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# U.S. Coast Guard Equipment Deployment Requirements for Hazardous Chemical Spill Response

Transportation Systems Center
Cambridge MA 02142

November 1982
Final Report



U.S. Department of Transportation
United States Coast Guard

Office of Marine Environment and Systems
Environmental Response Division
Washington DC 20590

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16. Abstract


The objective of the study was to determine the types, quantities and locations of equipment required by the U.S. Coast Guard to respond to spills of hazardous chemicals into U.S. waters and adjacent shorelines, over and above the resources of private industry, contractors and other government agencies. The methodology was to (1) assess equipment availability outside the Coast Guard, (2) determine the distribution of hazardous chemical spills in time and location, and (3) determine the Coast Guard equipment deployment, allowing for the results of (1) and (2).

(1) It was found that strong response capabilities of specific types are available from EPA, DOD, local governments, industry groups and manufacturers. Because of the limited extent of the data it was not possible to establish a geographic distribution, but it was estimated that the national capability is about 59% commercial, 33% private and 8% governmental.

(2) It was found that historic chemical spill incidents cluster about industrial and population centers. Spills above a defined 'respondable' level were found to occur 40% in Central U.S., and 14%-26% in the East, Gulf and Western Coast areas

(3) Equipment for a 20-man response team was selected that can be fit into a single van, air-transportable by a Coast Guard C130 aircraft. A seven-site configuration with a total of 11 such vans was recommended as offering the best combination of response time and van availability.


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## PREFACE

This study of U.S. Coast Guard equipment deployment needed to respond to hazardous chemical spills in the United States was sponsored by the U.S. Coast Guard Office of Marine Environment and Systems, Marine Environmental Protection Division, and directed by the Pollution Response Branch G-WEP-4. The intent was to provide for hazardous chemical response a deployment analysis similar to that produced for oil spill response. The oil spill response deployment study[1] was a result of the U.S. Coast Guard's implementation of the Presidential Initiatives of March 1977.

The impetus for this study came in large part from the efforts of CDR J. L. Valenti, Chief of the Pollution Response Branch, GWEP-4. Assistance and guidance was provided throughout by Lt. M. Tobbe. Valuable contributions were made by many Coast Guard Personnel: Lt. Ron Weston, LCDR J. Paskowich, CDR D. Jensen, LCDR J. O'Beien, Ens. P. Fulton, Carlton Fowler, Lt. J. Gift, and others. Valuable and constructive comments were received from CDG R. Rufe, Jr. and Lt. D. Rome. Much assistance was received from private and industry sources, as well as from other government agencies. In particular, the assistance of Alan Humphries of the Environmental Protection Agency is acknowledged with thanks. Contributors within TSC included J. Cline, P. Hinchcliffe, D. O'Mathuna, W. MacLeod, T. Peters, and, especially, J. Garlitz.

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[1] "Deployment Requirements for U.S. Coast Guard Pollution Response Equipment," Rpt. No. CG-D-14-79; Vols. I and II, prepared for U.S. Department of Transportation, United States Coast Guard, by Transportation Systems Center, Cambridge MA, February 1979.

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# 1. INTRODUCTION

## 1.1 BACKGROUND AND OBJECTIVES

The Federal Water Pollution Control Act, as amended 1972, and subsequent legislation and directives require the U.S. Coast Guard to provide men and equipment to respond to spills of oil and hazardous materials into U.S. coastal waters, the Great Lakes, ports and harbors, and adjoining shorelines.* Since the inception of the Coast Guard pollution response program more than ten years ago, the agency has acquired substantial experience in responding to oil spills. In addition, three specialized units, referred to as Strike Teams, have developed an inventory of sophisticated oil removal equipment to augment local resources when that is necessary. Response to chemical spills, however, is a more complex problem because of the large variety of chemicals shipped commercially. The proper selection and quantity of equipment, and its location, needs to be established before full augmentation of the Coast Guard chemical response capability may proceed. Recognizing this need for planning information, the Coast Guard requested that the Transportation Systems Center undertake a study to determine the types, locations and quantities of equipment they should deploy to meet the threat of hazardous chemical spills in the 1980 to 1990 decade. This deployment should take into account the existing response capabilities outside the Coast Guard, as well as the geographic distribution of hazardous chemical spills to be expected in that time frame.

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*Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (P.L. 96-510) on 11 December 1980, subsequent to the initiation of the present project. This new statute broadens Coast Guard response authority in two significant ways: it provides jurisdiction for hazardous substance releases into environmental media other than surface waters (air, groundwater, land surface, tec.), and it increases by several times the number of hazardous substances for which the Federal government may initiate a removal operation. Although this project could not anticipate all the possible ramifications this increased responsibility will have on the Coast Guard response program (that will not be possible for some time), it does recognize all substances that are or may be considered hazardous under P.L. 96-510.

substances designated by the Materials Transportation Bureau under the Hazardous Materials Transportation Act (1975). The full lists of materials included and excluded are given in Reference 3.

A second important limitation on the scope of the study is the restriction to the navigable waters and adjacent shorelines of the U.S. This designation of the Coast Guard's area of response stems from the Federal Water Pollution Control Act and amendments of 1972. Under the National Contingency Plan, the Coast Guard provides the On-Scene Coordinator (OSC) for coastal spills and the Environmental Protection Agency (EPA) for inland spills. The demarcation line between the two OSC jurisdictions is decided on a regional and district basis and usually is not published or available in coded form. As an approximation to this line, and to make it possible to process the large amounts of data available from the Materials Transportation Bureau, this study was limited to the counties adjacent to the U.S. coasts, Great Lakes, and major navigable waterways. These are shown in Figure A-1 (Appendix A). A list of these counties and the waterways to which they are adjacent is also given in Appendix A.

A third limitation on the scope of the study is the restriction to emergency spill situations. This excludes long term waste disposal site cleanup and chronic releases. Such non-emergency problems are usually handled by the EPA, by the spiller or by contractors. They do not normally require specialized Coast Guard equipment. The restriction to emergency response equipment excludes from consideration all long-term operations and devices such as filtration systems, incinerating equipment, earth-moving and stream-diversion equipment and large-scale removal, treatment or disposal systems.

## 1.3 METHODOLOGY

A three-step methodology was adopted for the project:

1. Assess the state of the art and the level of equipment availability outside the Coast Guard for hazardous chemical response.

## 1.4 STRUCTURE OF THE REPORT

Section 2 outlines the major results of the first step of the methodology, i.e., the assessment of the state-of-the-art and level of equipment availability outside of the Coast Guard.

Section 3 reviews the results of the second step, i.e., the geographic and temporal distribution of hazardous chemical spills in the U.S. A list of counties with the highest frequency of spills is included.

Sections 4 and 5 carry out the last step of the methodology. Section 4 discusses the present Coast Guard chemical response capability and recommends types of equipment to complement the non-Coast Guard capability in the U.S. In Section 5, response times are calculated, based on the trial base configurations and the spill locations of step 2. Total numbers of response units are calculated for each configuration, and approximate costs estimated, assuming each response unit is composed of the equipments deduced from step 1.

Section 6 contains the conclusions and recommendations from the study.

# 2. ASSESSMENT OF NON-COAST GUARD HAZARDOUS CHEMICAL RESPONSE CAPABILITIES

The objective of the first part of the study was to estimate the quantity and types of equipment available outside the Coast Guard to respond to actual or threatened spills of hazardous chemicals. The ability of the private sector, including cleanup contractors, railroads, and chemical manufacturers, as well as agencies of the Federal, State and local Governments was to be reviewed.

A complete or nearly complete inventory of currently available equipment was not possible within the project because of resource limitations. In addition, no judgments were made as to whether or not the custodians of the equipment surveyed had conducted the training necessary to use the equipment properly or as to whether the equipment was maintained in good condition. Nevertheless, general qualitative information was obtained from a limited survey. The scope of the task was limited to certain equipments of interest in the initial response to a spill:

- o Personnel protection
- o Environmental monitoring
- o Emergency containment
- o Rupture-puncture plugging and repair
- o Offloading-transfer
- o Communications
- o Logistics

Specifically excluded were major items used in the longer-term containment and cleanup of a spill:

- o Neutralizers
- o Filtration systems
- o Incinerators
- o Earth moving equipment
- o Stream diversionary devices
- o Removal, treatment, or disposal systems

- Some of the entities contacted gave limited information concerning their capability.
- The equipment is frequently kept at central locations but can be deployed rapidly over a wide geographical area; attributing such equipment to the central location can be misleading.
- Much of the equipment used for spill response is multi-purpose i.e., it is normally used in the transportation, storage, and handling of chemicals, or it can also be used for response to petroleum spills.
- Large quantities of equipment are not available to the Coast Guard for response to all spills, but could be made available under specific situations. Examples are equipment stocked by chemical manufacturers, railroads, or military services.

The first of these limitations is serious. It cannot be overcome except by a full national inventory of equipment, a procedure not only requiring resources beyond the present project, but also contingent on approval of the Office of Management and Budget for the requisite survey. However, a national inventory of equipment available for hazardous material spills (SKIM) is maintained by the Coast Guard. While this listing had proven useful in locating oil spill response equipment, it was not known at the start of the study how complete a listing it provides of chemical spill clean up equipment. Accordingly, the approach taken was to extract such data from the SKIM list and to integrate it into the present assessment.

## 2.2 INTEGRATION OF INTERVIEW DATA AND SKIM LIST

Combining the SKIM listings and the results of the interview data presented several difficulties: the amount of relevant chemical response gear in SKIM was expected to be small; the SKIM list for the entire country is not practical to retrieve; matching of items was difficult because of differences in the data items of the two lists. Accordingly, the comparison was approached cautiously, in three steps.

As a first step, copies were obtained of the SKIM Lists for the Marine Safety Office (MSO) Boston, for the Third Coast Guard District, and for the Atlantic Strike Team. From these lists, it was seen that, although the activities. Some of the analytical items on the SKIM List and the study list were the same, but there were also many differences. Because of these differences and because of the small numbers of items listed, it was not possible to develop a reliable estimate of the total population of analytical equipment available. The SKIM List had no entries for the Boston MSO.

3. The SKIM Safety Equipment and Special Clothing list was not as comprehensive as the results of interviews for those regions where a major effort was made to contact the principal spill response agencies. In addition, where the same organization was cited on both lists, the items and quantities frequently differed. These differences could have arisen because the equipment lists were obtained at different times and from different people. The SKIM data were combined with the study data to provide a total list of equipment. Where quantities differed, the larger quantity was used.

As a final step, a comparison was made between the SKIM List and the study inventory for the First District. An effort was made to obtain a large data sample for this District, and most large response organizations were contacted, as well as many smaller ones. The results are shown in Table 2-1. Total numbers of equipment are shown as obtained from the two sources. The totals are the sum of the two numbers adjusted to prevent double counting (four agencies appeared on both lists). Overlap is those quantities which appear on both lists and which would cause double counting if the two lists were simply added. The SKIM to Total (S/T) percentage was calculated; it shows that the SKIM List is rather incomplete with regard to personnel protection equipment.

Similar calculations were not made for field meters and laboratory equipment because the numbers are too small to yield meaningful results. Despite the difficulties involved, the SKIM data were integrated into the overall assessment, and contributed a small but discernable amount to the quantitative results.

## 2.3 QUANTITATIVE RESULTS

### 2.3.1 Tabulation of Data

After the data collection effort was completed, the quantities of equipment for both the study lists and the SKIM List were entered into data sheets. (See Appendix A of Reference 4.) The data are summarized in Tables 2-2, 2-3, 2-4, and 2-5. Table 2-2 shows the quantities of protective clothing, breathing apparatus, field analytical meters, and laboratory analysis items, by each Coast Guard District, within the counties of interest as defined in Appendix A. Table 2-3 shows the same information, by state, for those agencies located outside of the counties of interest. Both tables also show the grand totals. The equipment totals by Coast Guard District for off-loading equipment are shown in Table 2-4 for the counties of interest and in Table 2-5 for outside those counties.

The quantity data seen in Table 2-2 for personnel protection equipment do not show any obvious pattern. The large quantities shown for the First and Third Districts are due to the special emphasis placed on obtaining a large data sample in those Districts. The quantities for the Second District are also large; this is probably due to the large geographical area included in the Second District (central U.S. including the Mississippi and Ohio River Valley) and to the large number of chemical industries located there.

The off-loading equipment, Tables 2-4 and 2-5, does not include the SKIM List data. The large amount of SKIM List data made entering it impractical. Further, the SKIM List does not identify the material of which the off-loading equipment is constructed. Thus all entries would have been in the Unknown Material class. Since this study was concerned with chemicalcompatible equipment, large numbers of equipment of unknown material would not have contributed to the end result of the project.

The offloading equipment data, Tables 2-4 and 2-5, show that the industry is still heavily petroleum oriented. Only 37 percent of the listed pumps are made of chemical-resistant materials. Similarly, only 20 percent of the vacuum trucks and 15 percent of the tank trucks are chemical-resistant.

TABLE 2-3. PERSONNEL PROTECTION EQUIPMENT AND ANALYTICAL EQUIPMENT QUANTITIES OUTSIDE OF COUNTIES OF INTEREST

| | Protective Clothing | | | | | Breathing Apparatus | | | | Field Meters | | | | | | Analytical Equipment | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Code* | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 0 | 1 | 2 | 3 | 4 | 5 | 0 | 1 | 2 | 3 |
| Arizona | | 6 | | 4 | | | 4 | 4 | 4 | 1 | | | 1 | | | | | | |
| California | | 12 | 15 | 23 | | | 11 | 8 | 8 | 2 | 1 | 1 | 2 | 1 | | | 1 | 1 | 1 |
| Colorado | | 6 | | 4 | | | 4 | 4 | 4 | | 1 | | 1 | | | | | | |
| Florida | | 2 | 2 | 4 | | | 2 | | | | | 1 | | 1 | | | | | |
| Georgia | | 36 | | 6 | | | 6 | | 6 | | | 10 | 10 | | | | | | |
| Idaho | | 6 | | 4 | | | 4 | 4 | 4 | 1 | | | 1 | 1 | | | | | |
| Illinois | | | 10 | 10 | | | 2 | | | | 1 | 1 | | 1 | | | | | |
| Kansas | | | 10 | 10 | | | 3 | | | | 2 | 2 | | 2 | | | 2 | | 2 |
| Louisiana | | 6 | | 4 | | | 4 | 4 | 4 | 1 | | | 1 | 1 | | | | | |
| Massachusetts | 8 | 20 | 37 | 36 | | | 86 | | 48 | | 3 | 3 | 5 | 4 | | 1 | 2 | | 1 |
| Michigan | | | | 19 | | 6 | 3 | 2 | | | 2 | | | 3 | | | 2 | 3 | |
| Minnesota | | 6 | | 4 | | | 4 | 4 | 4 | 1 | | | 1 | 1 | | | | | |
| Missouri | | | | 1 | | | | | | | | | | | | | | | |
| Montana | | 12 | | 8 | | | 38 | 8 | 8 | 5 | | 3 | 2 | 2 | 3 | | | | |
| Nebraska | | 6 | 5 | 9 | | | 6 | 4 | 4 | 1 | 1 | 1 | 1 | 2 | | | 1 | | 1 |
| New Jersey | | | 35 | 35 | | | 6 | | | | 3 | 3 | | 3 | | | 3 | | 2 |
| New Mexico | | 6 | | 4 | | | 4 | 4 | 4 | 1 | | | 1 | | | | | | |
| New York | | 100 | | 5 | | | 5 | | | | | | | | | | | | |
| North Carolina | | | 10 | 60 | | | 7 | 1 | 4 | 4 | 2 | | 3 | 1 | | 2 | 3 | 1 | 3 |
| Ohio | | | 35 | 212 | | | 262 | | | 1 | 12 | 44 | 2 | 5 | | | 2 | 1 | 1 |
| Oklahoma | | 10 | | 9 | | | 6 | 4 | 4 | 1 | 1 | | 1 | 1 | | 2 | | | |

*Type of Equipment Code; see Table 2-2.

TABLE 2-4. OFF-LOADING EQUIPMENT TOTALS BY COAST GUARD DISTRICT WITHIN COUNTIES OF INTEREST

| EQUIPMENT ITEM | COAST GUARD DISTRICT 1 | 2 | 3 | 5 | 7 | 8 | 9 | 11 | 12 | 13 | 17 | TOTAL | PERCENT OF TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pumps** | | | | | | | | | | | | | |
| Unknown | 10 | 0 | 25 | 11 | 0 | 4 | 2 | 1 | 0 | 1 | 0 | 54 | 18 |
| Steel | 2 | 15 | 42 | 32 | 0 | 19 | 20 | 2 | 2 | 2 | 0 | 136 | 45 |
| Stainless Steel | 0 | 2 | 5 | 20 | 5 | 7 | 4 | 5 | 5 | 1 | 0 | 54 | 18 |
| Rubber Lined | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 1 |
| Plastic Lined | 0 | 4 | 35 | 0 | 0 | 8 | 0 | 2 | 2 | 2 | 0 | 53 | 18 |
| **Vacuum Trucks** | | | | | | | | | | | | | |
| Unknown | 31 | 0 | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 37 | 34 |
| Steel | 0 | 3 | 25 | 6 | 0 | 0 | 14 | 2 | 0 | 1 | 0 | 51 | 46 |
| Stainless Steel | 0 | 0 | 12 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 14 | 13 |
| Rubber Lined | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 |
| Plastic Lined | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| Glass Lined | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 3 |
| **Tank Trucks** | | | | | | | | | | | | | |
| Unknown | 27 | 3 | 4 | 3 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 42 | 37 |
| Steel | 0 | 0 | 6 | 10 | 0 | 39 | 0 | 0 | 0 | 0 | 0 | 55 | 48 |
| Stainless Steel | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 4 | 3 |
| Rubber Lined | 0 | 0 | 0 | 0 | 0 | 2 | 12 | 0 | 0 | 0 | 0 | 14 | 12 |
| Plastic Lined | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Glass Lined | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Vacuum Tank Barges** | | | | | | | | | | | | | |
| Unknown | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 67 |
| Steel | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 33 |
| Plastic Lined | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Glass Lined | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## TABLE 2-5. OFFLOADING EQUIPMENT OUTSIDE OF COUNTRIES OF INTEREST

| CODE* | PUMPS | | | | | VACUUM TRUCK | | | | | | TANK TRUCK | | | | | | VACUUM BARGE | | | | VACUUM TANK SKID MTD. | | | | DRUMS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 | 5 | 0 | 1 | 2 | 3 | 4 | 5 | 0 | 1 | 2 | 3 | 0 | 1 | 2 | 3 | 0 | 1 | 2 |
| ARIZONA | | 2 | 1 | | 2 | | | | | | | | | | | | | | | | | | | | | | | |
| CALIFORNIA | | 4 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | |
| COLORADO | | 2 | 1 | | 2 | | | | | | | | | | | | | | | | | | | | | | | |
| FLORIDA | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | |
| GEORGIA | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| IDAHO | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ILLINOIS | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| KANSAS | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| LOUISIANA | | 2 | 1 | | 2 | | | | | | | | | | | | | | | | | | | | | | | |
| MASSACHUSETTS | | 3 | | | | | | | | | | | 2 | | | | | | | | | | | | | | | |
| MICHIGAN | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MINNESOTA | | 2 | 1 | | 1 | | | | | | | | | | | | | | | | | | | | | | | |
| MISSOURI | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MONTANA | | 4 | 2 | | 4 | | | | | | | | | | | | | | | | | | | | | | | |
| NEBRASKA | | 2 | 1 | | 2 | | | | | | | | | | | | | | | | | | | | | | | |
| NEW JERSEY | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NEW MEXICO | | 2 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| NEW YORK | | | | | | | 2 | 1 | | | | | | | | | | | | | | | | | | | | |

It should be noted that many of the larger cleanup contractors have standby or on-call contracts with chemical trucking companies, such as Chemical Leaman, Inc. or Matlack, Inc., whereby they can quickly obtain the necessary equipment.

Table 2-6 shows how the survey results are distributed among Federal Government, Local and State Government, Commercial, and Private organizations. About 59 percent of the equipments tabulated were in commercial contractor facilities, about 33 percent in private facilities. Government equipment (Federal, State and Local) was about 8 percent, including Coast Guard units.

### 2.3.2 National Total Estimates

The data tabulated in Tables 2-2, 2-3, 2-4 and 2-5, are necessarily incomplete. To assess the national capability, it is necessary to make an estimate of the actual totals of equipment of each type that are available in the Coast Guard Districts throughout the country. Preparing an estimate of total equipment available proved to be difficult, even for those selected areas where a comprehensive inventory effort was made. First, the sample data were not completely reliable. Quantities often differed between the study list and the SKIM List. Also, some contractors were expanding their chemical capability and were increasing and/or expanding their equipment lists. Second, some of the agencies contacted did not provide the requested information. Third, it was not possible to identify all agencies that had a chemical response capability. Fourth, equipment might not always be available to the Coast Guard. Chemical manufacturing plants were usually well equipped, but their equipment (and trained manpower) was usually available only for spills of their own chemicals.

For the above reasons, the sample is incomplete, and the relationship of the sample to the total equipment population is unclear; thus, the estimated equipment listing does not give a precise picture of overall chemical spill response capability. However, crude estimates of equipment availability, based on the best judgement of those who carried out the interviews and surveys, were made for use in the follow-on phases of the program. The completeness of the data was estimated to be as follows:

First District. A major effort was made to obtain a large data sample. The total listing (SKIM List plus Study List) is probably about two thirds of the total available equipment.

Third District. A strong effort was made to obtain a representative data sample. The total listing is probably about one half of the available equipment.

All other Districts. A reasonable sample was sought. The total listing is probably no greater than one third of the available equipment.

In order to obtain a conservative (low) estimate of actual equipment available, the above fractions were increased to 80 percent, 70 percent, and 50 percent, respectively. The corresponding amplification factors, to be applied to the survey data in order to obtain total equipment estimates, are 1.25, 1.43 and 2.0. The results are shown in Table 2-7. This table was obtained by applying the amplification factors for the several districts to the data of Tables 2-2, 2-3, 2-4 and 2-5, and adding the results for each equipment group.

The accuracy of Table 2-7 is poor. The lower limit to the error is -50 percent (based on the 2.0 amplification factor) but the upper limit cannot be estimated as accurately. Because most of the major cooperatives and contractors have been surveyed. The total remaining inventory probably does not exceed the amounts covered. This gives a nominal upper limit on the error of 100 percent. Thus the error limits to Table 2-7 are estimated as -50 percent, +100 percent.

## 2.4 QUALITATIVE RESULTS

Some qualitative results emerge from the interview and survey data, when combined with the SKIM information. Appendix B shows that:

(1) EPA strongest capability is in technical advice and detection and identification equipment.

(2) DOD has substantial equipment at its various bases for response to fire, Nuclear/Bacterological/Chemical (NBC) releases, for fuel handling, and explosion control.

(3) Local governments and authorities are well equipped for fire and communications, but little else.

(4) Many commercial contractors maintain mobile units with chemical suits, gas masks, self-contained breathing apparatus, and pumps, bladders and trucks. Mobile labs and communication equipment are also common.

(5) The Chlorine Emergency Plan, CHLOREP, operated by the Chlorine Institute maintains 64 response teams in the U.S., each with 24 hour coverage. Their capabilities include plugging and patching. The National Agricultural Chemicals Association (NACA) has 40 Pesticide Emergency Teams throughout the country. Mutual assistance programs also exist for vinyl chloride and hydrogen cyanide.

(6) Chemical manufacturers commonly equip their plants for response on-site. Most large chemical shippers also maintain emergency trailers to respond to spills of their products. They commonly contain chemical/acid suits, meters, breathing apparatus, tool kits, meters, and in some cases pumps, overpack drums, and tank trucks.

(7) Most railroads maintain one or more equipment storage sites along their line. They stock rubber suits, hoods, goggles, boots, and breathing apparatus. Offloading equipment is not common (exceptions: Southern Railroad, Boston and Maine).

The seven results just stated are displayed graphically in Figure 2-1. From this Figure:

(8) The <u>most general available</u> capability is lodged with commercial contractors.

| | EPA | US AF | US ARMY | US NAVY | DOE | STATE AGNCY | LOCAL AUTH. | CITY POL. | CITY FIRE | PVT CONTR. | CHEM TREC | CHLO REP | AAR | CHEM. MANU | R.R. | PVT LABS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TECHNICAL ADVICE | | | | | | | | | | | | | R | P | | |
| COMMUNICATIONS | | | | | | | | | | | | | | | | |
| FIELD INSTRUMENTS | | | | | | | | | | | | | | P | R | |
| LABORATORY ANALYSIS | | | | | | | | | | | | | | P | R | |
| FACE & GAS MASKS | | | | | | | | | | | | C | | P | R | |
| SELF-CONTAINED BREATHING APPARATUS | | | | | | | | | | | | C | | P | R | |
| PROTECTIVE CLOTHING | | | | | | | | | | | | C | | P | R | |
| FIRE SUITS | | | | | | | | | | | | | | P | | |
| CHEMICAL/ACID SUITS | | | | | | | | | | | | | | P | | |
| FOAMING CAPABILITY | | | | | | | | | | | | | | | | |
| OFFLOADING & CHEMICAL PUMPS | | | | | | | | | | | | | | P | | |
| CHEMICAL TANKS AND VANS, TRUCKS | | | | | | | | | | | | | | | | |
| PLUGGING AND PATCHING EQUIPMENT | | | | | | | | | | | | C | | | | |
| CHEMICAL OVERPACK DRUMS | | | | | | | | | | | | | | P | | |

FIGURE 2-1. QUALITATIVE DISPLAY OF NON-USCG HAZARDOUS CHEMICAL RESPONSE EQUIPMENT CAPABILITY (Continued)

## 2.5 CONCLUSIONS

From the above results the following conclusions are drawn:

First, because the assessment is not based on a comprehensive survey the potential for low estimation is greater than that for over estimation. Accordingly results showing large numbers of equipment (strong capability) are more reliable than those showing small numbers. In the strong capability category, are results (1), (2), (3), (5), (9), (12).

Second, the inaccuracy of the assessment, particularly outside of the first and third Districts, makes it difficult to ascribe a geographic distribution to the capabilities.

Third, samples of the SKIM Listing show that it is weak in chemical response gear, and especially deficient in personnel protective gear.

Fourth, the distribution of national capability is approximately 59 percent with commercial contractors, 33 percent with private organizations, and 8 percent with Federal, State and local agencies.

# 3. DISTRIBUTION OF HAZARDOUS CHEMICAL SPILLS IN THE U.S.

This Section describes the results of the data gathering and analysis performed to complete the second of the three steps in the methodology described in Section 1. It covers the geographic distribution of historic hazardous chemical (hazchem) spills as extracted from three sources:

(1) The Hazardous Materials Information Report (HMIR) file of the Materials Transportation Bureau (MTB).

(2) The Pollution Incident Reporting System (PIRS) of the Coast Guard.

(3) The Pipeline Carrier Accident Report (PCAR) file, obtained from the Office of Pipeline Safety of the MTB.

The three sources differ in their origins and purposes. The first two, the HMIR and the PIRS files, far outweight the third in volume of data and warrant some discussion.

The HMIR data have been submitted by carriers in accordance with 49 CFR 171.15 and 171.16 since 1970. This statute requires reports on Form DOT F 5800.1 of hazardous materials spills resulting in death, injury and damage over $50,000. Bulk shipments by water are excluded since they are governed by Coast Guard regulation. Moreover, "hazardous materials" were designated as materials capable of posing an unreasonable risk to health, safety, and property when transported in commerce. The PIRS data, on the other hand, cover spills of oil or hazardous substances in accordance with the Federal Water Pollution Control Act (FWPCA). From inception to 1978 there were no specific or mandatory regulations for hazardous material entries into PIRS. During this time PIRS reports represented spills that posed severe threats to the environment or public health and welfare or that originated from Coast Guard regulated sources, such as vessels or waterfront facilities. In 1978, a list of approximately 300 hazardous substances (40 CFR116) designated under the authority of section 311 of the FWPCA, came into effect, providing a specific basis for entries into PIRS.

The results of the above history is that the HMIR data covers incidents involving hazardous materials in transport, other than bulk water shipments, while PIRS recorded incidents involving hazardous shipments by water, or from waterfront facilities or otherwise threatening U.S. waters.

