National Cooperative Highway Research Program

NCHRP Synthesis 196

Highway Maintenance Procedures Dealing with Hazardous Material Incidents

A Synthesis of Highway Practice

Transportation Research Board
National Research Council

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Highway Maintenance Procedures Dealing with Hazardous Material Incidents

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PREFACE

A vast storehouse of information exists on nearly every subject of concern to highway administrators and engineers. Much of this information has resulted from both research and the successful application of solutions to the problems faced by practitioners in their daily work. Because previously there has been no systematic means for compiling such useful information and making it available to the entire highway community, the American Association of State Highway and Transportation Officials has, through the mechanism of the National Cooperative Highway Research Program, authorized the Transportation Research Board to undertake a continuing project to search out and synthesize useful knowledge from all available sources and to prepare documented reports on current practices in the subject areas of concern.

This synthesis series reports on various practices, making specific recommendations where appropriate but without the detailed directions usually found in handbooks or design manuals. Nonetheless, these documents can serve similar purposes, for each is a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems. The extent to which these reports are useful will be tempered by the user's knowledge and experience in the particular problem area.

FOREWORD

By Staff
Transportation
Research Board

This synthesis will be of interest to maintenance managers, maintenance engineers, health and safety officials, those responsible for environmental protection, police, and others concerned with responding to hazardous materials incidents on public highways. Information is presented on the educational, training, and equipment needs of maintenance personnel, as well as on the procedures for response, containment, and cleanup of hazardous materials.

Administrators, engineers, and researchers are continually faced with highway problems on which much information exists, either in the form of reports or in terms of undocumented experience and practice. Unfortunately, this information often is scattered and unevaluated, and, as a consequence, in seeking solutions, full information on what has been learned about a problem frequently is not assembled. Costly research findings may go unused, valuable experience may be overlooked, and full consideration may not be given to available practices for solving or alleviating the problem. In an effort to correct this situation, a continuing NCHRP project, carried out by the Transportation Research Board as the research agency, has the objective of reporting on common highway problems and synthesizing available information. The synthesis reports from this endeavor constitute an NCHRP publication series in which various forms of relevant information are assembled into single, concise documents pertaining to specific highway problems or sets of closely related problems.

This report of the Transportation Research Board discusses the procedures that are required by federal or state regulations and identifies the various response systems and responsibilities in effect in the states. It describes cautions and caveats that are generally recommended with regard to the training and involvement of highway maintenance forces.

Awareness training is noted as the primary and necessary requirement for maintenance personnel. Recommendations for improvements to educational procedures are also included.

To develop this synthesis in a comprehensive manner and to ensure inclusion of significant knowledge, the Board analyzed available information assembled from numerous sources, including a large number of state highway and transportation departments. A topic panel of experts in the subject area was established to guide the researcher in organizing and evaluating the collected data, and to review the final synthesis report.

This synthesis is an immediately useful document that records practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As the processes of advancement continue, new knowledge can be expected to be added to that now at hand.

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Eugene R. Russell, Sr., Ph.D., Kansas State University, was responsible for collection of the data and preparation of the report.

Valuable assistance in the preparation of this synthesis was provided by the Topic Panel, consisting of Raymond M. Brown, Supervisor, Hazardous Materials and Safety, The Port Authority of New York and New Jersey; James F. Condron, Highway Engineer, Federal Highway Administration, Georgia Division; Ernest N. Herrick, Highway Maintenance Planner, Connecticut Department of Transportation, Bureau of Highways; Antoine G. Hobeika, Director, Center for Transportation Research, Virginia Polytechnic Institute and State University; Howard A. Jongedyk, Research Engineer, Federal Highway Administration; Frank N. Lisle, Engineer of Maintenance, Transportation Research Board; and Keith L. Martin, Research Unit Engineer, Oregon Department of Transportation.

The Principal Investigators responsible for the conduct of this synthesis were Sally D. Liff, Manager, Synthesis Studies; and Scott A. Sabol, Program Officer, National Cooperative Research Program. This synthesis was edited by Linda S. Mason.

Information on current practice was provided by many highway and transportation agencies. Their cooperation and assistance were most helpful.

HIGHWAY MAINTENANCE PROCEDURES DEALING WITH HAZARDOUS MATERIAL INCIDENTS

SUMMARY

The main focus of this synthesis is to document the various procedures used by highway maintenance workers in different states to deal with emergencies involving hazardous material (hazmat) incidents on highways. Current practice is very diverse, there being more differences than commonalities among the states.

At one end of the spectrum are those states with policies or practices that limit their highway maintenance personnel to the observation and reporting of incidents. At most, such personnel are to protect themselves, secure the area, and assist in traffic control. At the other end of the spectrum, a few states expect maintenance personnel to do a little more (albeit as a support agency and under supervision) and give them a more clearly defined role in the direct containment of spills, plus cleanup activities when necessary. Based on questionnaire responses and accompanying written materials, one state has maintenance forces heavily involved in 12 different emergency activities, at least one other state indicated that the highway maintenance forces are sometimes "first responders," but only one state equips maintenance personnel with self-contained breathing apparatuses, encapsulated suits, and other safety devices.

The involvement of most states is limited to personnel training, mostly in first-level "awareness" or in the use of the U.S. Department of Transportation (USDOT) Emergency Response Guidebook (ERG). The ERG instructs personnel in all cases to protect themselves and the public by securing the area or by staying a safe distance away. It also emphasizes that, regardless of state policy, all highway maintenance personnel face the possibility of having a hazmat spill occur in their vicinity. They may thus become de facto first respondents: being prepared could save their lives.

In most states, a wide range of activities can be found between the extremes, but these activities focus on traffic control and providing some of the equipment and materials needed for containment and cleanup. Further, these activities are usually in the normal course of response, always as a support agency, and always under supervision.

State training appears to be, or is intended to be, at the level of expected involvement. Because the major involvement of maintenance workers is to observe, report, and protect one's self and the public, the majority of training is "awareness" training. As one state responded, it wants its personnel to be well-trained as incident reporters. In a few states, supervisory personnel are given emergency-response training. However, training does not appear to be well-defined or uniformly practiced. It appears to range from excellent to poor to nonexistent. The USDOT ERG appears to be the most universal training resource. State guideline manuals on specific procedure appear to be scarce or nonexistent; other written guidelines tend to be brief and general in content.

Only a few states conduct exercises in which highway maintenance personnel participate. Several respondents answered that procedures were transmitted only verbally. Only

a few respondents indicated that there was a full range of annual or regular formal training courses or exercises. At least one state responded that no training is given, and a few had no response to the question of training availability.

Most states do not provide special hazmat response equipment but do assist with digging and hauling equipment, e.g., shovels, backhoes, loaders, dump trucks. Many provide sand, but only a few stock or handle special absorbent materials. Two or three states make an attempt to disperse these materials at area maintenance facilities. Only one state disperses special hazmat response trailers (for use by others). Most of what is available to support incident response is normal maintenance equipment and temporary traffic-control devices.

Several states place hazmat incidents into categories such as minor, medium, or major; maintenance personnel are more likely to be involved, and to a greater extent, in those in the minor category.

Some states differentiate between oil spills and chemical-hazmat spills; highway maintenance forces are more likely to be involved in oil-spill mitigation and cleanup.

The following conclusions were drawn from the information developed for this synthesis:

- Highway maintenance personnel play a support role, albeit quite variable, from state to state.
- Traffic control assistance is the most common support activity.
- Most states have clear-cut policies and procedures, but they tend to be brief and generic.
- Most states provide some training, but it is not always high quality: training is not ongoing and training exercises are scarce.
- Most states feel that "right-to-know" training as specified by the Occupational Safety and Health Act of 1970 should be more widespread.
- In only a few states do maintenance forces have or stock special supplies or equipment for handling hazmat incidents.
- In several states, maintenance forces use radiological measuring equipment.
- Most states use contractors for major cleanup jobs; some states use contractors for response mitigation and cleanup.

Several recommendations may be drawn from the information developed in this synthesis:

- All states should have clear, written policies and specific procedures for highway maintenance personnel to follow.
- Personnel should receive training courses and annual refresher courses consistent with state policies and procedures.
- All states should better prepare maintenance personnel to take proper "first responder" action for incidents that occur by chance in their vicinity.
- All maintenance personnel should receive, at a minimum, hazmat awareness training, including the use of the USDOT ERG and, perhaps, the use of supplementary material.
- Copies of state hazmat incident policy and response guides should be available in all highway field personnel vehicles.
- Binoculars should be available in all highway field personnel vehicles.
- Supervisory maintenance personnel should receive training at levels higher than awareness training, preferably a hands-on response course.
- Highway maintenance departments should be involved in all multiagency training exercises.

- Storing prepositioned spill-containment materials and equipment throughout the state should be considered.
- A comprehensive study of the cost-effectiveness of using private contractors vs. state forces for all response, mitigation, and cleanup of hazmat incidents should be made.
- Better dissemination of information should be a priority. State technology transfer (T^2) centers should become more involved in "publicizing" policies and procedures regarding hazmat incidents, assisting local agencies in keeping up with federal regulations, and providing a forum for states' exchange of information (through the T^2 clearinghouse).

Finally, any state adopting highway maintenance personnel procedures for dealing with hazmat incidents should address the following questions:

- Are the personnel sufficiently trained to minimize hazmat incident danger to the public and to themselves, and to properly assess and report the situation?
- Is full use being made of the personnel's potential to mitigate, within the limits of personnel safety, certain incidents where immediate action could save lives or minimize environmental damage?
- No matter what the personnel's role, whether by plan or by chance, is it clear through written and posted instructions?
- Are the personnel adequately trained and equipped for their roles?
- Are the personnel adequately trained to protect themselves (and possibly others) in the event that they happen to be first on the scene?

CHAPTER ONE

INTRODUCTION

BACKGROUND

This synthesis is directed toward maintenance managers and other personnel concerned with responding to hazardous materials (hazmat) incidents on public highways. It is assumed that these workers are aware of their major hazmat transportation problems and few facts and figures on the problem's magnitude and other background material related to state administration of technological disasters are included.

Some readers may require more comprehensive and detailed information on the issues, problems, and risks associated with the highway transportation of hazmats in the United States. Several good sources of this material are included in the references at the end of this synthesis (*1–10*).

In this synthesis, "accident" is used in the usual sense, i.e., the collision of an errant vehicle with another vehicle or object, or an overturning or unintentional leaving of the highway. An "incident" is a release of hazmat from a container. An incident may be the result of an accident, but it can also occur without an accident, e.g., a leaky valve or container rupture due to corrosion. Not all accidents result in incidents, e.g., there may be an accident but no release of hazmat cargo. Generally, and for the purpose of this synthesis, a "hazmat incident" is a spill or release of the hazmat cargo. Incident, spill, and release are used interchangeably.

Great quantities of hazmat are shipped daily on streets and highways throughout the United States. Although petroleum products are the most common, there are thousands of others. No complete data are available on hazmat shipments; however, compilation and analyses of available data can be found in several reports (*11–18*). Some brief statistics that may be of interest to maintenance personnel are presented in the following paragraphs.

Accident Type

Multiple-vehicle collisions are the leading type of accidents both for vehicles carrying hazmats (74 percent) and for those not carrying hazmats (52 percent). However, single-vehicle overturning and run-off-road accidents are the leading accident types resulting in hazmat releases; together they constitute 64 percent of releases. While multiple-vehicle collisions represent 47 percent of the accidents for trucks carrying hazmats, these accidents result in only 16 percent of all hazmat releases and tend to be less severe than single-vehicle collisions, which result in 53 percent of all releases (*7*).

Accidents involving hazmat-carrying trucks are twice as likely as other truck accidents to result in an overturn. Furthermore, releases occur in 38 percent of hazmat overturns as compared to 14 percent of all accidents involving hazmat-carrying trucks. Hazmat accidents are 1.5 times more likely than other truck accidents to involve a single vehicle running off the road, and such accidents result in a hazmat release 33 percent of the time. These accident types are characteristic of tank trucks and represent the relatively larger use of tankers in hazmat trucking as compared to trucking in general (*7*).

Conclusions From a Recent Study of Incidents

Existing accident and incident databases provide insight into the nature of on-highway safety risks in hazmat transportation. The following conclusions were drawn from analysis of these databases (*7*):

- Approximately 11 percent of hazmat incidents on public highways are caused by traffic accidents. This estimate is higher than that found in previous studies because incidents that occur off the highway (in terminal, yard, and loading areas) were eliminated.
- About 90 percent of the deaths and 25 percent of the injuries were caused by hazmat releases due to traffic accidents.
- Between 35 and 68 percent of severe hazmat incidents are caused by traffic accidents, depending on the definition adopted for a severe hazmat incident. Thus, traffic accidents are far more likely to result in a severe hazmat incident (as defined in Table 1) than are other causes.
- Approximately 13 to 15 percent of accidents involving hazmat-carrying trucks result in a hazmat release.
- Higher-than-average probabilities of a hazmat release are found in traffic accidents involving the following:
  - — Truck-train accidents at railroad-highway grade crossings (45 percent release probability)
  - — Overturning in a single-vehicle accident (38 percent release probability)
  - — Running off the road in a single-vehicle accident (33 percent release probability)
  - — Trucks transporting solids in bulk (30 percent release probability)
  - — Freeway off-ramps (26 percent release probability)
  - — Freeway on-ramps (22 percent release probability)
  - — Highways with speed limits of 45 mph (72.5 km/h) or higher (18 percent release probability)
- Lower-than-average probabilities of a hazmat release are found in traffic accidents involving the following:
  - — Truck collisions with other trucks (9 percent release probability)
  - — Truck collisions with passenger cars (4 percent release probability)
  - — At-grade highway intersections (4 percent release probability)
  - — Truck collisions with parked vehicles (3 percent release probability)
  - — Truck collisions with pedestrians, bicyclists, and animals (2 percent release probability)

- Most fatalities and injuries in accidents involving hazmat-carrying trucks result from the physical impact and not the properties of the hazmats being transported.
- Trucks carrying liquids in bulk constitute 50 percent of accidents for hazmat-carrying trucks and 2 percent of accidents for other trucks. This large difference may be indicative of a major difference in tank truck exposure between hazmat and other trucking.

Recent Changes in Incident Reporting

Within the U.S. Department of Transportation (USDOT), the Research and Special Programs Administration (RSPA) is responsible for maintaining records on hazmat transportation, including the Hazardous Materials Information System (HMIS), the principal source of hazmat transportation safety data in the United States.

A revised incident report form went into effect January 1, 1990, after requirements for reporting releases of hazmats were revised to improve the utility and quality of information received by RSPA and to make the incident reporting form easier to use. Among the 1990 improvements were the following:

1. Emergency response communications standards. RSPA improved the quality of information available to emergency responders to hazmat incidents. As of 1990, emergency response information must accompany shipments of hazmats, technical constituents of hazmat mixtures must be identified, and a 24-hour emergency response number must appear on the shipping papers.
2. Hazardous substances. RSPA changed reportable quantities for more than 100 hazardous substances and added a listing for radio-nuclides.

