system repair records, release detection compliance records including inventory control, SPCC plans, monthly inspection checklists, and site investigation records for permanent closure (Florida, EPA UST regulations).

6.3.6 SPCC Plans

- update SPCC plans as necessary, perform and record daily inspection (SPCC Task Force).

6.4 Facility Closure Recommended Minimum Standards

Jordan recommends the following minimum standards for facility closure:

- adoption of NFPA 30 (1987) to ensure proper procedures for temporarily out-of-service tanks (NFPA 30);

- removal of product, cleaning, and dismantling of permanently closed facilities within a specified period of time after the facility has been taken out-of-service (Florida); and,

- performance of a site assessment and remedial action if any contamination is detected during the assessment (EPA UST regulations).

6.5 Standards for Aboveground Storage of Petroleum at Retail Outlets

In the past few years, a significant number of aboveground storage tanks for dispensing motor fuels have been installed at retail outlets in the state. The type of aboveground storage system currently being installed at retail outlets in Maine is not approved by any existing national code or standard and is not described in the current state of Maine regulations. The facilities Jordan observed posed serious fire hazards and very significant environmental threats. At a minimum, the following public safety and environmental safeguards should be applied to these facilities.

From a public safety standpoint:

- place continuously operating vapor sensors within the containment dikes of these facilities to provide a warning that explosive conditions may exist;

- make provisions for forced ventilation of diked areas to dissipate flammable vapors whenever they are detected;

- allow installations only where they can be placed a significant distance (hundreds of feet) from any occupied buildings;

- restrict public access (e.g. with chain link fence) to no closer than 50 feet from the storage structure to minimize sources of potential ignition;

- equip storage areas with automatic fire suppression systems;

- require new facilities to be designed by a registered professional engineer; and,

- require strict adherence to all applicable provisions of NFPA 30, NFPA 30A, and the federal SPCC plan regulations (e.g. diking, emergency venting)

From an environmental protection standpoint:

- require piping to be of double walled construction with a continuously operating leak detection device monitoring the space between the walls of the piping so that leaks can be detected early. In addition to leak monitoring, equip pressurized piping systems with devices which automatically shut off the product flow if a significant leak is detected in the piping;

- equip piping systems subject to gravity flow from the tank with anti-siphon devices to prevent draining of the tank if a leak in the piping should occur;

- anchor tanks located in diked areas where rainwater can accumulate to prevent flotation;

- do not locate storage systems in close proximity to water supplies (e.g., 300 feet from private wells, 1,000 feet from public water supplies); and,

- equip tanks with overfill protection devices to terminate deliveries before the tank is overfilled.

In view of the fact that such facilities are not approved by existing national codes such as NFPA 30A, the wisdom of allowing routine construction of this type of facility should be reconsidered.

6.6 Conclusions

Jordan reviewed current industry codes and standards and existing state regulations in order to devlop recommended minimum standards for aboveground facilities in Maine. The goal of these standards is to protect human health and the environment, particularly surface and groundwater resources. Jordan found that:

- Current industry codes and standards are designed primarily with public safety issues in mind. These codes are adequate to protect public safety, but they do not adequately address environmental concerns associated with aboveground storage tank facilities, especially protection of groundwater resources.

- Current State of Maine regulations are not based on up-to-date industry codes and do not adequately cover all important environmental aspects of aboveground facilities.

- A variety of environmentally based regulations relating to aboveground storage have been developed by a number of states. Many of these standards and regulations would be useful in protecting Maine's groundwater resources from contamination resulting from spills and leaks from aboveground storage systems.

7.0 TASK 6: ASSESSMENT OF ADEQUACY OF MAINE'S ABOVEGROUND STORAGE FACILITIES

The following methods were proposed to assess the adequacy of existing aboveground storage facilities:

- a review of DEP spill reports was conducted to evaluate the failure modes and compare the types of failures reported to the preventive measures and standards discussed in Tasks 3 and 4.

- a review of the Region I EPA spill prevention control and countermeasure (SPCC) inspection reports was performed to assess the compliance level of storage systems with the existing SPCC regulations.

- a series of site visits at operating facilities was conducted in order to evaluate factors such as actual facility siting, design and operation against existing codes and standards.

- photographs of facilities were taken to document the visual appearance of the facility's daily housekeeping practices.

7.1 Assessment of Adequacy from DEP Spill Reports

Although the DEP reports document that an spill incident has occurred, they typically do not provide any insight into why the incident occurred. For example, in the case of tank overfills, we were not able to tell from the spill reports whether any overfill equipment or procedures were in place at the time of the spill. Thus we do not know whether the overfills happened in spite of the presence of overfill equipment or because of the absence of overfill equipment. As a result, there is insufficient information provided in the DEP spill reports to determine whether the causes of spills noted above were due to lack of adherence to appropriate standards or to the inadequacy of the standards to prevent this type of spillage.

7.2 Assessment of Adequacy Based on SPCC Inspection Reports

As can be seen in Table 7-1, the compliance level of regulated facilities is low, as 50% or more of the facility visits resulted in deficiency reports and nearly half of the deficiencies involved the complete absence of SPCC plans. Even at the facilities which had SPCC plans, secondary containment, one of the principal elements of the SPCC program, was absent or inadequate at 38% of the facilities. In Jordan's judgement, the federal SPCC program has not been implemented at a majority of bulk oil storage facilities. Because the SPCC regulations constitute a federally mandated minimum standard to prevent oil spillage, the lack of implementation of these standards constitutes a significant inadequacy.