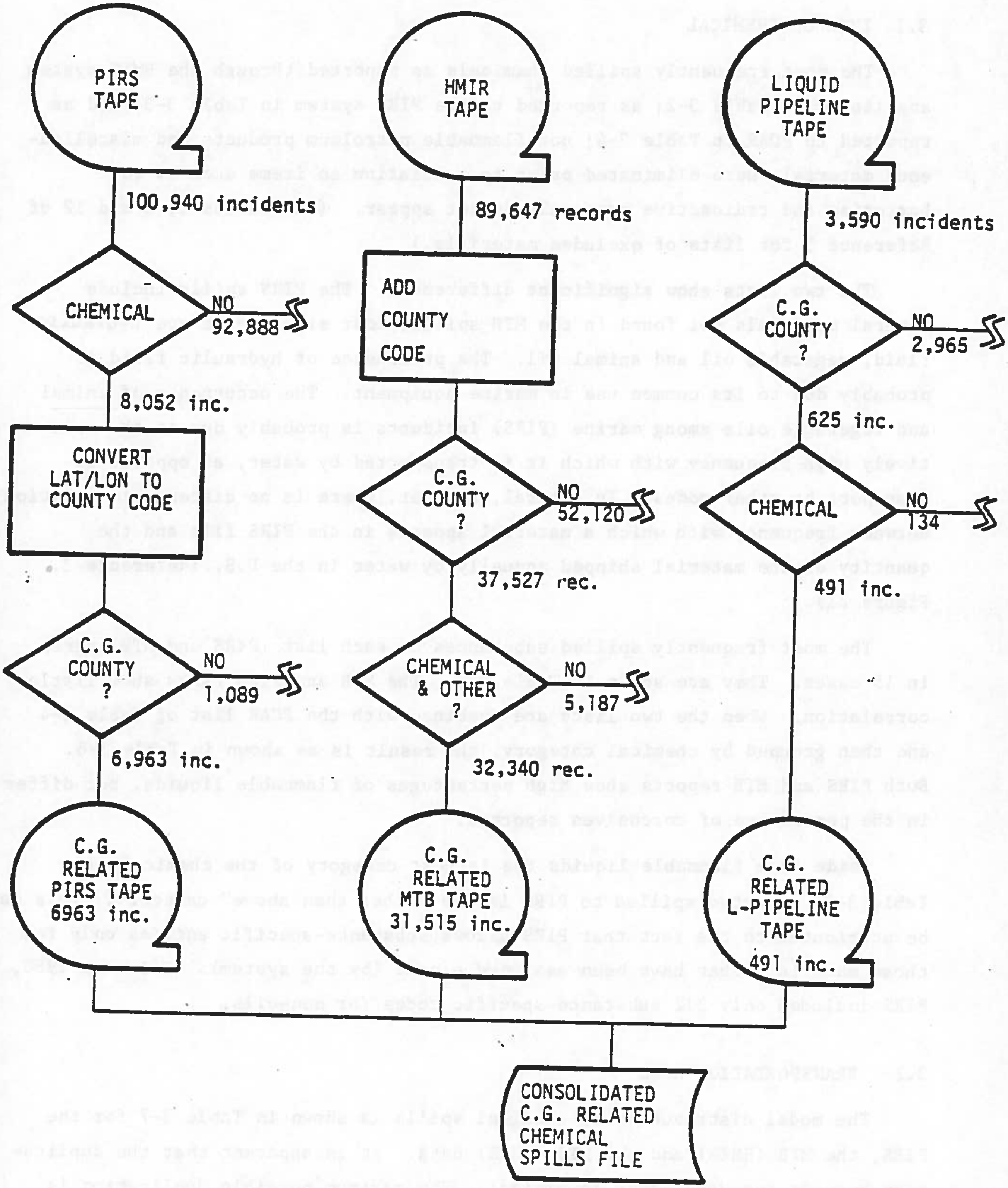



FIGURE 3-1. OUTLINE OF SPILL DATA PROCESSING

# TABLE 3-2. FIFTY MOST FREQUENTLY SPILLED CHEMICALS (1971-1979) - MTB DATA BASE

COAST GUARD RELATED HAZARDOUS CHEMICAL SPILL RECORDS - MTB DATA BASE ONLY (1971-1979)

| RANK | MTB CHEM. CL | MTB CHEM. CODE | WOR # REC. | WOR % | WOR CUM. % | WOOR # REC. | WOOR % | WOOR CUM. % | TOTAL # REC. | TOTAL % | TOTAL CUM. % | MTB CHEMICAL DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 25 | 8060 | 4847 | 24.16 | 24.16 | 2274 | 18.52 | 18.52 | 7121 | 22.02 | 22.02 | PAINT ENAM LAQ STAN |
| 2 | 25 | 5350 | 1303 | 6.48 | 30.64 | 1595 | 12.99 | 31.51 | 2895 | 8.95 | 30.97 | GASOLINE |
| 3 | 95 | 3490 | 1384 | 6.90 | 37.54 | 944 | 7.69 | 39.20 | 2328 | 7.20 | 38.17 | COMP CLEANING LIQ C |
| 4 | 95 | 3730 | 1101 | 5.49 | 43.03 | 360 | 2.93 | 42.13 | 1461 | 4.52 | 42.69 | CORR LIQ N.O.S. |
| 5 | 25 | 5110 | 1051 | 5.24 | 48.27 | 395 | 3.22 | 45.35 | 1446 | 4.47 | 47.16 | FLAM LIQUID N.O.S. |
| 6 | 25 | 3560 | 850 | 4.24 | 52.50 | 510 | 4.15 | 49.50 | 1360 | 4.21 | 51.36 | COMP PAINT REMOVE F |
| 7 | 95 | 9930 | 605 | 3.32 | 55.52 | 474 | 3.86 | 53.36 | 1079 | 3.34 | 54.70 | SULFURIC ACID |
| 8 | 25 | 2840 | 608 | 3.03 | 58.55 | 399 | 3.25 | 56.61 | 1007 | 3.11 | 57.81 | CEMENT LIQ NOS |
| 9 | 95 | 5700 | 555 | 2.77 | 61.31 | 360 | 2.93 | 59.55 | 915 | 2.83 | 60.64 | HYDROCHLORIC ACID |
| 10 | 25 | 9030 | 582 | 2.90 | 64.22 | 124 | 1.01 | 60.56 | 706 | 2.18 | 62.83 | RESIN SOLUTION |
| 11 | 95 | 4560 | 276 | 1.38 | 65.59 | 252 | 2.05 | 62.61 | 528 | 1.63 | 64.46 | ELECTR BATT FL |
| 12 | 25 | 5960 | 267 | 1.33 | 66.92 | 168 | 1.37 | 63.98 | 435 | 1.35 | 65.80 | INK |
| 13 | 25 | 1130 | 258 | 1.29 | 68.21 | 167 | 1.36 | 65.34 | 425 | 1.31 | 67.12 | ALCOHOL N.O.S. |
| 14 | 60 | 8520 | 267 | 1.33 | 69.54 | 155 | 1.26 | 66.60 | 422 | 1.30 | 68.42 | POISONOUS LIQ NOS B |
| 15 | 50 | 6330 | 189 | 0.94 | 70.48 | 140 | 1.14 | 67.74 | 329 | 1.02 | 69.44 | LIQ PETROLEUM GAS |
| 16 | 95 | 1120 | 123 | 0.61 | 71.09 | 149 | 1.21 | 68.95 | 272 | 0.84 | 70.28 | ACID LIQUID N.O.S. |
| 17 | 20 | 3475 | 208 | 1.04 | 72.13 | 42 | 0.34 | 69.29 | 250 | 0.77 | 71.05 | COMBUSTIBLE LIQ NOS |
| 18 | 95 | 7700 | 93 | 0.49 | 72.62 | 137 | 1.12 | 70.41 | 236 | 0.73 | 71.78 | NITRIC ACID |
| 19 | 95 | 8365 | 186 | 0.93 | 73.55 | 42 | 0.34 | 70.75 | 228 | 0.71 | 72.49 | PHOSPHORIC ACID |
| 20 | 45 | 1520 | 144 | 0.72 | 74.27 | 75 | 0.61 | 71.36 | 219 | 0.68 | 73.17 | AMMONIA ANHYDROUS |
| 21 | 25 | 3500 | 129 | 0.64 | 74.91 | 86 | 0.70 | 72.06 | 215 | 0.66 | 73.83 | COMP CLEANING LIQ F |
| 22 | 95 | 3735 | 165 | 0.82 | 75.74 | 42 | 0.34 | 72.41 | 207 | 0.64 | 74.47 | CORR SOLID N.O.S. |
| 23 | 25 | 9720 | 139 | 0.54 | 76.27 | 90 | 0.73 | 73.14 | 198 | 0.61 | 75.08 | SOLVENTS N.O.S. |
| 24 | 60 | 5980 | 68 | 0.34 | 76.61 | 130 | 1.05 | 74.20 | 198 | 0.61 | 75.70 | INSECTICIDE LIQUID |
| 25 | 95 | 9575 | 195 | 0.97 | 77.58 | 0 | 0.00 | 74.20 | 195 | 0.60 | 76.30 | SODIUM HYDROXIDE LQ |
| 26 | 25 | 10820 | 112 | 0.56 | 78.14 | 82 | 0.67 | 74.87 | 194 | 0.60 | 76.90 | METHYL ALCOHOL |
| 27 | 95 | 2330 | 23 | 0.10 | 78.24 | 152 | 1.24 | 76.10 | 172 | 0.53 | 77.43 | CAUSTIC SODA LIQ |
| 28 | 50 | 3570 | 61 | 0.30 | 78.55 | 96 | 0.78 | 76.89 | 157 | 0.49 | 77.92 | COMPR GASES NOS FG |
| 29 | 95 | 3540 | 98 | 0.49 | 79.03 | 41 | 0.33 | 77.22 | 139 | 0.43 | 78.35 | COMP RUST REMOVER |
| 30 | 25 | 1010 | 71 | 0.35 | 79.39 | 65 | 0.53 | 77.75 | 136 | 0.42 | 78.77 | ACETONE |
| 31 | 25 | 10890 | 87 | 0.43 | 79.82 | 45 | 0.37 | 78.12 | 132 | 0.41 | 79.17 | XYLENE (XYLOL) |
| 32 | 25 | 10340 | 72 | 0.36 | 80.18 | 51 | 0.42 | 78.53 | 123 | 0.38 | 79.55 | TOLUENE |
| 33 | 25 | 8320 | 66 | 0.33 | 80.51 | 55 | 0.45 | 78.98 | 121 | 0.37 | 79.93 | PETROLEUM NAPHTHA |
| 34 | 60 | 3600 | 47 | 0.23 | 80.74 | 70 | 0.57 | 79.55 | 117 | 0.36 | 80.29 | COMP TR & WD KILLER |
| 35 | 95 | 2260 | 80 | 0.40 | 81.14 | 37 | 0.30 | 79.85 | 117 | 0.36 | 80.65 | BOILER COMP LIQ |
| 36 | 95 | 3510 | 85 | 0.42 | 81.57 | 18 | 0.15 | 80.00 | 103 | 0.32 | 80.97 | COMP PAINT REMOVE C |
| 37 | 25 | 6000 | 74 | 0.37 | 81.94 | 27 | 0.22 | 80.22 | 101 | 0.31 | 81.28 | INSECTICIDE LIQ FL |
| 38 | 95 | 4430 | 16 | 0.08 | 82.02 | 85 | 0.69 | 80.91 | 101 | 0.31 | 81.60 | DRUGS CHEMICALS COR |
| 39 | 95 | 1240 | 63 | 0.31 | 82.33 | 37 | 0.30 | 81.21 | 100 | 0.31 | 81.90 | ALKALINE LIQUID NOS |
| 40 | 35 | 7731 | 92 | 0.46 | 82.79 | 0 | 0.00 | 81.21 | 92 | 0.28 | 82.19 | NITRIC ACID >40% |
| 41 | 35 | 8010 | 53 | 0.26 | 83.05 | 38 | 0.31 | 81.52 | 91 | 0.28 | 82.47 | OXI MATERIAL N.O.S. |
| 42 | 45 | 3660 | 31 | 0.15 | 83.21 | 57 | 0.46 | 81.98 | 88 | 0.27 | 82.74 | COMPR GASES NOS NFG |
| 43 | 25 | 3590 | 61 | 0.30 | 83.51 | 24 | 0.20 | 82.18 | 85 | 0.26 | 83.01 | COMP TR-WD KILL FL |
| 44 | 95 | 10730 | 66 | 0.33 | 83.84 | 19 | 0.15 | 82.33 | 85 | 0.26 | 83.27 | WATER TREAT COMP |
| 45 | 60 | 2670 | 45 | 0.22 | 84.06 | 37 | 0.30 | 82.64 | 82 | 0.25 | 83.52 | CARBOLIC ACID LIQ |
| 46 | 95 | 5870 | 57 | 0.28 | 84.35 | 21 | 0.17 | 82.81 | 78 | 0.24 | 83.76 | HYPOCHLORITE SOL |
| 47 | 95 | 5770 | 39 | 0.19 | 84.54 | 37 | 0.30 | 83.11 | 76 | 0.24 | 84.00 | HYDROFLUORIC AC SLN |
| 48 | 25 | 7330 | 48 | 0.24 | 84.78 | 26 | 0.21 | 83.32 | 74 | 0.23 | 84.23 | OIL N.O.S. |
| 49 | 95 | 1336 | 74 | 0.37 | 85.15 | 0 | 0.00 | 83.32 | 74 | 0.23 | 84.46 | AMMON HYDROXIDE <45 |
| 50 | 95 | 5850 | 16 | 0.08 | 85.23 | 57 | 0.46 | 83.78 | 73 | 0.23 | 84.68 | HYDROGEN PEROXIDE |
| 629 | | | | | | | | | | | 100.00 | |
| TOTAL | | | 20062 | | 100.00 | 12279 | | 100.00 | 32340 | | 100.00 | |

TABLE 3-3. MOST FREQUENTLY SPILLED CHEMICALS, 1973-1979 AS REPORTED TO USCG/PIRS (Cont.)

| RANK | MATERIAL[1] | NUMBER OF SPILLS | % | CUM % | MATERIAL NAME |
|---|---|---|---|---|---|
| 43 | 2069 | 6 | 0.09 | 97.72 | Methyl Ethyl Ketone (2-Butunone) |
| 44 | 2075 | 6 | 0.09 | 97.80 | Nitric Acid |
| 45 | 2094 | 6 | 0.09 | 97.89 | Vinyl Acetate |
| 46 | 2120 | 6 | 0.09 | 97.98 | Chromium Compounds |
| 47 | 2078 | 5 | 0.07 | 98.05 | Oleum |
| 48 | 2153 | 5 | 0.07 | 98.12 | Lead Compounds |
| 49 | 2213 | 5 | 0.07 | 98.19 | Zinc Compounds |
| 50 | 2029 | 4 | 0.06 | 98.25 | Carbon Tetrachloride |
| 51 | 2049 | 4 | 0.06 | 98.31 | Ethyl Acrylate |
| 52 | 2050 | 4 | 0.06 | 98.36 | Ethyl Alcohol |
| 53 | 2091 | 4 | 0.06 | 98.42 | Trichloroethylene |
| 54 | 2124 | 4 | 0.06 | 98.48 | Cyanide Compounds |
| 55 | 2145 | 4 | 0.06 | 98.54 | Ethylbenzene |
| 56 | 2002 | 3 | 0.04 | 98.58 | Acetic Anhydride |
| 57 | 2008 | 3 | 0.04 | 98.62 | Acrylic Acid |
| 58 | 2027 | 3 | 0.04 | 98.66 | Bromine |
| 59 | 2070 | 3 | 0.04 | 98.71 | Methyl ISO-Butyl Ketone |
| 60 | 2072 | 3 | 0.04 | 98.75 | Methyl Methacrylate |
| 61 | 2103 | 3 | 0.04 | 98.79 | Aluminum Sulfate (Alum) |
| 62 | 2117 | 3 | 0.04 | 98.84 | Chlordane |
| 63 | 2173 | 3 | 0.04 | 98.88 | PCB'S |
| 64 | 2180 | 3 | 0.04 | 98.92 | Potassium Permanganate |
| 65 | 2204 | 3 | 0.04 | 98.97 | Toxaphene |
| 66 | 2001 | 2 | 0.03 | 98.99 | Acetaldehyde |
| 67 | 2011 | 2 | 0.03 | 99.02 | Allyl Alcohol |
| 68 | 2022 | 2 | 0.03 | 99.05 | N-Butyl Acrylate |
| 69 | 2023 | 2 | 0.03 | 99.08 | N-Butyl Alcohol |
| 70 | 2025 | 2 | 0.03 | 99.11 | N-Bulyraldehyde |
| 71 | 2031 | 2 | 0.03 | 99.14 | Chloroform |
| 72 | 2039 | 2 | 0.03 | 99.17 | Dichloropropane-Dichloropropane Mix |
| 73 | 2052 | 2 | 0.03 | 99.20 | Ethylenediamine |
| 74 | 2055 | 2 | 0.03 | 99.22 | Formaldehyde |
| 75 | 2062 | 2 | 0.03 | 99.25 | Hydrogen Peroxide (Greater Than 60%) |
| 76 | 2083 | 2 | 0.03 | 99.28 | N-Propyl Alcohol |
| 77 | 2090 | 2 | 0.03 | 99.31 | Trichloroethane |
| 78 | 2095 | 2 | 0.03 | 99.34 | Vinylidene Chloride |
| 79 | 2151 | 2 | 0.03 | 99.37 | Iron Compounds |
| 80 | 2156 | 2 | 0.03 | 99.40 | Maleic Acid |
| 81 | 2169 | 2 | 0.03 | 99.43 | Nitrogen Dioxide |
| 82 | 2172 | 2 | 0.03 | 99.45 | Parathion |
| 83 | 2174 | 2 | 0.03 | 99.48 | Pentachlorophenol |
| 84 | 2181 | 2 | 0.03 | 99.51 | Propionic Acid |

TABLE 3-4. MOST FREQUENTLY SPILLED LIQUIDS (1968-1979) SELECTED FROM MTB (PCAR) REPORTS

| RANK | CHEM-CODE | CHEMICAL DESCRIPTION | #INCIDENTS | % | COM% |
|---|---|---|---|---|---|
| 1 | 28 141 13 | Anthracene, Crude | 330 | 67 | 67 |
| 2 | 29 111 35 | Gasoline, Blended | | | |
| | 29 111 90 | Gasoline, n.e.c.(1) | | | |
| | 49 081 76 | Gasoline, Casing Head | 117 | 24 | 91 |
| 3 | 49 057 11 | Liquified Petroleum | 44 | 9 | 100 |
| | | | 491 | | 100 |

(1) Not otherwise classified

TABLE 3-6. MOST FREQUENTLY SPILLED CHEMICALS REPORTED TO PIRS AND MTB, BY CHEMICAL GROUP

| | PIRS | | MTB[1] | |
|---|---|---|---|---|
| | spills | % | spills | % |
| Flammable Liquids | 6,867 | 85 | 13,970 | 58 |
| Corrosives | 340 | 4 | 8,181 | 34 |
| Poisons | - | - | 740 | 3 |
| Flammable Gases | 132 | 2 | 540 | 2 |
| Non-Flammable Gases | 35 | 0 | 219 | 1 |
| Other than above | 709 | 9 | 422 | 2 |
| | 8,083 | 100 | 24,072 | 100 |

[1] Includes PCAR (Pipeline Carrier Accident Reports)

however, is substantially less, for most modes as shown in the last column of Table 3-7. The duplicate reocrds discovered represent an average overlap of less than 0.5 percent.

The reasons for the low overlap fractions are not difficult to find.

(1) Incident reports are not made to the MTB for bulk shipments by water, but are required under the PIRS. Hence the PIRS reports of water incidents seldom duplicate the MTB reports.

(2) Most highway and rail spills probably do not impact the navigable waters, even though they occur in coastal or waterway counties. If so, they would appear in the PIRS data with much lower frequency than in the MTB data.

(3) The category of marine and land facility does not apply to MTB recorded incidents, except as these later are of unknown mode. Since there are relatively few records of that type in the MTB data, the overlap is small.

Because of the low overlap it was deemed unnecessary to consolidate PIRS amd MTB data into a single data base, i.e., to eliminate duplication. The PIRS data can be taken to reflect water-borne and facility spills, while the MTB data can be taken to cover highway and rail spills. Pipeline spill data, however, must be extracted from both sources. Also, a check of the air-mode spills showed no overlap.

Figures 3-2 and 3-3 illustrate the breakdown by mode of the PIRS and MTB data.

The overall picture emerging from the modal breakdown, for the chemicals and counties covered, is:

(1) Water-borne incidents occur at the rate of about 300 per year.

(2) Spills at facilities, affecting the navigable waters, occur at the rate of about 250-year.

(3) About 3 percent of all highway spills reported to the MTB in the coastal counties (about 90 per year) are reported in the PIRS data base as affecting the navigable waters.

(4) Railroad incidents in the counties of interest occur at about one tenth the rate of highway incidents.

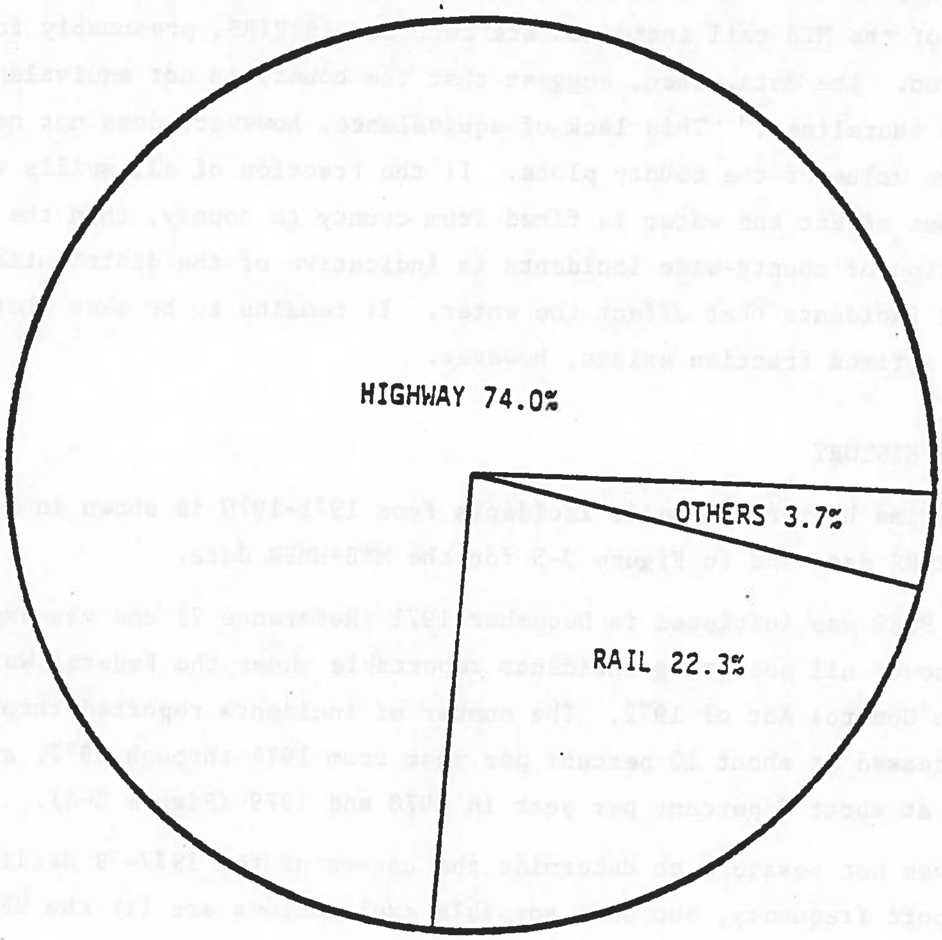



FIGURE 3-3. COAST GUARD RELATED HAZARDOUS MATERIAL INCIDENTS - MTB DATA BASE (MINIMUM DAMAGE = $1,000.00) TOTAL INCIDENTS = 2,358

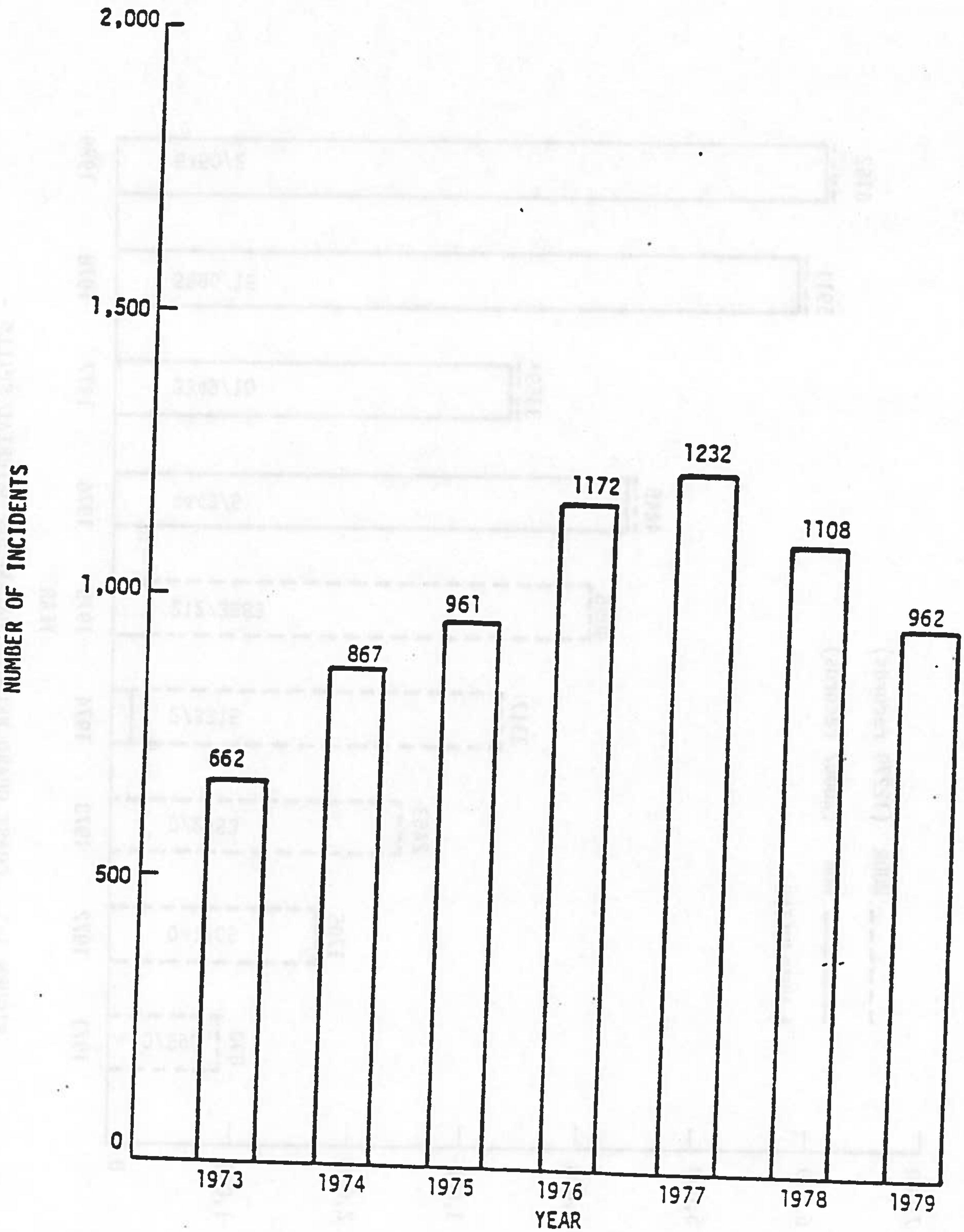



FIGURE 3-4. COAST GUARD RELATED HAZARDOUS MATERIAL SPILLS
PIRS DATA BASE (TOTAL 6,964 INCIDENTS)

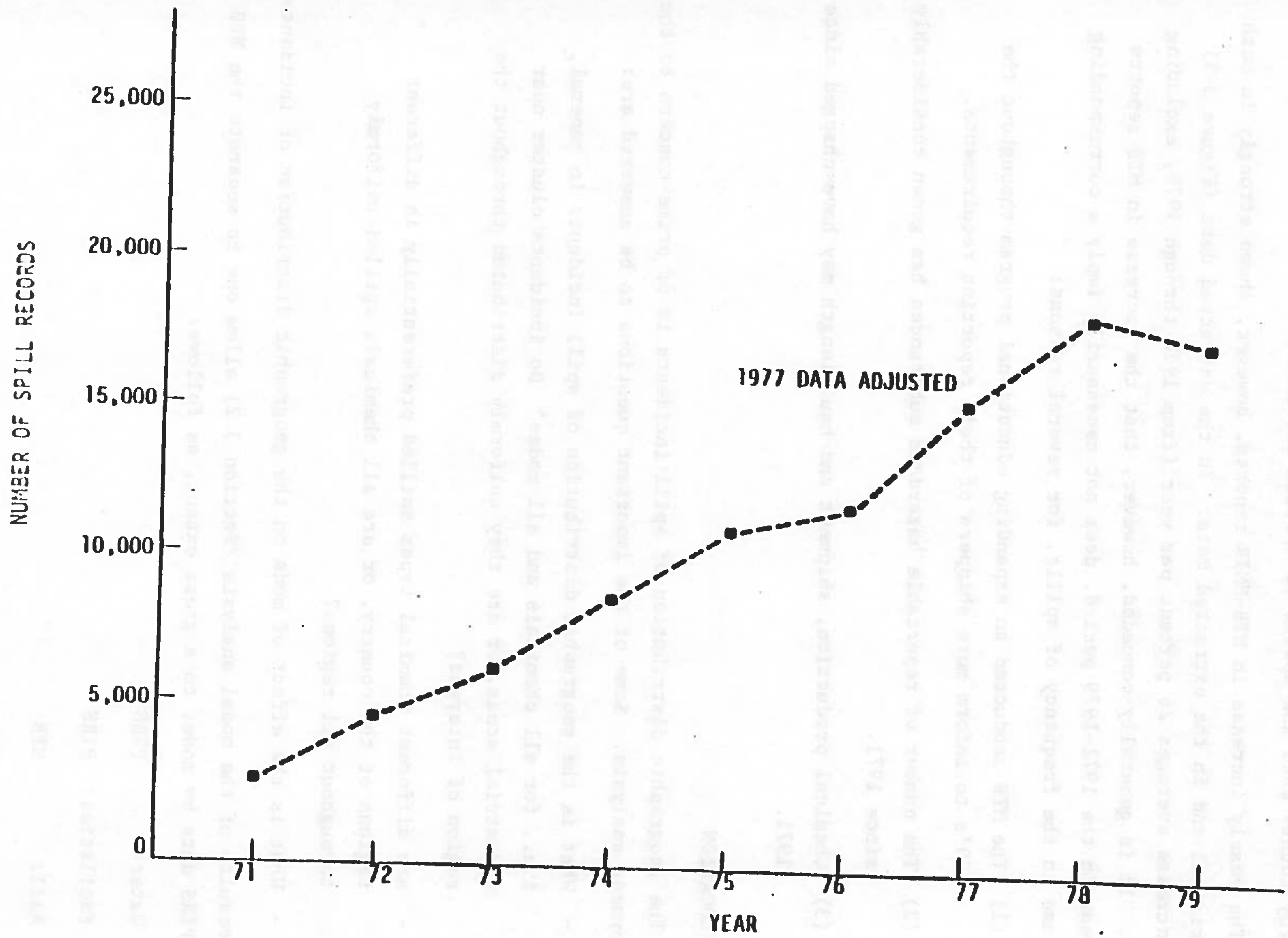



FIGURE 3-6. NUMBER OF HAZARDOUS MATERIAL SPILL RECORDS REPORTED TO MTB

Pipeline: MTB + PIRS

Air: MTB

The geographic distribution of incidents, is obtained in terms of county of occurrence but, not all spills in a county of interest affect the navigable waters of the U.S. This is deduced from the large differences between PIRS and MTB data in most counties. The MTB data includes many more incidents, in general, than the PIRS. One explanation of this is the inclusion in the MTB data of many incidents that do not affect the navigable waters of the United States even though they occurred in a county of interest.

PIRS - Geographic Distribution

The chemicals appearing in the PIRS data base were divided into three groups, for convenience in plotting:

1. Flammable Oils: Gasoline, solvents, light flammable oils, paint, LPG, animal and vegetable oils.
2. Chemicals: PIRS chemical codes 2000-2999, plus oil-based pesticides.
3. Chemical and Industrial Wastes: PIRS Codes 7008, 7016.

The third category involves only 121 incidents (less than 2 percent of the incidents of interest) and hence could not provide any detailed information regarding their geographic distribution over the 612 counties of interest. (But the total quantity spilled of chemical and industrial wastes comprises 15 percent of the total spillage in 1973-79. Most of this spillage was chemical wastes released from tankers.)

Figures 3-7(a) through (d) shows the geographic distribution of incidents reported to PIRS in 1973-79 in the counties of interest. Unshaded counties experienced no incidents in the period; counties in black experienced more than nine times the average number of incidents. Intermediate shadings indicate frequencies of incidents between these extremes. The pattern shows incidents in the heavily industrialized counties of the country. These are listed in Table 3-8, which shows those counties having 50 or more spills of flammable oils or chemicals from 1973 to 1979, as recorded in PIRS. Since the average number of incidents per county is about 8.6, the occurrence of over 50 spills in any one county is a very significant deviation from the average.

The regional distribution of PIRS spill incidents is as follows:


FIGURE 3-7(b). DISTRIBUTION OF HAZARDOUS MATERIAL SPILLS BY COASTAL AND WATERWAY COUNTIES - PIRS, SOUTHEAST U.S.