To increase awareness of safety considerations and regulations involved in transporting hazmats, RSPA has proposed amending the Hazardous Materials Regulations (HMR) to enhance training requirements.

Federal Statistics (RSPA, 1991)

With the above changes in mind, some of the latest figures from the RSPA 1990 annual report are presented below (*18*). (In addition, some updated figures and tables that will be in the 1991 report were obtained from RSPA through personal contacts. These are the latest statistics available; 1992 statistics will be published late 1994.

Two points can be noted: (1) the number of highway incidents appears large, i.e., close to 6,000, and (2) the total number of incidents appears to have increased from 1988 to 1989. However, it should be kept in mind that most incidents are small and because of increased publicity regarding fines for not reporting incidents, more carriers are reporting all incidents, whereas in previous years many were likely ignored.

Some of the main points in the RSPA report are as follows (*18*):

1. The increase in the reported number of 1989 hazmat incidents was primarily the result of an improved level of reporting by railroads and small-package carriers.

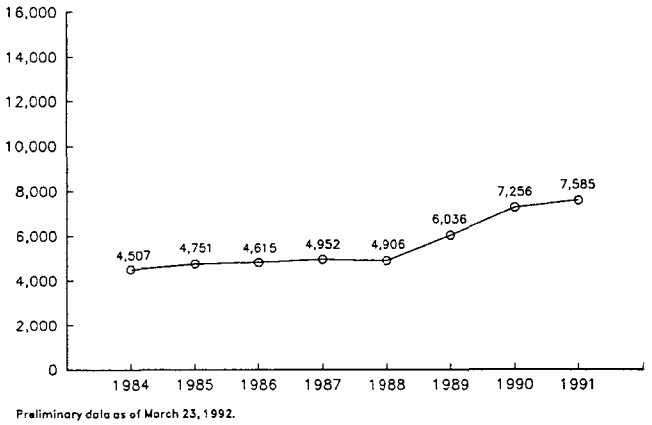

FIGURE 1 Reported incidents on highways, 1984–1991. (*18*)

2. Highway incidents accounted for the eight fatalities in 1989 and the four fatalities in 1990.
3. The larger and more industrial states show a greater incidence of hazmat spills, injuries, and damages. (Deaths show no pattern because of the small number.)
4. In regard to the reported number of incidents by hazard class, flammable liquid represented the largest number (3,380/38.9 percent), corrosive material was second (3,243/37.3 percent), and combustible liquid was third (644/7.4 percent).
5. In regard to damages by hazard class, these same materials were in the top three in the following order: (1) flammable liquid ($13,456,650/40.2 percent), (2) combustible liquid ($7,756,610/23.2 percent), and (3) corrosive material ($3,938,169/11.8 percent).
6. Information on the deaths and injuries that occurred by hazard class should serve to alert concerned shippers, carriers, and responders to the most dangerous classes. (See Tables 1 and 2.)
7. As in past years, gasoline accounted for the greatest number of fatalities (three in 1990 and six in 1989).
8. In the highway mode, only 266 incidents out of 5,977 (4.5 percent) are caused by vehicle accident; the greatest number, 1,259 (21.1 percent), are caused by errors such as leaving a valve open, not securing a hatch, or not loading properly.
9. Of a total of more than 2,400 hazmats identified in the Hazardous Materials Table (49 CFR 172.10), 50 account for 77.5 percent of all incidents, while 14 account for more than 50 percent. For the most part, these are common, household names of which few people would express any great fear.
10. Incidents reported by three-digit zip codes show that the areas with the greatest concentration of hazmat incidents, origins, and destinations were either industrial centers or contained transportation terminal facilities.

Figure 1 is a plot of the incidents on highways reported to the USDOT for the years 1983–1991. Figure 2 shows the total hazmat fatalities for the same years. Figure 3 shows the location of highway incidents reported to the USDOT in 1991. Tables 1 and 2 give the reported injuries and deaths by hazard class for 1991 and 1990, respectively.

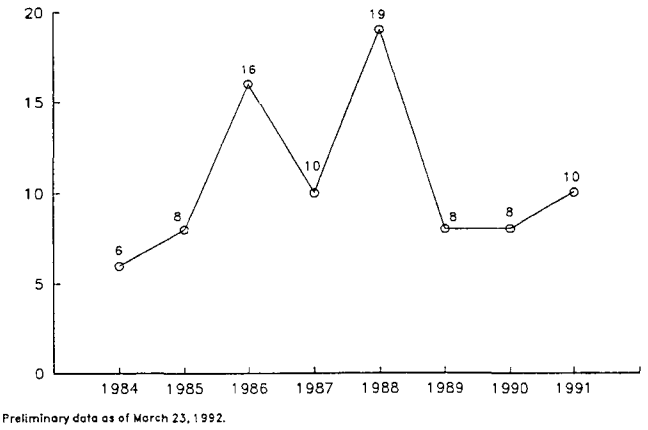

FIGURE 2 Hazardous materials fatalities, 1983–1991. (*18*)

Environmental Protection Agency (EPA) Statistics

Although the majority of incidents likely to be faced by highway personnel are spills of petroleum products and corrosive materials (as shown in Table 1), it should not be overlooked that an incident could involve any one of thousands of other chemicals. Although the percentage of spills of these materials is relatively small, some are extremely dangerous and life-threatening.

The information in the rest of this section is taken from a recent EPA report on hazmat team-planning guidance and emphasizes the possible dangers from thousands of chemicals (*19*).

Several recent federal studies show that there are currently between 5 and 6 million chemicals. This number grows at a rate of about 6,000 chemicals per month. Furthermore, a recent computer review of the complete list of known chemicals by the Chemical Abstract Service indicates that a first responder can expect to encounter any of 1.5 million of these chemicals in an emergency, with 33,000 to 63,000 of those chemicals (depending on which list or definition is used) considered to be hazardous. To complicate matters, these hazardous chemicals are known by 183,000 different names.

The USDOT and the EPA have used several measures of toxicity and volume of production to develop a shortened list of the chemicals that they consider hazardous when transported in commerce. This list, comprising about 2,700 chemicals, is found in 40 CFR 172.101. The USDOT emergency response guidebooks also list these chemicals. The Occupational Safety and Health Administration (OSHA) regulates about 400 hazardous chemicals on the basis of occupational exposures. The National Institute of Occupational Safety and Health (NIOSH) Pocket Guide to Chemical Hazards contains a list of these chemicals. As required by Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986, EPA has prepared a list of extremely hazardous substances that currently includes about 360 lethal air toxins. Although narrowed considerably, the USDOT and OSHA lists present a formidable, even intimidating, list for response personnel.

An EPA study in 1985 reviewed commonly released hazmats. The study covered 6,928 major chemical incidents, other than vehicle fuels, from throughout the United States and found the following (*20*):

- Release Locations

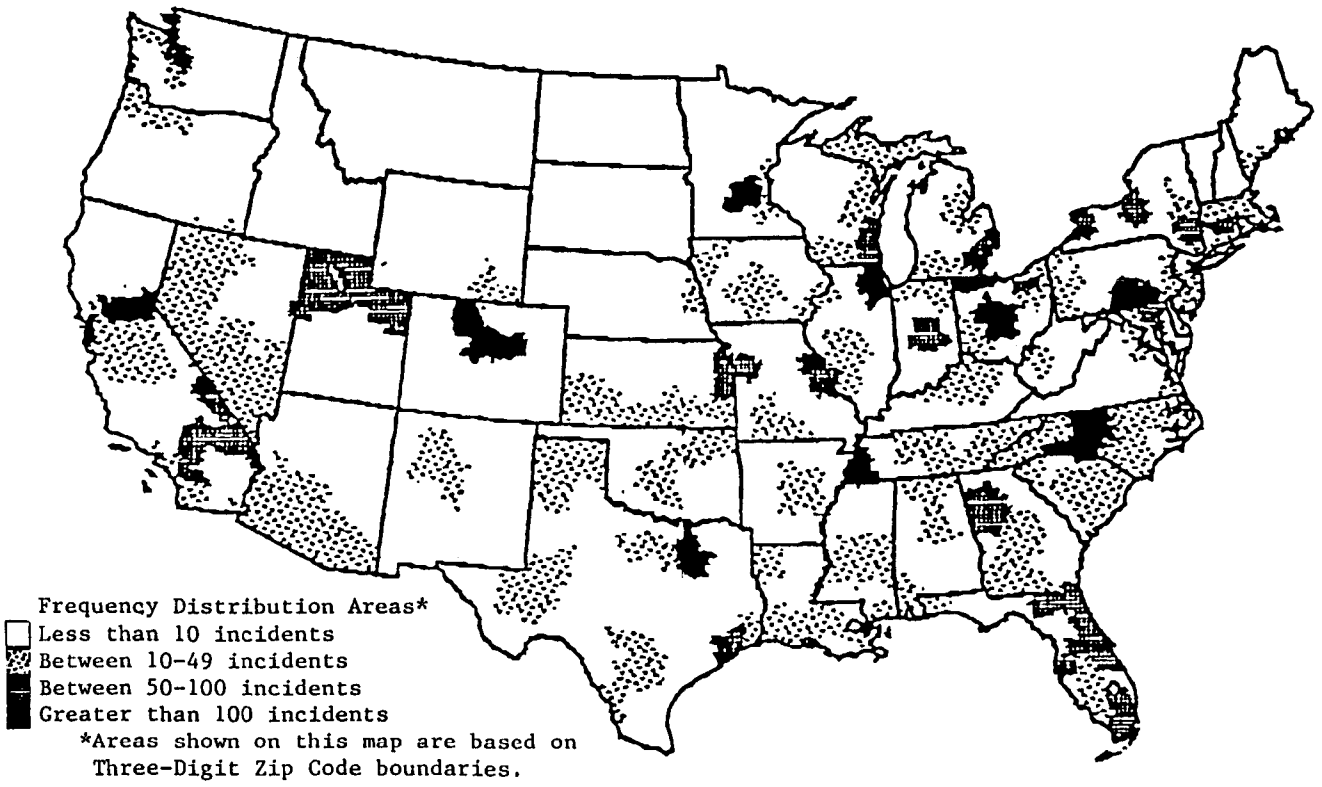

FIGURE 3 Transportation incidents involving hazmats, reported to the USDOT, 1991. (*18*)

TABLE 1
INJURIES BY HAZARD CLASS, 1990

Hazard Class [b]	Number of Injuries	Percent of Injuries	Major Injuries [c]	Minor Injuries	Number of Incidents with Injuries
Corrosive Material	196	45.0	15	181	113
Flammable Combustible Liquid	95	21.8	2	93	65
Poisonous Materials	50	11.5	1	49	22
Miscellaneous Hazmats	20	4.6	0	20	11
Combustible Liquid	16	3.7	1	15	9
Nonflammable Gas	16	3.7	3	13	12
Poisonous Gas	16	3.7	0	16	5
Oxidizer	12	2.8	1	11	11
Flammable Gas	8	1.8	3	5	5
Dangerous When Wet Material	5	1.2	0	5	2
Infectious Substance (Etiologio)	2	0.5	0	2	1
TOTAL	436	100.3	26	410	256

Note: All percentages rounded to nearest 0.1 percent.

[a] Effective with the implementation of HM1818 on December 21, 1990, hazard classes have been modified to reflect international classes.
[b] No reports received for other hazard classes.
[c] Major injuries are those requiring hospitalization, involving second- or third-degree burns, or resulting in injury-related loss of time at work of 1 or more days, such as would be caused by inhalation of strong irritating vapors. All other injuries are considered minor.

- — 74.8 percent occurred in facilities (production, storage, use)
- — 25.2 percent occurred in transportation

• Commonly released chemicals
- — 49.5 percent of the incidents involved only 10 chemicals
- — 35.7 percent of the death and injury events involved the same 10 chemicals

(Note that there is no strong correlation among chemicals that cause the most incidents and those causing the most deaths.) Table 3 summarizes the EPA study results (*19*).

In any state, region, or community, different chemicals may be prevalent. Data should be acquired on all local chemicals that could be encountered. As emphasized in the EPA Hazmat Team Planning Guidance (*19*):

Getting the information [on local chemicals] in a systematic manner cannot be done while responding to an incident.

Locations of Incidents

In regard to location and type of highway or type of segment, local accident data are generally not available to draw reliable conclusions. States should consider keeping better data of this nature to more accurately pinpoint high-risk sections. Currently, only a few states do so. Harwood and Russell looked at Missouri data and determined that the probability of a hazmat release given an accident was 14.6 percent on interstate highways, 16.6 percent on U.S. or State routes, and 4.2 percent on city streets. On streets in urban areas, the release rate was 6.2 percent vs. 19.4 percent on roads in rural areas (*7*).

PREVIOUS STUDIES OF HAZMAT PROBLEMS

Several previous studies have addressed state hazmat problems, responsibilities, and practices. While these studies are not directly

TABLE 2
FATALITIES BY HAZMAT CLASS, 1990 (*18*)

Hazmat	Hazard Class	Number of Deaths
Gasoline	Flammable Liquid	3
Paint	Flammable Liquid	1
	TOTAL	4

related to state maintenance activities, they are referenced and briefly described below so that those who may have an interest will be aware of them.

A Report on the Use of the 1974 AASHTO Publication: *A Guide for Control and Cleanup of Hazardous Materials*

This 1974 publication was written by the American Association of State Highway and Transportation Officials (AASHTO) Administrative Subcommittee on Highway Transport (*21*). It was one of the earliest published documents to address procedures and methods of operation for the proper control and disposal of hazmats released by accidents or other causes. In the mid 1980s, a task force reviewed the 1974 guide and made the following conclusions (*21*):

- The 1974 AASHTO Guide is not the primary response publication.
- The majority of states use the USDOT Emergency Response Guide (ERG) and/or their own response manuals.
- The states use the ERG and other publications because they contain more up-to-date information.
- The 1974 AASHTO Guide contains useful information but it has been surpassed by other, more comprehensive publications.
- There does not seem to be a need to revise the 1974 guide.

The task force commented that the fact that 19 (44 percent) of the responders provided no staff training in the area of hazmat emergency response could point to a significant problem. However, the survey did not connect training with need, i.e., it was not known if there was a need in any of these 19 states.

State Practice Related to 16 Key Areas of Responsibility

A study by Harwood and Russell reported on current state practice in 16 key areas of responsibility (*7*):

1. Regulation of hazmat transportation
2. Routing of hazmat shipments
3. Regulation and routing of explosive shipments
4. Regulation and routing of radioactive shipments
5. Regulation and routing of hazardous waste shipments
6. Signing of hazmat routes
7. Enforcement of hazmat transportation regulations
8. Hazmat materials incident detection
9. Emergency response
10. Incident traffic management
11. Incident site cleanup
12. Hazmat incident and accident reporting
13. Monitoring hazmat flows
14. Personnel training
15. Research
16. Information exchange

The following noteworthy observations were made regarding state responsibilities in these areas (*7*).