7.3 Assessment of Adequacy Based on Facility Site Visits

Jordan, accompanied by DEP personnel, conducted site visits at 39 aboveground storage facilities, including four oil terminals, twenty bulk plants, ten retail outlets and five hazardous substance storage facilities. Facilities were evaluated against national codes and standards in twelve different areas (adequate containment volume, impermeable dike walls, drainage controlled, SPCC plan present, tank overfill protection present, tank foundation adequate, piping

TABLE 7-1
LIST OF SPCC PLAN DEFICIENCIES
RECORDED IN EPA INSPECTION REPORTS

FACILITY DEFICIENCIES	Number	Percent
Total facilities with deficiencies	166	
Facilities without SPCC plans	72	43%
Facilities with SPCC plans	94	57%
PAPERWORK DEFICIENCIES AT FACILITIES WITH SPCC PLANS		
Plan storage capacity is inaccurate	25	27%
Tank not included in SPCC plan	18	19%
SPCC plan not up to date	17	18%
SPCC plan not certified by P.E.	15	16%
Inspection forms not available	7	7%
Phone number missing	4	4%
New owner not in plan	4	4%
Tank use not addressed	2	2%
Storm drain not in plan	2	2%
PHYSICAL DEFICIENCIES AT FACILITIES WITH SPCC PLANS		
Facilities with absent/incomplete containment	36	38%
Maintenance/repair needed	26	28%
Plan not implemented	18	19%
Spillage apparent	12	13%
Locks missing	6	6%
Sand catch basin needed	3	3%
Alarm needs repair	2	2%

construction adequate, piping components adequate, emergency venting present, truck rack contained, truck overfill protection present and facility security adequate), and three additional areas which Jordan believed to be important (impermeable dike floor, evidence of spillage present, and water supplies within 500 feet). The criteria which were used to determine adequacy in each of these areas are described in section 2.3 of the Task 6 Technical Memorandum included in Volume II of this report. The results of the evaluation are presented in Figures 7-1 through 7-4.

There is considerable variability in the adequacy of the the different types of facilities, as can be seen by comparing Figures 7-1 through 7-4. There is considerable variation in adequacy within a specific type of facility as well. In general, oil terminals and chemical plants are adequate relative to codes and standards in effect in Maine today. The adequacy ratings would have been even higher for these two types of facility except that for each type, a single facility which was visited was responsible for a disproportionate number of inadequacies. Bulk plants were rated significatnly lower in overall adequacy, as deficiencies were noted at many facilities in many areas.

Retail facilities are generally adequate with regard to containment and construction standards, but certain areas (SPCC plans, tank overfill protection and emergency venting) are clearly being overlooked. The facility site visits also revealed what Jordan believes to be significant public safety and environmental deficiences in the retail facilities which were evaluated. Because the type of retail facility being constructed in Maine is not described by existing codes (e.g., NFPA 30, NFPA 30A) or the State of Maine's Rules and Regulations Relating to Gasoline and Other Flammable Liquids, these facilities must be evaluated primarily in terms of common sense. Inadequacies which Jordan commonly observed at retail aboveground petroleum facilities included:

- Dike construction was such that flammable vapors could accumulate and pose an explosion hazard. This situation was particularly severe in many structures which were covered by roofs and largely enclosed by fencing or screening. One enclosed retail facility had the tank vents located <u>inside</u> the tank enclosure, creating a severe explosion hazard every time the tanks were filled.

- Public access in the area of the storage tanks was not sufficiently restricted, so that sources of ignition such as cigarrettes and automobiles could not be adequately controlled

- Lack of anti-siphon valves to prevent product from draining out of the tank should a piping leak develop.

- Lack of corrosion protection or leak detection provisions for buried piping.

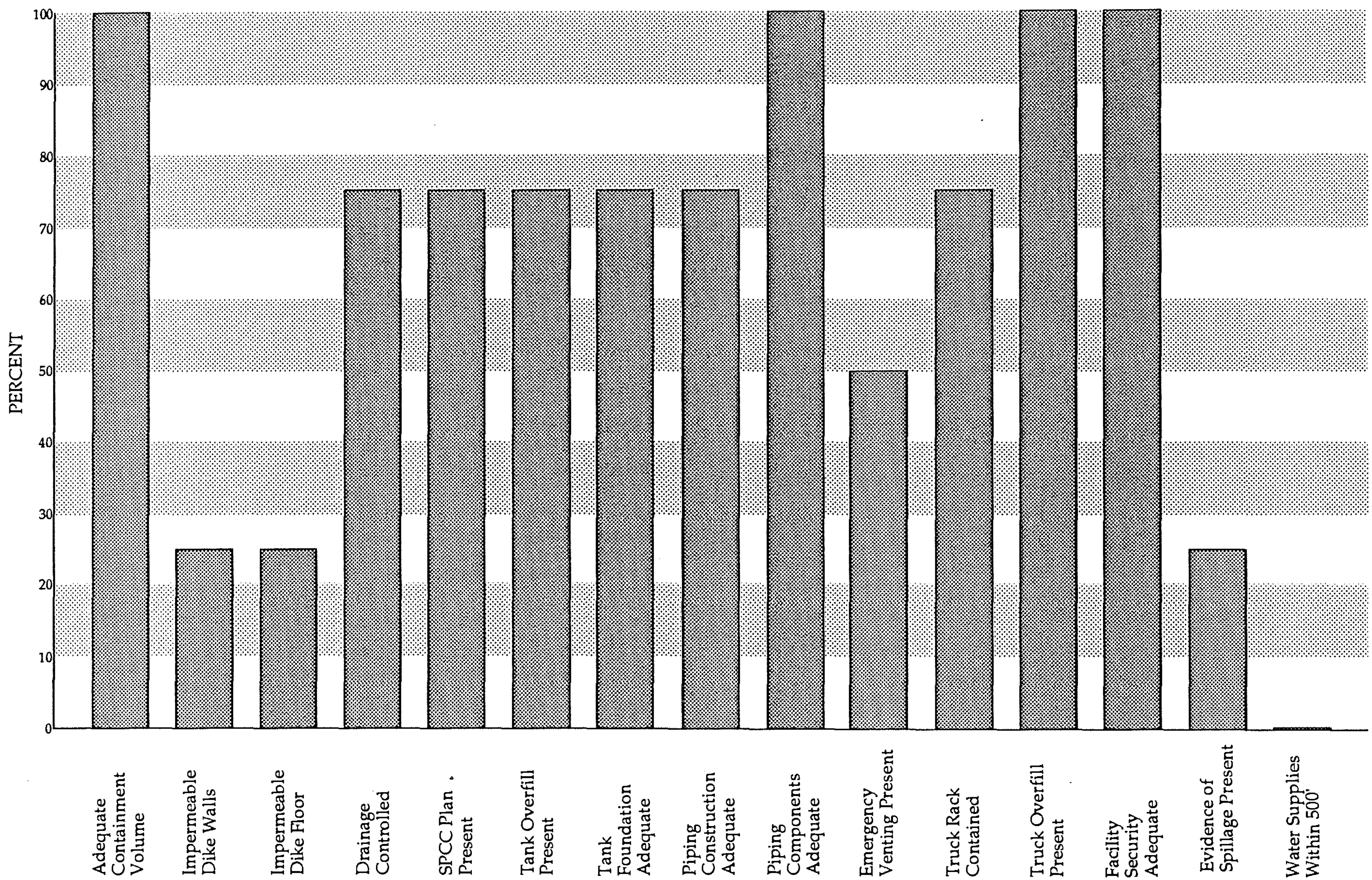
- Lack of tank overfill protection equipment.