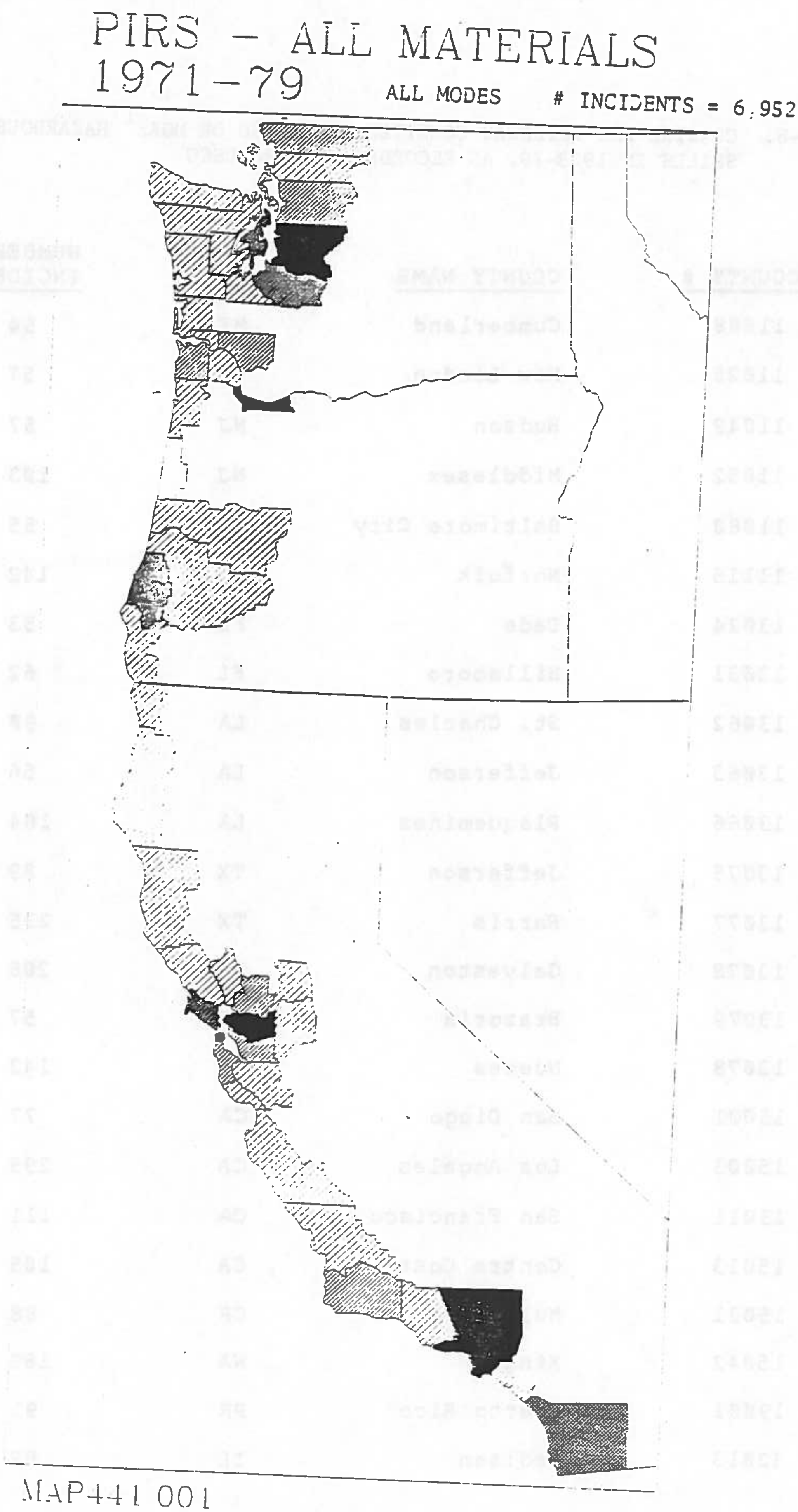



FIGURE 3-7(d). DISTRIBUTION OF HAZARDOUS MATERIAL SPILLS BY COASTAL AND WATERWAY COUNTIES - PIRS, WESTERN U.S.

TABLE 3-8. COASTAL AND WATERWAY COUNTIES HAVING 50 OR MORE[1] HAZARDOUS CHEMICAL SPILLS IN 1973-79, AS RECORDED BY PIRS-USCG (Cont.)

| COUNTY # | COUNTY NAME | STATE | NUMBER OF INCIDENTS |
|---|---|---|---|
| 33001 | Will | IL | 54 |
| 34024 | Jefferson | KY | 67 |
| 34036 | Hamilton | OH | 78 |
| 34070 | Allegheny | PA | 84 |
| 53034 | Cook | IL | 61 |
| 57066 | Wayne | MI | 92 |
| 57068 | Lucas | OH | 96 |

[1] A county with 52 or more incidents has .75% or more of all incidents in the (modified) PIRS file of 6952 incidents.

MTB - ALL REGULATED CHEMICALS
1971-79

MODE = ALL
CHEM CLASS = ALL
# INCIDENTS = 31,515

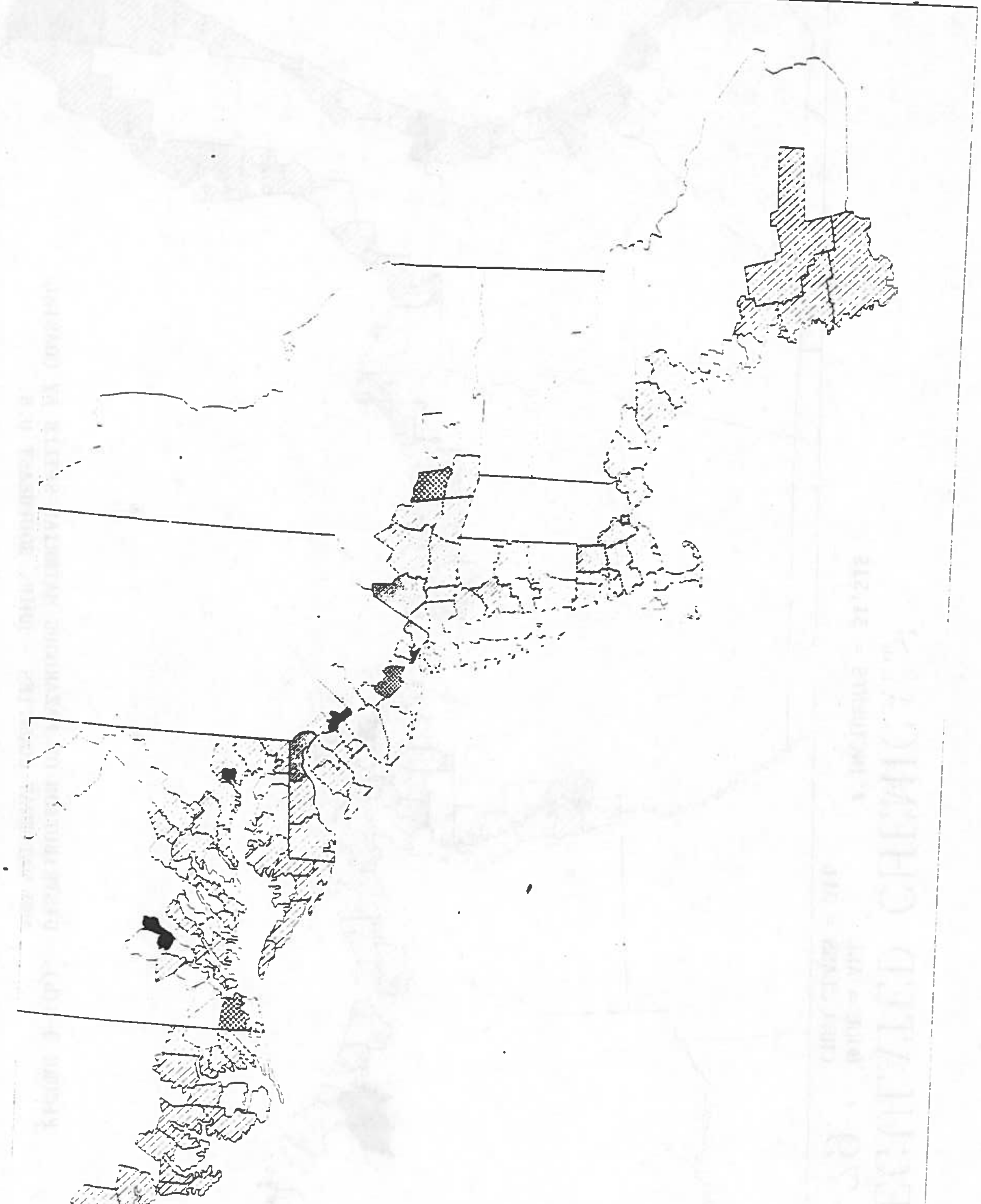


FIGURE 3-8(a).

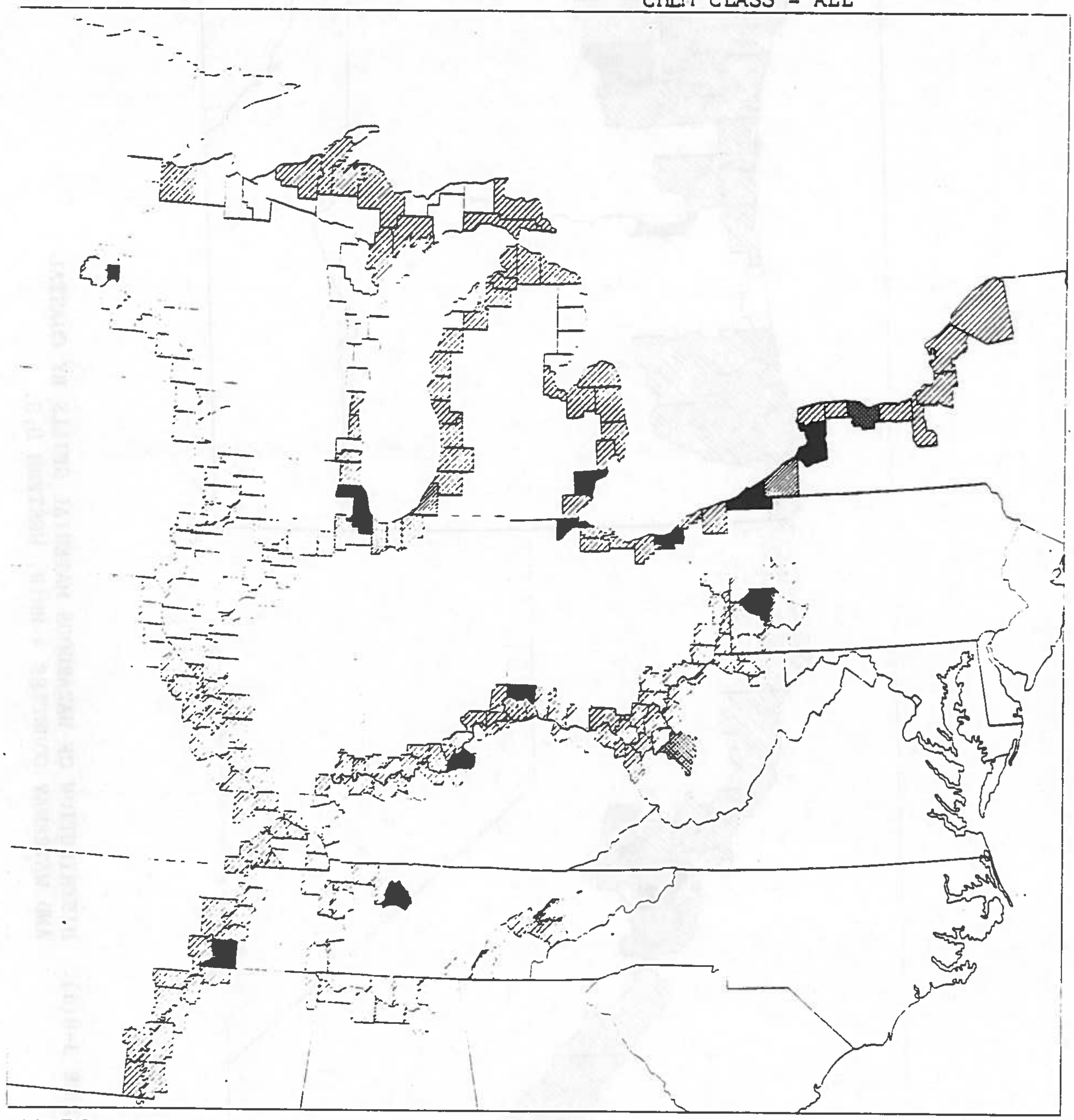
DISTRIBUTION OF HAZARDOUS MATERIAL SPILLS BY COASTAL AND WATERWAY COUNTIES - HMIR, NORTHEAST U.S.

MAP241.001

MTB

ALL REGULATED CHEMICALS
1971–79

MODE = ALL # INCIDENTS =31,515
CHEM CLASS = ALL



MAP241.001

FIGURE 3-8(c). DISTRIBUTION OF HAZARDOUS MATERIAL SPILLS BY COASTAL AND WATERWAY COUNTIES - HMIR, CENTRAL U.S.

TABLE 3-9. COASTAL AND WATERWAY COUNTIES HAVING 230 OR MORE[1] HAZARDOUS CHEMICAL SPILLS IN 1971-79, AS RECORDED BY HMIR-MTB

| COUNTY # | COUNTY NAME | STATE | NUMBER OF INCIDENTS |
|---|---|---|---|
| 11034 | Orange | NY | 234 |
| 11039 | Albany | NY | 266 |
| 11049 | Hudson | NJ | 475 |
| 11052 | Middlesex | NJ | 349 |
| 11063 | Philadelphia | PA | 476 |
| 11080 | Baltimore City | MD | 599 |
| 11108 | Henrico | VA | 931 |
| 11115 | Norfolk | VA | 306 |
| 11138 | Brunswick | NC | 744 |
| 13014 | Duval | FL | 249 |
| 13024 | Dade | FL | 289 |
| 13049 | Mobile | AL | 249 |
| 13064 | Orleans | LA | 515 |
| 13077 | Harris | TX | 876 |
| 15003 | Los Angeles | CA | 1187 |
| 15012 | Alameda | CA | 418 |
| 15031 | Multnomah | OR | 292 |
| 15042 | King | WA | 330 |
| 31023 | Shelby | TN | 1694 |
| 32056 | Ramsey | MN | 633 |
| 32057 | Hennipin | MN | 232 |
| 34024 | Jefferson | KY | 577 |
| 34036 | Hamilton | OH | 1084 |

2. East St. Louis, IL

3. San Diego, CA

which are more prominent in the PIRS than in the MTB data.

When the MTB incidents are broken down by Coast Guard Districts, the result is:

| | | |
|---|---|---|
| USCG Districts 1, 3, 5 | 7,526 incidents | 24% |
| USCG Districts 7, 8 | 3,819 | 12 |
| USCG Districts 11, 12, 13 | 3,360 | 11 |
| USCG Districts 2, 9 | 16,751 | 53 |
| TOTAL | 31,456 | 100 |

plus 59 incidents in Puerto Rico, Hawaii, and the Virgin Islands.

This list provides an informative comparison with the corresponding list for PIRS incidents, above. It shows clearly that a larger percentage of MTB incidents occurred in Districts 2 and 9 than did PIRS incidents, (54% vs. 27%). This may be due to the relatively larger importance of land-based industry in Districts 2 and 9. Another unusual aspect is that Districts 1, 3, and 5 have about the same percentage of incidents (24%) in both reporting systems. An explanation may be that chemical industry and transport in those Districts have a large water-based transport component. The remainder of the country would appear to be balanced between chemical industries that have water-based and land-based transport.

## 3.5 PROJECTION

The problem of estimating the rate of hazardous chemical spills in the 1980-1985 time frame is important for deployment planning, and has been studied at least since 1973 (Reference 13). Despite the drawbacks of employing chemical production figures as surrogates for hazchem transport exposure (Reference 13, p. 33) it is still necessary to do so, because direct measures of exposure are not generally available even today. Therefore, an attempt was made to correlate chemical production with chemical spills, based on 1971-79 data for both, and to use the results for projection into 1980-90. The results are shown in Figure 3-9 and 3-10.

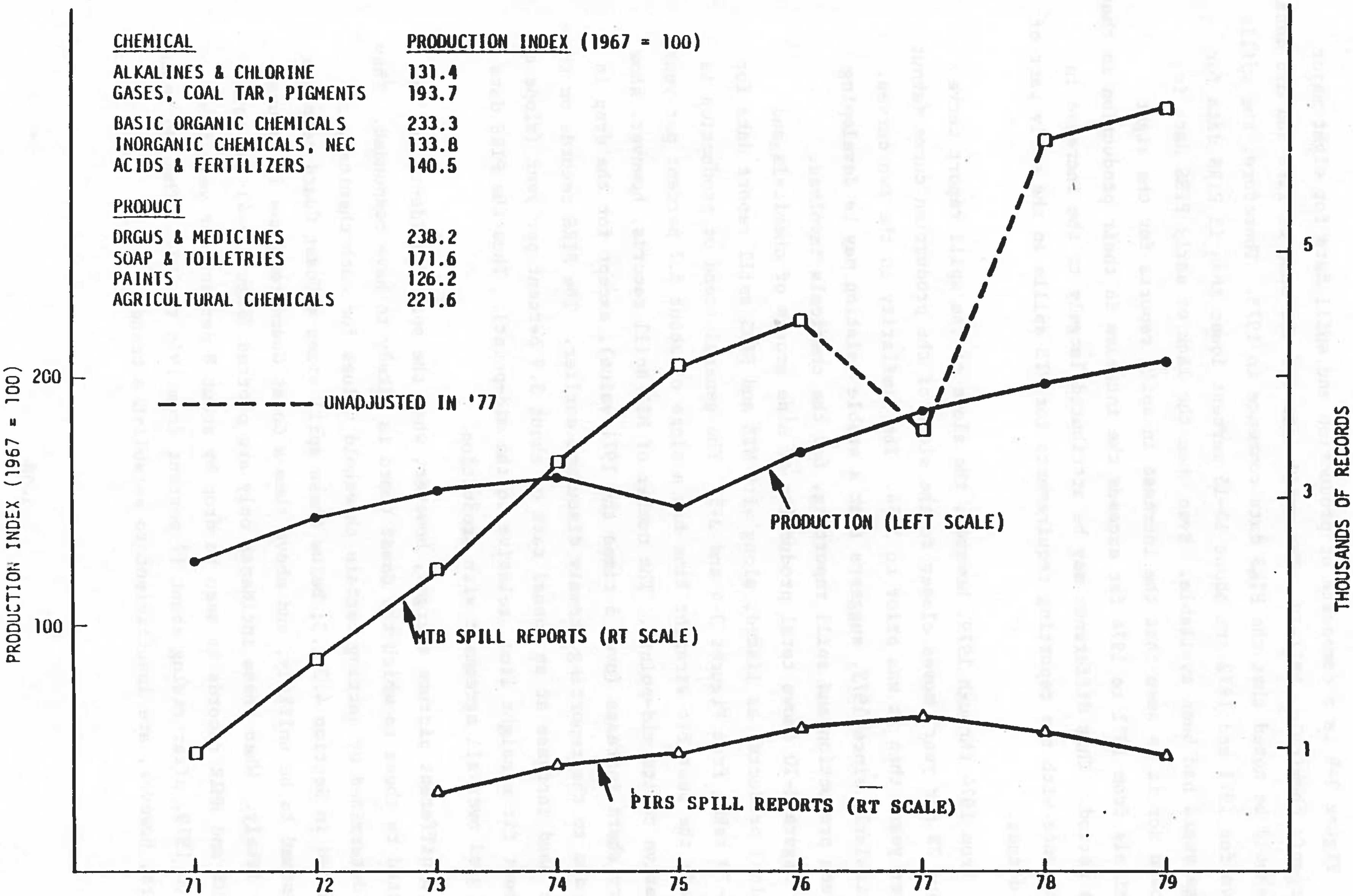



FIGURE 3-10. CHEMICALS AND PRODUCTS, PRODUCTION AND SPILL REPORTS 1971-79

In summary it can be stated that while both production and total number of spills reported have been increasing at about 4-7 percent in the latter half of the decade, the number of "respondable" spills shows a leveling or declining trend in the last four years.

## 3.6 SUMMARY

The information and conclusions drawn from the preceding analyses apply to spills of hazardous (non-oil) materials in the coastal and waterway counties of the United States.

Mode

1. The MTB data are representative of highway, rail, and air mode spills; the PIRS data cover water and facility-based spills. There is less than 0.5 percent overlap of the two data sources.

Chemicals

2. There is also poor correlation of the two sources with regard to the types of chemicals reported spilled. This is attributed to (1) differences in the two chemical coding schemes, and (2) differences in the types of chemicals shipped by water as opposed to highway, rail, and air.

3. About 60 percent of the spills reported to MTB, and over 80 percent of the spills reported to PIRS, are flammable liquids.

4. The MTB and the PIRS systems differ in the scope and character of the substances they report (i.e., "hazardous" vs. "polluting"). This difference makes comparison of the chemicals in the two data bases very difficult.

Time History

5. The number of incidents reported to PIRS increased at about 10 percent per year from 1973 through 1977, then declined about 8 percent per year in 1978 and 1979. The MTB reports, on the other hand, show a 26 percent per year increase in number from 1971 through 1978. This rapid increase is attributed to an increase in reporting fraction rather than to an increase in incidents.

# 4. U.S. COAST GUARD CHEMICAL SPILL RESPONSE EQUIPMENT TYPES

The preceding Sections of this report have reviewed the non-U.S. Coast Guard chemical spill response capability and estimated the geographic distribution of chemical spills threat to be expected in 1985.

The final step of the basic methodology is carried out in this and the following Section. The present and recommended types of chemical response equipment are treated in this Section. The number and location of the response units are determined in the next Section. It will be seen that, for reasons of mobility and response time, the chemical response equipment assigned to a base should be pre-loaded onto response vehicles. Therefore, the objective of this Section is to describe the mix of equipment to be contained in these vehicles.

## 4.1 PRESENT COAST GUARD EQUIPMENT TYPES

A sampling of the Coast Guard hazchem response equipment was taken from the SKIM listing. Based on interviews with field personnel, it is evident that the listing was not current as of December 1980, since many equipment items reported from the field are not on the SKIM list. The following SKIM tabulation, therefore, probably underestimates the actual capability:

| Item | Number |
|---|---|
| Self contained breathing apparatus | 44 |
| Gas Masks | 135 |
| Unspecified type, breathing apparatus | 52 |
| Fire Suits | 3 |
| Acid Suits | 38 |
| pH meters | 2 |
| Explosimeters | 15 |
| Multiple-gas meters | 2 |
| Oxygen sampler | 2 |

(4) The response vehicles and teams described here are to be the major USCG response to chemical spills. The MSO is assumed to provide the OSC, and general expertise in chemical cleanup, but would otherwise rely on the response vehicles and teams.

(5) The equipment and capability deployed by the Coast Guard will be for

(a) rapid, but temporary assistance when other sources of response are not available.

(b) protection of Coast Guard personnel on the scene.

(c) initial assessments and monitoring of removal operations.

The guideline 5(a) is significant in that it implies that mobility should be given high priority. The general measure of mobility, of course, is response time, which in turn depends on transport mode. Two approaches are possible: (1) numerous small bases that respond over short distance via highway, and (2) few, relatively large bases that respond via air. Combinations are also possible.

Land response is best achieved by units pre-loaded and dedicated to hazardous chemical spill response. The pre-loaded unit not only saves time and improves preparedness at the initial stages of a response, but also provides storage space for the equipment between responses. The major questions in this approach are the size and contents of the response vehicle, and the numbers of such vehicles at the various bases.

Air response is more limited by cost than is land response. A significant cost saving can be achieved, however, if USCG transport aircarft (C130H, C130B) are employed, since they are normally maintained in a ready status for the Search and Rescue mission.

An ideal arrangement, but one suitable for only some bases, is a set of air-transportable response vans that are located at or near USCG airbase with C130H/B aircraft. These are:

| | |
|---|---|
| Barber's Point, HI | 3-HC-130B |
| Clearwater, FL | 3-HC-130B |
| Elizabeth City, NC | 4-HC-130B |
| Kodiak, AK | 6-HC-130H |
| Sacramento, CA | 4-HC-130H |

(1) pH meters - These are inexpensive devices that determine hydrogen ion concentrations in water, soil or liquids. Many materials have a profound effect on pH values and the extent of contamination can often be detected by these meters.

(2) Sampling meters - Many types are available. They measure levels of methane, ethane, chlorine, hydrogen sulfide. Photo-ionizer units are available that can detect a wide variety of organic compounds and some inorganic compounds. Hydrogen flame ionization meters can detect and measure almost all organic vapors.

(3) Multi-meters - These employ indicator tubes for each chemical to be detected. Although they are not highly accurate they are very flexible and reliable. The utility depends on the number of indicator tubes stocked.

(4) Combustible gas indicator - These measure the level of specific gases in the atmosphere and compare it with known limits to determine the possibility of explosion of the particular air/gas mixture present. Many meters can be adjusted for more than one gas.

(5) Oxygen meter - These measure molecular oxygen in the atmosphere as a function of partial pressure.

4.2.1.2 Personnel Protective Gear (PPG) - This is the largest and, perhaps, most important category for USCG response teams. Even if Coast Guard personnel do not themselves undertake pollutant removal actions, they require protective equipment to conduct the initial assessment of the reported spill, to effectively monitor the corrective measures of the responsible party, if any, and to supervise the efforts of any contractors whom the OSC has hired. Personnel Protective Gear (PPG) falls into two categories: respiratory protection and protective clothing. (Reference 7).

Respiratory Protection

Respiratory protective gear fall into two classes, air-purifying respirators and supplied or self-contained air- or oxygen-breathing apparatus.

(1) Air purifying respirator (gas mask) - A breathing system which supplies breathing air to the user from the ambient atmosphere. Protection is provided by mechanical filters, chemical reactants or

referred to as a rebreather, removes the carbon dioxide from the contained air and replaces it with oxygen.

Protective Clothing

Several groups of protective clothing may be defined. The groupings below are based on the type of use to which the clothing is put rather than on the specific materials from which they are constructed. Generally, an adequately equipped response vehicle will have gear of each type.

Standard Protective Gear (splash gear) - A suit made of rubber or polymer exterior or coating over a fabric base. These suits are primarily used by Fire Departments and other agencies concerned with protection against water; these suits offer protection against heat and acid for short periods of time or for light exposures, but not against intense corrosive atmospheres or lethal poisons.

In addition to the suits themselves, numerous auxiliary items are available. These include hoods, goggles, gloves, boots, face masks, coveralls, aprons and hats. All such items are available separately. Although included in the chemical/gas suits described below each separate item should be available because it serves a distinct, single, purpose in many spills. The materials must be selected so as to provide resistance to the spectrum of chemicals likely to be encountered.

Fire Suit - a suit made with an exterior of aluminized-glass or asbestos fabric over other layers of glass, asbestos, or cloth fabrics. The more layers of insulating glass or asbestos fabric, the greater thermal protection afforded the wearer. The inner layer is usually cloth to provide strength to the suit and a non-irritating surface to the wearer. These suits always include a helmet or hood, and fully encapsulate the wearer. Accordingly, breathing apparatus is required. Several types of suits are available, and are classified accordingly to the degree of protection they give the wearer:

Proximity suit - Allows the wearer to come close to a fire; it provides protection against moderate heat and occasional contact with hot surfaces.

Approach suit - Allows the wearer to come very close to a fire; it provides protection against high radiant heat levels for extended periods of time.

data were those available from the chemical manufacturing industry. Nevertheless, in many cases, the assignments were purely judgemental in nature.

Chemical List Bridging

Inconsistency of existing material/chemicals lists was not the only difficulty encountered in this approach. A major problem emerged when the chemicals listed by PIRS were compared with those listed by the MTB. The match was poor. The attempt at 'bridging' these two lists of chemicals to a uniform system of designations, as given in the CHRIS (Chemical Hazard Response Information System) system failed for reasons described in Reference 3 and Appendix C. Therefore the analysis of chemical/material requirements for historic spills was carried out separately on the MTB and PIRS chemicals. The analysis of chemical compatibility was carried out on all materials that appeared in the PIRS spill data from 1973 to 1979 and on all MTB materials that had 10 or more spill records with quantity released data from 1976 through 1979. This resulted in 130 out of the 265 PIRS chemicals and 157 out of more than 1600 MTB chemicals being selected for analysis.

The chemicals selected for analysis were then used to extract the spill frequency and release quantity from the MTB and PIRS spill data bases. Fortunately, it was discovered (Reference 3, Table 22) that the duplication of incidents in the two data bases was less than 0.5 percent, so that the number of incidents involving a given chemical was closely approximated by the sum of the PIRS and MTB records involving that chemical. Further, it was found that the major source of mismatch between the two bases was the use of generic descriptions of chemicals (e.g., "zinc compounds", or "Corrosive Liquid, N.O.S."). In those cases the chemical was treated as the most common chemical among the group of chemicals covered by the designation.

Types and Numbers of Equipment

Each of 157 MTB materials and 130 PIRS materials were examined to determine the type of response equipment and the number of units of equipment required as a function of spill size. The results are tabulated in Appendix C1. This Appendix also shows the material recommended for each piece of equipment for compatibility with the chemical.