TABLE 3
THE 10 MOST FREQUENTLY SPILLED HAZMATS (*after 19*)

Chemical Name	Percent of Releases	Percent of Death and Injuries
PCBs (Polychlorinated Biphenyls)	23.0	2.8
Sulfuric Acid	6.5	4.7
Anhydrous Ammonia	3.7	6.8
Chlorine	3.5	9.6
Hydrochloric Acid	3.1	5.6
Sodium Hydroxide	2.6	1.9
Methyl Alcohol	1.7	0.4
Nitric Acid	1.7	1.5
Toluene	1.4	2.4
Methyl Chloride	1.4	0.0

Highway agencies do not usually have a lead role in hazmat transportation safety, but generally play a key support role because they operate the highway system over which hazmat shipments move. It was found that in *every* area of responsibility related to hazmat transportation safety, the state highway agency has a key support role.

The management of hazmat transportation safety is a cooperative venture with many diverse responsibilities to be met. No state has attempted to meet these responsibilities within a single agency. The state agencies that are most involved are as follows:

- Police agencies
- Fire departments
- Emergency management agencies
- Environmental agencies
- Highway agencies.

The successful state programs reviewed were characterized by the following (*7*):

- Strong commitments on the part of agency management to work together on hazmat safety issues
- Effective day-to-day cooperative relationships among working-level personnel with hazmat responsibilities in each agency.

The Virginia Transportation Research Council (VTRC) Study

In response to a request from Transportation Research Board Committee A1A05, Planning and Administration of Transportation Safety, the VTRC conducted a survey of hazmat safety administrators in the 50 states between November 1986 and March 1987 (*22*). The purpose of the survey was to determine each state's type of safety regulations, enforcement procedures, and emergency response capabilities. Conclusions from this study are summarized as follows (*22*):

- States have used a great variety of approaches in regulating hazmat transportation. The most uniformity found was in the adoption of the federal hazmat regulations by 26 states; however, no state had adopted the federal regulations without amendment or supplementation.
- All states have adopted some type of statutory regulation of hazmats.
- Illinois is mentioned as the state with the most complete hazmat transportation safety program; the least complete programs are in states with de facto delegation of responsibilities to local communities.
- Eighteen states have hazmat response teams; five more states are in the development stage.
- Illinois is the only state that has conducted a quantitative probabilistic risk assessment of the hazmat threat.
- Arizona and Virginia are the only states that have conducted long-term studies of the flow of hazmats through the state by all modes of transport.
- Twenty-seven states reported studying hazmat transportation needs, all using task forces comprising a broad section of their state agencies.
- None of the states that have adopted fee programs for hazmat carriers in general use the fee revenues to directly fund the prevention and cleanup of hazmat incidents, although this is the general practice with waste-hauler fees.

The AASHTO Survey of Hazmat Routing and Signing Practices

In 1988, AASHTO conducted a nationwide survey of states on routing and signing practices in the area of hazmat transportation (*23*). These functions typically are found within state departments of transportation (DOTs), generally highway departments or divisions, and quite often are maintenance personnel responsibilities (especially signing).

CHAPTER TWO

KEY FEDERAL, STATE, AND LOCAL ROLES RELATED TO HAZMAT INCIDENTS ON HIGHWAYS

This chapter briefly examines the background of managing hazmat accidents and incidents, and provides an overview of state DOT involvement, particularly of maintenance forces. This background and overview will enhance understanding of the information in the following chapters and the significance of the survey summarized in Chapter Six. To give the reader a better perspective of how the present hazmat incident management procedures and practices evolved, the background information begins in the late 1960s. This overview also includes short excerpts and examples from various states that represent a range of practice.

BACKGROUND

The material in this section is based in part on material from courses taught in the 1980s. These courses ranged from 1-day identification and awareness courses, including the basics of regulations, to 2-week in-depth courses such as those taught by Vanderbilt University and the Colorado Training Institute (*24,25*).

At that time, the big question was, "Who is in charge?" Almost every instructor had a favorite horror story of jurisdictional fights among federal, state, and local personnel or between police and fire personnel. Problems arose over the definition of authority, the lack of contingency plans in most states, and the lack of coordination among federal, state, and local laws, ordinances, and personnel. Al J. Smith, Jr., one of the nation's leading federal on-scene coordinators (OSCs) (EPA, Region V), is the author of a book that provides in-depth coverage of the problems and of the state of the art in 1980 (*26*).

In 1966, the federal government formed a separate agency, the Federal Water Pollution Control Administration (later named the Federal Water Quality Administration), and placed this agency in the Department of the Interior. In 1970, the agency was augmented with air, solid waste, and pesticide jurisdictions and renamed the Environmental Protection Agency (EPA). During this evolution, the existing basic water quality act, Public Law (PL) 92-500, the Federal Water Pollution Control Act, was amended a number of times. The most important amendments were contained in Section 311, Oil and Hazardous Substances Spills. Section 311 had been inserted in 1970 and generally addressed U.S. water pollution problems. The amendment was the first mention of hazardous spills to appear in U.S. federal law (*26*). In 1972 and 1977, the act was made more specific with the 1977 amendment supporting development of specific, enforceable, hazardous substance spill regulations to complement existing oil spill regulations. This was the first significant mention of hazardous spills to appear in federal law. Under Section 311, the EPA and the U.S. Coast Guard (USCG) were mandated to regulate spills of oil and hazardous substances for inland waterways and coastal waterways, respectively. Smith stressed the following (*26*):

> Under Public Law 92-500, Section 311, the federal government is automatically involved when spills of oil or hazardous substance threaten waters of the United States.

Given the statutory pre-emption and federal primacy arguments of the above federal laws, state and local government participation is essential.

The President's Council on Environmental Quality developed a national contingency plan, codified as federal law in the Federal Water Pollution Control Act of 1978 and referred to as the 1510 Plan. The 1510 Plan outlined a completed scenario of spill response, provided a forum for the participation of all units of government and industry interests, and established regional response teams (RRTs).

Within each of the 10 federal EPA regions (and each USCG district) exists an oil and hazardous substance spill program. Each regional office has an emergency group, which is charged with the inland portion of the spill law. Members of this group serve as federal OSCs.

By federal law (PL 92-500, Section 311), EPA responders have authority to take charge of any spill that is a threat or potential threat to an inland waterway. Some legal authorities argue that this can be construed to cover all spills. In practice, the EPA lets a designated state lead organization be responsible for most spills; the state, in turn, leaves minor incidents to designated local authorities, who actually handle most spills and report incidents according to specified requirements. State forces usually respond only if it is determined that the incident exceeds local capability. The state handles the more serious incidents, calling in an EPA regional response team (of which the state lead agency is a member) if it is determined that the incident is beyond the state's capability, is a direct threat to a waterway, or exceeds specified quantities. In the latter two cases, it is likely that a federal OSC from EPA or the USCG will take charge; they, in turn, may activate technical advisory teams (TATs) and federal response organizations. Thus, a hierarchy of size or danger of spills of hazmat incidents determines the level of response.

The operational concepts presented above must be coordinated and managed. These concepts are the subjects of state incident contingency plans (ICPs) or emergency operations plans (EOPs), which are discussed in the following paragraphs. Highway maintenance or state DOT involvement must be coordinated within the framework of local, state, and federal laws, policies, and procedures.

The state plans that spell out the management plan that defines roles and coordinates response to a hazmat incident were developed in the 1980s as a result of legislation mandating that each state develop a plan, designate a lead agency, and institute an incident command system (ICS), a plan or mechanism to handle incidents under a unified command concept. The following sec-

tions review these plans and the role of state DOTs and highway maintenance forces.

Two federal laws passed since 1980 have given impetus to state and local plans: Comprehensive Environmental Response, Compensation and Liability Act of 1980-(Superfund Act); and Superfund Amendments and Reauthorization Act of 1986 (SARA).

STATE EMERGENCY RESPONSE PLANS

In response to the questionnaire sent out to all states for this synthesis, several respondents provided their state emergency plans or portions thereof relating to the role of the state DOT, including highway maintenance forces. In some cases, these plans are thick, elaborate, published manuals; in other cases, they are less formal memoranda of varying length. Their themes are basically the same: establish policies and procedures and assign responsibilities to ensure the effective management of emergency operations during the release or threatened release of a hazmat. Common to all plans are specific details of both organization and structure of an appropriate response that provide state agencies with a basis for integrating their activities with the overall management of the incident response.

Commonalities exist in all state plans, but no two are alike—just as no two hazmat incidents are exactly alike. Incidents can range from those small enough to be handled by local personnel, to those requiring the assistance of state response forces, to those requiring a federal OSC and the RRTs and TATs available in each federal EPA region, to extreme incidents in which the federal OSC may call in the National Strike Force or other groups to support the national response mechanism with specialized expertise. These plans appear to have solved the problems of the early 1980s regarding lack of authority, clear-cut organizational structures, coordination, and the "who's in charge" question.

In accordance with 29 CFR 1910.120, all states must have an ICS (*19*). The ICS is the backbone of all state emergency response plans. It is a management structure that incorporates a unified command concept that is useful in coordinating a multitude of organizations that might respond to an incident—whether it be two or more local organizations, a mix of local organizations and state forces from several departments or divisions, or a mix of local, state, and federal forces. Roles are specifically spelled out, as are guidelines regarding command and the orderly transition of command from first-on-scene to designated commander, or to higher levels in major or escalating incidents. The ICS is designated to be flexible and expandable to meet the needs of any incident.

Authorization for ICS control is generally covered by state statutes that in many cases spell out the roles of state organizations and personnel. Laws vary from state to state but must be compatible with existing federal laws and regulations.

Some states specify a scene commander or scene command system separate from an ICS. The incident commander concentrates exclusively on the incident, while the scene commander concentrates on controlling and securing appropriate surrounding areas or zones and the health and welfare of those in these affected areas. The scene manager/management concept is common in police operations and, therefore, is usually found in the emergency response plans of states in which the state police have been designated as the lead agency. In these states, during relatively small incidents, the incident commander and the scene commander may be the same person.

Managing Emergency Operations

Good management of emergency operations is critical to success. Excerpts from the California plan are presented here to illustrate this concept (*27*).

> All emergency responders and their communications shall be coordinated and controlled through the individual in charge of the ICS for each employer. The "senior official" at an emergency response is the most senior official who has responsibility for controlling operations at the site. Initially it is the senior official on the first-due piece of apparatus to arrive at the scene. As more senior officials arrive (battalion chief, fire chief, state law enforcement officials, site coordinator, others who may be designated by state or federal law, etc.) the position is passed up the line of authority which has been previously established.

In those states that have a clearly defined and identified central authority and State emergency response command and team, the emergency management plan is generally more clear-cut and roles are more easily defined. In those states that have a decentralized approach to response, the roles and coordination of organization and their management are more complex and the plan has to be more detailed. This is typical of many states, particularly coastal states or states with significant waterways. (For coastal waters, the USCG is the responsible federal agency.)

As an example of the complexity of coordination, the California approach to command is presented below (*27*):

> At a hazardous material incident, a clearly defined and identified command staff is critical to the appropriate management of the incident. The decentralized nature of California's approach to hazardous material management does not permit a uniform statewide description of command, coordination, finance, and other factors that will determine the overall emergency management of a hazardous material incident. These factors include:
>
> - Location (e.g., on highway, off-highway, incorporated, unincorporated),
> - Nature of substance (i.e., oil, other hazardous material),
> - Magnitude (i.e., minor, moderate, major, catastrophic),
> - Capability (i.e., adequately trained and equipped personnel, inadequately trained and equipped personnel),
> - Mandate (i.e., responsibility designated by a legislative body, responsibility not designated by legislative body),
> - Responsible party (e.g., willing and able to provide a safe and adequate response, unable and/or unwilling to provide a safe and adequate response), and
> - Finance (funding agency requires direct control over expenditures, funding agency does not require direct control over expenditures).
>
> State agencies will provide command functions consistent with legislative and agency policy requirements (e.g., state agency coordinator, state warning center) and physical jurisdiction.

STATE DOT MAINTENANCE ROLES: OVERVIEW AND EXAMPLES

Chapter Six presents specific information from a 50-state survey of state DOT/maintenance involvement in emergency response. In all cases, the state DOT has a support role, but not a lead response role. In some states this role is quite limited; in others it is very broad. A few examples of this diversity are presented below.

State Lead Organizations

This section presents a brief overview of lead organizations as they indirectly govern the roles of state highway maintenance departments and personnel. Specific examples of maintenance involvement are presented in the next section.

Each state has designated a lead agency to deal with hazmat incidents that require state-level intervention. In some states, the state police organization is the lead agency. In several other states, a special department whose prime function is to deal with emergencies (natural as well as man-made or technological) is the lead agency. These agencies have a variety of names, such as department or division of emergency management, emergency services, environmental protection, or environmental quality. In Kansas, the Adjutant General's Department is the lead agency. In only one state, Illinois, is the state DOT/Division of Highways the lead agency; its strong role is unique among state DOTs. However, the agency's primary role is enforcement by a special section within the DOT. The DOT's highway maintenance forces are not involved in this role.

Most states have laws that are consistent with federal law and give the state, generally acting through its lead agency, broad powers in regard to response, control containment, and cleanup of hazmat incidents. A few states (e.g., Ohio) are "home rule" states, where state agency jurisdiction is limited to the state highway system and local governments have legal authority or jurisdiction over all areas but those few specified by state law (e.g., the state highway system).

It may be concluded that, although a state is mandated to have an emergency response plan, a lead agency, and an ICS, response plans generally fit into the state's existing governmental structure and any mechanisms that may have existed for responding to civil defense emergencies or natural disasters. Only a few states have developed comprehensive emergency response systems (e.g., the Tennessee Emergency Management Agency) primarily for hazmat transportation.

Highway Maintenance Involvement

State DOT highway maintenance involvement varies considerably from state to state, but within narrow boundaries. Maintenance forces are generally a support agency—never a response team or designated first responders. Typical duties include helping with securing the area, traffic control, detours, supply containment materials and equipment, and road repair.

In some states, official or planned involvement is minimal, i.e., "report and stay a safe distance." However, it cannot be overemphasized that by virtue of their daily highway duties, *maintenance crews are often de facto emergency responders.* Because they work where hazmat incidents occur, they will often be involved or be first on the scene irrespective of plans or policy to the contrary. Maintenance crews must therefore be aware of the dangers and be prepared to protect themselves. In other states where maintenance workers are more involved, they actually become part of the containment team.

In some states, generally those with strong "spiller pays" legislation, cleanup is done by the spiller; if the spiller cannot pay, the state hires a contractor. In others, state highway maintenance personnel are more involved in the cleanup. Details of actual involvement vary from state to state.

A few examples of highway maintenance response are described below. No evaluation of state plans was attempted; the plans presented here were selected to depict a range of planned involvement from relatively heavy to little or none.