It is Jordan's opinion that the although there are few codes and standards against which to judge retail facilities, significant inadequacies do exist and should be addressed if human health and the environment are to be protected.

Figure 7-1: Oil Terminal Adequacy Profile.

Each bar in the Figure represents one of the categories listed in the text in Section 2.3 of the Task 6 Technical Memorandum in Volume II of this report. The height of the bar represents the percent of the facilities evaluated which met the criteria as described in the text. The data presented here represent evaluations of only four of the 31 oil terminal facilities in the tank data base, or 13% of the estimated total population. In general, the terminals fared quite well in the evaluation, with the prevailing inadequacy being the permeability of dike walls and floors. Emergency venting was absent on tanks at two facilities. All of the remaining deficiencies which caused the columns to reach only 75% were noted at a single oil terminal facility. Obvious evidence of spillage was noted at only one facility, although the DEP spill records contain a number of reports of incidents at oil terminals. All of the oil terminal facilities we visited were remote from water supplies.

OIL TERMINAL ADEQUACY PROFILE



NOTE:
Height of bars represents percent of facilities visited which were judged adequate for each of the criteria listed.

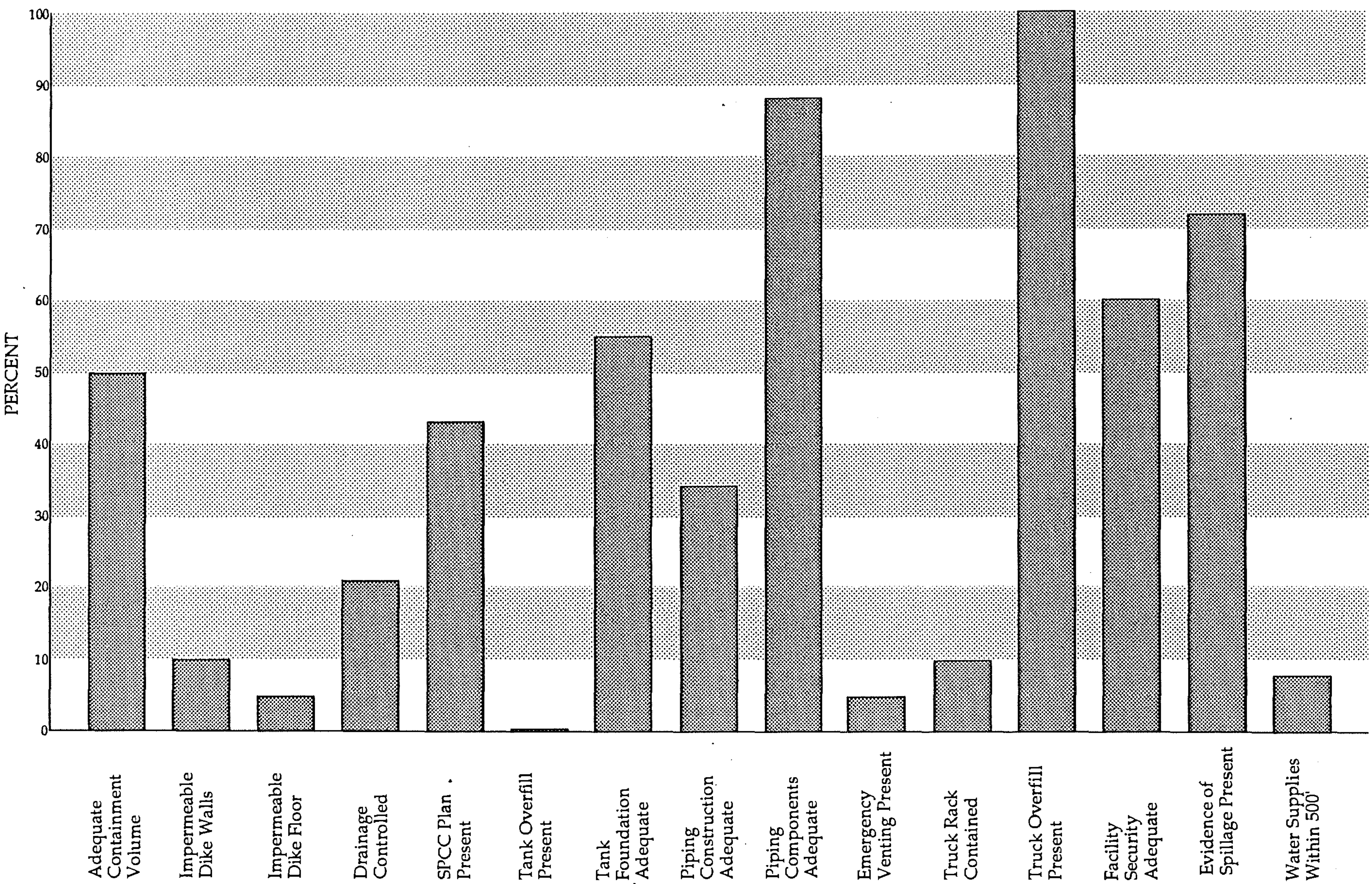
FIGURE 7-1
MAINE DEPARTMENT of ENVIRONMENTAL PROTECTION
E.C.Jordan Co.