The materials and equipment requirements for specific chemicals were applied to actual historic spills from PIRS in 1973 through 1979 and to the

TABLE 4-1. NUMBER OF SPILLS ABOVE RESPONSE THRESHOLD TABULATED BY EQUIPMENT TYPE

| | PIRS 73-79 | HMIR 76-79 | Total | % of Spills |
|---|---|---|---|---|
| A1 SCBA (self-contained breathing apparatus) | 587 | 320 | 907 | 78.32 |
| A2 SCBA - for high concentration | 0 | 6 | 6 | .52 |
| A3 SCBA - PLASTIC LENS | 0 | 6 | 6 | .52 |
| B1 CANISTER - ALL PURPOSE | 9 | 7 | 16 | 1.38 |
| C1 CANISTER - ORGANIC | 18 | 51 | 69 | 5.96 |
| D1 CANISTER - AMMONIA (ALKALI) | 0 | 7 | 7 | .60 |
| E1 CANISTER - CHLORINE | 0 | 2 | 2 | .17 |
| F1 CANISTER - ACID | 4 | 11 | 15 | 1.30 |
| G1 DUST MASK | 33 | 63 | 96 | 8.29 |
| H1 CHEMICAL GOGGLES | 39 | 72 | 111 | 9.59 |
| I1 FACE SHIELD | 79 | 45 | 124 | 10.71 |
| J1 ALL RUBBER CLOTHING - NEOPRENE | 539 | 119 | 658 | 56.82 |
| J2 " " " - BUTYL RUBBER | 38 | 52 | 90 | 7.77 |
| J3 " " " - EPR | 2 | 6 | 8 | .69 |
| J4 " " " - HYPALON | 8 | 16 | 24 | 2.07 |
| J5 " " " - BUTADIENE | - | - | - | - |
| J6 " " " - FLUORO-ELASTOMER | 9 | 45 | 54 | 4.66 |
| K1 RUBBER GLOVES - NEOPRENE | 20 | 183 | 203 | 17.53 |
| K2 " " - BUTYL RUBBER | 3 | 16 | 19 | 1.64 |
| K3 " " - EPR | 2 | 8 | 10 | .86 |
| K4 " " - HYPALON | 0 | 8 | 8 | .69 |
| K5 " " - BUTADIENE | - | - | - | - |
| K6 " " - FLUORO-ELASTOMER | 20 | 26 | 46 | 3.97 |
| L1 RUBBER BOOTS - NEOPRENE | 18 | 180 | 198 | 17.10 |
| L2 " " - BUTYL RUBBER | 3 | 4 | 7 | .60 |
| L3 " " - EPR | 2 | 1 | 2 | .26 |
| L4 " " - HYPALON | 0 | 0 | 0 | .00 |
| L5 " " - BUTADIENE | - | - | - | - |
| L6 " " - FLUORO-ELASTOMER | 20 | 23 | 43 | 3.71 |
| M1 RUBBER HOOD - NEOPRENE | 0 | 0 | 0 | .00 |
| M6 " " - FLUORO-ELASTOMER | 12 | 0 | 12 | 1.04 |
| O1 CORROSIVE | 123 | 135 | 258 | 22.28 |
| | 667 | 491 | 1158 | |

TABLE 4-2. MOST FREQUENTLY SPILLED CHEMICALS AND THEIR HAZARD CLASSIFICATIONS AS REPORTED TO PIRS, 1973-1979.

| | % | H | F | R | |
|---|---|---|---|---|---|
| 1. Gasoline | 45.7 | 1 | 3 | 0 | |
| 2. Hydraulic Fluid | 12.5 | - | - | - | |
| 3. "Other Hazardous Substances" | 5.9 | - | - | - | |
| 4. Lacquer-based paint | 4.8 | 1 | 2 | 0 | TGF |
| 5. Natural gasoline | 3.6 | 1 | 3 | 0 | |
| 6. Vegetable oil | 3.2 | 0 | 1 | 0 | |
| 7. Animal oil | 2.3 | 0 | 1 | 0 | |
| 8. Naptha | 1.7 | 2 | 3 | 0 | |
| 9. Other petroleum solvent | 1.6 | - | - | - | |
| 10. Xylene | 1.5 | 2 | 3 | 0 | |
| 11. LPG | 1.3 | 1 | 4 | 0 | FG |
| 12. Benzene | 1.3 | 2 | 3 | 0 | |
| 13. Toluene | 1.3 | 2 | 3 | 0 | |
| 14. Styrene | 1.3 | 2 | 3 | 2 | |
| 15. Sulphuric Acid | 1.2 | 3 | 0 | 2 | |
| 16. Industrial Waste | 1.1 | - | - | - | |
| 17. Caustic Soda | .80 | 3 | 0 | 1 | |
| 18. Hydrochloric Acid | .66 | 3 | 0 | 0 | TG |
| 19. Chemical Waste | .66 | - | - | - | |
| 20. Mineral Spirits | .65 | - | - | - | |
| 21. Paraffin Wax | .56 | 0 | 1 | 0 | |
| 22. Cresol | .42 | 3 | 2 | 0 | |
| 23. Napthalene | .30 | 2 | 2 | 0 | |
| 24. Ammonia | .21 | 2 | 1 | 0 | TG |
| 25. Phosphoric Acid | .29 | 2 | 0 | 0 | |
| 26. Oil-based pesticides (1) | .27 | 3 | 1 | 0 | PP,TGF |
| 27. Phenol (Carbolic Acid) | .26 | 3 | 2 | 0 | |
| 28. Sodium Hydroxide | .26 | 3 | 0 | 1 | |
| 29. Cyclohexane | .22 | 1 | 3 | 0 | |
| 30. Ammonium Compounds (2) | .20 | 2 | 0 | 3 | TGF,EX |
| 31. Turpentine | .19 | 1 | 3 | 0 | |
| 32. Isopropyl Alcohol | .14 | 1 | 3 | 0 | |
| 33. Methyl Alcohol | .14 | 1 | 3 | 0 | |
| 34. Chlorine | .14 | 3 | 0 | 0 | TG |
| 35. Acetic Acid | .13 | 2 | 2 | 1 | |
| 36. Acetone | .11 | 1 | 3 | 0 | |
| 37. Acrylonitrile | .10 | 4 | 3 | 2 | TG,TGF |
| 38. Glycol | .10 | 1 | 1 | 0 | |
| 39. Ethylene Glycol | .10 | 1 | 1 | 0 | |
| 40. Perchloro ethylene | .10 | 2 | 0 | 0 | |
| 41. Calcium Compounds | .10 | - | - | - | |
| 42. Copper Compounds | .10 | - | - | - | |
| 43. Methyl Ethyl Ketone | .09 | 1 | 3 | 0 | |
| 44. Nitric Acid | .09 | 3 | 0 | 0 | TG |
| 45. Vinyl Acetate | .09 | 2 | 3 | 2 | FG |
| 46. Chromium Compounds | .09 | - | - | - | |
| 47. Oleum | .07 | 3 | 0 | 2 | |
| 48. Lead Compounds | .07 | - | - | - | |

TABLE 4-2. MOST FREQUENTLY SPILLED CHEMICALS AND THEIR HAZARD CLASSIFICATIONS AS REPORTED TO PIRS, 1973-1979 (CONTINUED)

| | % | H | F | R | |
|---|---|---|---|---|---|
| 97. Ethylene Cyanohydrin | .01 | 2 | 1 | 1 | TGF |
| 98. Glycerin | .01 | - | - | - | |
| 99. n-Hexane | .01 | 1 | 3 | 0 | |
| 100. Hydroflouric Acid | .01 | 4 | 0 | 0 | TG |
| 101. Isoprene | .01 | 2 | 4 | 2 | |
| 102. Methyl Acrylate | .01 | 2 | 3 | 2 | |
| 103. Propylene Oxide | .01 | 2 | 4 | 2 | FG |
| 104. Tetraethyl Lead | .01 | 3 | 2 | 3 | |
| 105. Butylamine | .01 | 2 | 3 | 0 | |
| 106. Flourine Compounds | .01 | - | - | - | TG,TGF |
| 107. Methyl Parathion | .01 | 4 | 3 | 2 | PP |
| 108. Phosphorous Trichloride | .01 | 3 | 0 | 2 | TG |
| 109. Sodium Bisulfite | .01 | 3 | 1 | 2 | TGF |
| 110. Sodium Hydrosulfide | .01 | - | - | - | |
| 111. Sodium Nitrite | .01 | - | - | - | |
| 112. Sodium Phosphate, Monobasic | .01 | - | - | - | |
| 113. Sodium Sulfide | .01 | 2 | 1 | 0 | TGF |
| 114. Strychnine | .01 | - | - | - | PP |
| 115. Uranium Compounds | .01 | - | - | - | |
| | 100.00 | | | | |

NOTES:

✓ indicates that the material or group of materials can present one or more of the following hazards:

FG = gives off flammable or explosive gas

TG = gives off toxic gas

TGF = gives off toxic gas when on fire

EX = Class A or B explosive

PP = pesticide or poison

% indicates the percentage of incidents involving the listed material from among the 6964 incidents extracted from the PIRS data base, 1973-79.

(1) Endrin, in solution, taken as typical.
(2) Ammonium Nitrate taken as typical.
(3) Sodium Cyanide taken as typical.

TABLE 4-3. FIFTY MOST FREQUENTLY SPILLED CHEMICALS AND THEIR HAZARD CLASSIFICATIONS AS REPORTED TO MTB, 1971-1979 (CONTINUED)

NOTES:

✓ indicates that the material or group of materials can present one or more of the following hazards:

FG = gives off flammable or explosive gas

TG = gives off toxic gas

TGF = gives off toxic gas when on fire

EX = Class A or B explosive

PP = pesticide or poison

% indicates the percentage of incidents involving the listed material from among the 31,515 incidents extracted from the MTB data base, 1971-79.

(1) Endrin, in solution, taken as typical.
(2) Ammonium Nitrate taken as typical.
(3) Sodium Cyanide taken as typical.

accomplished by another vessel, or by terminal auxiliary pumps.

In some cases of marine incidents involving hazardous materials, however, Coast Guard offloading capability may be of use. These are cases of bulk shipments of chemicals in barges (as opposed to barge shipments of chemicals in special containers or tanks). Products such as sulphuric acid, liquid fertilizer, and pesticides are commonly shipped in bulk. Conventional offloading equipment, such as steel pumps, are subject to corrosion and/or fouling by these materials; stainless steel pumps or teflon or polyethylene-lined pumps are required depending on the substance. In the event that operative pumps are not available on the barge involved and barge-mounted pumping/vacuum tank equipment cannot reach the scene rapidly, Coast Guard unloading or transfer of bulk chemicals may be necessary.

The acquisition and deployment by the Coast Guard of chemical vacuum trucks and/or truck-mounted tanks is not necessary because of the large supply of such vehicles available from chemical transport firms, such as Chemical Leahman, Inc. or Matlack, Inc. (See Section 2.) Coast Guard resources expended on this type equipment would have a low effectiveness/cost ratio because of their high cost and low utilization by the Coast Guard. The same is true of chemical barges and barge-mounted chemical tanks. Chemical-compatible overpack drums, however, are relatively inexpensive and of potential utility for small quantity releases.

4.2.1.6 Communication Equipment - Although access to extensive communication networks are usually available through local police and fire departments, Coast Guard participation in a response action should not place additional loads on such networks. In addition, response to vessel incidents may involve only Coast Guard resources.

The communication facilities employed by the Coast Guard for oil pollution response are adequate for chemical spill response with the exception of communication with and between personnel in helmetted or encapsulated suits. This can be provided by a number of types of headsets, including microphone and transmitter, since the distances involved are usually under 1000 feet.

2. The request may be for back-up of a previous response, i.e., it may be intended to augment USCG forces already on scene from the same or from another base. If it is to support another base's response, the distance to the scene may be considerable. For this reason, the response vehicles should be air transportable via USCG C130B aircraft or larger.

3. The identification of the chemicals involved will probably have been made before departure from the base or before arrival at the scene. One of the first tasks will probably be determination of the physical location and concentration of contaminants, by samples of soil, air and water. This is likely to be a continued operation that the response team will carry out throughout the mission.

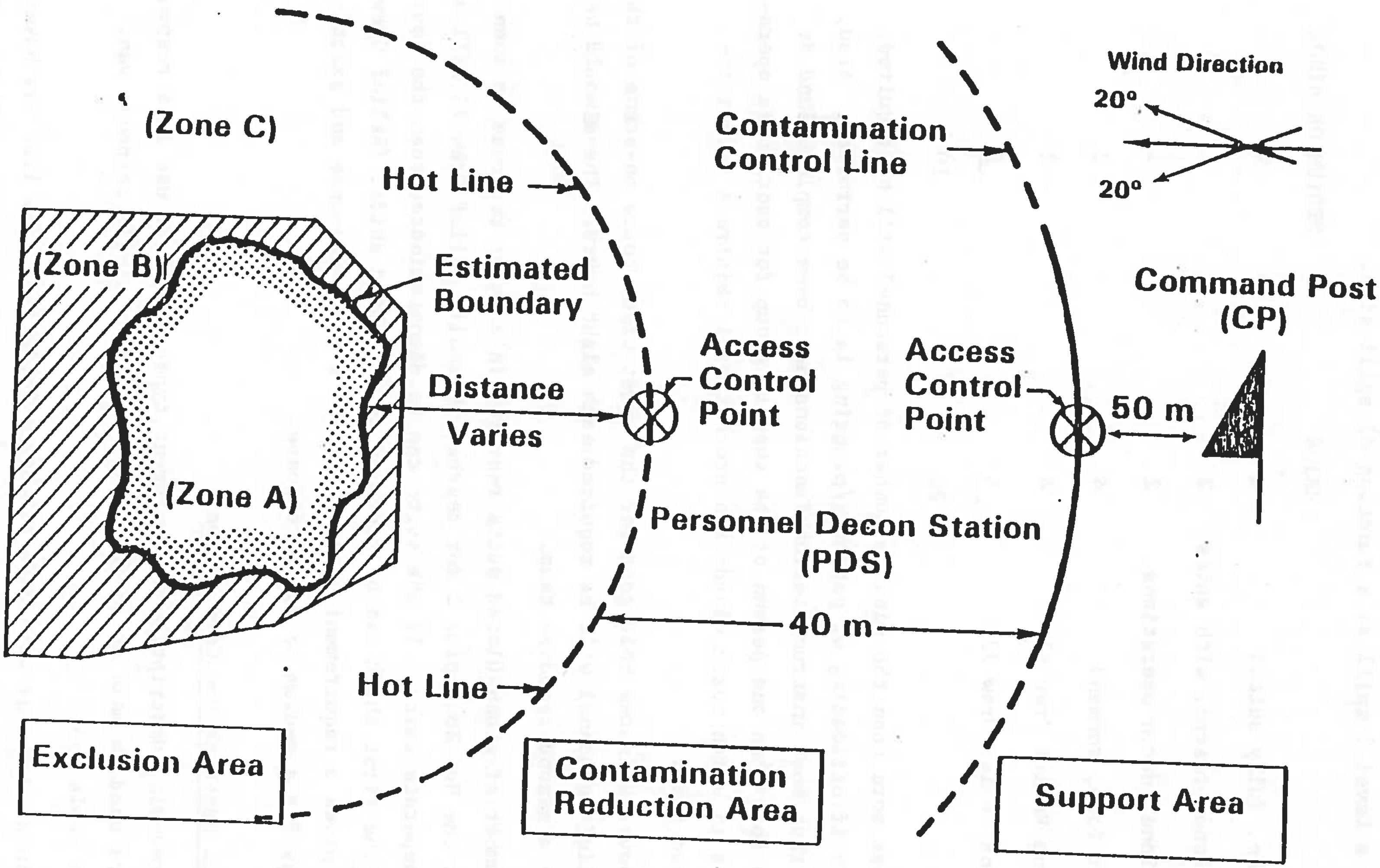
4. Upon determination of the general extent and nature of the hazard, and its possible evolution, personnel protection gear will be selected. The nature of protection will be dependent on the hazard level and on the distance from the source(s), as follows:

<u>Level 1 hazard</u> - This is the lowest level of hazard requiring protective clothing: coveralls, gloves, boots, goggles, or face shield. Respiratory protection is afforded by dust or gas masks.

<u>Level 2 hazard</u> - This is typically the level of protection required for corrosive material spills. The suits must provide full protection against skin and face contact. This level required an acid-resistant splash suit, with overlapping fabric on coveralls. If a hood is employed it may be necessary to use SCBA (Self-Contained Breathing Apparatus) or externally supplied air systems.

<u>Level 3 hazard</u> - This is the most serious hazard level. Both respiratory and cutaneous protection are required. It is typically encountered when the material produces a poisonous or noxious gas. It calls for full body protection by heavily overlapped clothing or by an encapsulating suit, plus SCBA or an externally supplied air system.

5. The second consideration in determining personnel protection requirements is distance from the hazard source. Account must be taken of wind conditions. Typically, four zones can be distinguished:




**NOTE:** Zone dimensions are for illustration purposes only.
Zone dimensions will vary on a case-per-case basis.

FIGURE 4-1. HAZARDOUS MATERIAL SPILL SITE WORK AREAS

TABLE 4-4. ESTIMATED EQUIPMENT REQUIREMENT FOR CHEMICAL SPILL RESPONSE VAN

INSTRUMENTATION (7.0 CU. FT.)[1]

| | |
|---|---|
| 1. pH meter (Orion Research Model 2-1) | 4 |
| 2. Oxygen meter (Bendix Gas-Tech) | 4 |
| 3. Portable Organic Vapor Analyzer (HNU) | 2 |
| 4. Combustible gas indicators (MSA Model 20) | 4 |
| 5. Multi-Test (indicator tube type,* MSA Universal) | 4 |
| 6. Portable weather station | 2 |
| 7. Emergency first-aid kits (Coast Guard Approved) | 2 |
| 8. Emergency medical equipment (stretcher, blankets (2), oxygen mask and tank) | 1 |

PROTECTIVE CLOTHING (240 CU. FT.)

| | |
|---|---|
| 1. Chemical Goggles | 24 |
| 2. Face Shield | 12 |
| 3. Coveralls and Jackets (Full Body, Norton) | |
| Neoprene | 24 |
| Butyl Rubber | 12 |
| Fluoro-Elastomer | 12 |
| 4. Gloves (pairs) | |
| Neoprene | 24 |
| Butyl Rubber | 12 |
| Fluoro-Elastomer | 24 |
| EPR | 12 |
| Hypalon | 12 |

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* recommended inventory of indicator tubes:

Ammonia
Hydrocarbons
Acetone
Alcohol
Benzene
Carbon Disulfide
Carbon Monoxide
Chlorine
Formaldehyde
Monostyrene
Sulfur Dioxide
Toluene
Hydrogen Sulfide
Vinyl Chloride

TABLE 4-4. ESTIMATED EQUIPMENT REQUIREMENT FOR CHEMICAL SPILL RESPONSE VAN (Cont.)

| | | |
|---|---|---|
| | PLUGGING, PATCHING, REPAIR (3.0 CU. FT.) | |
| 1. | Plugging kit (bentonite, plugs, gasket material, straps) | 2 |
| | LIGHT SUPPORT EQUIPMENT (230 CU. FT.) | |
| 1. | Escape device, (Robertshaw 5-minute) | 12 |
| 2. | Tool kit | 2 |
| 3. | Reference Library | 1 |
| 4. | Portable shower | 1 |
| 5. | Eye shower | 1 |
| 6. | Decontamination support equipment | 1 set |

(1) Based on packing fraction of 0.25.

4.2.4 Offloading and Support Equipment

In addition to the basic response van, loaded with the equipment of Table 4-4, one or more auxiliary support vehicles may be dispatched. The primary such vehicle should carry offloading equipment, such as described in Table 4-5. If an offloading operation is called for, a selection of this equipment can be mounted on the 32 ft. low bed semitrailers (Model GPX-12-FS) currently located at the USCG Strike Team bases. These semitrailers are C130-air transportable.

Most chemical response missions do not call for an offloading operation by the Coast Guard team, because commercial, private or spiller resources are better able to perform the operation. The decision to commence unloading is usually reached several hours, or even days, after the first response personnel have arrived, because a substantial amount of information must be gathered before the decision can be made. Therefore, outside assistance will usually have arrived by the time it is decided to offload. For this reason USCG offloading equipment need not be dispatched immediately and routinely along with the basic spill response van previously described.

# 5. RESPONSE UNIT DEPLOYMENT

The major questions to be dealt with in this section are those of the locations and the numbers of USCG response units for hazardous chemical spills. The units under discussion are the response vans and offloading trailers described in the preceding section. The spill threat to be met is that described in Section 3.

## 5.1 METHODOLOGY

(a) A set of response base configurations will be selected for evaluation. Each configuration will consist of several bases at which one or more vans, trailers or both are stationed.

(b) Response time will be calculated for each configuration. The response time is the time from receipt at the base of a request for assistance to the time the first vehicle arrives at the spill site or other location designated by the OSC.

(c) Numbers of response vans and trailers required at each base will be calculated on the assumption that there are enough at each base to respond to 90 percent of the spills without delay.

(d) The various configurations will be compared in terms of number of sites, level of personnel, response times, and number of response units and an overall evaluation made.

## 5.2 BASE CONFIGURATIONS

A base configuration is a set of locations (assumed to be existing USCG installations) at which chemical spill response equipment and personnel are to be located. In addition to one or more response vans and/or trailers, the base must accommodate at least 20 men (who may also perform oil pollution response functions), as well as supporting staff, storage and repair facilities, etc. If the base is at or near one of the five USCG air stations at which C130B or C130H aircraft are based, then the equipment will be available for assistance well beyond the area normally served by the base.

chemical. (See Appendix C1.) These levels were selected to represent the average spill size normally warranting a U.S. Coast Guard response. These 'respondable' spills are tabulated by MSO/COTP area in Table 5-1. The corresponding MTB spills in 1976-79 are also shown. The breakdown by coastal region of these 'respondable' spills is compared with the same breakdown for all spills in Table 5-2. It is seen in Table 5-2 that while all PIRS spills are relatively evenly distributed, 'respondable' spills are more heavily concentrated in Districts 2 and 9, and less heavily concentrated in Districts 11, 12, 13. This concentration in the central U.S. is also seen in the distribution of MTB spills, Table 5-2. The restriction to 'respondable' spills improves the agreement between MTB and PIRS data; the rank correlation coefficient increases from .4 to .8 when that restriction is made on the data set. This suggests that the distribution of response capability by coastal area should be about 25 percent, 20 percent, 15 percent, 40 percent for Eastern, Gulf, Western, and Central areas, similar to Table 5-2.

An eleven-site configuration was obtained from the above percentages by assigning three sites to the East Coast, two sites to the Gulf Coast, two sites to the West Coast, and four sites to the Central U.S. Specific locations were obtained by identifying the sub-areas on each coast with high incidence of PIRS-recorded spills. Figures 5-1(a) through (d) show the counties of interest with encirclements of county groups having substantial numbers of spills in 1973-79.

<u>East Coast</u> (Figure 5.1(a)) - The major areas of spill activity have been (1) the greater New York-New Jersey region, (2) the Wilmington-Philadelphia-Trenton region, and (3) the western shore of the Chesapeake Bay (Norfolk to Baltimore). This suggests sites at New York, Philadelphia, and Washington, DC. The latter, however, can be replaced by the Elizabeth City Strike Team, which has the advantage of an air base.

<u>Gulf Coast</u> (Figure 5-1(b)) - The two Gulf Coast sites are New Orleans and Galveston-Houston.

<u>West Coast</u> (Figure 5-1(c)) - The two West Coast sites are best located at Los Angeles and San Francisco.

<u>Central U.S.</u> (Figure 5-1(d)) - The widespread spill pattern in the central U.S. makes adequate coverage difficult. The most direct approach places bases at

TABLE 5-1. RESPONDABLE SPILLS BY MSO/COTP PIRS (1973-79) AND MTB (1976-79) DATA (CONT.)

| CGD | MSO/COTP AREA | PIRS '73-'79 | MTB '76-'79 |
|---|---|---|---|
| 14 | MSO HONOLULU, HI | - | 1 |
| 17 | MSO ANCHORAGE, AK | - | 4 |
| 17 | MSO JUNEAU, AK | - | 0 |
| 17 | MSO VALDEZ, AK | - | 0 |
| 7 | MSO OLD SAN JUAN, PR | 7 | - |
| | | 667 | 491 |

correlation coefficient = .574.

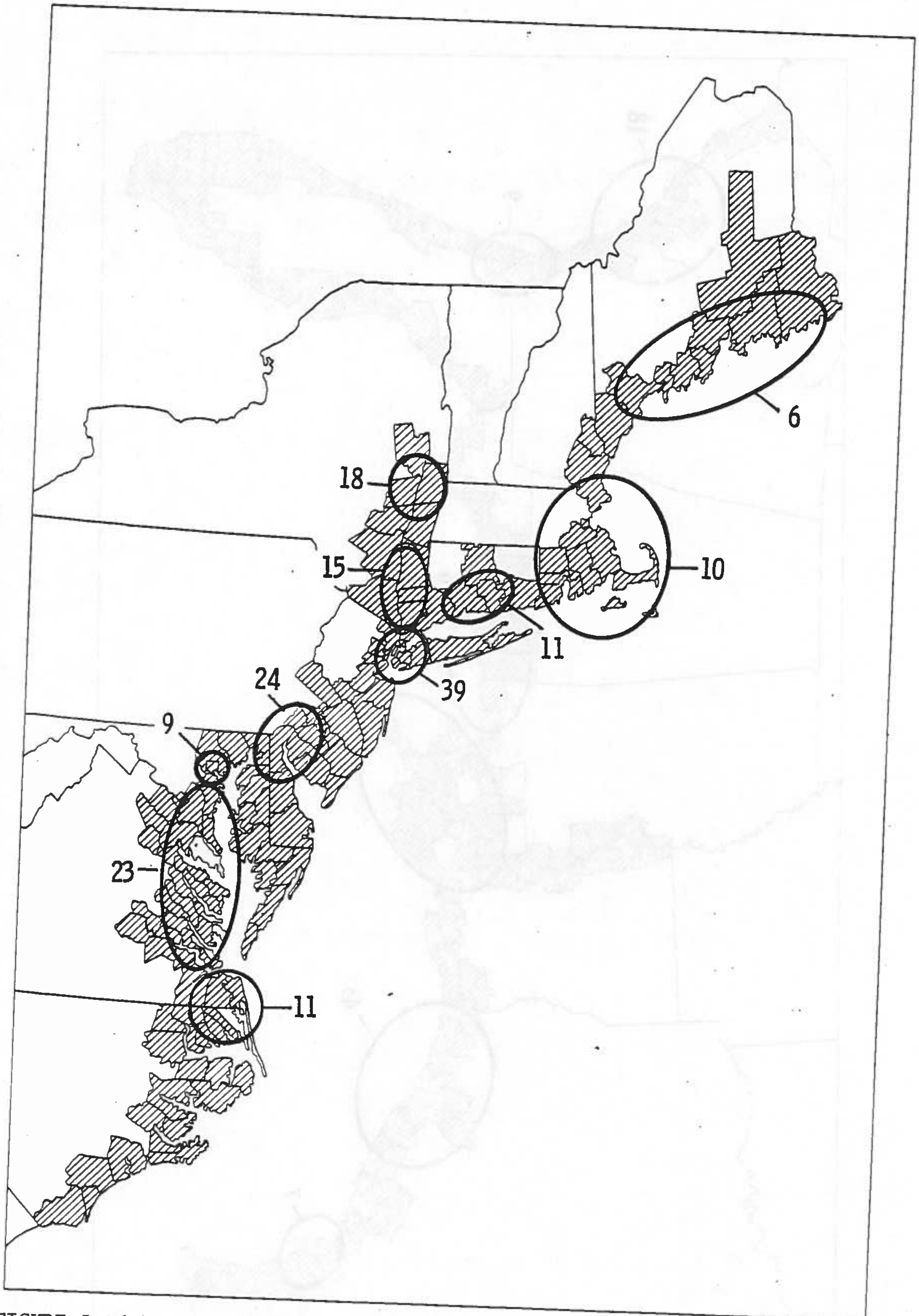


FIGURE 5-1(a). MAJOR AREAS OF CHEMICAL SPILLS, PIRS 1973-79, EAST COAST

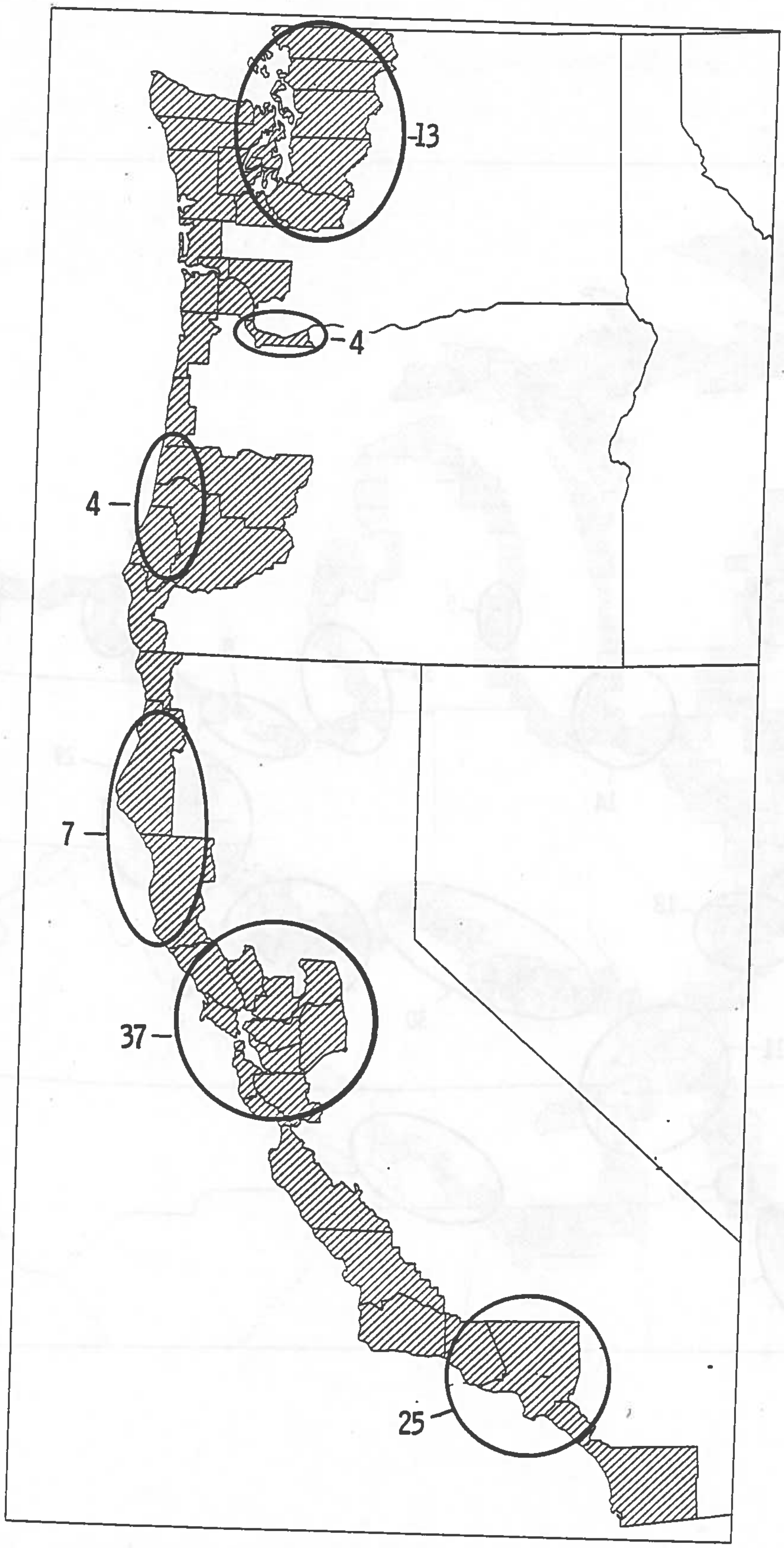


FIGURE 5-1(c). MAJOR AREAS OF CHEMICAL SPILL, PIRS 1973-79, WEST COAST

Detroit/Toledo, Pittsburgh, Cincinnati, and St. Louis. This leaves heavy spill areas such as Knoxville, Memphis, Chicago, and, primarily, Charleston, WV without direct coverage. Charleston WV, however, is less than 5 road hours from Cincinnati and Pittsburgh; also Chicago is less than 5 road hours from Toledo. But response times would be improved by placing one site at Cairo, IL (MSO Paducah, KY) rather than St. Louis, from which both St. Louis and Memphis are accessible in less than 4 road hours. Therefore, the four sites are selected at the MSO's: Toledo, Pittsburgh, Cincinnati, Paducah.

Table 5-3 shows the four candidate site configurations. The table also shows the Districts or OSC areas covered by each base.

## 5.3 RESPONSE TIMES

Response time is defined as the time from request by the OSC for assistance to arrival at the spill scene of the first van or offloading trailer, from the assigned response base. The response time for each configuration depends on the spill location relative to the base, and on the mode of transport, i.e., land or air. The mean response time for each base was determined by estimating the response time from the base to the respondable spills shown in Figure 5-1. The response times were weighted in proportion to the number of spills. The mode of transport was taken to be over-the-road, except for spills covered from one of the air bases [Elizabeth City, Hamilton AFB]. In those cases the air mode was assumed if it resulted in a lower response time to the spill.

The ground response time was calculated as (A + R/33.33) hours, where R is the great-circle distance from base to spill in nautical miles, and A is the sum of the following intervals:

| | | |
|---|---|---|
| 1. | Receipt of request, notification of CO | .25 hours |
| 2. | Assembly of team | .50 |
| 3. | Vehicle inspection and preparation | .25 |
| 4. | Team briefing | .25 |
| | A = | 1.25 hours |

This value of A assumes a pre-loaded response van.

The air response time was calculated as B + R/300 hours, where B is the sum of the following intervals:

from Elizabeth City, NC

| | | |
|---|---|---|
| 1. | Receipt of request | .25 hours |
| 2. | Aircraft requisition | .25 |
| 3. | Aircraft preparation (1.00 hr) | |
| 4. | Team assembly (.50 hr) | |
| 5. | Vehicle inspection (.25 hr) | |
| 6. | Maximum of 3., 4., 5. | 1.00 |
| 7. | Aircraft loading | .50 |
| 8. | Aircraft checkout, takeoff, landing, refuel, | .50 |
| | takeoff (over 1500 n.mi.) | 2.00 |
| 9. | Aircraft landing, taxi | .25 |
| 10. | Aircraft unloading | .50 |
| 11. | Travel to spill location | .50 |
| | B = | 3.75 |
| | = | 5.75 (over 1500 n.mi.) |

from Hamilton AFB, CA

| | | |
|---|---|---|
| 1. | Receipt of request | .25 |
| 2. | Aircraft requisition | .25 |
| 3. | Aircraft preparation, takeoff ferry to Hamilton AFB (1.75) | |
| 4. | Team assembly (.50) | |
| 5. | Van inspection (.25) | |
| 6. | Maximum of 3., 4., 5. | 1.75 |
| 7. | Aircraft loading | .50 |
| 8. | Aircraft checkout, takeoff | .50 |
| 9. | Aircraft landing, taxi | .25 |
| 10. | Aircraft unloading | .50 |
| 11. | Travel to spill location | .50 |
| | B = | 4.50 |

These response times are plotted in Figure 5-2. They apply to the off-loading trailers as well as to the chemical response vans, both being air transportable. It will be noticed that air transport is faster than land transport for distances greater than about 90 n.mi. from Elizabeth City, NC and for distances greater than about 125 n.mi from Hamilton AFB. In fact many remote locations are served more rapidly by air from Elizabeth City or Hamilton AFB, than by land from the nearest base.