New York

New York is a state with a policy of minimal involvement. All maintenance personnel are required to carry a copy of "Policy for Hazardous Materials Maintenance Incidents" and "Response Procedures for Hazardous Materials Incidents" (*28*).

The first sentence of the New York policy sets the tone (*28*). "Do not clean up hazardous materials," which is followed by No. 2, "Keep a safe distance away from hazardous materials spills, and situations where you suspect the presence of hazardous materials." Maintenance division personnel are instructed to provide support to emergency services when supervisory personnel determine it safe to do so and to provide, from a safe distance, traffic control assistance until police and fire control arrive.

The New York response procedures deal primarily with keeping a safe distance, reading placards if possible, reporting the incident, and setting up a perimeter to isolate the hazard area. The New York policy suggests one-quarter mile as a safe perimeter.

Florida

In Florida, highway maintenance personnel have great responsibilities not found in other states. This is probably because Florida suffers natural disasters such as hurricanes, which are much more dangerous than the typical hazmat spill. In addition, Florida has more waterways to protect than most other states. The operational organization of the Florida DOT is defined in a state law that sets forth certain actions and responsibilities during and after a peacetime emergency (*29*). The DOT developed a plan for an organization, communication, and operational system within the department. Each district developed an individual plan in concert with the DOT plan and consistent with the state's overall emergency response plan instituted by the governor.

Under Florida's emergency plan, the DOT has 12 assignments—3 designated as "primary" and 9 as "support." These are paraphrased below (*29*).

Primary:

- Remove debris from DOT-maintained rights-of-way.
- Assist in the containment and cleanup of hazmat spills that occur on state-maintained streets or highways including handling and disposal of the material.
- Develop and implement emergency transportation plans, as needed.

Support:

- Assess damage after an emergency has occurred.
- Conduct damage surveys (detailed).
- Assist the Department of Community Affairs in planning detour routes and actual routing.
- Perform hazard-mitigation activities to eliminate or reduce the effects of future emergencies.
- Provide personnel and equipment, whenever requested, to

support operations by those agencies specified by the State Peacetime Emergency Plan.
- Provide search-and-rescue operations to assist whenever life or property is in danger.
- Coordinate with the Department of Community Affairs and the Federal Emergency Management Agency (FEMA) to facilitate the movement of temporary housing (mobile) units over state roads when needed.
- Develop and implement a training program for personnel that will ensure more effective performance of those individuals who would be involved in an emergency operation.
- Store and maintain pipe and other related equipment necessary to respond effectively to a water supply emergency.

The DOT organization to carry out the above 12 functions resides in the central office, districts, and subdistricts, as for normal operations. Actual involvement (off-state roads, right-of-way, or property) of the DOT personnel, equipment, and material requires administrative declaration by the governor. Because any statewide emergency response is considered one operation headed by the governor and administered through the Division of Emergency Management, highway maintenance forces remain a support organization even though they may be called on for a broader involvement.

West Virginia

The West Virginia plan lists the following responsibilities for highway maintenance crews (*30*):

- Provide necessary signs, traffic lanes, barricades, lights, and flaggers to maintain flow of traffic and establish detours when required;
- Provide communications from command post to state emergency operation center, when required;
- Provide necessary abrasives, dry sand, or other materials requested through the incident commander;
- Provide available material to block the flow from highways into sewers, drains, or bodies of water of runoff contaminants that would cause harm to human life, health, or the environment;
- Assist in evacuation procedures;
- Provide a representative for supervision of the activities listed above;
- Initiate standby cleanup contractors when required;
- Provide laboratory services on a cooperative basis; and
- Assist with identification of the hazmat or hazmats involved.

California

By statute, the California department of transportation, Caltrans, is responsible for maintaining a safe and usable highway system. To contain, remove, or cause spilled material to be removed, Caltrans will attempt to perform hazard assessment based on the information at the time of the emergency (*31*).

In the course of managing emergency spill conditions, Caltrans will establish traffic control to provide for public safety and will perform hazard assessment to establish reasonable precautions to prevent either Caltrans employees or the public from being exposed to an unidentified substance or to an identified one that is hazardous to health, safety, or the environment.

The Caltrans policy states: "If at any stage of this process, it appears that our personnel using our standard procedures and equipment, cannot proceed safely, the services of a qualified hazmat specialist will be sought."

Within the state highway right-of-way, Caltrans will do the following (*31*):

- Provide immediate verbal notification to the district of any hazmat incident affecting a state highway (file a verbal and written report to county health department and board of supervisors, as required).
- Ensure, in cooperation with other public and private agencies, the identification and containment of hazmats and restoration of the orderly flow of traffic.
- Assist CHP [California Highway Patrol—the lead agency] with traffic control and routing requirements.
- Restore contaminated highways and other transportation facilities under its jurisdiction.
- Contract with cleanup companies to assist with highway cleanup.
- Provide radiological monitoring by spill teams.

Caltrans is not legally or financially responsible for contamination or cleanup outside the state right-of-way even if an incident began within the right-of-way. The District Maintenance Hazardous Materials Coordinator is to be contacted for detailed information in these cases.

Levels of service. For all highway spills, districts shall do the following:

- Be enroute within $\frac{1}{2}$ hour after notification.
- Commence cleanup operations within 4 hours.

Vermont Agency of Transportation

The Vermont Secretary of Transportation is responsible for overall agency response to a hazmat incident. Delegation of authority is as follows (*32*).

The maintenance engineer is responsible through the district transportation administrators for the following:

- Providing preliminary damage assessments of transportation systems or facilities under his or her jurisdiction;
- Providing personnel and materials, such as signs and barricades to assist in the control and rerouting of traffic;
- Providing labor, equipment, and absorbent materials such as sand or hay to assist in the containment, and emergency control, of hazmat spills; and
- Coordinating emergency repairs and debris clearance, including cleanup following hazmat incidents affecting transportation systems under his or her jurisdiction.

Maintenance personnel will not be trained as hazmat responders; they will be equipped for regular maintenance activity. Protective clothing will consist of rain gear, leather or rubber work boots, gloves, and hard hats.

Each district transportation administrator will be responsible for notification and response within individual districts. As soon as

notified, the administrator, or the foreman, shall contact the appropriate state police office by telephone or radio for instruction. Response time may vary from first-on-scene to approximately one hour following notification. The Montpelier radio room in the capitol building may coordinate the AOT response.

Illinois

During the past several years, Illinois has been cited often as a state leader for its laws, policies, organization, and enforcement procedures relating to hazmat transportation and to response to accidents and incidents. The Illinois Department of Transportation (IDOT) is the state's lead agency for hazmat transportation by highway. The material in this section is derived from interview notes and references obtained during a personal visit to Illinois in 1987 in conjunction with a Federal Highway Administration (FHWA)-sponsored study on state practices regarding highway transportation of hazmats (*33-36*).

General Information

IDOT is the lead agency in the state for hazmat transportation by highway. The coordination unit is responsible for coordinating with other state and local agencies, in particular, the emergency response to hazmat incidents.

The Illinois Hazardous Materials Advisory Board was established in 1976. Its mission was redefined and expanded in 1984 legislation that established that the board would be funded through IDOT. The coordination unit serves as the staff for the Board. The Board was designated as the State Emergency Response Commission under SARA Title III.

The Hazardous Materials Advisory Board has established a hazmat incident reporting system operated by IDOT that applies to both fixed-facility and transportation incidents. The reporting form has three pages, the first two of which request information about the incident that the spiller or first responder should assemble before telephoning an 800 number operated by the Illinois Emergency Services and Disaster Agency to report the incident.

The Hazardous Materials Section (HMS) within the IDOT Bureau of Traffic Safety forms the heart of IDOT hazmat transportation activities. HMS has approximately 20 staff members and consists of four units: Coordination, Compliance, Training and Regulation Development, and Data Processing. The HMS advises local agencies on the purchase of emergency response equipment and coordinates hazmat training in Illinois.

Because radioactive shipments often require an overweight vehicle permit, the IDOT Bureau of Traffic also gets involved in these shipments. The Bureau is not involved in hazmat routing or signing, because Illinois has no authority to regulate hazmat shipping.

The Illinois state police have about 70 full-time field officers who perform compliance checks to enforce state hazmat regulations (49 CFR Parts 200-999, The Federal Motor Carrier Safety Regulations). By order of the governor, shipments of spent nuclear fuel are inspected and then escorted by a state police car from state line to state line. This is done at state expense.

The state's hazmat-trained police officers are usually dispatched for emergency response to hazmat incident sites.

IDOT Bureau of Maintenance

IDOT has 150 field maintenance headquarters and 2,800 maintenance workers.

IDOT responsibilities in incident site management include providing traffic control, establishing detours, and providing materials such as sand.

IDOT maintenance workers, in some cases the first to encounter a hazmat incident, have good communications to summon other help. Often, however, IDOT is summoned by the state police or the Emergency Services and Disaster Agency.

Highway maintenance workers are not emergency response personnel. They do not have specialized training; they work an 8-hour day and are not on 24-hour call (except during the winter for snow removal). The real value of IDOT to emergency response is its statewide network of personnel, facilities, equipment, and supplies.

It was brought out in the 1987 interviews that the Illinois state EPA will purchase and maintain three different types of hazmat response trailers. The trailers will include foam generators and storage of absorbent materials, which will be stored in IDOT maintenance yards. Three such trailers are currently stored by IDOT—one in the north (Rockford), one in the central part of the state (Springfield), and one in the south (East St. Louis). IDOT's only role is to provide storage.

It should be noted that IDOT personnel are not considered responders to hazmat incidents. As in most states, they are support personnel. However, by virtue of their jobs, they may be the first on the scene and may thus be de facto first responders. In this context, they should have at least the minimum of training, equipment, and supplies needed to protect themselves and to mitigate consequences. The proper action may be to stay far away from the incident and to keep others away. Thus, hazmat awareness training becomes critical.

There are cases in which maintenance personnel can contain a hazmat spill to minimize damage with minimal risk to themselves. This is based on the assumption that they have had adequate training to know the difference between situations that require "fight" vs. "flight," as many experienced responders often say. It also requires that they have some basic equipment, particularly of the type to divert or contain spills. IDOT publishes a pamphlet for its maintenance forces titled *Emergency Response Manual* (*36*).

Washington State Department of Transportation

The DOT has clearly defined and documented emergency procedures that are functions of DOT highway and maintenance personnel. These procedures appear to be indicative of expectations for and responsibilities of an actively supportive maintenance section as part of a state's well-organized plan for emergency response to both natural and man-made hazards. The DOT emergency procedures presented below illustrate typical state DOT and maintenance involvement. They are taken directly from the state plan (*37*).

The purpose of this section of the Washington plan is to provide guidance to maintenance crews who happen upon an incident that requires emergency action. The most frequent incidents are those associated with transportation accidents and with material spills of a hazardous or dangerous nature.

Hazmats are substances that when spilled may make driving unsafe, endanger the lives of people nearby, or contaminate the

air or water. These materials include such substances as oil, flour, or industrial products that may make a roadway surface slippery, impair visibility, or create obstructions. Materials that are dangerous in themselves include explosives, flammables, corrosives, poisons, and radioactive materials. (Note: Many trucks are placarded with information about the hazmat being transported. If the truck is not placarded, the shipment manifest can be found in a pouch on the driver's side door.)

Departmental employees at the scene of an incident will normally take emergency actions only as required to protect human life and property until the State Patrol has control of the situation.

The State Patrol is responsible for promoting safety measures at an accident site and for coordinating cleanup. Before helping with removal or otherwise coming in contact with spilled material, maintenance personnel should first verify from the placard or manifest that the material is not toxic or explosive. If the placard is not visible, personnel should not approach the truck, unless they are certain that no personal hazard exists.

Maintenance Field Personnel

Maintenance crews will take the following actions when encountering a natural or man-made hazardous condition on the roadway (*37*):

- Advise the superintendent of the problem and request aid from the Washington State Patrol.
- Take sufficient precautionary actions to protect yourself and your crew from continued exposure to the hazardous condition.
- Physically close the highway or restrain traffic from entering the hazardous area.
- Survey the situation and report the exact location, the cause of the block or temporary closure, and the extent of the closure to the division or district maintenance office or its supervisor or lead technician by radio or other means of communication.
- If the spilled substance is identified and is spreading toward water courses or additional traffic lanes or is likely to cause groundwater damage, take action to absorb or confine the spill, using careful judgment. Avoid contact with unknown substances or with those of unknown chemical properties.
- Remain in the area to safeguard traffic until proper traffic control devices are installed or until relieved by the foreman, the leadman, or a Washington State Patrol Trooper.
- Patrol for stranded motorists in the isolated area when other traffic has been controlled, when applicable.

CHAPTER THREE

EDUCATION AND TRAINING NEEDS FOR HAZMAT INCIDENT RESPONSE

BACKGROUND

Most of the information in this chapter is derived from the 1989 Annual Report of the U.S. Department of Transportation (USDOT) Research and Special Programs Administration (RSPA) (*18*). This information could be of value to those state DOT maintenance sections that have an involvement in hazmat spills response, cleanup, or site restoration. Unless otherwise specifically referenced, all of the following information is taken from the latest annual RSPA report (*18*).

As pointed out in a recent Congressional Research Service report, "Emergency response is not a one-time event" (*38*). There is frequent need for new training to instruct inexperienced personnel (who are always present due to turnover) and to keep experienced personnel updated on new techniques, equipment, and protective clothing.

Training courses range from those that teach awareness to those that focus on highly specialized areas of emergency response:

- Awareness training,
- First-level responder courses,
- Training for members of specialized hazmat emergency response teams,
- Personal protection and equipment training,
- Emergency management courses for state and local officials, and
- Specialized courses on how to plan to deal with spills of hazmats.

Various topics need to be covered in training any responder for involvement with hazardous incidents. Topics include recognition of hazmats, assessment of hazards at the scene, personal safety, appropriate response strategies, and the duties of emergency response personnel at the scene.

Dedicated response teams should, of course, have specialized, in-depth training for properly responding to and managing hazmat incidents, including how to obtain support offered by various national and industry emergency response systems. It is critical that the type of training fit the responsibilities of the trainee; be timely, up-to-date, and ongoing; and fit into his/her regular job responsibilities and time constraints.

Currently (1992), several laws mandate that information and training be made available to all workers who may come into contact with toxic materials or hazards in the workplace. For example, employers must follow worker "right-to-know" laws, which generally have been promulgated by EPA or the Occupational Safety and Health Administration (OSHA) in accordance with their statutory authority. In some areas, the EPA and OSHA have promulgated identical health and safety standards. States also have similar laws that may or may not follow OSHA guidelines. In some cases, laws may overlap or even conflict. Requirements may be complex in regard to applicability to maintenance personnel who might respond to a hazmat incident. An overview of OSHA and EPA worker protection standards, taken from three EPA publications on the subject (*39–41*), is presented in Appendix A. Appendix A also contains additional references.