5797-60

Figure 7-2: Bulk Plant Adequacy Profile.

Each bar in the Figure represents one of the categories listed in the text in Section 2.3 of the Task 6 Technical Memorandum in Volume II of this report. The height of the bar represents the percent of the facilities evaluated which met the criteria as described in the text. The data presented here represent evaluations of 20 of the 171 distributor category facilities on the tank data base, or 12% of the estimated total population. Bulk plants fared much lower in the adequacy ratings than the oil terminals, showing significant deficiencies in almost all areas except truck overfilling and adequacy of piping components. None of the facilities visited had any form of tank overfill hardware present, and 10 percent or less had impermeable dike walls or floors, emergency venting or truck rack containment. Also commonly judged to be inadequate were control of drainage, piping construction, containment volume, tank foundations, and facility security. Because the majority of the bulk plants visited were spotted in the course of the trip, facility personnel were often absent from the site and the presence of an SPCC plan could not be determined. At the seven facilities where SPCC plans were requested, only three were produced. Over 70% of the facilities showed some evidence of spillage. Only one facility, however, was found to be close to water supplies.

BULK PLANT ADEQUACY PROFILE



NOTE:
Height of bars represents percent of facilities visited which were judged adequate for each of the criteria listed.

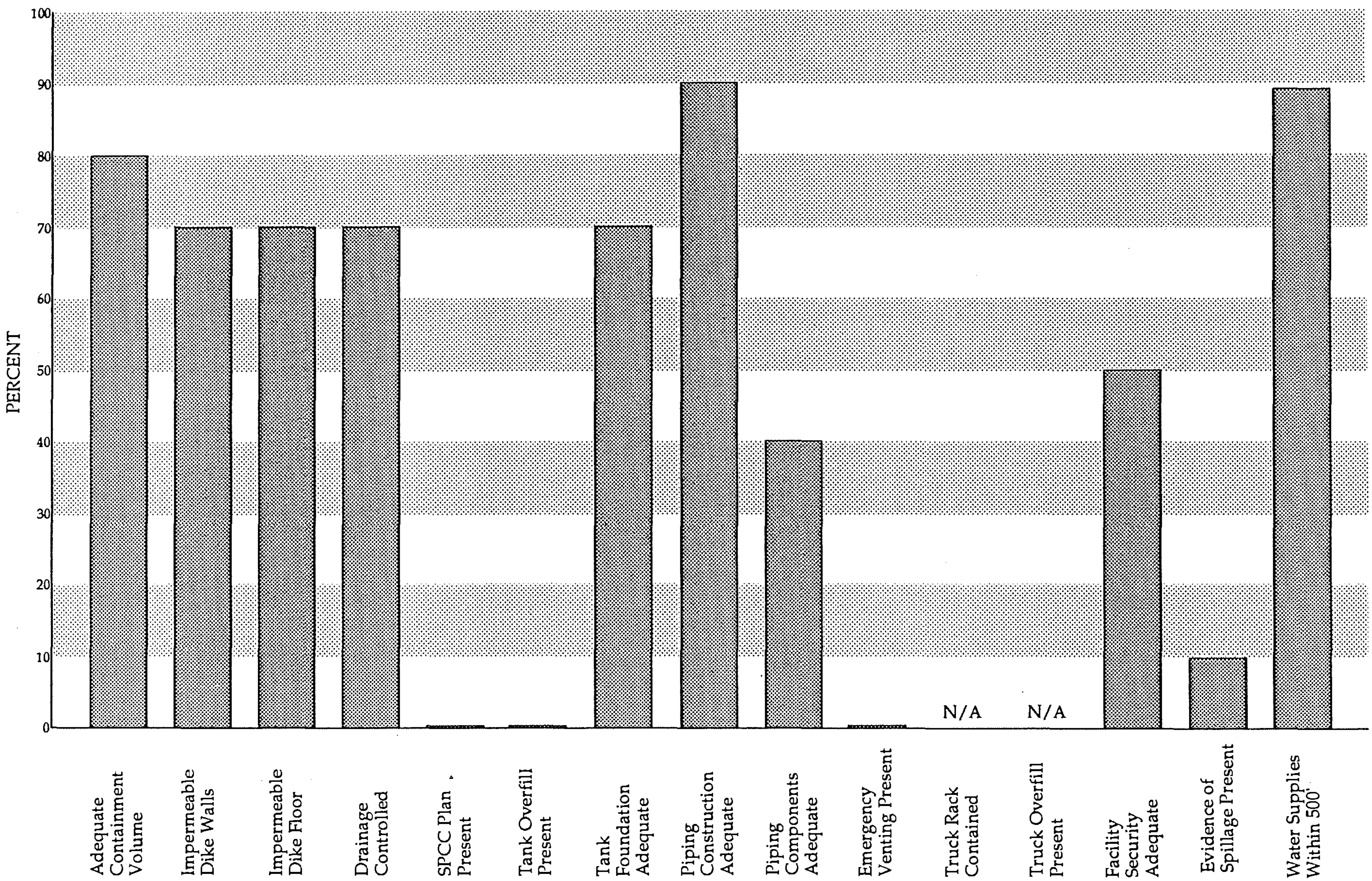
FIGURE 7-2
MAINE DEPARTMENT of ENVIRONMENTAL PROTECTION
E.C.Jordan Co.