The results of the response time calculations are shown in Table 5-4. As expected, the Strike Team Configuration has lower response times than the single-site, but the reduction in mean response time is only 5 percent, even though the number of bases is tripled. Moreover, the maximum response time increases to 18.8 hours from 13.3 hours. This is due to the land responses originating from Bay St. Louis, the longest of which are to Miami, FL and Brownsville, TX. Clearly, the single-site is competitive with the Strike Team Configuration because of the lower response times achievable by air from Elizabeth City, NC.

The 11-Site Configuration achieves the lowest mean response time of the four configurations. The striking aspect of this configuration is the large mean and maximum response times from Miami, FL. This is due in large part to responses from Miami to Savannah, GA and Jacksonville, FL areas. These spills are more expeditiously handled by air from Elizabeth City, NC in the single-site configuration.

The Modified 11-Site Configuration has a mean response time greater than the original 11-Site Configuration. The attempt to reduce response times by four sites placed in the Central U.S. (Districts 2 and 9) has actually resulted in longer response times. The reason is that land response from those four bases is longer than the air response from Elizabeth City, NC that they replaced. Another difficulty with the Modified 11-Site Configuration is the long response time from Bay St. Louis, which serves by land the large area formerly covered from Miami, FL.

One conclusion that emerges from the above comparisons is that areas in the Eastern U.S., more than 100-200 n.mi from a land base are usually reached more rapidly by air from Elizabeth City than from the land base. For example, the 79 spills serviced from Paducah, KY in the modified 11-Site Configuration are scattered along the lower and upper Mississippi from Memphis to St. Paul. The average response time by land from Paducah is 7.44 hours; but they can be reached from Elizabeth City by air in 5.07 hours or less, as seen in the Strike Team Configuration. The same is true of the lower eastern coast, from South Carolina to Florida, which require, on average, from 10 to 12 hours by land from Miami or Bay St. Louis, but which are reached by air from Elizabeth City in 5-6 hours.

A corollary of the above conclusion is that land-based response sites are most effective in areas of high spill density. This is seen, for example in Galveston, Long Beach, San Francisco, and Groton, NJ; these are areas of high spill density, with limited geographic extent because of adjacent land bases, as in the Modified 11-Site Configuration.

The above results suggest a means to improve the response times of the 11-Site Configuration, which has the lowest mean response time of the four candidates. This is done by eliminating the site at Miami, and servicing the area it covers by air from Elizabeth City, NC. The result is to reduce the mean response time for spills in Miami's area from 11.25 hours to 5.27 hours, and to reduce the mean response time for the entire configuration from 4.49 hours to 4.29 hours. A further improvement can be achieved by elimination of the Boston, Seattle and Kodiak sites, since their areas can be served by air without seriously affecting the mean response time. The statistics for the resulting 7-Site Configuration are given in Table 5-5. It is assumed in that Table that Elizabeth City provides response time for the 1st, 2nd, 9th, and 7th Districts, and for the 5th District below Baltimore. This table shows that a Seven-Site Configuration with air support is more effective than the 11-Site Configuration of Table 5-4.

A final improvement suggests itself in the Modified 11-Site Configuration. The Cincinnati and Paducah sites may be placed at Louisville and Huntington, and along with Pittsburgh and Toledo they are restricted to responses within about 100 n.miles of the site, the remaining area being covered by air from Elizabeth City, NC. The resultant response time statistics are shown in Table 5-6. This configuration is the same as the 7-Site Configuration except for the direct land coverage provided by the four Central sites within their immediate area. The Table (5-6) shows that this 11-Site Configuration with air support is not only superior in response time to the 7-Site Configuration with air support, but also the 11-Site Configuration of Table 5-4.

## 5.4 NUMBER OF RESPONSE UNITS

The response times calculated in the subsection above referred to the arrival of the first unit, usually a chemical response van. This van, as described in Section 4, is assumed to provide adequate support for a 20-man team. It is assumed that at the end of the response action at the site, the unit will

TABLE 5-6. MODIFIED 11-SITE CONFIGURATION WITH AIR - RESPONSE TIMES[(1)]

| NAME OF SITE (CITY) | RESPONDABLE SPILLS, '73-'79 (PIRS recs) | MEAN RESPONSE (hours) | MAXIMUM RESPONSE (hours) |
|---|---|---|---|
| MODIFIED 11-SITE CONFIGURATION WITH AIR | | | |
| New York, NY | 83 | 3.35 | 4.8 |
| Gloucester City, NJ | 33 | 2.70 | 3.6 |
| *Elizabeth City, NC | 211 | 5.26 | 6.9 |
| Bay St. Louis, MS | 40 | 3.64 | 5.2 |
| Galveston, TX | 52 | 3.58 | 9.1 |
| Long Beach, CA | 28 | 2.35 | 4.4 |
| *Hamilton AFB, CA | 66 | 3.74 | 6.5 |
| Pittsburgh, PA | 29 | 3.20 | 4.0 |
| Louisville, KY | 30 | 2.80 | 3.2 |
| Huntington, WV | 29 | 2.80 | 3.0 |
| Toledo, OH | 30 | 3.20 | 4.0 |
| | 631 | 3.93 | 9.1 |

(1) Response to Alaska, Hawaii, Puerto Rico and Virgin Islands not included.

*Response by air when a lower response time would result.

where:

$$K = \frac{r^n}{n!} \frac{r/n}{1-r/n}$$

$$S = \sum_{i=o}^{n} r^i/i!$$

$$r = \lambda/\mu = \lambda t$$

The probability P(r,n) is plotted in Figure 5-3 as a function of r. It shows the steady state probabilities of the spill demands exceeding the number of response units assigned to a site, as a function of the ratio of demand rate to service rate of a single unit. The probability goes to unity when that ratio equals the number of units available at the site. Stated another way: when the spill rate exceeds the combined service rate of all the units, the probability is unity that in the steady state there will be spills waiting for a free unit. The analysis can be refined by considering other than exponential distributions of the response cycle time, and by looking at the probabilities in the transient state, e.g., starting from no units out on call. These refinements are considered unnecessary at the present level of analysis and with the present accuracy of data.

### 5.4.2 Application of the Analysis

In order to employ Figure 5-3 a value must be assigned to r, the ratio of spill rate to (single unit) response rate. The rate at which spills can be expected to occur in the area covered by a site can be deduced from the PIRS spill data. Only 'respondable' incidents will be taken account of (See Section 5.2 and Table 5-1). The respondable spills per year for the entire U.S. are plotted in Figure 5-4, both as a percent of all spills listed in PIRS for 1973-79 and as a percent of only those spills in PIRS for 1973-79 that have an entry in the data field for quantity released. It is seen that, in both cases, the percent of spills above 'respondable' levels shows a smoothly diminishing increase from 1974 to 1978. This is not unlike the behavior of the total PIRS spill rate, Figure 3-4. It is difficult to conceive of a mechanism whereby the occurrence of larger spills would increase relative to spills of all sizes in a fashion so similar to the increase in overall spill history. The explanation may lie in a real increase in 'respondable' spills, or in a reporting anomaly. In either case the latter four years are more representative of the rate of 'respondable' spill occurrences in the next few years, than are the first three years shown in

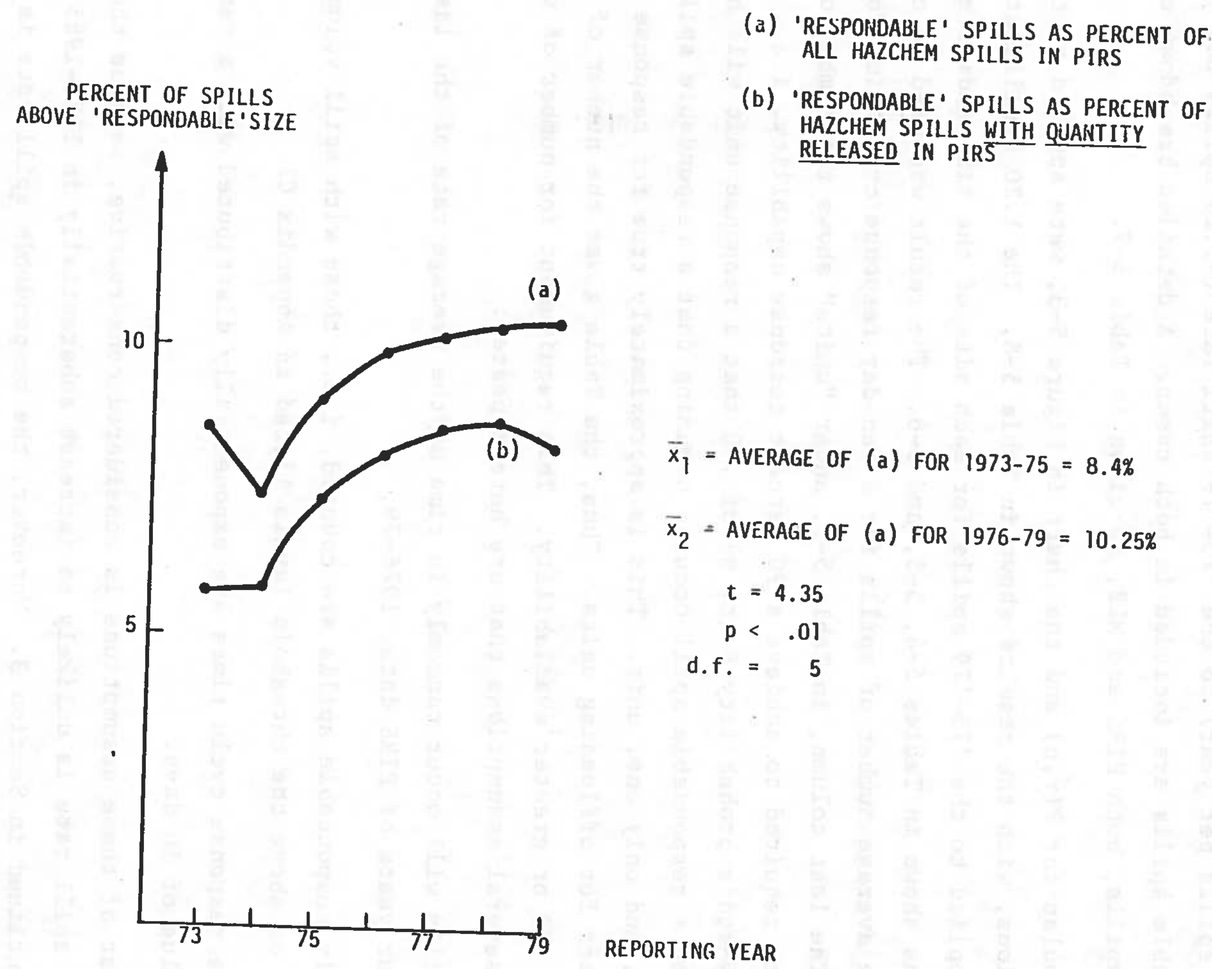


FIGURE 5-4. RESPONDABLE SPILLS IN PIRS, 1973-79

TABLE 5-7. BREAKDOWN BY YEAR AND USCG DISTRICT OF PIRS AND MTB 'RESPONDABLE' SPILLS

| SPILL YEAR | DT 01 | DT 03 | DT 05 | RG EC | DT 07 | DT 08 | RG GC | DT 11 | DT 12 | DT 13 | RG WC | DT 02 | DT 09 | RG IG | DT 14 | DT 17 | RG AP | ALL TOTAL | DATA BASE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1976 | 4 | 14 | 7 | 25 | 3 | 9 | 12 | 2 | 4 | 4 | 10 | 34 | 22 | 56 | 0 | 1 | 1 | 104 | MTB |
| 1977 | 2 | 18 | 6 | 26 | 5 | 18 | 23 | 9 | 6 | 7 | 22 | 33 | 20 | 53 | 0 | 3 | 3 | 127 | MTB |
| 1978 | 6 | 15 | 5 | 26 | 4 | 17 | 21 | 6 | 3 | 20 | 29 | 31 | 27 | 58 | 1 | 0 | 1 | 135 | MTB |
| 1979 | 2 | 11 | 4 | 17 | 6 | 18 | 24 | 8 | 11 | 9 | 28 | 37 | 19 | 56 | 0 | 0 | 0 | 125 | MTB |
| TOTAL | 14 | 58 | 22 | 94 | 18 | 62 | 80 | 25 | 24 | 40 | 89 | 135 | 88 | 223 | 1 | 4 | 5 | 491 | |
| X | 3.50 | 14.50 | 5.50 | 23.50 | 4.50 | 15.50 | 20.00 | 6.25 | 6.00 | 10.00 | 22.25 | 33.75 | 22.00 | 55.75 | 0.25 | 1.00 | 1.25 | 122.75 | |
| S.D. | 1.91 | 2.89 | 1.29 | 4.36 | 1.29 | 4.36 | 5.48 | 3.10 | 3.56 | 6.98 | 8.73 | 2.50 | 3.56 | 2.06 | 0.50 | 1.41 | 1.26 | 13.23 | |
| 1973 | 2 | 13 | 0 | 15 | 8 | 7 | 15 | 2 | 5 | 2 | 9 | 11 | 7 | 18 | 0 | 0 | 0 | 57 | PIRS |
| 1974 | 1 | 10 | 5 | 16 | 4 | 15 | 19 | 3 | 2 | 1 | 6 | 14 | 10 | 24 | | | | 65 | PIRS |
| 1975 | 1 | 16 | 3 | 20 | 7 | 9 | 16 | 6 | 12 | 2 | 20 | 22 | 9 | 31 | | | | 87 | PIRS |
| 1976 | 2 | 10 | 7 | 19 | 3 | 14 | 17 | 10 | 8 | 7 | 25 | 39 | 16 | 55 | | | | 116 | PIRS |
| 1977 | 3 | 18 | 16 | 37 | 8 | 17 | 25 | 2 | 9 | 4 | 15 | 38 | 11 | 49 | | | | 126 | PIRS |
| 1978 | 6 | 23 | 8 | 37 | 4 | 20 | 24 | 5 | 7 | 2 | 14 | 29 | 11 | 40 | | | | 115 | PIRS |
| 1979 | 1 | 19 | 11 | 31 | 8 | 14 | 22 | 0 | 2 | 4 | 6 | 35 | 7 | 42 | | | | 101 | PIRS |
| TOTAL | 16 | 109 | 50 | 175 | 42 | 96 | 138 | 28 | 45 | 22 | 95 | 188 | 71 | 259 | 0 | 0 | 0 | 667 | 7 years |
| X | 2.29 | 15.57 | 7.14 | 25.00 | 6.00 | 13.71 | 19.71 | 4.00 | 6.43 | 3.14 | 13.57 | 26.86 | 10.14 | 37.00 | 0 | 0 | 0 | 95.29 | |
| S.D. | 1.80 | 4.86 | 5.27 | 9.71 | 2.24 | 4.46 | 3.99 | 3.32 | 3.69 | 2.04 | 7.18 | 11.42 | 3.08 | 13.34 | 0 | 0 | 0 | 26.60 | |
| TOTAL | 12 | 70 | 42 | 124 | 23 | 65 | 88 | 17 | 26 | 17 | 60 | 141 | 45 | 186 | 0 | 0 | 0 | 458 | 4 years |
| X | 3.00 | 17.50 | 10.50 | 31.00 | 5.75 | 16.25 | 22.00 | 4.25 | 6.50 | 4.25 | 15.00 | 35.25 | 11.25 | 46.50 | 0 | 0 | 0 | 114.50 | |
| S.D. | 2.16 | 5.45 | 4.04 | 8.49 | 2.63 | 2.87 | 3.56 | 4.35 | 3.11 | 2.06 | 7.79 | 4.50 | 3.69 | 6.86 | 0 | 0 | 0 | 10.28 | |

TABLE 5-8. PROBABILITY P(r,n) OF NON-RESPONSE FOR SITE CONFIGURATIONS OF TABLES 5-4, 5-5, 5-6 (CONT.)

| SITE NAME | SPILLS PER 10 DAYS r | Probability of Non-Response for n = 1 | 2 | 3 | 4 | 5 | 6 | UNITS (1) |
|---|---|---|---|---|---|---|---|---|
| **SEVEN-SITE CONFIGURATION** | | | | | | | | |
| New York, NY | .39 | 0.160 | 0.013 | 0.001 | | | | 2 |
| Gloucester City, NJ | .15 | 0.023 | | | | | | 1 |
| Elizabeth City, NC | 1.55 | 1.000 | 0.510 | 0.130 | 0.034 | 0.007 | 0.002 | 4 |
| Bay St. Louis, MS | .19 | 0.039 | 0.002 | | | | | 1 |
| Galveston, TX | .24 | 0.060 | 0.003 | | | | | 1 |
| Long Beach, CA | .13 | 0.017 | | | | | | 1 |
| Hamilton AFB, CA | .31 | 0.095 | 0.007 | | | | | 1* |
| | 2.96 | | | | | | | 11 |
| **MODIFIED 11-SITE CONFIGURATION WITH AIR** | | | | | | | | |
| New York, NY | .39 | 0.160 | 0.013 | 0.001 | | | | 2 |
| Gloucester City, NJ | .15 | 0.023 | | | | | | 1 |
| Elizabeth City, NC | .99 | 1.00 | 0.170 | 0.029 | 0.005 | | | 3 |
| Bay St. Louis, MS | .19 | 0.039 | 0.002 | | | | | 1 |
| Galveston, TX | .24 | 0.060 | 0.003 | | | | | 1 |
| Long Beach, CA | .13 | 0.017 | | | | | | 1 |
| Hamilton AFB, CA | .31 | 0.095 | 0.007 | | | | | 1* |
| Pittsburgh, PA | .14 | 0.020 | | | | | | 1 |
| Louisville, KY | .14 | 0.020 | | | | | | 1 |
| Huntington, WV | .14 | 0.020 | | | | | | 1 |
| Toledo, OH | .14 | 0.020 | | | | | | 1 |
| | 2.96 | | | | | | | 14 |

(1) Number of response units required for probability of non-response .10 or less.

*Adding one more unit at the site will reduce probability of non-response to .05 or less.

is assumed that all vans will be similarly equipped, for several reasons. First, uniform furbishing simplifies training, e.g., by making it possible to produce a single training manual for all sites. Further, a single van layout can lead to economies in purchasing, since all van purchases can be grouped into a single procurement, thus reducing the per unit contractual cost, and gaining the advantage of wider competitive bidding. Finally, uniform equipment arrangement in the van improves the safety of a response operation by making it easier to identify pieces of equipment and to detect lost or expended items rapidly.

(2) Personnel Costs: It is assumed that at single-van sites chemical response will be performed by a team of fixed composition (about 20). At low intensity sites (i.e., sites at which respondable spills are less than, say, one per month) most of these personnel will have other duties as well as chemical spill response. For example, the 20-man team at one of the 11 pollution response bases will have oil spill response duties as well as chemical spill response duties. If the site is not a general pollution response site, these other duties will lie in other mission areas.

At sites housing more than one chemical response van , each additional van is assumed to require an additional team. These teams must be distinct, i.e., two part-time teams cannot be combined into one full-time team, for then the number of teams, rather than the number of vans, would be the limiting factor in response availability; an analysis identical to that above for vans would lead to the same numerical requirements for teams.

Therefore, in either the single-van or multiple-van case, the personnel complement is assumed to be proportional to the number of vans.

(3) Storage areas, repair facilities: In these cases, the true cost may be non-linear with the number of vehicles, since there is often an overhead incurred with the establishment of the garage or repair shop. In some cases, the storage facilities already exist, or can be rented at a per-square-foot cost, thus leading to no cost or to proportional costs. Given the spectrum of possibilities, the proportionality assumption cannot be considered conservative or non-conservative.

(4) Replacement costs: It is assumed that use life is time-dependent rather than use-dependent. This may not be accurate for one of the major cost items, encapsulating suits, because of the build-up of chemical contaminants.

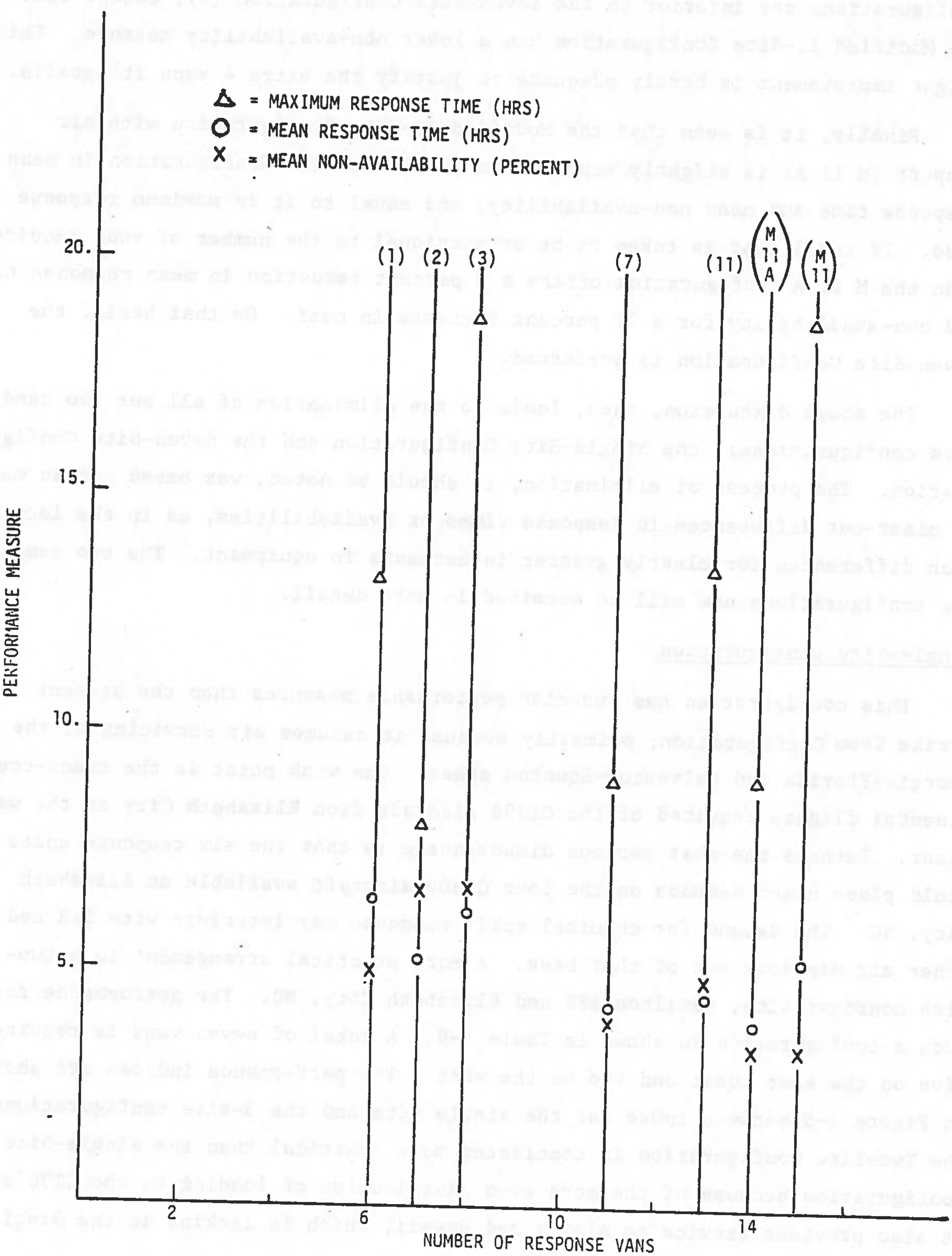


FIGURE 5-5. PERFORMANCE MEASURES FOR SITE CONFIGURATIONS

TABLE 5-9. TWO-SITE CONFIGURATION (1)

RESPONSE TIMES

| NAME OF SITE (CITY) | RESPONDABLE SPILLS, '73-'79 PIRS | MEAN RESPONSE (hours) | MAXIMUM RESPONSE (hours) |
|---|---|---|---|
| *Elizabeth City, NC | 537 | 5.45 | 8.1 |
| *Hamilton AFB, CA | 94 | 4.27 | 6.5 |
| | 631 | 5.27 | 8.1 |

PROBABILITY OF NON-RESPONSE

| | SPILLS PER 10 DAYS | Probability of Non-Response for 1 | 2 | 3 | 4 | 5 | 6 | Units |
|---|---|---|---|---|---|---|---|---|
| *Elizabeth City, NC | 2.52 | 1.00 | 1.000 | .60 | .22 | .075 | .023 | 5 |
| *Hamilton AFB, CA | .44 | 0.20 | 0.017 | | | | | 2 |
| | 2.96 | | | | | | | |

(1) Response times do not include Alaska, Hawaii or Puerto Rico.

*Response by air when lower response times result.

B: Contract to Two Air Sites: If resources are too limited to allow implementation of 7 sites, then an improved capability can still be acquired by strengthening the air capability to deliver hazchem response equipment on each coast. This will achieve reduced response times by expanding the area covered by Elizabeth City to include the entire eastern U.S. This configuration calls for 5 units at Elizabeth City and 2 at Hamilton AFB.

The total number of vans called for in either course is based on the 1976-1979 PIRS 'respondable' spill rate as defined in Appendix C1. This rate is slightly above that actually observed but may be closer to what will occur when the full Coast Guard capability is realized, and they are called upon in a wider variety of situations. As experience is gained, a more accurate estimate may be made of the respondable spill rate and the mean response cycle time, and the number of vans required reestimated.

# 6. CONCLUSIONS AND RECOMMENDATIONS

## CONCLUSIONS

The study was directed to U.S. coastal and waterway counties and to hazardous substances other than non-flammable oils. The three steps of the methodology produced the results summarized here in qualitative form, detailed data being contained in the Sections indicated:

Assess the Non-USCG Capability for Hazardous Chemical Spill Response (Section 2)

1. Because the assessment was not based on a comprehensive survey, the potential for error is great. The error is estimated to be -50% and +100%. The results relative to the U.S. Coast Guard are:

- o EPA's strongest capability is in technical advice and detection and identification equipment.
- o DOD has substantial equipment at its various bases for response to fire, Nuclear/Bacteriological/Chemical releases, for fuel handling and for explosion control.
- o Local governments are usually well equipped for fire and communications, but lack most other resources.
- o The Chlorine Emergency Plan (CHLOREP), the National Agricultural Chemicals Association (NACA), and other trade organizations as well as the manufacturers themselves provide extensive response capability for specific chemicals.
- o Chemical offloading equipment, such as pumps, trucks, and tanks appeared in few numbers in the survey, but a few commercial firms have large fleets of offloading vehicles.

2. The Spill Cleanup Inventory System (SKIM) provided about 25% of the total survey list. It is weak in chemical response gear and especially deficient in protective gear. A sample of the SKIM list shows it to contain about 5% of the protective clothing and breathing apparatus in the First District.

3. Over half of the protective gear and instrumentation in the survey is contained in the coastal and waterway counties. But a more specific

Determine the Types, Quantities and Locations of U.S. Coast Guard Equipment Required to Respond to Spills of Hazardous Chemicals

TYPES (Section 4)

1. An analysis of historical 'respondable' spills showed that 78% of them called for Self-Contained Breathing Apparatus, 57% needed neoprene protective splash suits, and 17% neoprene boots and gloves.

2. A complement of equipment for a 20-man response team comprising instrumentation, protective clothing, respiratory equipment, communications, and light support equipment, occupies about 1100 cubic feet, weighs about 12,000 lbs and can be fit into a single van that can be transported by a Coast Guard C130 aircraft.

3. A selection of offloading equipment can be made that fits onto a 32 ft, air transportable, low bed semi-trailer of the type currently used by the Coast Guard for oil spill response.

NUMBER AND LOCATION (Section 5)

1. Air-based Strike Teams at Elizabeth City, NC and Hamilton AFB, CA alone provide more rapid response than when a third Strike Team serves the 7th and 8th Districts by land from Bay St. Louis. (Table 5-9, Two-Site Configuration compared to Table 5-4, Strike-Team Configuration.)

2. Hazchem spills in the Central U.S. are reached more rapidly by air from Elizabeth City, NC, than by land from Toledo, OH, Pittsburgh, PA, Cincinatti, OH and Paducah, KY. (Table 5-5, Seven-Site Configuration compared with Table 5-4, Modified 11-Site Configuration.)

3. The response times for the seven configurations evaluated are (Tables 5-4, 5-5, 5-6, 5-9):

| (#) Configuration | Response Times (hours) Mean | Maximum |
|---|---|---|
| (1) Single-Site | 6.58 | 13.3 |
| (2) Two-Site | 5.27 | 8.1 |
| (3) Strike Team | 6.24 | 18.8 |
| (4) Seven-Site | 4.32 | 9.1 |
| (5) 11-Site | 4.49 | 13.3 |
| (6) Modified 11-Site | 5.34 | 18.8 |
| (7) Modified 11-Site with Air | 3.93 | 9.1 |

- Expansion to the full 11 units called for in the Seven-Site Configuration, contingent on the actual experience regarding (a) respondable spill rate, and (b) response cycle time.

- Addition of 4 sites in Central U.S., at Toledo, Pittsburgh, Huntington and Louisville, yielding the Modified 11-Site Configuration.

Offloading units are not included in the above outline, but it is suggested that initially one offloading semi-trailer be stationed at each of the two air bases. Contingent on the demand for, and experience in their use, additional semi-trailers would be stationed at (in order): New York, Galveston, Bay St. Louis, and Elizabeth City. An additional requirement for deploying the offloading units to any site is that tractor(s) have already been stationed at the site for oil pollution response or other duty.

4. If expansion of the present site configuration is not possible within available funds, then it is recommended that the air response capability still be developed, with the objective of the Two-Site Configuration of Table 5-9. This Configuration provides relatively good response and availability with only 7 units. The stages suggested are:

- Development of air response capability with two units at Elizabeth City and one at Hamilton AFB. The present Gulf Strike Team would be retained.

- Addition of two more units at Elizabeth City and one more at Hamilton AFB, still converting the Bay St. Louis unit to air-transportable form.

- Transfer of the Gulf Strike Team unit to Elizabeth City.

Offloading semi-trailers would be phased in at Elizabeth City (2 units) and Hamilton AFB (1 unit).

5. If air transport capability is not available for the hazchem response equipment, then the first recommended objective is the Modified 11-Site Configuration. The response times for 15 units, shown in Table 5-8 and 5-4, however, will not be achieved. To bring response times down to the levels of the seven configurations shown in Table 5-4 would require expansion to more than 11 sites and, probably, more than 15 units. This course of action has not been investigated in detail because it is considered to be less cost-effective than development of an air-response capability.

# REFERENCES


1. Report Number CG-D-14-79, "Deployment Requirements for U.S. Coast Guard Pollution Response Equipment," U.S. Department of Transportation, Research and Special Projects Administration, Transportation Systems Center, Cambridge, MA 02142, February 1979.

2. CG-450, "Pollution Incident Reporting System, Coding Instruction Manual," February 1976, Department of Transportation, Coast Guard.

3. Report No. CG-123-1, Project Memorandum, CG-123, "Analysis of Hazardous Chemical Spills along the Coasts and Major Waterways of the United States," U.S. Department of Transportation, Research and Special Projects Administration, Transportation Systems Center, Cambridge, MA 02142.

4. Report No. CG-123-2, "Hazardous Material Pollution Response Resource Assessment," U.S. Department of Transportation, Research and Special Projects Administration, Transportation Systems Center, Cambridge, MA, 02142.

5. Report No. CG-023-1, Project Memorandum, CG -23, "Interim Report on Coast Guard Related Chemical Spill Data," September 1980, U.S. Department of Transportation, Research and Special Projects Administration, Transportation Systems Center, Cambridge, MA 02142.

6. "Program Plan for the USCG Marine Environmental Protection Program, FY83-92", G-WEP-1, February 1980.

7. "Survey of Personnel Protective Clothing and Respiratory Apparata for use by Coast Guard Personnel in Response to Discharges of Hazardous Chemicals," W.M. Hammer, et.al., U.S. Coast Guard Report No. CG-D-89-75, September 1974. NTIS AD A010110.