The Relationship Among Training, Knowledge, Skills, and Job Classification or Function

As discussed previously, not everyone will need to be trained as a responder. The primary training needs of maintenance personnel will be awareness, control or containment of spills that do not present great personal danger, and cleanup assistance. In addition, because personnel should not be expected to enter or work in contaminated areas without full protective gear, full training in its proper use must be provided. *Training must be in balance and must be consistent with job function and expectations of a crew's responsibilities in hazmat incidents.*

Two kinds of maintenance crew involvement must be considered: Involvement according to the role assigned in a predetermined plan, and Involvement by chance when a spill occurs in their area.

For the first example, proper role, equipment, and training can be predetermined. In the second example, the crews are de facto first responders. The degree to which crews should be equipped and trained for either case is a high-level policy decision. However, expected roles, equipment, and training must be consistent. In the second example, crews should be trained to understand the dangers, protect themselves, and warn others in the area. *Lack of such training could be dangerous to the crews and to the public.*

A USDOT guide for local officials outlines typical knowledge and skills required for various individual job descriptions in the form of a "knowledge" matrix and a "skills" matrix, originally developed by the Puget Sound Council of Governments (*42*). Material from these matrices that would be of interest to state and local maintenance departments is presented in Tables 4 and 5.

General Guidance from the USDOT *Emergency Response Guidebook* (ERG)

Maintenance crews that are first on the scene of an accident by chance or otherwise—irrespective of their planned role, equipment, and training—should follow these guidelines from the USDOT ERG (*43*):

> WHEN APPROACHING A HAZARDOUS MATERIALS INCIDENT, APPROACH CAUTIOUSLY. Resist the urge to rush in; you cannot help others until you know what you are facing.
> IDENTIFY THE HAZARDS. Placards, container labels, shipping

TABLE 4
HAZMATS KNOWLEDGE MATRIX (*after 42*)

Rating Scale: 1 Comprehensive knowledge of 2 Basic knowledge of 3 Partial knowledge of --- Not applicable or required Required Knowledge	Cleanup & Recovery: Supervisor	Cleanup & Recovery: Foreman	Cleanup & Recovery: Technician	Public Works Supervisor	Public Works Technician	City/ County Administrator	Incident Commander	Public Information Officer
1 The existence and intent of USDOT Regulations governing the shipment of hazmats.	1	2	2	---	---	---	2	---
2 The application of USDOT regulations governing the shipment of hazmats and the ability to recognize compliance.	1	2	2	---	---	---	2	---
3 The existence and intent of the regulations and the structure of the EPA relative to hazmats.	1	2	3	---	---	---	2	---
4 The application of EPA regulations governing hazmat incidents and the ability to recognize compliance.	1	2	3	---	---	---	3	---
5 The existence and intent of the regulations and structure of the Nuclear Regulatory Commission (NRC) relative to hazmats.	1	2	3	---	---	---	3	---
6 The application of the NRC regulations governing the shipment of hazmats and the ability to recognize compliance.	1	2	3	---	---	---	3	---
7 The applicable hazmat incident response plans.	1	2	3	2	3	2	2	---
8 The development of appropriate hazmat incident response plans.	1	2	---	2	3	2	2	---

TABLE 4
HAZMATS KNOWLEDGE MATRIX (*after 42*) (*Continued*)

Rating Scale: 1 Comprehensive knowledge of 2 Basic knowledge of 3 Partial knowledge of --- Not applicable or required Required Knowledge	Cleanup & Recovery: Supervisor	Cleanup & Recovery: Foreman	Cleanup & Recovery: Technician	Public Works Supervisor	Public Works Technician	City/ County Administrator	Incident Commander	Public Information Officer
9 All pertinent Standard Operating Procedures (SOPs) relative to a hazmat incident.	1	2	3	1	2	2	1	---
10 The development of the applicable hazmat incident SOPs in accordance with response plans.	1	2	---	1	2	2	1	---
11 The proper information and procedure for responder-to-dispatcher transmissions including designation and ultimate use of information.	1	2	---	1	2	---	1	---
12 The information that Chemical Transportation Emergency Center (CHEMTREC) needs to accurately and effectively assist in the incident.	1	2	---	---	---	---	1	---
13 The reporting procedure including report flow content and format following a hazmat incident.	---	---	---	1	3	3	1	---
14 The recognition or identification of hazmats from shipping papers, such as bill of lading and manifest.	1	2	2	---	---	---	1	---
15 The general types of hazmats based on the shape, color type, and other physical characteristics of the container.	2	2	3	---	---	---	1	---
16 The DOT hazmat classification system based on displayed placards, relative to hazmats.	1	2	2	3	---	---	1	---

TABLE 5
HAZMATS SKILLS MATRIX (*after 42*)

Rating Scale 1 —Comprehensive knowledge of 2 —Basic knowledge of 3 —Partial knowledge of ---Not applicable or required Required Skills	Cleanup & Recovery: Supervisor	Cleanup & Recovery: Foreman	Cleanup & Recovery: Technician	Public Works Supervisor	Public Works Technician	City/ County Administrator	Incident Commander	Public Information Officer
1 Prepare accurate shipping documents, such as the manifest or bill of lading, in compliance with applicable regulations.	---	---	---	---	---	---	---	---
2 Locate the shipping documents, such as the manifest or bill of lading, under emergency conditions.	1	2	2	3	---	---	---	---
3 Accurately receive and record information pertinent to the incident, such as product information from CHEMTREC responding unit information hazard zone determinations.	2	---	---	2	---	---	2	2
4 Identify hazmat from the shipping papers and interpret any other pertinent information on the documents.	2	2	2	---	---	---	1	---
5 Identify hazmats by characteristics such as smell, color, consistency, volatility or state.	1	2	2	---	---	---	1	---
6 Identify a hazmat category from the placard display on the transporting vehicle.	1	2	2	2	2	---	1	---

TABLE 5
HAZMATS SKILLS MATRIX (*after 42*) (*Continued*)

Rating Scale 1 —Comprehensive knowledge of 2 —Basic knowledge of 3 —Partial knowledge of ---Not applicable or required Required Skills	Cleanup & Recovery: Supervisor	Cleanup & Recovery: Foreman	Cleanup & Recovery: Technician	Public Works Supervisor	Public Works Technician	City/ County Administrator	Incident Commander	Public Information Officer
7 Locate and use all available reference materials or sources to assist in incident mitigation, such as computer services, books, periodicals, references, maps, descriptions, blueprints, and area experts.	1	2	2	2	2	---	1	3
8 Establish and operate a command post that effectively directs and coordinates the mitigation effort.	---	---	---	---	---	3	1	3
9 Assess the potential for all damages that could reasonably result from the incident within one's own area of expertise.	1	2	---	1	2	3	1	---
10 Assess the potential for all damages that could reasonably result from the incident in all aspects to include large-scale environmental consequences.	3	---	---	3	---	3	1	---
11 Establish the necessary actions to be taken to mitigate the incident and prioritize for one's own area of expertise.	1	2	3	1	3	---	1	---
12 Establish the necessary actions to be taken to mitigate the incident and prioritize for all aspects of the operations.	---	---	---	---	---	3	1	---

TABLE 5
HAZMATS SKILLS MATRIX (*after 42*) (*Continued*)

Rating Scale 1 —Comprehensive knowledge of 2 —Basic knowledge of 3 —Partial knowledge of ---Not applicable or required Required Skills	Cleanup & Recovery: Supervisor	Cleanup & Recovery: Foreman	Cleanup & Recovery: Technician	Public Works Supervisor	Public Works Technician	City/ County Administrator	Incident Commander	Public Information Officer
13 Identify the resources necessary to perform the identified actions to mitigate the incident within one's own area of expertise.	1	2	---	2	---	---	1	---
14 Identify the resources necessary to perform the identified actions to mitigate the incident for all aspects of the operation.	3	---	---	---	---	3	1	---
15 Perform the necessary triage for victims of the incident to facilitate the effective use of available medical service.	---	---	---	---	---	---	2	---

papers and/or knowledgeable persons on the scene are valuable information sources. Evaluate all of them and then consult the recommended guide page before you place yourself or others at risk. *Do not be alarmed if new information from a CHEMTREC expert changes some of the emphasis or details of the guide page warnings.* You must remember that the guide page provides only the most important information for your initial response with a family or class of hazardous materials. It is intended that as more accurate, i.e., material-specific, information becomes available, your response will become more appropriate for the situation.

SECURE THE SCENE. Without entering the immediate hazard area, do what you can to isolate the area and assure the safety of people and the environment. Move and keep people away from the scene and the perimeter. Allow room enough to move and remove your own equipment.

OBTAIN HELP. Advise your headquarters to notify responsible agencies and call for assistance from trained experts through CHEMTREC and the National Response Center which can be reached through CHEMTREC or dialed directly.

DECIDE ON SITE ENTRY. Any efforts you make to rescue persons, protect property or the environment must be weighed against the possibility that you could become seriously injured without appropriate protective gear. Above all—Do not walk into or touch spilled material. Avoid inhalation of fumes, smoke, and vapors even if no hazardous materials are known to be involved. Do not assume that gasses or vapors are harmless because of lack of a smell.

EVALUATING RESOURCES

It is always desirable to have criteria or a checklist to evaluate response resources—the personnel, training, equipment, facilities, and other resources available for responding to hazmat releases. Once the maintenance crew's appropriate response level has been established, selected items from the following checklists taken from the National Response Team planning guide can be used to evaluate maintenance resources, albeit they would not fit into this format as a supporting agency with varying degrees of involvement in actual response. However, these checklist questions should still be considered in the context of that level of involvement. Which of these would be applicable is a function of state policy and how highway maintenance forces fit into the state emergency response plan.

Personnel questions:

- Have the numbers of trained personnel available for hazmats been determined?
- Has the location of trained personnel available for hazmats been determined? Are these personnel located in areas identified in the hazards analysis as follows:
  - — Heavily populated?
  - — High hazard areas, e.g., those with numerous chemical (or other hazmat) production facilities?
  - — Hazmat storage, disposal, and/or treatment facilities?
  - — Transit routes?
- Are sufficient personnel available to maintain the level of response capability for the area?
- Has the availability of required special technical expertise (e.g., chemists, industrial hygienists, toxicologists, occupational health physicians) necessary for response been determined?
- Have limitations on the use of the above personnel resources been identified?
- Do mutual aid agreements exist to facilitate interagency support among organizations?

Training questions:

- Have the training needs for the state/local area been identified?
- Are centralized response training facilities available?
- Are specialized courses available in topics such as the following:
  - — Organizational structures for response actions (i.e., authorities and coordination)?
  - — Response actions?
  - — Equipment selection, use, and maintenance?
  - — Safety and first aid?
- Does the organization structure provide training and cross-training for or among organizations in the response mechanism?
- Does an organized training program for all involved response personnel exist? Has one agency been designated to coordinate this training?
- Have training standards or criteria been established for a given level of response capability? Is any certification provided upon completion of the training?
- Has the level of training available been matched to the responsibilities or capabilities of the personnel being trained?
- Does a system exist for evaluating the effectiveness of training?
- Does the training program provide for refresher courses or some other method to ensure that personnel remain up-to-date in their level of expertise?
- Have resources and organizations available to provide training been identified?
- Have standardized curricula been established to facilitate consistent statewide training?

Equipment questions:

- Have response equipment requirements been identified for a given level of response capability?
- Are the following types of equipment available?
  - — Personal protective equipment
  - — First aid and other emergency medical equipment
  - — Emergency vehicles for hazmat response
  - — Sampling equipment (for air, water, soil, etc.) and other monitoring devices (e.g., explosivity meters, oxygen meters)
  - — Analytical equipment or facilities available for sample analyses

CURRENT STATUS OF TRAINING AND INFORMATION DISSEMINATION

To assist emergency responders and others, USDOT has developed a comprehensive educational program for industry, federal inspectors, state/local law enforcement officers, and emergency management personnel. The program has three purposes:

- To encourage uniform enforcement of hazmat regulations by federal, state, and local enforcement personnel
- To promote compliance with the USDOT regulatory program
- To enhance state and local emergency preparedness.

All modal agencies of USDOT provide technical assistance, but RSPA directs the development and delivery of training programs. Classroom instruction is provided both at the Transportation Safety

Institution (TSI) at Oklahoma City, OK, and at field locations around the country.

The TSI primarily trains federal and state personnel, offering 17 types of hazmat training classes in the following areas:

- Basic Hazmat Compliance and Enforcement
- Cargo Tank Roadside Inspection
- Awareness of Initial Response to Hazmat Incidents
- Transportation of Hazmats/Wastes for the Department of Defense
- In-depth Inspection of Radioactive Materials
- Transportation of Hazmats for the General Services Administration
- Specialized Hazmat Training for the Federal Highway Administration (FHWA)
- Air Transportation of Hazmats for the Federal Aviation Administration
- Hazmat Training for Industry
- Specialized Hazmat Training for the Federal Railroad Administration.

RSPA and the modal agencies conduct a number of additional training seminars on specific topics at industry-sponsored training programs and conferences. In 1989, RSPA expanded educational programs to increase public awareness of the risks involved in the transportation of hazmats. RSPA produces and broadcasts teleconferences over FEMA's emergency education network, including programs such as First Response to Transportation Emergencies Involving Radioactive Materials (1989), and Anatomy of Decision Making for Hazardous Materials Emergencies (three modules) (1989).

A schedule of programs for the current year can be obtained from FEMA. RSPA is a good source of hazmat training modules on compliance and enforcement, which are a joint effort by RSPA, the Hazardous Materials Advisory Council, and the state enforcement/emergency management personnel of the Cooperative Hazardous Materials Enforcement Development (COHMED) program.

A joint effort of RSPA and FEMA is a 6-hour briefing for newly elected public officials that addresses key roles and responsibilities in regard to hazmat response, planning, prevention, and enforcement.

A joint effort of RSPA and the EPA is a series of 3-day workshops to assist industry in compliance with DOT and EPA regulations on the transportation of hazmats and hazardous wastes. Participants were given a demonstration of DOT's Hazardous Materials Information Exchange (HMIX), a computer bulletin board for training and planning information.

HMIX is a cooperative project of DOT and FEMA that provides a centralized database for information relevant to hazmat emergency management, training, resources, technical assistance, and regulations. HMIX provides technical assistance and information via two toll-free telephone numbers. (Specific instructions on accessing the HMIX from an individual computer are given in Appendix B.)

One HMIX menu selection is an EPA listing of chemicals. From a consolidated list of hazardous substances prepared by the USDOT Transportation Systems Center (TSC), the United States Coast Guard (USCG), FEMA, and RSPA staffs developed a format that allows users to look up a chemical by name, synonym, and CAS number or DOT number to determine the statutes that cover the chemical. The statuses may include the Resource Conservation and Recovery Act (RCRA), the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), and the Community Right-to-Know provisions of the Superfund Amendments and Reauthorization Act.