5797-60

Figure 7-3: Retail Outlet Adequacy Profile.

Each bar in the Figure represents one of the categories listed in the text in Section 2-3 of the Task 6 Technical Memorandum in Volume II of this report. The height of the bar represents the percent of the facilities evaluated which met the criteria as described in the text. The data presented here represent evaluations of ten of the 104 retail facilities in the active tank data base, or 10 percent of the estimated total population. Retail outlets fared reasonably well in containment related areas. This is because many of the facilities visited had concrete walls and floors for their containment structure. Piping construction was judged adequate at 90% of the facilities, but piping components were judged inadequate at 60% of the facilities. This is principally due to the lack of important piping components such as anti-siphon valves and emergency shut-off valves under dispensers. Totally absent from the facilities were SPCC plans, tank overfill hardware, and emergency venting. Evidence of spillage was infrequently observed, but gasoline generally does not leave a stain on surface soils as heating oil does. Almost 90% of the facilities evaluated were within 500 feet of water supplies. This is the only type of aboveground facility where water supplies were commonly found to be in close proximity. "N/A" indicates that this evaluation category does not apply to this type of facility.

RETAIL OUTLET ADEQUACY PROFILE



NOTE:
Height of bars represents percent of facilities visited which were judged adequate for each of the criteria listed.

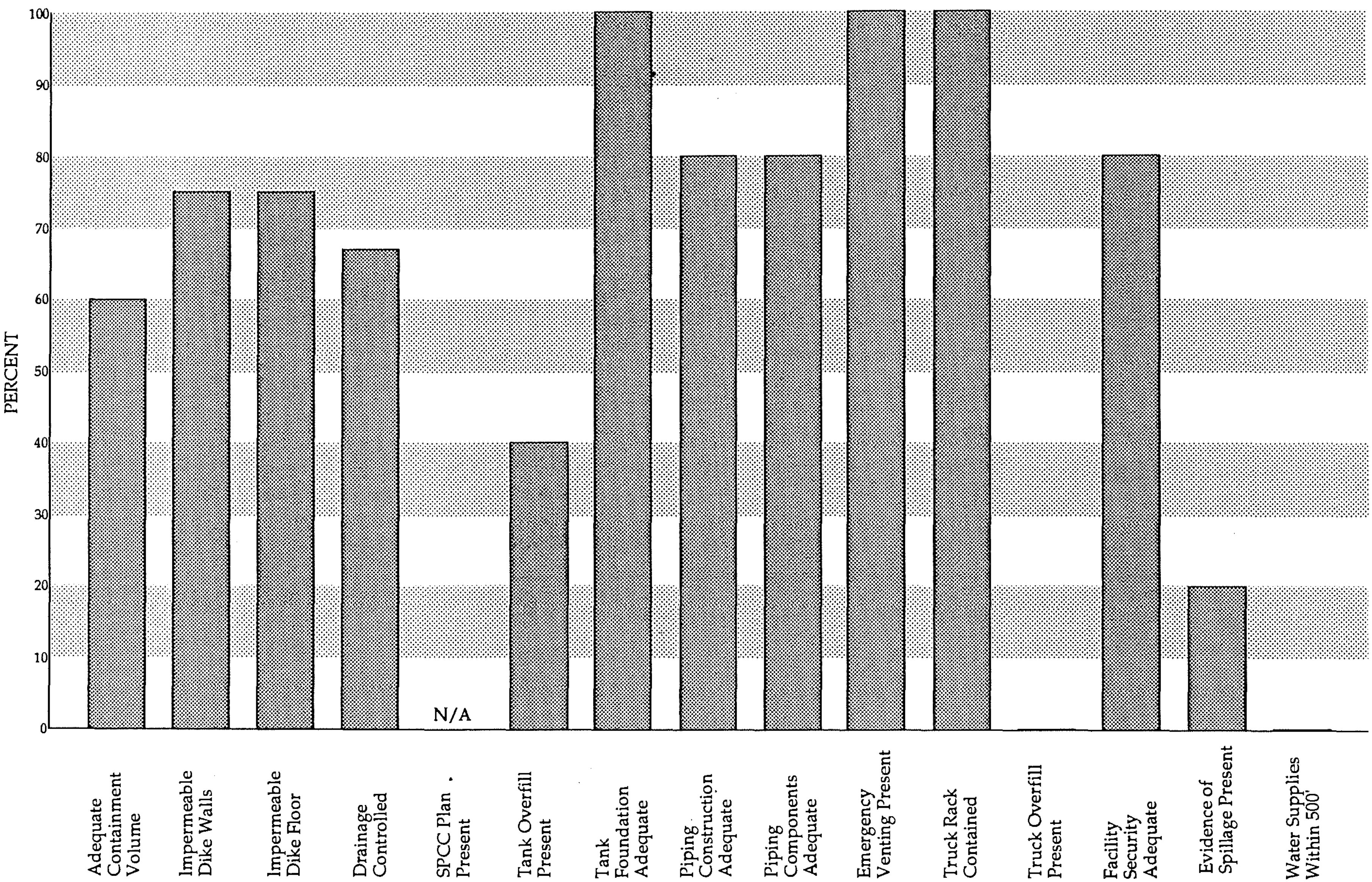
FIGURE 7-3
MAINE DEPARTMENT of ENVIRONMENTAL PROTECTION
E.C.Jordan Co.