8. "Policy Guidance for Response to Hazardous Chemical Discharges," U.S. Coast Guard COMDTINST 16465.16, 16 May 1979.

9. "Responding to Casualties of Ships Bearing Hazardous Cargoes", Marine Board, Assembly of Engineering, National Research Council, National Academy of Sciences, Washington DC, 1979, AD-A075203.

10. "Recommended System for the Identification of Fire Hazards of Materials, NFPA No. 704M". National Fire Protection Association, Boston MA, 02210.

# APPENDIX A

## DEFINITION OF AREA FOR HAZARDOUS CHEMICAL RESPONSE STUDY

The study area definition was evolved from consultation with the Coast Guard and from computational considerations. It was decided to limit the study to coastal regions, major "navigable waterways," and the Great Lakes. As a working definition of "navigable waters," it was decided to take all waterways of nine or more feet in depth, with substantial commerce. As an indicator of "substantial commerce", a minimum annual petroleum movement of 1,000,000 short tons was adopted. The resulting waterways are listed in Table A-1.

In order to clearly define the shorelines adjacent to coasts, waterways and the Great Lakes, it was found to be most practical to employ the boundaries of the counties contiguous to the shorelines. County data are easily obtained from the HMIR spill records and can be determined from the latitude and longitude given in the PIRS data base. Moreover, county boundaries for all counties in the U.S., are available in computerized form at the Transportation Systems Center, where they have been plotted on maps of the continental United States. Although the data base provided information on spills which have occurred in Alaska, Hawaii, Puerto Rico and the Virgin Islands, maps for these areas were not produced.

In summary, then, the study area was taken to be all counties adjoining the East, West and Gulf coasts, "navigable waterways of substantial commerce," the Great Lakes, and the costs of Alaska, Hawaii, Puerto Rico and the Virgin Islands.

This Appendix gives the names of the selected waterways, gives the number of counties found in each Coast Guard district, and gives the name of each Coast Guard-related county. Figure A-1 is a map of the continental United States, showing in outline, state boundaries and each county relevant to the study. (Actual spill maps appear in Section 3. Table A-2 shows the number of coastal counties in each Coast Guard District. Table A-3 is a complete list of the coastal and waterway counties defining the study area. Each was given a 5-digit code, according to the scheme shown at the front of the Table in parentheses.

4. Texas City channel, TX

5. Mississippi River, Baton Rouge to the Sea, LA

Great Lakes Waterways and Rivers

1. Chicago Sanitary and Ship Canal, Lockport, IL to Lake Michigan

West Coast Waterways and Rivers

1. San Francisco Bay, Suisan Bay Channel, Carquinez Strait, Marie Island Strait, San Pablo Bay, San Jaoquin River (mouth to Stockton, CA), Oakland, Richmond, CA

2. Columbia River, mouth to Portland, OR

3. Puget Sound (Tacoma and Seattle, WA).

The above rivers and waterways are in addition to coastal and Great Lakes ports and harbors, the Alaskan Coast, and coastal waters of: Hawaii, Puerto Rico, and the Virgin Islands.

TABLE A-2 COAST GUARD RELATED COUNTIES

| C.G. DISTRICT NO. | NUMBER OF COUNTIES |
|---|---|
| 1 | 24 |
| 2 | 209 |
| 3 | 44 |
| 5 | 70 |
| 7 | 43 |
| 8 | 62 |
| 9 | 84 |
| 11 | 4 |
| 12 | 18 |
| 13 | 25 |
| 14 | 4 |
| 17 | 25 |
| TOTAL | 612 |

## COAST GUARD RELATED COUNTY CODE



| T.S.C. CODE | ST CD | ST AB | CO CD | COUNTY NAME | CG DT |
|---|---|---|---|---|---|
| 10000 | | | | COASTAL AND COAST WTRWAY | |
| 11000 | | | | ATLANTIC COAST + WTRWAY | |
| 11001 | 23 | ME | 029 | WASHINGTON | 01 |
| 11002 | 23 | ME | 009 | HANCOCK | 01 |
| 11003 | 23 | ME | 019 | PENOBSCOT | 01 |
| 11004 | 23 | ME | 027 | WALDO | 01 |
| 11005 | 23 | ME | 013 | KNOX | 01 |
| 11006 | 23 | ME | 015 | LINCOLN | 01 |
| 11007 | 23 | ME | 023 | SAGADAHOC | 01 |
| 11008 | 23 | ME | 005 | CUMBERLAND | 01 |
| 11009 | 23 | ME | 031 | YORK | 01 |
| 11010 | 33 | NH | 017 | STRAFFORD | 01 |
| 11011 | 33 | NH | 015 | ROCKINGHAM | 01 |
| 11012 | 25 | MA | 009 | ESSEX | 01 |
| 11013 | 25 | MA | 025 | SUFFOLK | 01 |
| 11014 | 25 | MA | 021 | NORFOLK | 01 |
| 11015 | 25 | MA | 023 | PLYMOUTH | 01 |
| 11016 | 25 | MA | 001 | BARNSTABLE | 01 |
| 11017 | 25 | MA | 019 | NANTUCKET | 01 |
| 11018 | 25 | MA | 007 | DUKES | 01 |
| 11019 | 25 | MA | 005 | BRISTOL | 01 |
| 11020 | 44 | RI | 005 | NEWPORT | 01 |
| 11021 | 44 | RI | 001 | BRISTOL | 01 |
| 11022 | 44 | RI | 007 | PROVIDENCE | 01 |
| 11023 | 44 | RI | 003 | KENT | 01 |
| 11024 | 44 | RI | 009 | WASHINGTON | 01 |
| 11025 | 09 | CT | 011 | NEW LONDON | 03 |
| 11026 | 09 | CT | 007 | MIDDLESEX | 03 |
| 11027 | 09 | CT | 009 | NEW HAVEN | 03 |
| 11028 | 09 | CT | 003 | HARTFORD | 03 |
| 11029 | 09 | CT | 001 | FAIRFIELD | 03 |
| 11030 | 36 | NY | 005 | BRONX | 03 |
| 11031 | 36 | NY | 119 | WESTCHESTER | 03 |
| 11032 | 36 | NY | 087 | ROCKLAND | 03 |
| 11033 | 36 | NY | 079 | PUTNAM | 03 |
| 11034 | 36 | NY | 071 | ORANGE | 03 |
| 11035 | 36 | NY | 027 | DUTCHESS | 03 |
| 11036 | 36 | NY | 111 | ULSTER | 03 |
| 11037 | 36 | NY | 039 | GREENE | 03 |
| 11038 | 36 | NY | 021 | COLUMBIA | 03 |
| 11039 | 36 | NY | 001 | ALBANY | 03 |
| 11040 | 36 | NY | 083 | RENSSELAER | 03 |
| 11041 | 36 | NY | 091 | SARATOGA | 03 |
| 11042 | 36 | NY | 103 | SUFFOLK | 03 |
| 11043 | 36 | NY | 059 | NASSAU | 03 |
| 11044 | 36 | NY | 081 | QUEENS | 03 |
| 11045 | 36 | NY | 047 | KINGS | 03 |
| 11046 | 36 | NY | 061 | NEW YORK | 03 |
| 11047 | 36 | NY | 085 | RICHMOND | 03 |
| 11048 | 34 | NJ | 003 | BERGEN | 03 |
| 11049 | 34 | NJ | 017 | HUDSON | 03 |
| 11050 | 34 | NJ | 013 | ESSEX | 03 |
| 11051 | 34 | NJ | 039 | UNION | 03 |
| 11052 | 34 | NJ | 023 | MIDDLESEX | 03 |

| T.S.C. CODE | ST CD | ST AP | CO CD | COUNTY NAME | CG DT |
|---|---|---|---|---|---|
| 11108 | 51 | VA | 087 | HENRICO (= 087 + 760 ) | 05 |
| 11109 | 51 | VA | 760 | RICHMOND CITY | 05 |
| 11110 | 51 | VA | 041 | CHESTERFIELD | 05 |
| 11111 | 51 | VA | 149 | PRINCE GEORGE | 05 |
| 11112 | 51 | VA | 181 | SURRY | 05 |
| 11113 | 51 | VA | 093 | ISLE OF WIGHT | 05 |
| 11114 | 51 | VA | 695 | NANSEMOND (= OLD 123) | 05 |
| 11115 | 51 | VA | 710 | NORFOLK (=710+550+740) | 05 |
| 11116 | 51 | VA | 550 | CHESAPEAKE | 05 |
| 11117 | 51 | VA | 740 | PORTSMOUTH | 05 |
| 11118 | 51 | VA | 810 | VIRGINIA BEACH | 05 |
| 11119 | 37 | NC | 053 | CURRITUCK | 05 |
| 11120 | 37 | NC | 029 | CAMDEN | 05 |
| 11121 | 37 | NC | 139 | PASQUOTANK | 05 |
| 11122 | 37 | NC | 143 | PERQUIMANS | 05 |
| 11123 | 37 | NC | 041 | CHOWAN | 05 |
| 11124 | 37 | NC | 073 | GATES | 05 |
| 11125 | 37 | NC | 091 | HERTFORD | 05 |
| 11126 | 37 | NC | 015 | BERTIE | 05 |
| 11127 | 37 | NC | 187 | WASHINGTON | 05 |
| 11128 | 37 | NC | 177 | TYRRELL | 05 |
| 11129 | 37 | NC | 055 | DARE | 05 |
| 11130 | 37 | NC | 095 | HYDE | 05 |
| 11131 | 37 | NC | 013 | BEAUFORT | 05 |
| 11132 | 37 | NC | 137 | PAMLICO | 05 |
| 11133 | 37 | NC | 049 | CRAVEN | 05 |
| 11134 | 37 | NC | 031 | CARTERET | 05 |
| 11135 | 37 | NC | 133 | ONSLOW | 05 |
| 11136 | 37 | NC | 141 | PENDER | 05 |
| 11137 | 37 | NC | 129 | NEW HANOVER | 05 |
| 11138 | 37 | NC | 019 | BRUNSWICK | 05 |
| 13000 | | | | ATL + GULF CSTL + WTRWAY | |
| 13001 | 45 | SC | 051 | HORRY | 07 |
| 13002 | 45 | SC | 043 | GEORGETOWN | 07 |
| 3003 | 45 | SC | 019 | CHARLESTON | 07 |
| 3004 | 45 | SC | 029 | COLLETON | 07 |
| 3005 | 45 | SC | 013 | BEAUFORT | 07 |
| 3006 | 45 | SC | 053 | JASPER | 07 |
| 3007 | 13 | GA | 051 | CHATHAM | 07 |
| 3008 | 13 | GA | 029 | BRYAN | 07 |
| 3009 | 13 | GA | 179 | LIBERTY | 07 |
| 3010 | 13 | GA | 191 | MCINTOSH | 07 |
| 3011 | 13 | GA | 127 | GLYNN | 07 |
| 3012 | 13 | GA | 039 | CAMDEN | 07 |
| 3013 | 12 | FL | 089 | NASSAU | 07 |
| 3014 | 12 | FL | 031 | DUVAL | 07 |
| 3015 | 12 | FL | 109 | ST. JOHNS | 07 |
| 3016 | 12 | FL | 035 | FLAGLER | 07 |
| 3017 | 12 | FL | 127 | VOLUSIA | 07 |
| 3018 | 12 | FL | 009 | BREVARD | 07 |
| 3019 | 12 | FL | 061 | INDIAN RIVER | 07 |
| 3020 | 12 | FL | 111 | ST. LUCIE | 07 |
| 3021 | 12 | FL | 085 | MARTIN | 07 |
| 3022 | 12 | FL | 099 | PALM BEACH | 07 |
| 3023 | 12 | FL | 011 | BROWARD | 07 |

| T.S.C. CODE | ST CD | ST AP | CO CD | COUNTY NAME | CG DT |
|---|---|---|---|---|---|
| 13079 | 48 | TX | 039 | BRAZORIA | 08 |
| 13080 | 48 | TX | 321 | MATAGORDA | 08 |
| 13081 | 48 | TX | 239 | JACKSON | 08 |
| 13082 | 48 | TX | 057 | CALHOUN | 08 |
| 13083 | 48 | TX | 469 | VICTORIA | 08 |
| 13084 | 48 | TX | 391 | REFUGIO | 08 |
| 13085 | 48 | TX | 007 | ARANSAS | 08 |
| 13086 | 48 | TX | 409 | SAN PATRICIO | 08 |
| 13087 | 48 | TX | 355 | NUECES | 08 |
| 13088 | 48 | TX | 273 | KLEBERG | 08 |
| 13089 | 48 | TX | 261 | KENEDY | 08 |
| 13090 | 48 | TX | 489 | WILLACY | 08 |
| 13091 | 48 | TX | 061 | CAMERON | 08 |
| 15000 | | | | PACIFIC COAST + WATERWAY | |
| 15001 | 06 | CA | 073 | SAN DIEGO | 11 |
| 15002 | 06 | CA | 059 | ORANGE | 11 |
| 15003 | 06 | CA | 037 | LOS ANGELES | 11 |
| 15004 | 06 | CA | 111 | VENTURA | 11 |
| 15005 | 06 | CA | 083 | SANTA BARBARA | 12 |
| 15006 | 06 | CA | 079 | SAN LUIS OBISPO | 12 |
| 15007 | 06 | CA | 053 | MONTEREY | 12 |
| 15008 | 06 | CA | 087 | SANTA CRUZ | 12 |
| 15009 | 06 | CA | 081 | SAN MATEO | 12 |
| 15010 | 06 | CA | 085 | SANTA CLARA | 12 |
| 15011 | 06 | CA | 075 | SAN FRANCISCO | 12 |
| 15012 | 06 | CA | 001 | ALAMEDA | 12 |
| 15013 | 06 | CA | 013 | CONTRA COSTA | 12 |
| 15014 | 06 | CA | 067 | SACRAMENTO | 12 |
| 15015 | 06 | CA | 077 | SAN JOAQUIN | 12 |
| 15016 | 06 | CA | 095 | SOLANO | 12 |
| 5017 | 06 | CA | 055 | NAPA | 12 |
| 5018 | 06 | CA | 041 | MARIN | 12 |
| 5019 | 06 | CA | 097 | SONOMA | 12 |
| 5020 | 06 | CA | 045 | MENDOCINO | 12 |
| 5021 | 06 | CA | 023 | HUMBOLDT | 12 |
| 5022 | 06 | CA | 015 | DEL NORTE | 12 |
| 5023 | 41 | OR | 015 | CURRY | 13 |
| 5024 | 41 | OR | 011 | COOS | 13 |
| 5025 | 41 | OR | 019 | DOUGLAS | 13 |
| 5026 | 41 | OR | 039 | LANE | 13 |
| 5027 | 41 | OR | 041 | LINCOLN | 13 |
| 5028 | 41 | OR | 057 | TILLAMOOK | 13 |
| 5029 | 41 | OR | 007 | CLATSOP | 13 |
| 5030 | 41 | OR | 009 | COLUMBIA | 13 |
| 5031 | 41 | OR | 051 | MULTNOMAH | 13 |
| 5032 | 53 | WA | 015 | COWLITZ | 13 |
| 5033 | 53 | WA | 069 | WAHKIAKUM | 13 |
| 5034 | 53 | WA | 049 | PACIFIC | 13 |
| 5035 | 53 | WA | 027 | GRAYS HARBOR | 13 |
| 5036 | 53 | WA | 031 | JEFFERSON | 13 |
| 5037 | 53 | WA | 009 | CLALLAM | 13 |
| 5038 | 53 | WA | 045 | MASON | 13 |
| 5039 | 53 | WA | 035 | KITSAP | 13 |
| 5040 | 53 | WA | 067 | THURSTON | 13 |
| 5041 | 53 | WA | 053 | PIERCE | 13 |

| T.S.C. CODE | ST CD | ST AB | CO CD | COUNTY NAME | CG DT | | |
|---|---|---|---|---|---|---|---|
| 31017 | 28 | MS | 027 | COAHOMA | 02 | LM 620 - LM 662 | |
| 31018 | 05 | AR | 107 | PHILLIPS | 02 | LM 620 - LM 673 | |
| 31019 | 05 | AR | 077 | LEE | 02 | LM 673 - LM 697 | |
| 31020 | 28 | MS | 143 | TUNICA | 02 | LM 662 - LM 697 | |
| 31021 | 28 | MS | 033 | DE SOTO | 02 | LM 697 - LM 715 | |
| 31022 | 05 | AR | 035 | CRITTENDEN | 02 | LM 697 - LM 760 | |
| 31023 | 47 | TN | 157 | SHELBY | 02 | LM 715 - LM 755 | |
| 31024 | 47 | TN | 167 | TIPTON | 02 | LM 755 - LM 773 | |
| 31025 | 47 | TN | 097 | LAUDERDALE | 02 | LM 773 - LM 820 | |
| 31026 | 05 | AR | 093 | MISSISSIPPI | 02 | LM 760 - LM 829 | |
| 31027 | 47 | TN | 045 | DYER | 02 | LM 820 - LM 845 | |
| 31028 | 29 | MO | 155 | PEMISCOT | 02 | LM 829 - LM 870 | |
| 31029 | 47 | TN | 095 | LAKE | 02 | LM 845 - LM 905 | |
| 31030 | 21 | KY | 075 | FULTON | 02 | LM 905 - LM 930 | |
| 31031 | 29 | MO | 143 | NEW MADRID | 02 | LM 870 - LM 915 | |
| 31032 | 21 | KY | 105 | HICKMAN | 02 | LM 930 - LM 940 | |
| 31033 | 21 | KY | 039 | CARLISLE | 02 | LM 940 - LM 950 | |
| 31034 | 29 | MO | 133 | MISSISSIPPI | 02 | LM 915 - LM 954 | UM 0 - UM 26 |
| 32000 | | | | UPPER MISSISSIPPI RIVER | | | |
| 32001 | 29 | MO | 201 | SCOTT | 02 | UM 26 - UM 48 | OH 981 - OH 975 |
| 32002 | 17 | IL | 003 | ALEXANDER | 02 | UM 48 - UM 55 | OH 981 - OH 975 |
| 32003 | 17 | IL | 181 | UNION | 02 | UM 55 - UM 78 | |
| 32004 | 29 | MO | 031 | CAPE GIRARDEAU | 02 | UM 48 - UM 75 | |
| 32005 | 29 | MO | 157 | PERRY | 02 | UM 75 - UM 110 | |
| 32006 | 17 | IL | 077 | JACKSON | 02 | UM 78 - UM 110 | |
| 32007 | 17 | IL | 157 | RANDOLPH | 02 | UM 110 - UM 136 | |
| 32008 | 29 | MO | 193 | STE GENEVIEVE | 02 | UM 110 - UM 139 | |
| 32009 | 29 | MO | 099 | JEFFERSON | 02 | UM 139 - UM 161 | |
| 32010 | 17 | IL | 133 | MONROE | 02 | UM 136 - UM 172 | |
| 32011 | 17 | IL | 163 | ST. CLAIR | 02 | UM 172 - UM 183 | |
| 32012 | 29 | MO | 189 | ST. LOUIS | 02 | UM 161 - UM 196 | MO 0 - MO 49 |
| 32013 | 17 | IL | 119 | MADISON | 02 | UM 183 - UM 209 | |
| 32014 | 29 | MO | 183 | ST CHARLES | 02 | UM 196 - UM 237 | MO 0 - MO 67 |
| 32015 | 17 | IL | 083 | JERSEY | 02 | UM 209 - UM 220 | IL 0 - IL 18 |
| 32016 | 29 | MO | 113 | LINCOLN | 02 | UM 237 - UM 258 | |
| 32017 | 17 | IL | 013 | CALHOUN | 02 | UM 220 - UM 276 | IL 0 - IL 39 |
| 32018 | 29 | MO | 163 | PIKE | 02 | UM 258 - UM 297 | |
| 32019 | 17 | IL | 149 | PIKE | 02 | UM 272 - UM 312 | IL 39 - IL 72 |
| 32020 | 29 | MO | 173 | RALLS | 02 | UM 297 - UM 306 | |
| 32021 | 29 | MO | 127 | MARION | 02 | UM 306 - UM 329 | |
| 32022 | 17 | IL | 001 | ADAMS | 02 | UM 312 - UM 347 | |
| 32023 | 29 | MO | 111 | LEWIS | 02 | UM 329 - UM 351 | |
| 32024 | 29 | MO | 045 | CLARK | 02 | UM 351 - UM 361 | |
| 32025 | 17 | IL | 067 | HANCOCK | 02 | UM 347 - UM 391 | |
| 32026 | 19 | IA | 111 | LEE | 02 | UM 361 - UM 396 | |
| 32027 | 17 | IL | 071 | HENDERSON | 02 | UM 391 - UM 426 | |
| 32028 | 19 | IA | 057 | DES MOINES | 02 | UM 396 - UM 426 | |
| 32029 | 19 | IA | 115 | LOUISA | 02 | UM 426 - UM 449 | |
| 32030 | 17 | IL | 131 | MERCER | 02 | UM 426 - UM 449 | |
| 32031 | 17 | IL | 161 | ROCK ISLAND | 02 | UM 449 - UM 512 | |
| 32032 | 19 | IA | 139 | MUSCATINE | 02 | UM 449 - UM 470 | |
| 32033 | 19 | IA | 163 | SCOTT | 02 | UM 470 - UM 507 | |
| 32034 | 17 | IL | 195 | WHITESIDE | 02 | UM 512 - UM 525 | |
| 32035 | 19 | IA | 045 | CLINTON | 02 | UM 507 - UM 533 | |
| 32036 | 17 | IL | 015 | CARROLL | 02 | UM 525 - UM 549 | |

| T.S.C. CODE | ST CD | ST AB | CO CD | COUNTY NAME | CG DT | | |
|---|---|---|---|---|---|---|---|
| 34015 | 21 | KY | 059 | DAVIESS | 02 | OH 771 - OH 742 | GR 19 - GR 35 |
| 34016 | 21 | KY | 091 | HANCOCK | 02 | OH 742 - OH 712 | |
| 34017 | 18 | IN | 147 | SPENCER | 02 | OH 769 - OH 731 | |
| 34018 | 18 | IN | 123 | PERRY | 02 | OH 731 - OH 681 | |
| 34019 | 21 | KY | 027 | BRECKINRIDGE | 02 | OH 712 - OH 698 | |
| 34020 | 21 | KY | 163 | MEADE | 02 | OH 698 - OH 630* | |
| 34021 | 18 | IN | 025 | CRAWFORD | 02 | OH 681 - OH 663 | |
| 34022 | 18 | IN | 061 | HARRISON | 02 | OH 663 - OH 617 | |
| 34023 | 21 | KY | 029 | BULLITT | 02 | | |
| 34024 | 21 | KY | 111 | JEFFERSON | 02 | OH 630 - OH 593 | |
| 34025 | 18 | IN | 043 | FLOYD | 02 | OH 617 - OH 607 | |
| 34026 | 18 | IN | 019 | CLARK | 02 | OH 607 - OH 572 | |
| 34027 | 21 | KY | 185 | OLDHAM | 02 | OH 593 - OH 576 | |
| 34028 | 21 | KY | 223 | TRIMBLE | 02 | OH 576 - OH 555 | |
| 34029 | 18 | IN | 077 | JEFFERSON | 02 | OH 572 - OH 546 | |
| 34030 | 21 | KY | 041 | CARROLL | 02 | OH 555 - OH 535 | |
| 34031 | 18 | IN | 155 | SWITZERLAND | 02 | OH 546 - OH 510 | |
| 34032 | 21 | KY | 077 | GALLATIN | 02 | OH 535 - OH 517 | |
| 34033 | 21 | KY | 015 | BOONE | 02 | OH 517 - OH 477 | |
| 34034 | 18 | IN | 115 | OHIO | 02 | OH 510 - OH 499 | |
| 34035 | 18 | IN | 029 | DEARBORN | 02 | OH 499 - OH 491 | |
| 34036 | 39 | OH | 061 | HAMILTON | 02 | OH 491 - OH 455 | |
| 34037 | 21 | KY | 117 | KENTON | 02 | OH 477 - OH 470 | |
| 34038 | 21 | KY | 037 | CAMPBELL | 02 | OH 470 - OH 444 | |
| 34039 | 39 | OH | 025 | CLERMONT | 02 | OH 455 - OH 430 | |
| 34040 | 21 | KY | 023 | BRACKEN (Pendleton) | 02 | OH 444 - OH 421 | |
| 34041 | 39 | OH | 015 | BROWN | 02 | OH 430 - OH 405 | |
| 34042 | 21 | KY | 161 | MASON | 02 | OH 421 - OH 401 | |
| 34043 | 39 | OH | 001 | ADAMS | 02 | OH 405 - OH 375 | |
| 34044 | 21 | KY | 135 | LEWIS | 02 | OH 401 - OH 357 | |
| 34045 | 39 | OH | 145 | SCIOTO | 02 | OH 375 - OH 335 | |
| 34046 | 21 | KY | 089 | GREENUP | 02 | OH 357 - OH 325 | |
| 34047 | 21 | KY | 019 | BOYD | 02 | OH 325 - OH 317 | |
| 34048 | 39 | OH | 087 | LAWRENCE | 02 | OH 335 - OH 292 | |
| 34049 | 54 | WV | 099 | WAYNE | 02 | OH 317 - OH 312 | |
| 34050 | 54 | WV | 011 | CABELL | 02 | OH 312 - OH 287 | |
| 34051 | 54 | WV | 053 | MASON | 02 | OH 287 - OH 234 | KN 0 - KN 19 |
| 34052 | 39 | OH | 053 | GALLIA | 02 | OH 292 - OH 257 | |
| 34053 | 39 | OH | 105 | MEIGS | 02 | OH 257 - OH 200 | |
| 34054 | 54 | WV | 035 | JACKSON | 02 | OH 234 - OH 206 | |
| 34055 | 39 | OH | 009 | ATHENS | 02 | OH 200 - OH 196 | |
| 34056 | 54 | WV | 107 | WOOD | 02 | OH 206 - OH 165 | |
| 34057 | 54 | WV | 073 | PLEASANTS | 02 | OH 165 - OH 147 | |
| 34058 | 39 | OH | 167 | WASHINGTON | 02 | OH 196 - OH 140 | |
| 34059 | 54 | WV | 091 | TYLER | 02 | OH 147 - OH 133 | |
| 34060 | 54 | WV | 103 | WETZEL | 02 | OH 133 - OH 122 | |
| 34061 | 39 | OH | 111 | MONROE | 02 | OH 140 - OH 111 | |
| 34062 | 54 | WV | 051 | MARSHALL | 02 | OH 122 - OH 93 | |
| 34063 | 39 | OH | 013 | BELMONT | 02 | OH 111 - OH 84 | |
| 34064 | 54 | WV | 069 | OHIO | 02 | OH 93 - OH 82 | |
| 34065 | 39 | OH | 081 | JEFFERSON | 02 | OH 84 - OH 50 | |
| 34066 | 54 | WV | 009 | BROOKE | 02 | OH 82 - OH 65 | |
| 34067 | 54 | WV | 029 | HANCOCK | 02 | OH 65 - OH 40 | |
| 34068 | 39 | OH | 029 | COLUMBIANA | 02 | OH 50 - OH 40 | |
| 34069 | 42 | PA | 007 | BEAVER | 02 | OH 40 - OH 15 | |
| 34070 | 42 | PA | 003 | ALLEGHENY MH 0 - MH 35 | 02 | OH 15 - OH 0 | AL 0 - AL 30 |

| T.S.C. CODE | ST CD | ST AP | CO CD | COUNTY NAME | CG DT |
|---|---|---|---|---|---|
| 51007 | 55 | WI | 003 | ASHLAND | 09 |
| 51008 | 55 | WI | 051 | IRON | 09 |
| 51009 | 26 | MI | 053 | GOGEBIC | 09 |
| 51010 | 26 | MI | 131 | ONTONAGON | 09 |
| 51011 | 26 | MI | 061 | HOUGHTON | 09 |
| 51012 | 26 | MI | 083 | KEWEENAW | 09 |
| 51013 | 26 | MI | 013 | BARAGA | 09 |
| 51014 | 26 | MI | 103 | MARQUETTE | 09 |
| 51015 | 26 | MI | 003 | ALGER | 09 |
| 51016 | 26 | MI | 095 | LUCE | 09 |
| 51017 | 26 | MI | 033 | CHIPPEWA | 09 |
| 53000 | | | | LAKE MICHIGAN WATERWAY | |
| 53018 | 26 | MI | 097 | MACKINAC | 09 |
| 53019 | 26 | MI | 153 | SCHOOLCRAFT | 09 |
| 53020 | 26 | MI | 041 | DELTA | 09 |
| 53021 | 26 | MI | 109 | MENOMINEE | 09 |
| 53022 | 55 | WI | 075 | MARINETTE | 09 |
| 53023 | 55 | WI | 083 | OCONTO | 09 |
| 53024 | 55 | WI | 009 | BROWN | 09 |
| 53025 | 55 | WI | 029 | DOOR | 09 |
| 53026 | 55 | WI | 061 | KEWAUNEE | 09 |
| 53027 | 55 | WI | 071 | MANITOWOC | 09 |
| 53028 | 55 | WI | 117 | SHEBOYGAN | 09 |
| 53029 | 55 | WI | 089 | OZAUKEE | 09 |
| 53030 | 55 | WI | 079 | MILWAUKEE | 09 |
| 53031 | 55 | WI | 101 | RACINE | 09 |
| 53032 | 55 | WI | 059 | KENOSHA | 09 |
| 53033 | 17 | IL | 097 | LAKE | 09 |
| 53034 | 17 | IL | 031 | COOK | 09 |
| 53037 | 18 | IN | 089 | LAKE | 09 |
| 53038 | 18 | IN | 127 | PORTER | 09 |
| 53039 | 18 | IN | 091 | LA PORTE | 09 |
| 53040 | 26 | MI | 021 | BERRIEN | 09 |
| 53041 | 26 | MI | 159 | VAN BUREN | 09 |
| 53042 | 26 | MI | 005 | ALLEGAN | 09 |
| 53043 | 26 | MI | 139 | OTTAWA | 09 |
| 53044 | 26 | MI | 121 | MUSKEGON | 09 |
| 53045 | 26 | MI | 127 | OCEANA | 09 |
| 53046 | 26 | MI | 105 | MASON | 09 |
| 53047 | 26 | MI | 101 | MANISTEE | 09 |
| 53048 | 26 | MI | 019 | BENZIE | 09 |
| 53049 | 26 | MI | 089 | LEELANAU | 09 |
| 53050 | 26 | MI | 055 | GRAND TRAVERSE | 09 |
| 53051 | 26 | MI | 009 | ANTRIM | 09 |
| 53052 | 26 | MI | 029 | CHARLEVOIX | 09 |
| 53053 | 26 | MI | 047 | EMMET | 09 |
| 55000 | | | | LAKE HURON WATERWAY | |
| 55054 | 26 | MI | 031 | CHEBOYGAN | 09 |
| 55055 | 26 | MI | 141 | PRESQUE ISLE | 09 |
| 55056 | 26 | MI | 007 | ALPENA | 09 |
| 55057 | 26 | MI | 001 | ALCONA | 09 |
| 5058 | 26 | MI | 069 | IOSCO | 09 |
| 5059 | 26 | MI | 011 | ARENAC | 09 |
| 5060 | 26 | MI | 017 | BAY | 09 |
| 5061 | 26 | MI | 157 | TUSCOLA | 09 |

APPENDIX B

# SYNOPSES OF INTERVIEWS MADE TO ASSESS CHEMICAL SPILL RESPONSE CAPABILITIES OUTSIDE OF THE U.S. COAST GUARD

## 1. RESPONSE CAPABILITIES OF GOVERNMENTS AND THEIR AGENCIES

### 1.1 FEDERAL GOVERNMENT

#### 1.1.1 Environmental Protection Agency

The Environmental Protection Agency (EPA) has the primary responsibility to protect the land areas of the United States, except for those designated areas of Coast Guard responsibility, from pollution caused by the spill of hazardous materials. The EPA provides the On-Scene Coordinator (OSC) for its areas of jurisdiction.