The HMIX DOT information topics were expanded and restructured to address the specific needs of both COHMED participants and the FHWA's Hazardous Materials Division. COHMED information includes a description of the program, a listing of chairpersons for each region, and future conference information. FHWA provides educational information through "Technical Advisory Bulletins" and provides a technical contacts list.

RSPA, FEMA, and the EPA jointly published the *Handbook of Chemical Hazardous Analysis Procedures* and accompanying computer software program known as ARCHIE (Automated Resource for Chemical Hazard Incident Evaluation). This program simulates the consequences of a potential release of hazmats. Emergency planning personnel can use ARCHIE to comprehensively evaluate their preparedness. These sources of information discussed above could be adapted to highway maintenance personnel needs.

Publications

RSPA publishes 40 different pamphlets, charts, fact sheets, technical guides, etc. One recent publication, "Hazardous Materials Transportation Regulatory and Enforcement Programs—A Governor's Guide," provides models and examples that can assist state personnel in developing a management plan based on federal guidelines and the practices of other states.

Every 3 years RSPA revises and updates the ERG, its most widely distributed technical guide. The ERG contains a list of all USDOT-regulated hazmats and response procedures to be used at the scene of a spill, fire, or explosion where hazmats may be involved. The ERG is the publication most widely used by state highway personnel.

The EPA also publishes several guidance documents on a variety of subjects of interest to persons or organizations involved in response to hazmat incidents. Some of these are noted in the last section of Appendix A. Information on others can be obtained by contacting an EPA regional office.

AVAILABLE TRAINING PROGRAMS (*44*)

Numerous training courses and materials exist to explain federal hazmat regulations, describe uniform inspection and enforcement techniques, and provide guidelines for responding to emergencies. Courses have been developed by the Department of Transportation, state and local training institutes, individual firms, industry trade organizations, colleges and universities, private training institutes, and consultants. A number of different groups have developed training courses, including: government inspectors, fire departments, law enforcement agencies, manufacturing companies, chemical companies, shippers, carriers, and emergency response teams. These training courses and materials provide the following:

- Discussion of a variety of chemicals and hazmat groups: oil spills, pesticides, flammable liquids, hazardous wastes, combustible liquids, restricted articles, and radioactive materials;
- A broad range of topics: spill monitoring and sampling, label-

ing, marking, response personnel protection and safety, disposal requirements, packaging, hazard evaluation, mitigation and treatment, shipping requirements, and inspection procedures;
- A focus on movements by all modes (truck, rail, barge, pipeline, air); and
- Simulated drills and field exercises, as well as classroom training.

The USDOT Information Services Division is a prime source of information on training courses and seminars that may be available in your area. USDOT regularly compiles a listing of hazmat training courses being offered throughout the U.S. by colleges and universities, corporations, business organizations, and federal, state, and local government agencies. (For copies of this listing, contact the Training Officer, Information Services Division (DMT-11.10), U.S. Department of Transportation, 400 Seventh Street, SW, Washington, DC 20590.)

Illinois

The training materials summarized in Tables 6 through 8 were adapted from existing materials used in Illinois that were developed and recommended by the National Fire Protection Association (NFPA) and later adopted by OSHA. These tables indicate what should be included in first- and second-level courses. Table 6 summarizes a complete state training program. Table 7 presents the typical contents of an introductory course, sometimes referred to as "awareness" course, which is probably appropriate for most maintenance personnel. Table 8 presents the typical contents of a course for first responders. Because maintenance personnel are sometimes forced into the first-responder role by chance, key maintenance supervisors, and in turn, the personnel they supervise, could benefit from a first-responder course.

HMTUSA Training and Planning Grants

The Hazardous Materials Transportation Act, as amended by the Hazardous Materials Transportation Uniform Safety Act of 1990 (HMTUSA), established a training and grants program that provides for grants to states for emergency response planning, and to states and Indian tribes for emergency response training. A fact sheet on Section 117A of HMTUSA is presented in Appendix C. Additional information and an application kit for hazmat public sector training and planning grants can be obtained by contacting the HMTUSA Grants Manager, Office of the Associate Administrator for Hazardous Materials Safety, Programs RSPA, USDOT, 400 Seventh Street, SW, Washington, DC 20590-0001, telephone (202) 366-4900.

TABLE 6
SUMMARY OF HAZMAT TRAINING IN ILLINOIS (*35*)

The Hazardous Materials curriculum currently offered in the state of Illinois consists of four courses in three levels of training:

Hazardous Materials - Level I
Hazardous Materials Awareness
(8 hours)
Hazardous Materials: The First Responder
(32 hours)

Hazardous Materials - Level II
The Hazardous Materials Response Team
(40 hours)

Hazardous Materials - Level III
Chemistry of Hazardous Materials
(80 hours)

LEVEL I
Hazardous Materials I consists of two courses designed for personnel who will most likely be the first on the scene of a hazmat incident. *Hazardous Materials Awareness* is an 8-hour introduction to hazmats. Emphasis is placed on recognition and identification of the hazmats along with a greater awareness of the risks they pose. *Hazardous Materials: The First Responder* is a 32-hour course designed around the goal of defining the capabilities and limitations of "First Responders" at incidents involving hazmats. The students are taught that there are things that they can do, without specialized equipment, to mitigate incidents involving hazmats; more importantly, they are given the skills to determine when an incident is beyond their capabilities.

LEVEL II
Hazardous Materials II is a 40-hour course titled *The Hazardous Materials Response Team.* This course deals with the specialized skills and equipment needed by response team personnel. Classroom sessions provide the background for hands-on training activities that can be offered.

LEVEL III
Chemistry of Hazardous Materials is an 80-hour course that focuses on the areas of chemistry that can assist the response team in the decision-making process. The course is designed for personnel with little or no background in chemistry. In addition to these courses, the Fire Service Institute has developed a fifth course to address the needs of chief officers at hazmat emergencies. *Hazardous Materials for the Incident Commander* is an 8-hour course designed to provide chief officers with the background necessary to command an incident. The need seems to be particularly apparent in departments that operate response teams. This short course identifies some of the capabilities and limitations of response teams as well as the different tactics that a hazmat incident may require.

TABLE 7
COURSE OUTLINE:HAZARDOUS MATERIALS AWARENESS (8 hrs.) (*35*)

Course Description: This course is designed to introduce fire, police, and other emergency personnel to the growing problem of hazmat emergencies. Emphasis is placed on providing the student with the skills necessary to properly identify hazmats along with a greater awareness of the potential hazards that the materials may present. Classroom exercises allow the student to utilize the DOT Emergency Response Guidebook.

Course Outline:

I. Introduction

II. Classifications of Hazmats
- A. Properties of Hazmats
  - 1. Vapor Density
  - 2. Specific Gravity
  - 3. Water Solubility
  - 4. Flash Point
  - 5. Ignition Temperature
  - 6. Flammable Range
    - a. UEL
    - b. LEL
- B. Other Properties
  - 1. Toxicity
  - 2. Oxidizing Ability
  - 3. Corrosiveness
  - 4. Explosive
  - 5. Reactivity
- C. DOT Classifications
  - 1. Explosives
  - 2. Compressed Gages
  - 3. Flammable and Combustible Liquids
  - 4. Flammable Solids
  - 5. Oxidizers
  - 6. Organic Peroxides
  - 7. Etiologic Agents
  - 8. Corrosives
  - 9. Radioactive Material
  - 10. Poisons

III. Identification of Hazmats
- A. Shipping Containers
  - 1. Individual Containers
  - 2. Bulk Containers
    - a. Tank Cars
    - b. Tank Trucks
  - 3. Container Markings
- B. Placards and Labels
  - 1. Regulations
  - 2. Identification
  - 3. UN Identification Numbers
  - 4. Limitations
- C. Shipping Papers
  - 1. Trucking Papers
  - 2. Railroad Papers
  - 3. Other Shipping Papers
- D. NFPA 704
  - 1. Symbols
  - 2. Uses
  - 3. Limitations

IV. Obtaining Technical Assistance
- A. Hazmat Guidebooks
  - 1. DOT Emergency Response Guidebook
  - 2. Emergency Handling of Hazmats in Surface Transportation
  - 3. Fire Protection Guide for Hazmats
  - 4. Other guides
- B. CHEMTREC
  - 1. What is CHEMTREC?
  - 2. Reasons for calling CHEMTREC
  - 3. Information needed by CHEMTREC
- C. State Agencies
  - 1. IEPA
  - 2. State Police
- D. Industry
  - 1. Shipper
  - 2. Carrier
  - 3. Manufacturer

TABLE 8
COURSE OUTLINE: HAZARDOUS MATERIALS: THE FIRST RESPONDER (32 HRS.) (*34*)

Course Description: This course identifies the capabilities and limitations of emergency response organizations in handling hazmat incidents. The first section examines some of the hazards that different hazmats may present. The remainder of the course focuses on actions that a response organization can take to minimize the effects of a hazmat incident. Classroom simulations allow students to practice the decision-making processes used during an incident.

Course Outline:

I. Introduction
- A. Definition of the "First Responder"
- B. Importance of the First Responder at the Scene of an Incident Involving Hazmats

II. Chemistry of Hazmats for First Responders
- A. Characteristics of Hazardous Materials
  1. Flashpoint
  2. Ignition Temperature
  3. Water Solubility
  4. Vapor Density
  5. Specific Gravity
  6. Flammable Range
- B. Reactions
  1. Water Reactive
  2. Air Reactive
  3. Exothermic
  4. Endothermic

III. Toxicology
- A. Levels of Toxicity
  1. LD_{50}
  2. LC_{50}
  3. TLV
- B. Routes of Entry
  1. Inhalation
  2. Ingestion
  3. Absorption
- C. Respiratory Poisons
  1. Upper Respiratory Poisons
  2. Lower Respiratory Poisons
  3. Whole Respiratory Poisons
- D. Asphyxiants
- E. Narcotics, Anesthetics
- F. Systemic Poisons
- G. Nerve Poisons

IV. Pesticides
- A. Types of Pesticides
  1. Insecticides
  2. Herbicides
  3. Rodenticides
  4. Fungicides
  5. Others
- B. Product Label Information
  1. Signal Word
  2. Trade Name
  3. Ingredients
  4. Statement of Practical Treatment
  5. EPA Registration Number
- C. Symptoms of Pesticide Poisoning
- D. First Aid for Pesticide Poisoning
- E. Tactical Considerations
  1. Spill
  2. Fire

V. Corrosive Materials
- A. Characteristics of Acids
- B. Characteristics of Bases
- C. Tactics for Incidents Involving Corrosives

VI. Radioactive Materials
- A. Types of Radiation
- B. Units of Measure
- C. Detecting and Measuring Radiation
- D. Effects of Radiation on the Body
- E. Recommended Exposure Limits
- F. Protection Factors
- G. Tactical Considerations

VII. Flammable Liquids
- A. Characteristics
- B. Firefighting Foam
- C. Tactics
  1. Fixed-Storage Facilities
  2. Gasoline Tank Trucks

VIII. Flammable and Compressed Gases
- A. Characteristics and Tactics
  1. LPG
  2. Anhydrous Ammonia

TABLE 8
COURSE OUTLINE: HAZARDOUS MATERIALS: THE FIRST RESPONDER (32 HRS.) (*34*) (*Continued*)

3. Chlorine
4. Cryogenics

IX. Flammable Solids
A. Characteristics and Tactics

X. Oxidizers and Organic Peroxides
A. Characteristics and Tactics

XI. The First Responder: Capabilities and Limitations
A. Capabilities
1. Cooling
2. Spill Containment
3. Extinguishment
4. Initiate Evacuation
5. Rescue
B. Limitations
1. Personal Protective Clothing
2. Manpower
3. Training
4. Information

XII. Approach and Size-Up
A. Information Available at the Time of the Alarm
B. Stage of the Incident
C. Hazardous Nature of the Material
D. Type, Condition of Container

XIII. Identification
A. Container Shape
B. Placards and Labels
C. Container Markings
D. Shipping Papers

XIV. Reference Materials
A. *Emergency Response Guidebook* (DOT)
B. *Fire Protection Guide for Hazardous Materials* (NFPA)
C. *Emergency Handling Hazardous Materials in Surface Transportation* (BOE)
D. *CHRIS*, Vol. II (U.S. Coast Guard)
E. *Emergency Action Guides* (BOE)

XV. Obtaining Technical Assistance
A. CHEMTREC
B. NERC
C. Illinois ESDA
D. Illinois EPA
E. Shipper/Manufacturer

XVI. The First Responder: Objectives and Tactics
A. Rescue and Evacuation
B. Prevent Container Failure
C. Protect Exposures
D. Containment of the Product
E. Extinguishment of Burning Material

XVII. Tools of the Trade
A. Plugging Devices
B. Patching Devices
C. Spill Control Tactics

XVIII. Personnel Safety
A. Protective Clothing
1. Limitations of Protective Clothing
2. EPA Levels of Protective Clothing
B. Decontamination
C. Safety Officer

XIX. Command Post Operations
A. Function
B. Location
C. Personnel

XX. Pre-Planning for Hazardous Materials Emergencies
A. How Can a Pre-Plan Help?
B. What Should Be Included in a Pre-Plan?

CHAPTER FOUR

EQUIPMENT NEEDS AND RESPONSE PROCEDURES

BACKGROUND

The following sections suggest basic equipment needs for various levels of response. These are followed by a more detailed discussion of criteria for developing procedures for hazard mitigation and cleanup. The detailed criteria and procedures were developed primarily for a trained emergency response organization but should be valuable for the protection of highway maintenance personnel. The criteria emphasize the dangerous and complex nature of mitigating hazmat releases of which maintenance personnel (even those in a support role) should be aware. They also emphasize the need for specialized advance training for maintenance personnel who may be involved in response functions. Maintenance personnel should be well-trained and equipped for whatever their role may be, and they (and state administrators) must understand their need to be trained for various roles, including that of de facto first responder. *Adequate training is a key element of safety.*

MITIGATION, CLEANUP, AND DISPOSAL OF HAZMAT INCIDENTS: OVERVIEW

Cleanup and disposal of incidents of significant magnitude are generally accomplished and supervised by experts, e.g., an experienced, competent contractor with guidance from federal or state EPA personnel. However, maintenance personnel may be called on to clean up relatively small (as defined by state policy) incidents. They should be aware of the dangers, and properly equipped and trained. The following information is from a USDOT report that contains a great deal of specific information on transferring hazardous cargo, wreckage removal, cleanup, and disposal (*45*).

> Cleanup personnel must have proper tools, equipment, and materials for pickup, handling, packaging, and disposing of spilled hazardous materials or residual contaminated materials. Cleanup or transfer of spilled materials may have to precede wreckage removal and cleanup. This should be done with experienced crews, dedicated response teams, or contractors with the proper expertise. Disposal procedures must meet all EPA requirements. Contaminated materials moved off-site must be moved in USDOT-approved containers and in accordance with USDOT hazardous materials shipping regulations. Prior approval and arrangements are needed for shipping a material to particular disposal sites under RCRA [Resource Conservation and Recovery Act] regulations. Recommended procedures of shippers should be strictly followed.