5797-60

Figure 7-4: Hazardous Substance Facility Adequacy Profile.

Each bar in the Figure represents one of the categories listed in the text in Section 2.3 of the Task 6 Technical Memorandum in Volume II of this report. The height of the bar represents the percent of the facilities evaluated which met the criteria as described in the text. The data presented here represent evaluations of five of the 42 chemical storage facilities in the tank data base, or 12% of the estimated total population. Chemical facilities fared well overall, with one particular facility responsible for most of the inadequacies. The areas where several facilities were judged deficient were tank and truck overfill. Spillage was evident at only one facility, and there were no facilities located within 500 feet of a water supply. "N/A" indicates that this evaluation category does not apply to this type of facility.

HAZARDOUS SUBSTANCE FACILITY ADEQUACY PROFILE



NOTE:
Height of bars represents percent of facilities visited which were judged adequate for each of the criteria listed.

FIGURE 7-4
MAINE DEPARTMENT of ENVIRONMENTAL PROTECTION
E.C.Jordan Co.

5797-60

7.4 Assessment of Adequacy based on Recommended Minimum Facility Standards

Included in the Task 5 Technical Memorandum (Refer to Section 6 and Volume II of this report) for this study were recommended minimum standards for aboveground storage facility siting, design, operation and closure. These recommended standards provide another measure of adequacy of Maine's aboveground storage facilities. In Sections 7.4.1 through 7.4.4, the recommended minimum standards for aboveground storage facility siting, design, operation and closure from Task 5 of this study will be summarized and compared to existing conditions in Maine today.

7.4.1 Adequacy of Facility Siting

In the Task 5 Technical Memorandum, Jordan recommended the following minimum standards for facility siting:

- Review the siting of all proposed aboveground storage facilities, regardless of size or location.

- Require additional construction and monitoring requirements for proposed facilities which are to be located in sensitive geologic areas.

- Adopt NFPA 30 (1987) to update distance requirements of facilities from property lines and public ways.

- Impose special requirements on facilities sited in 100 year floodplains.

In comparing these recommendations with observations made of existing practices and conditions, Jordan finds that:

- Recently constructed facilities show little regard for siting considerations. During the site tour we observed a bulk plant with a capacity of over 21,000 gallons under construction in an area mapped as a sand and gravel aquifer. Construction had begun without the proposed facility undergoing Site Law review. Construction was suspended at the request of the DEP until such a review could be completed. That the DEP became aware that the facility was being built was fortuitous.

- Numerous newly constructed aboveground retail gasoline facilities were found to be in close proximity to water supplies. These facilities did not have any leak detection equipment for buried piping or overfill protection. Some facilities even lacked adequate containment.

- A number of newly constructed aboveground retail outlets were found to be in areas where the public has free access and in close proximity to inhabited structures. As a result sources of ignition cannot be controlled and fires and/or explosions could result in loss of life.

- The Maine Rules and Regulations Relating to Gasoline and Other Flammable Liquids contain specific guidelines to be followed for aboveground tanks located in areas which may be flooded (Rules 108 through 115). These provisions appear to be either inadequate or are not being enforced, as more than 100,000 gallons of oil, much of it from aboveground tanks, was spilled into the Kennebec River alone during the 1987 spring floods.

Based on the above observations, Jordan believes that existing siting practices are in general inadequate relative to the recommended minimum standards proposed in the Task 5 Technical Memorandum.

7.4.2 Adequacy of Facility Design

In the Task 5 Technical Memorandum, Jordan recommended the following minimum standards for facility design:

- **Materials and Construction.** Tanks should be built according to current codes, they should carry a stamp or label to document this construction, and tanks which do not meet current standards should not be moved and reinstalled.

- **Leak Detection.** Testing of storage systems prior to operation, periodic testing while the storage system is in use, installation of leak detection equipment on tanks, and monthly inspection of all visible components of the storage system.

- **Leak Prevention.** Use of impermeable secondary containment barriers for all tanks, leak detection system required for tanks and piping, and cathodic protection required for new buried piping.

- **Spill and Overfill Protection.** Institute overfill protection whenever a tank is being filled (e.g. automatic pump cutoff or tank level gauge which can be read by the delivery person), provide secondary containment in loading and unloading areas.

In comparing these recommendations with observations made of existing practices and conditions, Jordan finds that:

- **Materials and Construction.** Many aboveground petroleum tanks bore no stamp or label so that the code or standard to which they were constructed could not be determined.

- **Leak Detection.** Periodic testing/inspection of storage systems occurs at some oil terminal facilities, but, based on our observations, is uncommon at bulk plants. Periodic external inspection of retail outlet tanks should suffice as most tanks are raised off the ground on low cradles. Visual inspections are performed frequently at most oil terminals we visited, but, based on our observations, are infrequent or else cursory at most bulk plants. The below ground piping portions of retail outlets, which are perhaps the most vulnerable portions of these facilities, cannot be visually inspected and are not routinely tested.

- **Leak Prevention.** Many newly constructed aboveground retail facilities include concrete containment barriers. One newly constructed and operational small bulk plant with concrete containment was also observed during the site tour conducted for this project. However, the containment structure had no drainage control mechanism so that precipitation, as well as any oil which might leak, would drain freely out of the containment structure. No facility which was visited was equipped with state-of-the-art leak detection systems for the tank or piping. We observed very little use of cathodic protection or non-corrosive materials for buried piping.