The EPA maintains local emergency response teams ERT. In accordance with the National Contingency Plan these teams provide information, expert consultation, and general support to the OSC. They are not equipped, however, for actual removal action.

For example, the Boston Regional Office has an eight-man team on 24-hour standby. Each man has a self-contained breathing system, a full-face gas mask, a five-minute escape pack, a face shield, and disposable coveralls, gloves, and boots. The team has a complete kit of hand tools and equipment and full complement of detection identification meters (two of each type); H-nu organic vapor detector, oxygen sampler, explosimeter, organic vapor detector tube sampler, continuous oxygen monitor, and pH meter. They can borrow two portable gas chromatographs. Thus, the EPA does have a good investigative response capability but must bring in contractor assistance for containment, off-loading, plugging, removal, and cleanup.

In addition, some bases also have units equipped with encapsulating suits used for handling exotic rocket fuels. The recent Titan II missile mishap in Arkansas pointed out the use of these suits; the chemicals involved were hydrazine and nitrogen tetroxide.

1.1.2.2 Army - The Army Technical Escort Center is responsible for transportation of chemicals and related materials, and has a limited initial spill response capability. Depending on the material spilled, the Army may use contractors for follow-on containment and cleanup. Response capabilities exist at all Army bases; decontamination facilities exist throughout the Army. A typical complement is 100 M-3 suits and a much larger number of M-9 gas masks. In addition to the typical 30-man decontamination team, other units such as the Military Police also have gas masks, so the total number of potentially available masks is large.

Other response capabilities also exist at Army bases. The fire department at Fort Devens, Massachusetts, has 15 fire approach suits and 25 air packs in addition to their regular nomex turnout (rain type) suits. The Fire Chief has also been designated the base OSC by the Environmental Control Office for both oil and chemical spills, and the Department has a small supply of containment boom for oil. Chemical response capability is limited as the base uses few hazardous chemicals. Fort Devens relies extensively on contractors for both initial response and cleanup.

Fort Devens also has an Explosive Ordnance Disposal (EOD) Team equipped with fullface protective masks, M-20 self-contained breathing apparatus, and M-3 protective clothing with acid-resistant aprons. A typical team consists of five men.

1.1.2.3 Navy - Like the other Armed Services, the Navy relies primarily on contractors for response to both chemical and oil spills. The Operations Department, Supervisor of Salvage, has overall responsibility. Some equipment, primarily for oil spills, is stored at central locations at Cheatham Annex, Virginia, and Stockton, California.

Therefore, beyond establishing that these development efforts exist, little information could be obtained.

### 1.1.3 Department of Energy

The Department of Energy (DOE) has both regional and national response teams for response to spills of radiological materials. While these teams normally would respond only to radiological accidents, they do have personnel protection equipment and communication equipment which has direct application to hazmat spill response.

## 1.2 STATE GOVERNMENTS

State government agencies concerned with hazmat spill response are usually either Environmental Protection Agencies or Water Resources Agencies, who are responsible for preventing contamination of lakes, streams, and waterways. These agencies dispatch inspectors to spill sites, who may act as OSCs to coordinate containment and cleanup efforts. Most contacted states maintain a limited inventory of supplies and equipment, but this capability is intended only for initial response use. Subsequent efforts are transferred either to the spiller or to a cleanup contractor.

Maine, Pennsylvania and Virginia have no protective clothing except rain gear. Ohio has nine ammonia suits with self-contained breathing apparatus. Maryland has five sets of fire-fighting type rubberized clothing with breathing apparatus, and two acid suits. None have asbestos fire suits.

The field inspectors or response teams have field meters. Maine teams have pH meters, explosimeters and gas samplers. Pennsylvania has some pH meters and explosimeters. Ohio and Virginia field inspectors have these meters, plus a water testing capability. Maryland inspectors have pH meters, and 10 equipment trailers have a pump and explosimeter. Ohio has a portable gas chromatograph.

Maine and Pennsylvania rely on police radio networks for communication. The other three states have their own radios and networks for spill response.

facilitate emergency response team operations, by evacuating surrounding areas if necessary, and by providing transportation for cleanup personnel and equipment to the spill site.

Police rely on the Coast Guard for hazmat identification. They do have the Chemical Hazard Response Information System (CHRIS) Manual, and lists and procedures issued by the Coast Guard and by CHEMTREC. Some departments have field meters.

1.4.2 City Fire Departments

Fire departments respond to a spill only when requested. They do not patrol their areas, and thus do not detect spills. The fire departments' involvement in a hazmat spill is limited to control of fire. These departments have the primary foam-delivery capability by fire boats and fire trucks. Their on-vehicle foam supply is supported by centralized department supplies and by ready access to manufacturers' stocks, so their foam delivery capability is almost unlimited. In some ports, Coast Guard and Port Authority crews also have a foaming capability.

Fire departments do not have any plugging or off-loading equipment. They rely on the Coast Guard and CHEMTREC for material identification. They also have the CHRIS Manual and the Hazmat Classification Book. They have field meters associated with their fire-fighting mission, such as explosimeters, carbon monoxide testers, oxygen samplers, etc.

The departments usually have fire suits. Philadelphia has three special chemical units equipped with asbestos fire suits with self-contained breathing apparatus. Both New York and Philadelphia also use standard protective clothing, with gas masks, for fire approach and entry.

Most fire departments have extensive communication networks, and can establish working control of a spill area pending arrival of police.

Transportation of equipment to the site area may be accomplished by utilizing one or a combination of several means including: 1) land transport by truck or van; 2) water transport by boat or barge; or 3) cargo airlift. The latter mode is utilized by Marine Pollution Control of Detroit in the event of a major spill. Their "response kit" consists of acid, disposable, and rubber suits, external and internal breathing apparatus, respirators, vacuum tank trucks, pumps, and drums. All of this equipment is airlifted on a Boeing 747 to the site area.

Contractors generally do not maintain substantial equipment inventories in the following areas:

- o Fire Entry and Proximity Suits - equipment is maintained primarily by chemical manufacturers and large city fire departments.
- o Plugging and Repair Capabilities - contractors generally perform these functions by subcontracting this work to an ocean salvage company or on land, a chemical shipper producer. Crowley Environmental Services of Seattle, OH Materials of Findlay, Ohio, and Ocean Salvage Corporation of New York do, however, maintain pre-packaged plugging kits containing items such as bentonite, plugs, gasket material, and straps.
- o Foam Systems - none of the contractors contacted maintain foam delivery systems or their equivalent.

Several contractors, such as OH Materials, operate mobile laboratories for analytical testing. These self-contained laboratories are capable of being placed anywhere on a site and can run samples utilizing a mass spectrometer in one hour or less to identify chemical components and their respective concentrations. If the sample is beyond the capability of the mobile laboratory it can be analyzed at the company's fixed laboratory in Findlay.

Field testing units such as pH meters, oxygen and multiple gas meters are maintained adequately by most contractors to monitor cleanup efforts. More exotic field testing equipment includes fluorescence, specification, flame iohization, and electron capture techniques, among others. Many smaller, local contractors depend upon independent testing laboratories for thorough and objective chemical analysis.

The second stage of CHEMTREC's duties becomes more difficult if either the shipper is unknown or the material is unidentified. In this instance, CHEMTREC may rely upon other information sources such as the Coast Guard National Response Center to identify the shipper/carrier or the Association of American Railroads' commodities movement/tracking system.

CHEMTREC provides no physical assistance in a spill incident, but serves as the vital communication point for the entire emergency response system of the private sector. Its capabilities have been recognized by the DOT as well; working together, the capabilities of both systems are enhanced.

The Chlorine Institute of New York (CHLOREP) is a private consortium of chlorine and compressed gas manufacturers and shippers; it has established 32 designated response zones in the U.S. In the event of a chlorine or compressed gas discharge, CHLOREP's emergency response coordinator receives a notification of the incident from CHEMTREC. The coordinator then dispatches one of 64 U.S.-based response teams to the incident site. The location of these teams is concentrated in areas where the greatest number of manufacturing plants is situated. For example, the Louisiana Panhandle area contains the greatest proportion of chlorine producers in the Nation. Hence this area displays a high correlation of response teams relative to other areas of the Nation.

CHLOREP's emergency response teams are staffed with 12 personnel per team which provide 24-hour coverage. The staffing objective is to provide three personnel per six-hour shift. CHLOREP has also designed and distributed 6,500 chlorine emergency kits to industrial and water treatment plants throughout the U.S. Kits contain various plugging and repair supplies including gasket material, strapping, bentonite clay sealant, heavy plastic tarpulins, and plugs.

Each response team is equipped with at least one kit and enough self-contained breathing apparatus, spare tanks, and respirators to supply each man for an indefinite period of time. CHLOREP response teams arrive at the scene in an average time of 20 minutes, depending upon location and accessibility.

Manufacturers response teams have been developed to offer initial emergency spill control assistance in the event that a company product is involved in an accidental release. The manufacturer of that product is most familiar with its chemical properties. In addition, manufacturers are now formulating mutual aid agreements to exchange emergency support teams and equipment in the event of a spill outside a given company's region.

The chemical manufacturers' teams are usually not the first to arrive at the spill site. Further, the manufacturers typically limit their function to initial response. They do not engage in longer term containment and cleanup; these functions are turned over to contractors.

For example, Dow Chemical Corporation has over 50 plants manufacturing hazardous materials in the United States. Four major divisions are located in Midland, Michigan; Plaquemine, Louisianna; Freeport, Texas; and Pittsburgh, California. The remaining 46 locations are classified as "satellite plants." Each plant is equipped with a fire department on the premises. Further, Dow has 22 sales offices throughout the Nation which each maintain at least one self-contained breathing unit and have a Sales Officer able to provide advice and request company assistance.

Each plant has developed an emergency response system which is activated through the Emergency Response Coordinator. The Coordinator's legal responsibility is merely advisory but he may and often does provide technical and equipment assistance when needed. Each major division is home base for an emergency response trailer. The contents of each trailer consist of at least the following equipment and supplies dedicated to hazmat emergencies:

- o Personal protective clothing including two Acid King or Eastwind acid suits and three heavy vinyl suits for corrosives
- o Self-contained breathing apparatus consisting of five Scott air-packs (45 minute) and spare cylinders
- o Two each portable pH, oxygen, and explosion meters
- o Two stainless steel, explosion-proof chemical transfer pumps

for handling truck spills of gasoline or other hydrocarbons, but may have wider applications. Trailers contain a number of explosimeters and air packs, as well as sorbent material and containment boom.

Hooker Chemical Corporation has adopted a unique approach to respond to chemical emergency indicents. They have developed standard emergency equipment kits as follows:

- o Kit #1 - Personal Safety Equipment includes one each of the following: full face MSA respirator, MSA cannister, disposable dust mask, Homer coveralls, face shield, rain suit, gloves, and boots.
- o Kit #2 - Tool Kit & Miscellaneous Equipment
- o Kit #3 - Self-Contained Breathing Apparatus consists of one 30-minute Scott air pack and spare cylinder.
- o Kit #4 - Acid Suit consists of one Eastwind acid suit.
- o Kit #5 - Specialty Kits Equipment may contain any or all of the following: explosion meter, oxygen meter, vapor acid suit, phosphorous suit, etc.

A number of kits by type are distributed among each of 22 Hooker plants in the United States. Distribution of kits is based upon historical spill incidents and, in the case of specialty kits (#5), the plant's major products. For example, the Jeffersonville, Indiana plant is a major phosphorous production unit. It maintains the following emergency kit inventory: six each-Kit #1, one each-Kit #2, three each-Kit #3, three each-Kit #4, and three each of Kit #5 which contains a total of three phosphorous suits.

Mobay Chemical Corporation is another example of a manufacturer which has anticipated a need for coordinated response to chemical emergencies with trained personnel and equipment. They have developed an emergency response program to handle their own chemicals by assembling seven response teams in Union, New Jersey; New Martinsville, West Virginia; Pittsburgh, Pennsylvania; Bushy Park, South Carolina. Response teams normally consist of two to three members at each producing facility.

specific training to handle hazardous material emergencies. Generally, if a spill presents a threat to the health of personnel, they are instructed to evacuate the area immediately.

If a freight car is found to be leaking hazmat by a line inspector, the incident is reported to the local dispatcher or trainmaster utilizing the locomotive's radio. The dispatcher must then take steps to isolate the car and identify its contents. The AAR's Standard Transportation Commodity Code (STCC) "49" designates all hazardous materials and their positions in the train's consist. A computer-generated printout of this information is carried by trainmen to expedite chemical identification. Procedures and actions to be taken are followed utilizing the AAR's "Transportation Emergency Guide." The dispatcher than notifies the safety department which in turn notifies government officials, CHEMTREC, and the consignee or shipper. The situation is then re-examined and a decision is made as to whether a "go-team" response is warranted at the incident scene. Spill type, quantity, risk factor, and in-house resources bear on the determination of whether clean-up contractors will be called to the scene.

If a railroad maintains equipment for control and containment, it is usually located in or around classification yards and engine terminals. Both the Chessie System and Norfolk and Western Railroad maintain equipment along rivers which traverse their trackage. Southern's hazmat storage areas are in Atlanta, Birmingham, Greensboro, and Chattanooga.

As a general rule, railroads do not own chemical or thermal protective clothing. The Boston and Maine Railroad and Conrail maintain rainsuits for inclement weather. Chessie System outfits its superintendents with rubber suits, goggles, boots, and self-contained breathing apparatus. Norfolk and Western maintains a supply of respirators and self-contained breathing apparatus at various locations. Southern Railway operates three emergency storage trailers which contain one combustible gas meter, a minimum of 6-12 vinyl rainsuits, and two acid suits with hoods, gloves, boots, and self-contained breathing apparatus. These trailers are towed to the incident scene by one of six vehicles operated by the safety department. Spill crews arrive at the scene by rail, automobile, or air.

# APPENDIX C

# PERSONNEL PROTECTION GEAR REQUIREMENTS FOR HAZARDOUS CHEMICAL SPILL RESPONSE

I. Litant
Office of Energy and Environment
Transportation Systems Center

- This Appendix summarizes the work leading to the quantification of the personnel protective equipment required for response to various types and sizes of hazardous chemical spills that have occurred in the United States in 1973-1979.

## 1. INTRODUCTION

A large amount of work has been done over the past years by government and private agencies in assembling data on the types and frequency of occurrence of spills of hazardous materials, as well as categorizing response gear for use against each type of spilled material. (References 1 through 11.) In most spills, the hazardous materials were capable of being identified as individual chemicals. In some cases, however, the spilled material was a mixture, sometimes complex, containing one or more hazardous chemicals.

A spilled hazardous material requires that some action be taken to prevent an adverse effect upon the local population and the environment. A hazardous spill response team, if provided with correct information concerning the type and quantity of the material, should be prepared to cope with the situation without delay.

Historic hazardous materials spills have been recorded by the Materials Transportation Bureau (MTB) and the Coast Guard Pollution Incident Reporting System (PIRS). These data have been summarized by type, frequency, and wherever possible, by quantity of spill. (See Reference 12.) Many of the spills were identified only vaguely, and required judgment to determine how to categorize them.

Various coding systems have been devised to group the materials into some sort of order that would be useful in determining how to cope with the spills. The CHRIS Code is one example of the several methods to do this.

There was little problem in "bridging" between the MTB and PIRS lists and CHRIS where the chemical compound or material was specific in each. However, bridging became difficult where one MTB or PIRT entry consisted of groups such as "Zinc Compounds" or "Cyanide Compounds." Even more difficult to classify were "Corrosive Liquid N.O.S.", "Flammable Liquids", or "Comp. Rust Preventer or Remover". In the case of grouped compounds of the same element, the entry was treated as would be the most hazardous commonly used compound of that group. In the second type, "Corrosive Liquids", etc. the literature was consulted, where possible, to get an idea of the chemicals that might be used in such mixtures. A judgment was then made as to its classification.

Altogether, 156 MTB and 166 PIRS materials were classified. As might be expected, there was some duplication between the lists. However, the cases in which no direct correspondence could be established between MTB, PIRS and CHRIS chemicals represented a majority of the cases of historic spills. (Reference 13.) Accordingly, attempts employ a single chemical list were abandoned, and equipment assignments were made on the PIRS and MTB chemical lists separately.

2. Response Gear Required for Different Hazardous Materials

The second task in this project was to list the types of personnel protective gear that would be required by a person responding to a spill of each of the different hazardous materials. The results are shown in Appendix C-1. In preparing this list, several considerations to be made before defining the level of protection categories. W.M. Hammer, et al (Reference 11) propose the following requirements in the selection of equipment:

a. Physical motion should be as natural and unimpeded as possible.

b. The equipment should be able to function throughout the period of time that an individual expects to be within the boundaries of the hazard.

c. The equipment should be tough and reusable, if it can be determined.

d. Normal decontamination methods should be simple, rapid and non-destructive.

e. Personnel utilizing the equipment should feel reasonably comfortable and confident of their own safety.

will reduce the oxygen content of the air. In that case, an SCBA must be substituted for the canister.

3. Elastomer Compatibility with Different Hazardous Materials

Following the selection of personnel gear, it became necessary to specify, for each hazardous material, the type of elastomer that could be used in the coating of the body protective clothing, and in the gloves and boots. A number of references were consulted, and surprisingly, very significant differences were found among these as to the recommended elastomers. In several cases, various source recommendations varied from "excellent' to "poor" for the same chemical. It was finally decided to rely heavily on the recommendations of the chemical industry, augmented by other judgmental factors.

The six types of elastomer that were found to be most used were: neoprene, butyl rubber, EPA, Hypalon, butadiene and fluoroelastomers. In many cases it was found that more than one type of elastomer was suitable, and these were indicated on the work sheets; however, only one is listed in the final compilation. It should be pointed out that in several cases, the best elastomer available was listed nowhere better than "fair" in its resistance to the particular material.

4. Quantities of Equipment as a Function of Spill Size and Material

Finally, since spills of hazardous materials come in various sizes, it was necessary to determine how many units of personnel response gear should be available for different size spills of the same material. Here, again, some assumptions had to be made.

a. In most cases, if the spill was into a waterway, the methods of response would require the use of a different set of parameters than those used in this work. It was therefore assumed that the spill occurred either on land adjacent to a waterway or on board a vessel in a waterway.

b. The minimum gear recommended, no matter what the material spilled, nor the size of the spill, was two units. The reason for two units is principally the premise that any spill considered as a hazardous material should be approached by at least two individuals suitably prepared and clothed. A backup is always needed in the event of a

## REFERENCES
## TO APPENDIX C

1. USCG Commandant Instruction M16465.12 (OLD CG-446-2). Manual of the Chemical Hazardous Response Information System (CHRIS).

2. USCG Commandant Instruction 16465.16. Policy Guidance for Response to Hazardous Chemical Discharges.

3. Standard Transportation Commodity Code Tariff No. 1-G (STCC 49).

4. U.S. Coast Guard Pollution Incident Reporting System (PIRS) CG-450.

5. USCG Commandant Instruction M16465.14. CHRIS Response Methods Handbook.

6. USCG Survey of Personnel Protective Clothing and Respiratory Apparatus for use by Coast Guard Personnel in Response to Discharges of Hazardous Chemicals. W.M. Hammer et al (Sept. 1974).

7. The General Chemical Resistance of Various Elastomers - 1979 Yearbook of the Los Angeles Rubber Group, Inc.

8. Chemical Resistance of DuPont Elastomers - E.I. Dupont Co.

9. SAX, N.I. - Dangerous Properties of Industrial Materials. (Reinhold)

10. Kirk-Othmer-Encyclopedia of Chemical Technology.

11. Hammer, W.F. et al, "Survey of Protective Clothing and Respiratory Apparatus for Use by Coast Guard Personnel in Response to Discharge of Hazardous Chemicals," CG-D-89-75.

12. "Analysis of Hazardous Chemical Spills Along the Coasts and Major Waterways of the United States," U.S. Department of Transportation, Transportation Systems Center, Cambridge, MA, Report No. CG-123-1.

13. "Interim Report on Coast Guard Related Chemical Spill Data," Project Memorandum, CG 023, September 1980. Report No. CG-023-1, Transportation Systems Center, Cambridge, MA 02142.

# APPENDIX C1

## ESTIMATES OF PERSONNEL PROTECTION GEAR REQUIRED AS A FUNCTION OF SPILL SIZE

This Appendix lists, for each of 157 MTB-listed chemicals and 130 PIRS-listed chemicals, the types and quantities of protective gear estimated to be needed to respond to a spill of given size of the chemical.

The first two columns show the MTB or PIRS code for the chemical. (A description of the chemical is given in the last column.) The third column lists spill size (QTY) and the units (U) which are either gallons (G) or pounds (P). The next column (headed NU) gives the minimum number of units estimated to be required to respond to a spill size not exceeding that under QTY of the same line, but exceeding the amount on the preceding line. (The amount zero is understood for the first value of QTY of the chemical.) Spills of quantities greater than the largest listed for the chemical require the largest number of units shown in the NU column.

The types of gear are indicated in the column headed "Personnel Protection Gear Code." The codes are explained on p. 28. The number of units required applied to each type of gear for which there is an entry under "Personnel Protection Gear Code." The terminology 'rubber clothing', 'rubber gloves', 'rubber boots' are used generically to indicate items of the specific material following the hyphen.

USCG HAZARDOUS CHEMICAL SPILLS RESPONSE

PERSONNEL PROTECTION GEARS REQUIREMENTS (@ DIFFERENT SPILL SIZES)



| MTB CL-CODE | PIRS CODE | QTY U | N U | PERSONNEL PROTECTION GEAR CODE -A-B-C-D-E-F-G-H-I-J-K-L-M-N-O- | CHEMICAL DESCRIPTION |
|---|---|---|---|---|---|
| 2008319 | | | | A1 K6L6 | PETROLEUM NAPHTHA COMBUSTIBLE LIQUID |
| 2008319 | | 001000G | 2 | | |
| 2008319 | | 005000G | 2 | | |
| 2008319 | | 010000G | 3 | | |
| 2008319 | | 025000G | 4 | | |
| 2009719 | | | | B1 K6L6 | SOLVENT N.O.S. COMBUSTIBLE |
| 2009719 | | 001000G | 2 | | |
| 2009719 | | 005000G | 3 | | |
| 2009719 | | 010000G | 4 | | |
| 2501010 | | | | A2 J2 | ACETONE |
| 2501010 | | 002000G | 2 | | |
| 2501010 | | 005000G | 2 | | |
| 2501010 | | 010000G | 2 | | |
| 2501010 | | 025000G | 3 | | |
| 2501140 | | | | A1 J1 | ACRYLONITRILE |
| 2501140 | | 000500G | 2 | | |
| 2501140 | | 005000G | 3 | | |
| 2501140 | | 025000G | 4 | | |
| 2501190 | | | | C1 K4 | ALCOHOL N.O.S. FLAMMABLE LIQUID |
| 2501190 | | 002000G | 2 | | |
| 2501190 | | 005000G | 2 | | |
| 2501190 | | 050000G | 3 | | |
| 2501660 | | | | C1 K1L1 | ANTIFREEZE COMPOUND FLAMMABLE LIQUID |
| 2501660 | | 001000G | 2 | | |
| 2501660 | | 005000G | 2 | | |
| 2501660 | | 010000G | 2 | | |
| 2501660 | | 050000G | 3 | | |
| 2502070 | | | | A1 J6 | BENZENE (BENZOL) |
| 2502070 | | 001000G | 2 | | |
| 2502070 | | 005000G | 2 | | |
| 2502070 | | 010000G | 3 | | |
| 2502070 | | 030000G | 3 | | |
| 2502470 | | | | C1 K6L6 | BUTYL ACETATE |
| 2502470 | | 005000G | 2 | | |
| 2502470 | | 030000G | 3 | | |
| 2502690 | | | | A1 J6 | CARBON BISULFIDE OR CARBON DISULFIDE |
| 2502690 | | 000250G | 2 | | |
| 2502690 | | 001000G | 3 | | |
| 2502690 | | 005000G | 4 | | |
| 2502840 | | | | C1 J6 | CEMENT LIQUID N.O.S. |
| 2502840 | | 002000G | 2 | | |
| 2502840 | | 010000G | 3 | | |
| 2502840 | | 050000G | 3 | | |
| 2502860 | | | | C1 K1L1 | CEMENT ROOFING LIQUID |
| 2502860 | | 002000G | 2 | | |
| 2502860 | | 010000G | 3 | | |
| 2502860 | | 050000G | 3 | | |

| MTB CL-CODE | PIRS CODE | QTY U | N U | PERSONNEL PROTECTION GEAR CODE =A=B=C=D=E=F=G=H=I=J=K=L=M=N=O= | CHEMICAL DESCRIPTION |
|---|---|---|---|---|---|
| 2505130 | | | | A1 J6 | FLAMMABLE LIQUIDS N.O.S. |
| 2505130 | | 001000G | 2 | | |
| 2505130 | | 005000G | 3 | | |
| 2505130 | | 010000G | 3 | | |
| 2505130 | | 050000G | 4 | | |
| 2505360 | | | | A1 K1L1 | GASOLINE |
| 2505360 | | 001000G | 2 | | |
| 2505360 | | 005000G | 2 | | |
| 2505360 | | 010000G | 3 | | |
| 2505360 | | 025000G | 4 | | |
| 2505580 | | | | A1 K1L1 | HEXANE |
| 2505580 | | 001000G | 2 | | |
| 2505580 | | 005000G | 2 | | |
| 2505580 | | 010000G | 3 | | |
| 2505580 | | 030000G | 4 | | |
| 2505960 | | | | G1H1 J1 | INK |
| 2505960 | | 000150F | 2 | | |
| 2505960 | | 001000F | 2 | | |
| 2505960 | | 005000F | 3 | | |
| 2506000 | | | | A1 J1 | INSECTICIDE FLAMMABLE LIQUID N.O.S. |
| 2506000 | | 000500G | 2 | | |
| 2506000 | | 001000G | 2 | | |
| 2506000 | | 005000G | 3 | | |
| 2506000 | | 010000G | 4 | | |
| 2506080 | | | | A1 K1L1 | ISOPENTANE |
| 2506080 | | 001000G | 2 | | |
| 2506080 | | 005000G | 2 | | |
| 2506080 | | 010000G | 3 | | |
| 2506080 | | 025000G | 3 | | |
| 2506924 | | | | B1 J1 | METHYLAL |
| 2506924 | | 001000G | 2 | | |
| 2506924 | | 005000G | 2 | | |
| 2506924 | | 010000G | 3 | | |
| 2506924 | | 050000G | 4 | | |
| 2507040 | | | | A1 J3 | METHYL ETHYL KETONE |
| 2507040 | | 002000G | 2 | | |
| 2507040 | | 005000G | 2 | | |
| 2507040 | | 010000G | 2 | | |
| 2507040 | | 025000G | 3 | | |
| 2507100 | | | | A1 J3 | METHYL METHACRYLATE MONOMER INHIBITED |
| 2507100 | | 001000G | 2 | | |
| 2507100 | | 005000G | 2 | | |
| 2507100 | | 010000G | 3 | | |
| 2507100 | | 025000G | 3 | | |
| 2507490 | | | | A1 K1L1 | MOTOR FUEL N.O.S. FLAMMABLE LIQUID |
| 2507490 | | 001000G | 2 | | |
| 2507490 | | 005000G | 2 | | |
| 2507490 | | 010000G | 3 | | |
| 2507490 | | 025000G | 4 | | |

| MTB CL-CODE | PIRS CODE | QTY U | N U | PERSONNEL PROTECTION GEAR CODE -A-B-C-D-E-F-G-H-I-J-K-L-M-N-O- | CHEMICAL DESCRIPTION |
|---|---|---|---|---|---|
| 2510340 | | | | A1 K6L6 | TOLUENE OR TOLUOL |
| 2510340 | | 000500G | 2 | | |
| 2510340 | | 005000G | 3 | | |
| 2510340 | | 010000G | 3 | | |
| 2510340 | | 025000G | 4 | | |
| 2510650 | | | | A1 J1 | VINYL ACETATE |
| 2510650 | | 001000G | 2 | | |
| 2510650 | | 005000G | 2 | | |
| 2510650 | | 010000G | 3 | | |
| 2510650 | | 025000G | 3 | | |
| 2510890 | | | | A1 K6L6 | XYLENE (XYLOL) |
| 2510890 | | 002000G | 2 | | |
| 2510890 | | 005000G | 2 | | |
| 2510890 | | 010000G | 3 | | |
| 2510890 | | 050000G | 4 | | |
| 3002535 | | | | G1 K1L1 | CALCIUM CARBIDE |
| 3002535 | | 000500F | 2 | | |
| 3002535 | | 002000F | 2 | | |
| 3002535 | | 010000F | 3 | | |
| 3005140 | | | | A1 J6 | FLAMMABLE SOLIDS N.O.S. |
| 3005140 | | 001000G | 2 | | |
| 3005140 | | 005000G | 3 | | |
| 3005140 | | 010000G | 3 | | |
| 3005140 | | 050000G | 4 | | |
| 3008460 | | | | A1 J1 O1 | PHOSPHORUS WHITE OR YELLOW WET |
| 3008460 | | 000250F | 2 | | |
| 3008460 | | 001000F | 3 | | |
| 3008460 | | 005000F | 4 | | |
| 3009570 | | | | G1H1I1J1 | SODIUM HYDROSULFITE |
| 3009570 | | 001000F | 2 | | |
| 3009570 | | 005000F | 2 | | |
| 3009570 | | 010000F | 3 | | |
| 3009570 | | 050000F | 3 | | |
| 3501340 | | | | G1 K1L1 | AMMONIUM NITRATE NO ORGANIC COATING |
| 3501340 | | 001000F | 2 | | |
| 3501340 | | 025000F | 2 | | |
| 3501350 | | | | G1 K1L1 | AMMONIUM NITRATE FERTILIZE |
| 3501350 | | 005000F | 2 | | |
| 3501350 | | 010000F | 2 | | |
| 3501350 | | 025000F | 3 | | |
| 3502130 | | | | A1 J2 | BENZOYL PEROXIDE |
| 3502130 | | 000500G | 2 | | |
| 3502130 | | 002000G | 3 | | |
| 3502130 | | 010000G | 4 | | |
| 3502560 | | | | F1 K2L2 O1 | CALCIUM HYPOCHLORITE MIXTURE DRY .GT. 39% CHLORINE |
| 3502560 | | 000250F | 2 | | |
| 3502560 | | 001000F | 2 | | |
| 3502560 | | 005000F | 2 | | |
| 3502560 | | 010000F | 3 | | |
| 3502560 | | 030000F | 3 | | |

| MTB CL-CODE | PIRS CODE | QTY U | N U | PERSONNEL PROTECTION GEAR CODE -A-B-C-D-E-F-G-H-I-J-K-L-M-N-O- | CHEMICAL DESCRIPTION |
|---|---|---|---|---|---|
| 5003670 | | | | C1 | COMPRESSED GAS FLAMMABLE N.O.S. |
| 5003670 | | | 0 | | |
| 5004710 | | | | C1 K2 | ETHYLENE |
| 5004710 | | 000001G | 2 | | |
| 5005690 | | | | C1 K1 | HYDROCARBON GAS NONLIQUEFIED |
| 5005690 | | | 0 | | |
| 5005810 | | | | A1 J6 | HYDROGEN |
| 5005810 | | 000001G | 2 | | |
| 5005860 | | | | A1 J1 | HYDROGEN SULFIDE |
| 5005860 | | 000500G | 2 | | |
| 5005860 | | 005000G | 3 | | |
| 5005860 | | 010000G | 3 | | |
| 5006300 | | | | A1 H1 | LIQUID PETROLEUM GAS |
| 5006300 | | | 0 | | |
| 5010480 | | | | C1 K1L1 | TRIMETHYLAMINE ANHYDROUS |
| 5010480 | | 001000G | 2 | | |
| 5010480 | | 010000G | 2 | | |
| 5010480 | | 025000G | 3 | | |
| 6001640 | | | | C1 J2 | ANILINE OIL LIQUID |
| 6001640 | | 001000G | 2 | | |
| 6001640 | | 005000G | 2 | | |
| 6001640 | | 010000G | 2 | | |
| 6001640 | | 025000G | 3 | | |
| 6002670 | | | | A1 J2 O1 | CARBOLIC ACID LIQUID |
| 6002670 | | 001000G | 2 | | |
| 6002670 | | 005000G | 3 | | |
| 6002670 | | 010000G | 3 | | |
| 6002670 | | 030000G | 4 | | |
| 6002680 | | | | A1 J2 O1 | CARBOLIC ACID SOLID |
| 6002680 | | 001000G | 2 | | |
| 6002680 | | 005000G | 3 | | |
| 6002680 | | 010000G | 3 | | |
| 6002680 | | 030000G | 4 | | |
| 6003600 | | | | C1 K1L1 | COMPOUND TREE/WEED KILLER POISON B. LIQUID |
| 6003600 | | 000500G | 2 | | |
| 6003600 | | 002000G | 3 | | |
| 6003600 | | 005000G | 3 | | |
| 6003600 | | 010000G | 4 | | |
| 6003820 | | | | G1H1I1J1 | CYANIDE OR MIXTURES |
| 6003820 | | 000250F | 2 | | |
| 6003820 | | 001000F | 3 | | |
| 6003820 | | 005000F | 3 | | |
| 6003820 | | 010000F | 4 | | |
| 6003860 | | | | G1H1I1 K1L1 | SODIUM CYANIDE SOLID |
| 6003860 | | 001000F | 2 | | |
| 6003860 | | 005000F | 3 | | |
| 6003860 | | 010000F | 3 | | |