Suggested Equipment

The equipment that should actually be carried can vary greatly. Equipment inventory must be a function of expectations and responsibilities. If personnel are expected only to report incidents and warn motorists, they will primarily need communication and traffic control equipment, and a good pair of binoculars. If, on the other hand, they are expected to take action to mitigate consequences of spills, or assist others, they must have more specialized equipment (and training). In some situations, where quick action with the proper equipment can save a life or lives of personnel who are on the scene, whether by plan or by chance, maintenance personnel must act quickly and prudently without great risk to their own person. However, these incidents are never easy to predict or plan for, and there is no correct philosophy.

It does seem reasonable that in states with an adequate number of well-planned and trained emergency response teams, maintenance personnel would not take much, if any, action; but in states with little or no trained response team capability, nor mechanisms to hire consultants, maintenance personnel might have to do more, for a longer time, to control an incident. It seems reasonable to better train and equip these crews, if for no other reason than their own personal safety.

From a report of the Illinois Hazardous Materials advisory board, suggested minimum lists of equipment are shown in Tables 9, 10, and 11 for various levels of expected response or involvement (*35*). It should be noted that the EPA is a good contact for guidance regarding lists of this type.

A USDOT guide for local officials lists and describes basic equipment and materials used in hazmat incidents (see Table 12) and recommends the minimum inventory and equipment for hazmat vehicles (see Table 13) (*39*).

Table 12 provides an overview of basic equipment and material items needed for emergency response, the function of the equipment or material, and brief explanatory comments. Although personal protective and firefighting equipment, for example, will not generally be used by maintenance crews, they should never consider responding to or cleaning up hazmat spills without adequate equipment and training in correct use of that equipment. If maintenance crews are expected to function in a strong support role, they should have the basic communications equipment, environmental monitoring devices, sorbents, chemical agents, construction equipment, containment devices, and first aid equipment listed in Table 12. Being properly equipped is essential to safety and is as important as education and training.

Table 14 gives a suggested list of prepositioned equipment. Prepositioned equipment may be helpful in mitigating hazmat incidents.

DEVELOPING PROCEDURES FOR HAZMAT RESPONSE AND CLEANUP

Persons directly involved at the scene must be guaranteed proper protective clothing, gear, and breathing apparatus, as well as continuous communications within the group and adequate supervision of experts and incident command. Equipment and materials must be compatible with the hazardous commodity involved, as determined by materials experts and contact with CHEMTREC, the

TABLE 9
SUGGESTED MINIMUM EQUIPMENT FOR HAZMAT AWARENESS (*35*)

Additional Items

- Binoculars — Enable emergency response personnel to "size-up" an incident from a safe distance.
- Streamer — Allows personnel to visually monitor changes in wind conditions at the scene.
- Emergency Phone List — Should be available both at the scene and at the dispatch center to allow for the timely notification of other responding agencies and additional resources.
- U.S. Geological Survey Maps — Enable personnel to view the incident site and the surrounding area in detail. Excellent for plotting potential problem locations if runoff is involved.
- Evacuation and Isolation Corridor Overlay — Enables personnel to plot areas most likely to be affected by a toxic cloud and determine evacuation needs.
- Notebook with Pens, Pencils, Grease Pens — Important for record keeping during the incident.
- Banner Tape — Useful in marking off areas to keep both emergency and civilian personnel out of the isolation area.
- Light Sticks — Safe source of light for reading reference materials, or for marking off zones at night.
- Case — All of the above items will fit into a small briefcase, or similar bag. While this is not required, it will mean that all items will be in one place when needed.
- Flashlight — For use in reading reference materials.

Reference Materials

Emergency Handling of Hazardous Materials in Surface Transportation, Bureau of Explosives
Emergency Response Guidebook, USDOT (*39*)
Fire Protection Guide for Hazardous Materials, National Fire Protection Association (NFPA)
Local Hazmat Contingency Plan Summary

well-known Chemical Transportation Emergency Center. It is a phone hot-line/clearinghouse that provides 24-hour information for chemical transportation emergencies. When notified of a spill, a CHEMTREC operator contacts the shipper for information, assistance, and follow-up help. If the product involved can be identified by chemical or trade name, CHEMTREC provides immediate warnings and limited guidance to those at the scene.

A process must be developed to establish procedures for hazards mitigation and cleanup methods. According to a USDOT report on post-accident procedures, the following selected criteria should be met (*45*):

- The hazardous materials involved must be identified along with their physical, chemical, and thermal properties.
- Assessment of toxic, flammable, and explosive vapor hazards associated with the particular hazardous material(s) involved in the accident must be carried out.
- Accident site conditions must be identified.

In determining accident site conditions, procedures must be established to handle the following situations (*45*):

- Hazardous material(s) or fire resulting in toxic or corrosive combustion products (e.g., burning vinyl chloride yields hydrochloric acid);
- Releases resulting in either a massive liquid pool or a small continuous leak as a result of loose, damaged, or unseated fittings or valves; and
- Situations where no release occurs but there is fire impingement on intact tanks containing hazardous material(s).

In deciding on the proper hazard-mitigation technique to use, personnel with expert knowledge of the material involved must be accessed. Personnel must be aware of the available alternatives, personnel and equipment requirements, and site and material-specific applications of each method considered. We emphasize that

TABLE 10
SUGGESTED MINIMUM EQUIPMENT FOR HAZMAT FIRST RESPONDERS (*after 35*)

The following list contains items that could enhance the response capabilities of first responders when confronted with an incident involving hazmats. Some of the items are already available in most departments, so they would not represent any additional cost to the department.

Foam
- 25 Gallons of AFFF/ATC (minimum)

Protective Clothing
- PVC Rain Suits (4)
- Tyvek/Saranex Coveralls (4)
- Silver Shield Gloves (10)

Miscellaneous
- 2-1/2 gal. AFFF Extinguisher
- ABC Extinguisher (30 lb)
- Class D Extinguisher (30 lb)
- Purple K Extinguisher (30 lb)
- CO_2 Extinguisher (20 lb)
- Rope
- Permissible Lights (4)
- Drinking Water w/Cups

Reference library
- *Fire Protection Guide for Hazardous Materials*, NFPA; *Emergency Handling of Hazardous Materials in Surface Transportation*, Bureau of Explosives (BOE); *Emergency Response Guidebook* (USDOT); *CHRIS*, Vol.II (U.S. Coast Guard); *Firefighter's Handbook of Hazardous Materials*, Maltese Publishing Co.; *Prehospital Care of Hazardous Materials Injuries*, Dr. Doug Stutz, Bradford Publishing Co.; *Local Hazmat Contingency Plan*.

Leak Control Kit
- Plugging Compound
- Assorted Plugs and Patching Devices
- Assorted Tools
- Duct Tape

Spill Control
- 2 Spade-Type Shovels
- 10 Empty Sand Bags

Absorbent Material (e.g., sand, oil dry, soda ash)
- Visqueen
- Sorbent Pads
- Brooms w/Dust Pan
- Plastic Dike Tubing (100 ft.)

Safety
- Binoculars
- Combustible Gas Indicator
- Decontamination Solutions
  - Sodium Carbonate
  - Trisodium Phosphate
  - Calcium Hypochlorite
  - Chlorine Bleach
- Barricade Tape
- Radiological Monitoring Kit

Estimated Costs:

The following costs are based on 1986 prices, but should give the reader some approximate idea of costs for the various categories above.

Reference Materials	$ 89.00
Foam	500.00
Protective Clothing	125.50
Leak Control Kit	155.00
Spill Control	87.00
Safety	490.00
TOTAL	$1,446.50

properly trained and experienced emergency response teams must be involved in such decisions, preferably on-scene.

With the expertise for proper decision making and supervision being on-scene, options must be developed in an integrated manner so that the total operation and affected area are considered at every step of the wreck-handling and mitigation operations. The USDOT report points out that the following items must be considered when selecting hazard mitigation techniques (*45*):

- Vapor suppression by foam or other suppressants;
- Liquid containment on land by dikes, dams, berms, pits, gels, sorbents, etc.;

TABLE 11
SUGGESTED MINIMUM EQUIPMENT FOR HAZMAT RESPONSE TEAMS (*35*)

The response team equipment list has been prepared to provide emergency response groups with guidance as they develop and implement an emergency response team trained and equipped to deal with incidents involving hazmats. (The items listed are considered to be minimum; it should be recognized that these items will not allow a team to handle every incident involving hazmats.)

Reference Materials
- *Emergency Handling of Hazardous Materials in Surface Transportation*
- *Fire Protection Guide on Hazardous Materials*
- *Hazardous Materials: Emergency Response Guidebook*
- *Hazardous Chemical Data* (CHRIS)
- *Emergency Action Guides* (BOE)
- *Condensed Chemical Dictionary*
- *Pocket Guide to Chemical Hazards* (NIOSH)
- *Occupational Health Guidelines for Chemical Hazards* (NIOSH)
- *Guidelines for the Selection of Chemical Protective Clothing*
- *Farm Chemical Handbook*
- *Rapid Guide to Chemical Hazards in the Workplace*
- *Chemical Hazards in the Workplace*
- *Prehospital Care of Hazardous Materials Injuries*
- *Firefighters Handbook of Hazardous Materials*
- *Car and Locomotive Cyclopedia*

Protective Clothing
- Encapsulated Suits (4 minimum)
- Saranex/Tyvek Cocoon Suits (8)
- Saranex/Tyvek Coveralls (8)
- SCBAs (60 minute) (4)
- Assorted Boots
  - PVC (8)
  - Butyl (8)
  - Disposable (1)
- Assorted Gloves
  - PVC (12)
  - Viton (8)
  - Butyl (8)
  - Latex (100)
- Hard Hats (8)
- Flash Protection for Suits (4)
- Radios with SCBA Capability (5)
- Hearing Protection (4)

Decontamination
- Visqueen
- Garden Hose w/Fittings
- Plastic Buckets (obtain locally)
- Plastic Bags
- First Aid Kit
- Disposal Drums (2)
- Inflatable Pools (4)
- Decontamination Solutions
- Brushes (3)
- Barricade Tape
- Trash Bags
- Chlorine Bleach

Monitoring Devices
- Binoculars
- Spotting Scope
- Radiation Monitoring Kit
- Combustible Gas Indicator
- Multigas Detection Kit
- Oxygen Monitor
- Ph Paper
- Instant Camera w/Film
- 35 mm Camera w/Film
- Thermometers
- Weather Station
- Pocket Calculator

Spill Control
- Sorbent Pads
- Sorbent Pillows
- Sorbent Booms
- Oil Dry
- Sand
- Hydrated Lime
- Citric Acid (100 lbs)
- Empty Sand Bags (24)
- Powdered Activated Carbon
- PVC Pipe (5' lengths)
- Funnels
- Metal Buckets or Pails

Leak control
- Access to Chlorine Kits A,B,C (cost to purchase)
- Tools:

TABLE 11
SUGGESTED MINIMUM EQUIPMENT FOR HAZMAT RESPONSE TEAMS (*35*) (*Continued*)

Non-Sparking Mechanics Tools	Estimated costs:
Recovery Drums (3)	The following costs are based on 1986 prices, but should give the reader some approximate idea of costs for the various categories of equipment listed above.[a]
Corrosives Pump	
Flammable Liquid Pump	
Patching Kits (price varies according to the number of items included)	
Dome Clamps (5 homemade)	
Grounding Rod and Cables	
Hand Truck	
Miscellaneous	
2 1/2 gal. AFFF Extinguisher	
ABC Extinguisher (30 lb.)	
Class D Extinguisher (30 lb.)	
Purple K Extinguisher (30 lb.)	
CO_2 Extinguisher (20 lb.)	
Rope	
Permissible Lights (4)	
Drinking Water w/cups	

Reference Materials	$ 431.95
Protective Clothing	16,417.50
Decontamination	218.00
Monitoring Devices	2,913.50
Spill Control	487.40
Leak Control	5,620.00
Miscellaneous	932.00
TOTAL	$27,020.35

- Stopping leaks if possible;
- Using firefighting techniques to cool intact tanks impinged by fire if the water supply is sufficient, or to extinguish fire if the source of leaks can be quickly and adequately secured to prevent reignition and flashing of flammable vapors;
- Evacuation considerations including dispersion of toxic and flammable vapors in the immediate accident area and downwind, and explosive potential with blast overpressure, radiant heat, and fragments;
- Introducing turbulence into release of dense gases in an attempt to increase air entrainment at the edges of the cloud, thereby diluting it for more rapid dispersion; and
- Assessment of the availability of resources (equipment, materials, and personnel) at the accident site.

The selection of wreckage removal operations depends on the following (*45*):

- An assessment and evaluation of the structural integrity of cars and containers mechanically stressed in an accident;
- Analytical capabilities (e.g., acoustic emission, infrared radiometry) for monitoring structural integrity and container pressure and temperature during wreck-clearing operations;
- Selection of handling options including rerailing, moving, lifting, uprighting, or off-loading of cars and containers in the field;
- Possibility of sufficient tank damage, fire, or inaccessibility in the case of compressed flammable gases like propane, butadiene, or vinyl chloride to warrant emptying the car and disposing of its contents (vent and burn); and
- Availability of equipment, adequate containers, compatible materials, and trained personnel with appropriate protective gear and equipment.

Cleanup and disposal procedures selected will depend on the following (*45*):

- The particular materials involved in the accident and their resulting condition (for example, pooled liquids with foam blanket would require removal, while a gas release would require monitoring until it was adequately dispersed);
- Mitigation options selected and used on-scene (e.g., gelled residue from liquid containment; foam residue from vapor suppression; contaminated, corrosive runoff from firefighting or tank cooling; and residues from neutralization of corrosives); and
- Regulatory mandates such as the EPA/USCG requirements under the Clean Water Act limiting spills of hazardous materials and indicating pollutant levels for cleanup of such spills and disposal requirements as delineated under the RCRA for hazardous spill residues.