- **Spill and Overfill Protection.** Spill and overfill protection are generally present at oil terminals and hazardous substance storage facilities, but are almost universally lacking even at new bulk plants and retail outlets.

Based on the above observations, Jordan believes that existing facility design practices, especially in the areas of leak prevention and spill and overfill protection, are in general inadequate relative to the recommended minimum standards proposed in the Task 5 Technical Memorandum.

7.4.3 Adequacy of Facility Operation

In the Task 5 Technical Memorandum, Jordan recommended the following minimum standards for facility operation:

- Registration and periodic re-registration of facilities to maintain an accurate data base of active facilities.

- Periodic inspection of corrosion protection systems and leak detection systems.

- Maintaining an up-to-date SPCC plan.

In comparing these recommendations with observations made of existing practices and conditions, Jordan finds that:

- New aboveground flammable or combustible liquid storage facilities are registered initially with the Fire Marshal's Office. However, this registration is never revised or updated. There are no records of supply tanks which fuel furnaces. A hazardous substance data base is being established and will be maintained by the Maine Emergency Management Agency (MEMA). The MEMA data base contains information on the amount and type of hazardous substances but only limited information about the hazardous substance storage systems.

- Corrosion protection and leak detection systems are absent.

- SPCC plans are current at most oil terminals, less than half of the bulk plants, and none of the retail outlets that were visited. SPCC plans are not presently required at hazardous substance facilities.

Based on the above observations, Jordan believes that existing operational practices are in general inadequate relative to the recommended minimum standards proposed in the Task 5 Technical Memorandum.

7.4.4 Adequacy of Facility Closure

In the Task 5 Technical Memorandum, Jordan recommended the following minimum standards for facility closure:

- Removal of product, cleaning and dismantling of closed facilities within a specified period of time.

- Performance of a site assessement to determine whether any contamination is present.

In comparing these recommendations with observations made of existing practices and conditions, Jordan finds that:

- About twenty-five empty tanks were recorded in the data base assembled for this study in Task 1. It is not known whether these tanks were cleaned or dismantled after being taken out of service, as no abandonment records are kept by any regulatory agency.

- Jordan conducts site assessments as part of the services offered to clients. It is Jordan's experience that site assessments are sometimes performed at aboveground storage facilities in the course of property transfers, but they are not routinely conducted as part of a storage system closure.

Although data on closure practices are somewhat sparse, Jordan believes that existing closure practices are in general inadequate relative to the recommended minimum standards proposed in the Task 5 Technical Memorandum.

7.5 Photographic Assessment

Over four hundred slides of facilites were taken during the facility tour. Approximately one hundred of these have been incorporated into the slide presentation which is a deliverable under Task 7 of this project. The slides and associated text present a synoptic view of the characteristics, regulatory requirements, and problem areas associated with aboveground storage of petroleum and hazardous substances in Maine.

7.6 Conclusions

Based on the information and discussions presented above, Jordan has arrived at the following conclusions regarding the adequacy of aboveground oil and hazardous substance storage facilities in Maine:

- Although the oil terminal facilities in the state are old they have in general been well maintained and managed. Containment areas should perhaps be made more impermeable in order to better protect ground water resources. These facilities do occasionally have massive leaks (tens of thousands of gallons) which could be minimized if state-of-the-art leak detection equipment and techniques were employed.

- Many of the bulk plant facilities in the state are also old; some have been well maintained and some have not. The majority of bulk plants are deficient in the areas of tank overfill protection (the most prevalent type of spill in the DEP spill records) and spill containment provisions. There is evidence of spillage at the majority of bulk plants, and most facilities could stand improvement in areas of operation and maintenance. Few wells have been contaminated by bulk plant facilities, apparently because they are generally not located in close proximity to water supplies.

- Aboveground petroleum storage systems at retail outlets have only recently become common in Maine. This type of facility is not covered by existing codes and standards. The spill containment systems at retail outlets are generally good, although a few are very poor. Piping construction generally meets applicable standards, but is below standard when compared to existing requirements for underground storage systems. Many important piping components, such as anti-siphon valves and line leak detectors for pressurized piping systems are often absent. Retail outlets generally are inadequate in the precautions taken to prevent the accumulation of flammable vapors and restricting sources of ignition from the tank storage area. SPCC plans were not found at any of the eight facilities where they were requested. Operators of these facilities are generally not aware of what it takes to properly manage an aboveground storage facility. A large percentage of retail outlets are located in rural locations in close proximity to water supplies. Jordan believes that these storage facilities pose a contamination threat to these water wells.

- Hazardous substance storage facilities have few explicit standards which they are required to meet. They measured up fairly well in most cases when the standards applied to oil storage facilities were applied to hazardous substance storage facilities.

8.0 DISCUSSION OF ADEQUACY OF MAINE'S ABOVEGROUND STORAGE FACILITIES

Before we enter into a discussion of the adequacy of facilities, we need to have a common understanding of what we mean by adequacy. 'Adequate' is usually defined as sufficient to meet a requirement. There are many specific requirements imposed on aboveground oil storage facilities, ranging from tank construction codes (API 620, API 650), to emergency venting requirements (NFPA 30). If these requirements are not met, then a tank can clearly be described as inadequate with regard to these requirements. There are also many less specific requirements (e.g., requirements for 'impermeable' diking and 'substantially' supported piping systems) which leave room for individual judgement on the part of the person determining adequacy. There are no specific requirements for hazardous substance storage systems, so that there is a great deal of judgement involved in determining the adequacy of such facilities.