## PERSONNEL PROTECTION GEARS REQUIREMENTS (@ DIFFERENT SPILL SIZES)



| MTB CL-CODE | PIRS CODE | QTY | NU | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | CHEMICAL DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6008540 | | | | | | C1 | | | | | | | J6 | | | | | | POISONOUS SOLID CLASS B N.O.S. |
| 6008540 | | 001000F | 2 | | | | | | | | | | | | | | | | |
| 6008540 | | 005000F | 2 | | | | | | | | | | | | | | | | |
| 6008540 | | 010000F | 3 | | | | | | | | | | | | | | | | |
| 6008540 | | 050000F | 3 | | | | | | | | | | | | | | | | |
| 6010336 | | | | | | C1 | | | | | | | J2 | | | | | | TOLUENE DIISOCYANATE |
| 6010336 | | 000500G | 2 | | | | | | | | | | | | | | | | |
| 6010336 | | 005000G | 3 | | | | | | | | | | | | | | | | |
| 6010336 | | 010000G | 4 | | | | | | | | | | | | | | | | |
| 9501004 | | | | | | | | | F1 | | | | J1 | | | | | 01 | ACETIC AQUEOUS SOLUTION |
| 9501004 | | 001000F | 2 | | | | | | | | | | | | | | | | |
| 9501004 | | 005000F | 2 | | | | | | | | | | | | | | | | |
| 9501004 | | 010000F | 3 | | | | | | | | | | | | | | | | |
| 9501004 | | 030000F | 3 | | | | | | | | | | | | | | | | |
| 9501006 | | | | | | C1 | | | | | | | J4 | | | | | 01 | ACETIC ACID GLACIAL |
| 9501006 | | 001000G | 2 | | | | | | | | | | | | | | | | |
| 9501006 | | 005000G | 3 | | | | | | | | | | | | | | | | |
| 9501006 | | 020000G | 4 | | | | | | | | | | | | | | | | |
| 9501008 | | | | A1 | | | | | | | | | J4 | | | | | 01 | ACETIC ANHYDRIDE |
| 9501008 | | 001000G | 2 | | | | | | | | | | | | | | | | |
| 9501008 | | 005000G | 3 | | | | | | | | | | | | | | | | |
| 9501008 | | 010000G | 3 | | | | | | | | | | | | | | | | |
| 9501008 | | 020000G | 3 | | | | | | | | | | | | | | | | |
| 9501120 | | | | A1 | | | | | | | | | J1 | | | | | 01 | ACID LIQUID N.O.S. |
| 9501120 | | 000500G | 2 | | | | | | | | | | | | | | | | |
| 9501120 | | 005000G | 3 | | | | | | | | | | | | | | | | |
| 9501120 | | 010000G | 3 | | | | | | | | | | | | | | | | |
| 9501120 | | 050000G | 4 | | | | | | | | | | | | | | | | |
| 9501125 | | | | | | | | | | | H1 | I1 | J1 | | | | | 01 | ACID SLUDGE |
| 9501125 | | 002000G | 2 | | | | | | | | | | | | | | | | |
| 9501125 | | 005000G | 3 | | | | | | | | | | | | | | | | |
| 9501125 | | 025000G | 3 | | | | | | | | | | | | | | | | |
| 9501132 | | | | | | C1 | | | | | | | J1 | | | | | 01 | ACRYLIC ACID |
| 9501132 | | 001000G | 2 | | | | | | | | | | | | | | | | |
| 9501132 | | 005000G | 2 | | | | | | | | | | | | | | | | |
| 9501132 | | 010000G | 3 | | | | | | | | | | | | | | | | |
| 9501240 | | | | A1 | | | | | | | | | J1 | | | | | 01 | ALKALINE LIQUID N.O.S. |
| 9501240 | | 001000G | 2 | | | | | | | | | | | | | | | | |
| 9501240 | | 005000G | 3 | | | | | | | | | | | | | | | | |
| 9501240 | | 010000G | 4 | | | | | | | | | | | | | | | | |
| 9501270 | | | | | B1 | | | | | | | | J1 | | | | | | ALKALINE CORROSIVE LIQUID N.O.S. |
| 9501270 | | 002000G | 2 | | | | | | | | | | | | | | | | |
| 9501270 | | 005000G | 2 | | | | | | | | | | | | | | | | |
| 9501270 | | 010000G | 3 | | | | | | | | | | | | | | | | |
| 9501270 | | 030000G | 3 | | | | | | | | | | | | | | | | |
| 9501336 | | | | A1 | | | | | | | | | J1 | | | | | | AMMONIUM HYDROXIDE .LT. 45% AMMONIA |
| 9501336 | | 002000G | 2 | | | | | | | | | | | | | | | | |
| 9501336 | | 005000G | 2 | | | | | | | | | | | | | | | | |
| 9501336 | | 010000G | 3 | | | | | | | | | | | | | | | | |
| 9501336 | | 050000G | 4 | | | | | | | | | | | | | | | | |

# USCG HAZARDOUS CHEMICAL SPILLS RESPONSE

## PERSONNEL PROTECTION GEARS REQUIREMENTS (@ DIFFERENT SPILL SIZES)



| MTB CL-CODE | PIRS CODE | QTY U | N U | PERSONNEL PROTECTION GEAR CODE -A-B-C-D-E-F-G-H-I-J-K-L-M-N-O- | CHEMICAL DESCRIPTION |
|---|---|---|---|---|---|
| 9503570 | | | | A1 J6 01 | COMPOUND PAINT REMOVER CORROSIVE LIQUID |
| 9503570 | | 000500G | 2 | | |
| 9503570 | | 002000G | 3 | | |
| 9503570 | | 005000G | 4 | | |
| 9503570 | | 010000G | 4 | | |
| 9503730 | | | | A1 J6 01 | CORROSIVE LIQUID N.O.S. |
| 9503730 | | 000250G | 2 | | |
| 9503730 | | 000500G | 2 | | |
| 9503730 | | 001000G | 3 | | |
| 9503735 | | | | G1H1I1J1 01 | CORROSIVE SOLID N.O.S. |
| 9503735 | | 001000F | 2 | | |
| 9503735 | | 005000F | 2 | | |
| 9503735 | | 010000F | 3 | | |
| 9503735 | | 050000F | 3 | | |
| 9504480 | | | | H1I1 K1L1 01 | DRUGS CHEMICALS CORROSIVE |
| 9504480 | | 002000G | 2 | | |
| 9504480 | | 010000G | 2 | | |
| 9504480 | | 025000G | 3 | | |
| 9504560 | | | | H1 J4 01 | ELECTROLYTE BATTERY FLUID |
| 9504560 | | 000500G | 2 | | |
| 9504560 | | 005000G | 3 | | |
| 9504560 | | 010000G | 3 | | |
| 9504560 | | 050000G | 4 | | |
| 9505005 | | | | G1H1I1J1 01 | FERRIC CHLORIDE SOLUTION |
| 9505005 | | 005000F | 2 | | |
| 9505005 | | 010000F | 2 | | |
| 9505005 | | 030000F | 2 | | |
| 9505165 | | | | A1 J1 01 | FLUOBORIC ACID |
| 9505165 | | 000250G | 2 | | |
| 9505165 | | 000500G | 2 | | |
| 9505165 | | 001000G | 3 | | |
| 9505190 | | | | A1 J2 01 | FORMIC ACID |
| 9505190 | | 000250G | 2 | | |
| 9505190 | | 001000G | 2 | | |
| 9505190 | | 005000G | 3 | | |
| 9505570 | | | | A1 J1 | HEXAMETHYLENE DIAMINE SOLUTION |
| 9505570 | | 000500G | 2 | | |
| 9505570 | | 002000G | 2 | | |
| 9505570 | | 005000G | 3 | | |
| 9505650 | | | | A1 J2 | HYDRAZINE SOL .LT. 51 WT |
| 9505650 | | 000100G | 2 | | |
| 9505650 | | 000500G | 3 | | |
| 9505650 | | 001000G | 4 | | |
| 9505700 | | | | A1 J2 01 | HYDROCHLORIC ACID |
| 9505700 | | 001000G | 2 | | |
| 9505700 | | 005000G | 3 | | |
| 9505700 | | 010000G | 4 | | |
| 9505700 | | 025000G | 4 | | |

PERSONNEL PROTECTION GEARS
REQUIREMENTS
(@ DIFFERENT SPILL SIZES)



| CL | MTB CODE | PIRS CODE | QTY U | N U | PERSONNEL PROTECTION GEAR CODE -A-B-C-D-E-F-G-H-I-J-K-L-M-N-O- | CHEMICAL DESCRIPTION |
|---|---|---|---|---|---|---|
| 95 | 08628 | | | | H1I1J2 01 | POTASSIUM HYDROXIDE LIQUID OR SOLUTION |
| 95 | 08628 | | 000200G | 2 | | |
| 95 | 08628 | | 000500G | 2 | | |
| 95 | 08628 | | 010000G | 3 | | |
| 95 | 08628 | | 025000G | 3 | | |
| 95 | 09760 | | | | A1 I1J1 01 | SULFURIC ACID SPENT |
| 95 | 09760 | | 001000G | 2 | | |
| 95 | 09760 | | 005000G | 2 | | |
| 95 | 09760 | | 010000G | 3 | | |
| 95 | 09760 | | 020000G | 3 | | |
| 95 | 08766 | | | | A1 K1L1 01 | PROPIONIC ACID |
| 95 | 08766 | | 001000F | 2 | | |
| 95 | 08766 | | 005000F | 2 | | |
| 95 | 08766 | | 025000F | 3 | | |
| 95 | 09930 | | | | A1 J1 01 | SULFURIC ACID |
| 95 | 09930 | | 001000G | 2 | | |
| 95 | 09930 | | 005000G | 3 | | |
| 95 | 09930 | | 010000G | 4 | | |
| 95 | 09890 | | | | A1 J1 01 | SULFURIC CHLORIDE |
| 95 | 09890 | | 000050G | 2 | | |
| 95 | 09890 | | 000250G | 3 | | |
| 95 | 09890 | | 001000G | 4 | | |
| 95 | 10230 | | | | A1 J6 01 | THIONYL CHLORIDE |
| 95 | 10230 | | 000250G | 2 | | |
| 95 | 10230 | | 000500G | 2 | | |
| 95 | 10230 | | 001000G | 3 | | |
| 95 | 10230 | | 005000G | 4 | | |
| 95 | 10290 | | | | A1 J2 01 | TIN TETRACHLORIDE ANHYDROUS |
| 95 | 10290 | | 001000G | 2 | | |
| 95 | 10290 | | 005000G | 3 | | |
| 95 | 10290 | | 025000G | 4 | | |
| 95 | 10730 | | | | H1I1 K1L1 01 | WATER TREATMENT COMPOUNL LIQUID |
| 95 | 10730 | | 002000G | 2 | | |
| 95 | 10730 | | 010000G | 3 | | |

| MTB CL-CODE | PIRS CODE | QTY U | N U | PERSONNEL PROTECTION GEAR CODE =A=B=C=D=E=F=G=H=I=J=K=L=M=N=O= | CHEMICAL DESCRIPTION |
|---|---|---|---|---|---|
| | 2002 | | | A1 J4 O1 | ACETIC ANHYDRIDE |
| | 2002 | 001000G | 2 | | |
| | 2002 | 005000G | 3 | | |
| | 2002 | 010000G | 3 | | |
| | 2002 | 025000G | 3 | | |
| | 2003 | | | A1 J2 | ACETONE |
| | 2003 | 002000G | 2 | | |
| | 2003 | 005000G | 2 | | |
| | 2003 | 010000G | 2 | | |
| | 2003 | 025000G | 3 | | |
| | 2004 | | | A1 J2 | ACETONE CYANOHYDRIN |
| | 2004 | 000250G | 2 | | |
| | 2004 | 001000G | 3 | | |
| | 2004 | 005000G | 3 | | |
| | 2004 | 010000G | 4 | | |
| | 2005 | | | A1 K1L1 | ACETONITRILE (METHYLCYANIDE) |
| | 2005 | 001000G | 2 | | |
| | 2005 | 005000G | 3 | | |
| | 2005 | 010000G | 3 | | |
| | 2005 | 025000G | 4 | | |
| | 2008 | | | C1 J1 O1 | ACRYLIC ACID |
| | 2008 | 001000G | 2 | | |
| | 2008 | 002000G | 2 | | |
| | 2008 | 025000G | 3 | | |
| | 2009 | | | A1 J1 | ACRYLONITRILE |
| | 2009 | 000500G | 2 | | |
| | 2009 | 005000G | 3 | | |
| | 2009 | 025000G | 4 | | |
| | 2010 | | | A1 J1 | ADIPONITRILE |
| | 2010 | 000500G | 2 | | |
| | 2010 | 001000G | 2 | | |
| | 2010 | 005000G | 3 | | |
| | 2010 | 025000G | 4 | | |
| | 2020 | | | A1 J6 O1 | BENZYL CHLORIDE |
| | 2020 | 000500G | 2 | | |
| | 2020 | 001000G | 2 | | |
| | 2020 | 005000G | 3 | | |
| | 2020 | 025000G | 4 | | |
| | 2011 | | | C1 J1 | ALLYL ALCOHOL |
| | 2011 | 001000G | 2 | | |
| | 2011 | 005000G | 2 | | |
| | 2011 | 010000G | 3 | | |
| | 2011 | 025000G | 3 | | |
| | 2013 | | | A1 J1 O1 | CADMIUM COMPOUNDS |
| | 2013 | 000500G | 2 | | |
| | 2013 | 002000G | 3 | | |
| | 2013 | 005000G | 4 | | |

PERSONNEL PROTECTION GEARS
REQUIREMENTS
(@ DIFFERENT SPILL SIZES)



| MTB CL-CODE | PIRS CODE | QTY U | N U | PERSONNEL PROTECTION GEAR CODE -A-B-C-D-E-F-G-H-I-J-K-L-M-N-O- | CHEMICAL DESCRIPTION |
|---|---|---|---|---|---|
| | 2029 | | | C1 J6 | CARBON TETRACHLORIDE |
| | 2029 | 002000G | 2 | | |
| | 2029 | 005000G | 2 | | |
| | 2029 | 025000G | 3 | | |
| | 2030 | | | G1H1I1J1 O1 | CAUSTIC SODA |
| | 2030 | 002000F | 2 | | |
| | 2030 | 005000F | 2 | | |
| | 2030 | 010000F | 3 | | |
| | 2030 | 025000F | 3 | | |
| | 2031 | | | A1 J1 | CHLOROFORM |
| | 2031 | 001000G | 2 | | |
| | 2031 | 005000G | 3 | | |
| | 2031 | 010000G | 4 | | |
| | 2032 | | | F1 J1 O1 | CHLOROSULFONIC ACID |
| | 2032 | 001000G | 2 | | |
| | 2032 | 005000G | 3 | | |
| | 2032 | 010000G | 3 | | |
| | 2032 | 025000G | 4 | | |
| | 2033 | | | C1 H1 J1 O1 | CRESOL |
| | 2033 | 001000G | 2 | | |
| | 2033 | 005000G | 3 | | |
| | 2033 | 010000G | 3 | | |
| | 2033 | 030000G | 4 | | |
| | 2034 | | | A1 J2 | CROTONALDEHYDE |
| | 2034 | 001000G | 2 | | |
| | 2034 | 005000G | 2 | | |
| | 2034 | 025000G | 3 | | |
| | 2035 | | | C1 K3L3 | CYCLO HEXANE |
| | 2035 | 002000G | 2 | | |
| | 2035 | 005000G | 2 | | |
| | 2035 | 010000G | 3 | | |
| | 2035 | 025000G | 3 | | |
| | 2039 | | | A1 J6 | DICHLOROPROPANE-DICHLOROPROPANE MIXTURE (D.D. SOIL FUMIGANT) |
| | 2039 | 002000G | 2 | | |
| | 2039 | 005000G | 2 | | |
| | 2039 | 010000G | 3 | | |
| | 2039 | 025000G | 3 | | |
| | 2040 | | | A1 J1 | DIETHANOLAMINE |
| | 2040 | 002000G | 2 | | |
| | 2040 | 005000G | 2 | | |
| | 2040 | 025000G | 2 | | |
| | 2044 | | | A1 J2 | DIMETHYLAMINE (40% AQUEOUS) |
| | 2044 | 002000G | 2 | | |
| | 2044 | 005000G | 2 | | |
| | 2044 | 010000G | 2 | | |
| | 2046 | | | H1 K1L1 | GLYCOL |
| | 2046 | 005000G | 2 | | |
| | 2046 | 010000G | 2 | | |
| | 2046 | 025000G | 2 | | |

| MTB CL-CODE | PIRS CODE | QTY U | NU | PERSONNEL PROTECTION GEAR CODE -A-B-C-D-E-F-G-H-I-J-K-L-M-N-O- | CHEMICAL DESCRIPTION |
|---|---|---|---|---|---|
| | 2060 | | | A1 J1 O1 | HYDROCHLORIC ACID |
| | 2060 | 001000G | 2 | | |
| | 2060 | 005000G | 2 | | |
| | 2060 | 010000G | 3 | | |
| | 2060 | 025000G | 4 | | |
| | 2061 | | | A1 J4 O1 | HYDROFLUORIC ACID (40% AQUEOUS) |
| | 2061 | 000150G | 2 | | |
| | 2061 | 000500G | 3 | | |
| | 2061 | 001000G | 4 | | |
| | 2062 | | | A1 J1 | HYDROGEN PEROXIDE (.GT. 60%) |
| | 2062 | 002000G | 2 | | |
| | 2062 | 005000G | 3 | | |
| | 2062 | 010000G | 3 | | |
| | 2062 | 025000G | 4 | | |
| | 2063 | | | A1 K1L1M1 | ISOPRENE |
| | 2063 | 002000G | 2 | | |
| | 2063 | 005000G | 2 | | |
| | 2063 | 025000G | 3 | | |
| | 2064 | | | C1 K2L2 | ISOPROPYL ALCOHOL |
| | 2064 | 002000G | 2 | | |
| | 2064 | 005000G | 2 | | |
| | 2064 | 010000G | 2 | | |
| | 2064 | 030000G | 3 | | |
| | 2065 | | | B1 J1 | LIQUID SULFUR |
| | 2065 | 005000F | 2 | | |
| | 2065 | 025000F | 2 | | |
| | 2066 | | | C1 K1L1 | METHYL ACRYLATE |
| | 2066 | 001000G | 2 | | |
| | 2066 | 005000G | 2 | | |
| | 2066 | 010000G | 3 | | |
| | 2066 | 025000G | 3 | | |
| | 2067 | | | C1 K1L1 | METHYL ALCOHOL |
| | 2067 | 002000G | 2 | | |
| | 2067 | 005000G | 2 | | |
| | 2067 | 010000G | 2 | | |
| | 2067 | 030000G | 3 | | |
| | 2069 | | | A1 J3 | METHYL ETHYL KETONE (2-BUTANONE) |
| | 2069 | 002000G | 2 | | |
| | 2069 | 005000G | 2 | | |
| | 2069 | 010000G | 2 | | |
| | 2069 | 025000G | 3 | | |
| | 2070 | | | C1 J1 | METHYL ISO-BUTYL KETONE |
| | 2070 | 002000G | 2 | | |
| | 2070 | 005000G | 2 | | |
| | 2070 | 010000G | 2 | | |
| | 2070 | 025000G | 3 | | |

| MTB CL-CODE | PIRS CODE | QTY U | N U | PERSONNEL PROTECTION GEAR CODE -A-B-C-D-E-F-G-H-I-J-K-L-M-N-O- | CHEMICAL DESCRIPTION |
|---|---|---|---|---|---|
| | 2085 | | | A1 K2L2 | PROPYLENE OXIDE |
| | 2085 | 005000G | 2 | | |
| | 2085 | 010000G | 2 | | |
| | 2085 | 025000G | 3 | | |
| | 2095 | 025000G | 2 | | |
| | 2086 | | | A1 J2 | STYRENE |
| | 2086 | 001000G | 2 | | |
| | 2086 | 005000G | 3 | | |
| | 2086 | 010000G | 3 | | |
| | 2086 | 030000G | 4 | | |
| | 2087 | | | A1 O1 | SULFURIC ACID |
| | 2087 | 001000G | 2 | | |
| | 2087 | 005000G | 2 | | |
| | 2087 | 010000G | 3 | | |
| | 2087 | 025000G | 3 | | |
| | 2088 | | | A1 J1 | TETRATHYL LEAD |
| | 2088 | 000500G | 2 | | |
| | 2088 | 002000G | 3 | | |
| | 2088 | 005000G | 3 | | |
| | 2088 | 010000G | 4 | | |
| | 2089 | | | A1 J1 | TOLUENE |
| | 2089 | 001000G | 2 | | |
| | 2089 | 005000G | 2 | | |
| | 2089 | 010000G | 3 | | |
| | 2089 | 030000G | 3 | | |
| | 2090 | | | C1 J6 | TRICHLOROETHANE |
| | 2090 | 000500G | 2 | | |
| | 2090 | 005000G | 2 | | |
| | 2090 | 010000G | 3 | | |
| | 2090 | 025000G | 3 | | |
| | 2093 | | | C1 K6L6 | TURPENTINE |
| | 2093 | 005000G | 2 | | |
| | 2093 | 010000G | 2 | | |
| | 2093 | 025000G | 3 | | |
| | 2094 | | | C1 J1 | VINYL ACETATE |
| | 2094 | 002000G | 2 | | |
| | 2094 | 005000G | 2 | | |
| | 2094 | 020000G | 2 | | |
| | 2095 | | | C1 J2 | VINYLIDENE CHLORIDE |
| | 2095 | 002000G | 2 | | |
| | 2095 | 005000G | 2 | | |
| | 2095 | 010000G | 2 | | |
| | 2096 | | | A1 K6L6M6 | XYLENE |
| | 2096 | 001000G | 2 | | |
| | 2096 | 005000G | 3 | | |
| | 2096 | 010000G | 3 | | |
| | 2096 | 025000G | 3 | | |

| MTB CL-CODE | PIRS CODE | QTY | U | N U | PERSONNEL PROTECTION GEAR CODE (A-B-C-D-E-F-G-H-I-J-K-L-M-N-O) | CHEMICAL DESCRIPTION |
|---|---|---|---|---|---|---|
| | 2124 | | | | A1 H1 J1 | CYANIDE COMPOUNDS |
| | 2124 | 000500 | F | 2 | | |
| | 2124 | 002000 | F | 3 | | |
| | 2124 | 010000 | F | 3 | | |
| | 2124 | 030000 | F | 4 | | |
| | 2125 | | | | G1H1 K1L1 | 2,4-D (ACID) |
| | 2125 | 001000 | F | 2 | | |
| | 2125 | 005000 | F | 3 | | |
| | 2125 | 010000 | F | 3 | | |
| | 2125 | 025000 | F | 4 | | |
| | 2136 | | | | A1 J1 | DINITROPHENOL |
| | 2136 | 001000 | F | 2 | | |
| | 2136 | 005000 | F | 3 | | |
| | 2136 | 010000 | F | 3 | | |
| | 2136 | 025000 | F | 4 | | |
| | 2145 | | | | A1 K2L2 | ETHYLBENZENE |
| | 2145 | 002000 | G | 2 | | |
| | 2145 | 005000 | G | 2 | | |
| | 2145 | 010000 | G | 2 | | |
| | 2145 | 030000 | G | 3 | | |
| | 2146 | | | | A1 J1 O1 | FLUORINE COMPOUNDS |
| | 2146 | 000500 | F | 2 | | |
| | 2146 | 002000 | F | 3 | | |
| | 2146 | 010000 | F | 3 | | |
| | 2146 | 030000 | F | 4 | | |
| | 2151 | | | | G1 I1 K1L1 | IRON COMPOUNDS |
| | 2151 | 002000 | F | 2 | | |
| | 2151 | 005000 | F | 2 | | |
| | 2151 | 010000 | F | 2 | | |
| | 2151 | 030000 | F | 3 | | |
| | 2153 | | | | B1 J1 | LEAD COMPOUNDS |
| | 2153 | 002000 | F | 2 | | |
| | 2153 | 005000 | F | 2 | | |
| | 2153 | 010000 | F | 2 | | |
| | 2153 | 030000 | F | 3 | | |
| | 2156 | | | | G1 I1 K1L1 | MALEIC ACID |
| | 2156 | 005000 | F | 2 | | |
| | 2156 | 010000 | F | 2 | | |
| | 2156 | 025000 | F | 2 | | |
| | 2158 | | | | G1 I1 K1L1 O1 | MERCURY COMPOUNDS |
| | 2158 | 000500 | F | 2 | | |
| | 2158 | 002000 | F | 3 | | |
| | 2158 | 010000 | F | 3 | | |
| | 2158 | 030000 | F | 4 | | |
| | 2161 | | | | C1 J2 | METHYL PARATHION |
| | 2161 | 000250 | F | 2 | | |
| | 2161 | 001000 | F | 3 | | |
| | 2161 | 005000 | F | 4 | | |

USCG HAZARDOUS CHEMICAL SPILLS RESPONSE

PERSONNEL PROTECTION GEARS
REQUIREMENTS
(@ DIFFERENT SPILL SIZES)



| MTB CL-CODE | PIRS CODE | QTY U | N U | PERSONNEL PROTECTION GEAR CODE -A-B-C-D-E-F-G-H-I-J-K-L-M-N-O- | CHEMICAL DESCRIPTION |
|---|---|---|---|---|---|
| | 2190 | | | A1 J2 | SODIUM HYDROXIDE |
| | 2190 | 002000G | 2 | | |
| | 2190 | 005000G | 3 | | |
| | 2190 | 010000G | 3 | | |
| | 2190 | 030000G | 4 | | |
| | 2191 | | | H1 K1L1 | SODIUM HYPOCHLORITE |
| | 2191 | 001000G | 2 | | |
| | 2191 | 005000G | 3 | | |
| | 2191 | 010000G | 3 | | |
| | 2191 | 025000G | 3 | | |
| | 2193 | | | G1 I1 K1L1 | SODIUM NITRITE |
| | 2193 | 005000F | 2 | | |
| | 2193 | 025000F | 2 | | |
| | 2195 | | | G1H1 J2 | SODIUM PHOSPHATE, MONOBASIC |
| | 2195 | 005000F | 2 | | |
| | 2195 | 025000F | 2 | | |
| | 2197 | | | G1H1 K1L1 O1 | SODIUM SULFIDE |
| | 2197 | 005000F | 2 | | |
| | 2197 | 025000F | 2 | | |
| | 2198 | | | G1H1 K1L1 | STRYCHNINE |
| | 2198 | 000050F | 2 | | |
| | 2198 | 000200F | 2 | | |
| | 2198 | 000500F | 2 | | |
| | 2199 | | | A1 J4 O1 | SULFUR MONOCHLORIDE |
| | 2199 | 001000G | 2 | | |
| | 2199 | 005000G | 3 | | |
| | 2199 | 010000G | 3 | | |
| | 2204 | | | C1 K2L2 | TOXAPHENE |
| | 2204 | 000050F | 2 | | |
| | 2204 | 000250F | 3 | | |
| | 2204 | 001000F | 4 | | |
| | 2209 | | | G1H1 K1L1 | URANIUM COMPOUNDS |
| | 2209 | 000200F | 2 | | |
| | 2209 | 001000F | 3 | | |
| | 2209 | 005000F | 3 | | |
| | 2209 | 010000F | 4 | | |
| | 2211 | | | A1 J2 | XYLENOL |
| | 2211 | 001000G | 2 | | |
| | 2211 | 005000G | 2 | | |
| | 2211 | 010000G | 3 | | |
| | 2211 | 025000G | 3 | | |
| | 2213 | | | A1 J1 O1 | ZINC COMPOUNDS |
| | 2213 | 002000F | 2 | | |
| | 2213 | 005000F | 2 | | |
| | 2213 | 010000F | 2 | | |
| | 2213 | 030000F | 3 | | |

| MTB CL-CODE | PIRS CODE | QTY U | N U | PERSONNEL PROTECTION GEAR CODE =A=B=C=D=E=F=G=H=I=J=K=L=M=N=O= | CHEMICAL DESCRIPTION |
|---|---|---|---|---|---|

NOTES :

COL 23 -- G = GALLONS ;
F = POUNDS

EQUIPMENTS CODES :

A1 = SCBA
A2 = SCBA - FOR HIGH CONCENTRATION
A3 = SCBA - PLASTIC LENS

B1 = CANISTER - ALL PURPOSE

C1 = CANISTER - ORGANIC

D1 = CANISTER - AMMONIA (ALKALI)

E1 = CANISTER - CHLORINE

F1 = CANISTER - ACID
F2 = CANISTER - ACID- CHROMIC AC FILT.

G1 = DUST MASK

H1 = CHEMICAL GOGGLES

I1 = FACE SHIELD

J1 = ALL RUBBER CLOTHING - NEOPRENE
J2 = ALL RUBBER CLOTHING - BUTYL RUBBER
J3 = ALL RUBBER CLOTHING - EPR
J4 = ALL RUBBER CLOTHING - HYPALON
J5 = ALL RUBBER CLOTHING - BUTADIENE
J6 = ALL RUBBER CLOTHING - FLUORO-ELASTOMER

K1 = RUBBER GLOVES - NEOPRENE
K2 = RUBBER GLOVES - BUTYL RUBBER
K3 = RUBBER GLOVES - EPR
K4 = RUBBER GLOVES - HYPALON
K5 = RUBBER GLOVES - BUTADIENE
K6 = RUBBER GLOVES - FLUORO-ELASTOMER

L1 = RUBBER BOOTS - NEOPRENE
L2 = RUBBER BOOTS - BUTYL RUBBER
L3 = RUBBER BOOTS - EPR
L4 = RUBBER BOOTS - HYPALON
L5 = RUBBER BOOTS - BUTADIENE
L6 = RUBBER BOOTS - FLUORO-ELASTOMER

M1 = HOOD

N1 = NO SPECIAL PROTECTION

O1 = CORROSIVE