Adequacy can also be approached from different perspectives. The overall purpose of this study is to assess the threat posed to groundwater resources by aboveground storage facilities. This is a specific performance criterion which implies that the judgement of adequacy is measured not by adherence to standards but by some measure of contamination or threat of contamination of groundwater resources. Lacking any definitive measurements of ground water contamination, some judgements must be made based on frequency of spill incidents, observations of facility housekeeping practices, and knowledge of contaminant migration and groundwater flow properties.

Both of these aspects of adequacy (sufficient to meet requirements and meeting performance criteria) should be considered. The final judgement of adequacy will be subjective, partly because all of the information necessary to base a decision is not known, but also because subjective judgements will always be required on issues such as what is adequate to protect human health and the environment.

The information presented here is subject to a number of different interpretations. There will no doubt be disagreements by various parties over the judgements reached in this report; Jordan hopes that this will foster a healthy debate and re-assessment of the status of aboveground storage facilities in the state.

8.1 Potential Threat to Groundwater Posed by Aboveground Storage Facilities

There is a general perception among storage system owners and operators that aboveground storage systems are intrinsically safer from an environmental perspective than underground storage system because the tank can visually be inspected for leaks. However, aboveground storage systems do not automatically address the environmental problems which are associated with tank overfilling, underground lengths of piping, and spillage resulting from transfer operations. In other words, being able to see the tank solves only a portion of the environmental problem associated with hazardous liquid storage systems.

In Jordan's view, both aboveground and underground storage systems can be constructed and operated so as to provide an acceptable level of environmental risk. The present issue in Maine is that while underground storage systems have received much attention in recent years, and are now subject to environmentally based regulations, aboveground storage systems have been virtually ignored. As a result, siting, design and operational standards for aboveground storage systems do not provide water resource protection equivalent to that now expected of underground storage systems. The lack of environmental standards for aboveground facilities means that they can be built and operated more inexpensively, and so the number of these facilities, especially in gasoline retailing operations, has increased dramatically. These new facilities will continue to have some of the problems associated with older underground systems such as overfilling and piping leaks because of the current lack of regulations mandating environmental safeguards to address these issues. Jordan believes it is likely that unless environmental safeguards are required of aboveground storage facilities, the contamination problems formerly associated with underground storage will be transferred to aboveground systems.

Jordan was not able to directly assess the degree of subsurface contamination present at aboveground storage facilities in the course of this study. There were surface indications that contamination may be significant at bulk plants as over 70 percent of the facilities visited showed evidence of significant surface spillage. The DEP spill records also document substantial contamination incidents resulting from large volume leaks at many oil terminal facilities.

However, the DEP spill files also document only one incident of an aboveground storage facility contaminating a water well. The incident appeared to have resulted from poor housekeeping and a loose fitting in a transfer hose. The water supply which was contaminated was located less than 100 feet from the bulk plant. Another well was contaminated in 1988 from a below ground piping leak at an aboveground retail gasoline facility. The DEP had responded to the spill but the spill was not yet recorded in the DEP files. The incident came to Jordan's attention during the site tour conducted as a part of this project. The well in this instance was located approximately 30 feet from the facility.

It is Jordan's experience in dealing with numerous well contamination incidents in Maine that the source of the contamination is almost always less than 500 feet from the well, and very often less than 100 feet. Jordan believes that the lack of well contamination incidents attributable to aboveground storage facilities is not an indication of the lack of groundwater contamination associated with aboveground facilities, but rather a reflection on the fact that most facilities are not located in close proximity to existing water supplies. This can be seen in Figures 7-1 though 7-4 in the last column labelled 'water supplies within 500 feet'. Except in the case of retail outlets, there are relatively few storage facilities in close proximity to water supplies. Because retail aboveground motor fuel outlets are typically built in rural areas where there is room and where the cost of an underground storage facility may not be justified by the volume of product sold, almost 90% of the retail outlets are close to water supplies. Although Jordan is aware of only one well contamination incident to date attributable to leakage from an aboveground retail facility, almost all of these facilities have been built in the last few years, allowing only a limited time for spill incidents to occur. Jordan anticipates that as the number of facilities in proximity to water supplies increases, and as these facilities age, the number of well contamination incidents will also increase.

8.2 The Need for Additional Regulation

Environmental consciousness in America is evolving, and environmental regulations have become more stringent with time. While some existing aboveground storage facilities in Maine are adequate by established codes and practices, all facilities fall quite short of the standards embodied in recently enacted state regulations on which most of the recommended minimum standards proposed in Section 6 of this report are based. This is to be expected given that most of these facilities have been in existence for some time and that these standards are developing based on recently increased environmental awareness and rapidly evolving leak detection and spill prevention techniques and equipment. Given the increasing value of the ground water resource in Maine, it is Jordan's recommendation that the state aboveground storage standards be upgraded to better protect this resource. A public policy decision must be made to determine whether Maine will keep pace with evolving environmental standards concerning aboveground storage facilities.

8.3 The Need for Enforcement

There are many types of aboveground storage facilities for oil and hazardous substances which pose a variety of threats to human health and the environment in Maine. There is also a wide variation in the quality of construction of these facilities and how they are operated and maintained. Many facilities which were visited were conscientiously maintained and operated. Many other facilities inspected during the site tour fall well below the standards and regulations which are already in effect, let alone the more demanding environmentally based regulations recommended by Jordan in Section 6 of this report. More stringent regulations will need to be accompanied by an increase in the regulatory presence necessary to enforce them. There is a need for uniform enforcement of standards of construction, maintenance and operation of aboveground storage facilities in order to ensure a uniform level of adequacy among these storage facilities, and a sense of fairness in the regulated community.