The types of hazard mitigation discussed above are not for the amateur or the untrained. They are for experts with specialized training and experience. It cannot be assumed that one or two courses makes one an expert. This point is made clear by the following section from a detailed report on this important subject (*45*):

(*from CHEMTREC*)

> Hazardous material training courses stress planning but also present some basic information concerning the nature of hazardous materials: how to identify spilled/leaking material, where to find technical help, danger assessment, decision-making, and to a certain extent some general procedures for on-scene actions such as controlling access to the area, evacuation, surveillance of vapor clouds, firefighting, rescue, and communications. In some instances, there is hands-on training such as use of polyurethane foam for sealing holes in drums or diking liquid pools, applying metal patches to

TABLE 12
BASIC EQUIPMENT AND MATERIALS USED IN HAZMAT INCIDENTS (*42*)

ITEM AND EXAMPLES	FUNCTION	COMMENTS
Personal Protective Equipment • Pressurized Self-Contained Breathing Apparatus (SCBA) • Full Protective Clothing • Special Protective Clothing	Protects emergency response personnel against toxics, fire, and/or explosion.	Exact type of clothing or apparatus needed depends upon specific hazard approached. Essential for hazmat work.
Communications • Radios, Telephone, Megaphones	Improves coordination of emergency response personnel.	Ensure that equipment is compatible. Basic fire radios are a necessity. Walkie-talkie and megaphones will also ease communications at the scene of the spill.
Environmental Monitoring • Water pollutant detectors • Airborne Gases/Chemical Monitors • Optical (binoculars, lamps) • Radiological Monitoring	Determines extent, severity, and nature of hazard.	Needed to identify factors (e.g., wind direction and speed) that might affect the emergency response operations. Explore resource sharing with nearby towns, equipment industry.
Firefighting Equipment • Trucks/Apparatus • Tools & Equipment • Foam/Agents • Dry Chemical Extinguishers • CO_2 Extinguishers • Foam Application Equipment	Extinguishes fires; reduces explosion hazard; reduces the flow of vapors, toxic, or dangerous materials; necessary to carry out rescue and evacuation.	Usually needed to combat large spills, rescue trapped people, and protect environment. Explore Mutual Aid with adjoining fire companies.
Sorbents • Natural (vegetable, mineral, animal) (e.g., dirt) • Synthetic (polymers) (e.g., polypropylene)	Sorb materials used to reduce hazards and ease cleanup.	Sorbents are inert, nontoxic solid materials that soak up spills or convert the spilled liquids into a semi-solid mass. Easier and safer to clean up spill.
Construction Equipment • Backholes, cranes, bulldozers, dump trucks, etc.	Used to construct dikes, collection ponds, and trenches to contain material. Clear wreckage.	Explore resource sharing with local contractors or builders, etc.
Chemical Agents	Neutralizes or otherwise chemically reduces hazard.	Example: Lime neutralizes some acids. (Get trained!!! Be safe — not sorry.)
Containment Devices	Reduces spread of hazmats.	Examples: patches, plugs, foam, etc.
First-Aid Equipment	Necessary to treat hazmat exposure victims.	Example: dressings for chemical burns. Supply of clean water to rinse off hazardous chemicals.

TABLE 13
MINIMUM INVENTORY AND EQUIPMENT FOR HAZMAT VEHICLES (*42*)

Foam (protein, AFFF & alcohol)
Nozzles and eductors
Reference books
Emergency phone numbers, current telephone books and tools
Minimum of two proximity or entry suits
Assorted hand tools
Plug & patch kits
pH meter or tape
Explosive gas meter
Wind sock
Self-contained breathing apparatus and spare tanks
Radio (CB, fire, or police)
Area maps
Ladders, hose, forcible entry
Gas detectors
Recovery drums, brooms, shovels
Absorbent material
Spare valves, fittings, etc.
Piping material, drains (PNC pipe)
Chlorine kit(s)
Safety valve protectors
Papers, tags, pencils, grease pens, shipping tags, etc.

TABLE 14
SUGGESTED MINIMUM PREPOSITIONED EQUIPMENT AND SUPPLIES (*42*)

Supplies that should be available throughout the state are listed as follows:

Sand
Lime
Salt
Absorbents including:
- Oil absorbents
- Acid absorbents
- Soda ash
- Powdered activated carbon and sodium Dihydrogen phosphate

Containment materials:
- Water booms (booms for use in water-borne situation)
- Skirted booms

Foam:
- AFFF
- High Expansion Foam
- Specialty Foams

Recovery Drums:
- For 55-gallon drums and smaller

Other supplies and equipment that the state already has throughout the state should be made available, such as cranes, front-end loaders, bulldozers, dump trucks, and other specialized construction-type equipment.

tank car holes by means of bolts, or stopping leaks with wooden plugs. These are useful techniques, but have limited application in specific situations. Heavy reliance must still be placed on the specialists from the various disciplines involved. These specialists operate and make decisions based predominately on their own experience and knowledge and, with few exceptions, perform tasks without the benefit of written procedures, particularly with respect to cargo transfer, wreckage removal, cleanup and disposal. Although these courses give some attention to restoring the scene to normal, there is a lack of procedural training in these four activities.

Examples from a State Plan: West Virginia

The previous section emphasizes what is involved in response to and cleanup of hazmat spills. It is a complex and dangerous operation requiring expert knowledge. The following list, taken from the West Virginia Hazardous Materials Response Plan, could be considered typical of what is expected of highway department maintenance personnel in most states in regard to a support role in hazmat incidents. (The first six items in the list are generally carried out by maintenance crews) (*30*):

- Provide necessary signs, traffic lanes, barricades, lights, and flagmen to maintain flow of traffic and establish detours when required.
- Provide communications from the command post to the State Emergency Operations Center (EOC), when required.
- Provide necessary abrasives, dry sand, or other materials requested through the incident commander.
- Provide available material to block the flow of runoff contaminants from highways into sewers, drains, or bodies of water that would cause harm to human life, health, or the environment.
- Assist in evacuation procedures.
- Provide a representative for supervision for the activities mentioned above.
- Initiate standby cleanup contractors when required.
- Provide laboratory services on a cooperative basis.
- Assist with identification of the hazardous material or materials involved.

RELATING TRAINING TO RESPONSE

Specific training requirements were identified in Chapter Three. This section emphasizes that training must be consistent with expected actions—planned or unplanned.

A hazmat incident requires initial and continuous assessment of the situation and evaluation of the requirements and effectiveness of various mitigation strategies. Supervisory personnel involved in a release should have specialized training in evaluation and assessment methods, decision making, the procedures required in their specific activities, and awareness of the impact of their actions. Specifically, they should have training and knowledge of the information needed for proper decision making and proper analysis procedures to determine hazards, potential dangers, dam-

age sustained, magnitude of the spill, who and what has been exposed, resources needed, and the potential effectiveness of corrective action.

Such training should include knowledge of how to do the following (*45*):

- Identify at a safe distance any hazmats involved or that have been released.
- Determine the integrity of the hazmat containers.
- Establish the danger perimeter.
- Predict the downwind toxic or flammable vapor concentration versus distance as well as cloud size and travel rate.
- Use resources most effectively.
- Determine the applicability and effectiveness of corrective actions.
- Use remote sensing/detection/analytical equipment.
- Interpret data.
- Spot changing conditions that pose additional dangers.
- Assess risks.
- Determine hazards.
- Monitor the scene for toxic or flammable vapor levels and for evidence of personnel exposure.

Training is valuable for maintenance employees even though they are primarily involved in support roles or employed by a state where the policy is to "report and stay away." Decisions have to be made when maintenance crews first appear on the scene. After presenting a detailed discussion of the subject of training needs, the DOT report on proper response to chemical spills stresses this point as follows (*45*):

> Decisions are made at every level by every person responding to or coming upon a transportation accident involving hazardous materials. The decision may be as simple as turning a car around and heading in the other direction, if one spots what appears to be a wreck five miles across the valley. Decisions must be made as to whether the wreckage can be safely approached or not.
>
> A decision must be made each time a person or piece of equipment is deployed. Appropriate cleanup procedures must be chosen. Someone must decide if residual material is to be neutralized, burned, vented, recovered on-site or disposed of off-site, as well as what methods to use. For every action that is taken a decision must be made. It is imperative that training be designed to meet the needs of all decision makers. Depending upon the individual responsibilities and the particular types of activities involved, training can range from checkoff lists to computer-simulated decision-making methods.

In other words, the assigned responsibilities and expected actions of maintenance crews when they encounter a hazmat spill or give assistance must be balanced with their training and the equipment available to them. Regardless of the type of activity, whether it involves immediate response, hazard mitigation, cargo transfer, wreckage removal, or cleanup and disposal, training must ensure that procedures are understood and that they are used to accomplish the following four basic goals (*45*):

- Provide effective communications;
- Evaluate/assess the situation, hazards, and actions;
- Make decisions; and
- Take appropriate actions at an appropriate level.

These four basic items are appropriate for highway maintenance crews even where their state policy calls for minimal or no involvement. In these cases, assessment, decision, appropriate action, and communication are very important.

CHAPTER FIVE

CONTAINMENT AND CLEANUP PROCEDURES

As discussed in previous chapters, highway maintenance forces are only minimally involved in mitigation of hazmat spills, generally under the guidance of an experienced responder with expertise in the particular material involved. However, in some states they are expected to participate in containment of some spills, usually minor, or an incident such as an oil spill.

There will be cases where the maintenance forces are de facto first responders no matter what the state or local plan stipulates. Their first responsibility in such an event is to protect themselves, as well as persons and property in the impacted area if they can do so with minimal risk to themselves, and then to properly report the incident. They will need a good understanding of hazmats and the resources available through activation of the existing emergency response plan via radio or telephone contact.

After proper contact is made, given that the involved personnel have correctly determined that the situation is not particularly life-threatening, timely containment strategies can sometimes keep a minor incident from escalating into a major one and becoming a major threat to life and/or property. As expressed by Smith (*26*), "Confining the danger and/or pollutant always pays dividends in terms of money, health, and welfare."

STATE GUIDELINES

A number of state documents and guidelines were reviewed in preparation of this synthesis. However, even in the states where the highway maintenance forces participate in hazmat incident containment and cleanup, few specific guidelines and documents set forth suggested response procedures for maintenance personnel.

Plans Involving Mitigation

Some plans we reviewed indicated that the duties of maintenance personnel included containment and cleanup. Examples from two states are cited: *North Carolina Oil Spill Contingency Plan, Division of Highways* (*46*)

The following procedure is to be followed:

1. Erect and maintain such signs, lights, barricades or other traffic control devices as deemed appropriate to maintain or control traffic along the affected routes or detour routes.
2. Maintain in readiness and, when requested by SERT (State Emergency Response Team), deploy oil spill cleanup response units located strategically across the state.
3. Maintain a stockpile of oil spill containment and absorbent materials.
4. Upon direction by the governor or by reimbursement agreement, provide equipment and manpower for removal of contaminated debris off rights-of-way.
5. Provide removal of contaminated debris and restore damage of rights-of-way under its jurisdiction.
6. Provide radio communications support.
7. Construct and maintain temporary access routes to spill sites as directed by the SERT Leader.

Oregon State Highway Division (*47*)

The Oregon employee guide to spill response was one of the most comprehensive manuals received and reviewed. The following sections are taken from the Oregon manual (*47*):

> Containing the material. Sand or absorbent materials may be needed to contain the hazardous material and prevent further contamination. Adjacent property or waterways should be protected when it can be done safely. Highway division personnel may take this action but should first consult with the lead state agency or other reliable source for recommended safety precautions. Such action shall be avoided when special protective equipment or clothing is recommended.
> Cleanup by highway division personnel. In some instances it is possible the material may not be toxic and can be safely cleaned up without using special protection equipment and clothing. However, you should not clean up the material until a reliable source has determined it safe and the district manager or his designee has been advised.

It should be pointed out that other sections of the manual stress safety. For example, in the first section, under actions to be taken, safety is stressed as follows (*47*):

> Avoid contact with spilled material. Avoid breathing vapors, smoke, or dust originating from the material.
>
> - Observe incident from a safe distance (use binoculars if available).
> - Stay upwind; keep out of low areas.
> - Take necessary actions to control traffic and protect motorists.
> - Do NOT clean up any unfamiliar, unknown, or suspected hazardous material.
> - Refer to USDOT Emergency Response Guidebook.
>
> Rescue. Providing rescue and first aid shall be at the responder's discretion. Providing for the safety of the public and activating other emergency responders is the first priority.

It can be seen from the above sections that personnel safety is the first priority of hazmat emergency response. Safety and caution are stressed throughout. One could argue that containment should not be attempted. That argument could be taken one step further, that guidelines, manuals, etc., for highway maintenance personnel should not include containment guidelines. Certainly before attempting containment, personnel should be confident that they have proper facts and information about the material, that they are in contact with persons who can provide technical assistance, and that they should never attempt to clean up any unfamiliar, un-

known, or suspected (dangerous) hazmats. In all cases, clear guideline procedures and training should be emphasized.

CONTAINMENT PROCEDURES

All of the precautions in the previous section must be given priority. However, simple actions by the first-on-scene persons can many times control the magnitude of an incident. Smith expresses the following (*26*):

> Three or four shovelsful of dirt, tossed in a swale or indentation in the ground, have restrained the flow of a large volume of chemicals at wreck scenes many times. A sack of sand or a few shovelsful of dirt can plug or impede flow.

Many types of containment are available on-scene (*26*):

- Dikes that afford direct containment,
- Dams that plug drainage swales or ditches,
- Natural topography,
- Excavated sumps,
- Trenches,
- Ponds, and
- Streams.

It should be noted that use of a stream or natural pond should be considered only in an emergency. If earth-moving equipment is available—such as a small tractor with a rear backhoe or a front loader—it can be very valuable in damming, diking, or diverting spilled materials. However, we stress that the objective is not to create a fancy structure but to contain the materials. Smith states the following (*26*):

> The kinds of dikes and dams we are discussing are not things of beauty, nor are they products of any particular design. They are trial-and-error mounds of dirt placed by eyeball leveling and common sense, but if timely and effective, they may ultimately be worth millions of dollars.

When using containment techniques, some precautions must be considered (*26*):

1. Never divert liquids to sanitary sewer lines. People have been killed at treatment plants by exploding gasoline; they have also been severely injured by volatile chemicals entering the plant.
2. Never trap volatile chemicals in closed conduits such as storm drains.
3. Never linger around impoundments of mixed chemicals.
4. Never allow smoking around the area.

Finally, always remember "Rule Number 1:" Stay away from unfamiliar, unknown, or suspected dangerous materials.

CONTAINMENT PRINCIPLES AND EXAMPLES

The material in this section is paraphrased from an EPA training course (*48*).

Once a hazmat release has occurred, the immediate objective is to contain the effects of the release to as small an area as possible. A spill that is quickly and properly contained reduces the risk to the endangered public, the cost of cleanup, and the environmental damage.

An important and necessary prerequisite to containment is adequate training to properly assess the situation and the dangers involved so that it can be properly determined if containment is within the capabilities of the personnel on the scene and the equipment available. Otherwise, the proper action would be to secure the area from a safe distance and wait for more experienced and better equipped response personnel.

The clearest possible assessment will include the following (*48*):

- Identification of all involved material;
- The physical properties of all materials being released, i.e., vapor density, vapor pressure, specific gravity, flashpoint, compatibilities, reactivities, boiling point, and solicibility;
- Weather conditions, i.e., wind direction and speed, pressure, temperature, and humidity; and
- Local geography.

This information allows response personnel to answer the following three questions (*48*):

1. What materials are involved?
2. Where will they go now that they are released?
3. What can be done to reduce the hazard?

Proper assessment of the situation provides answers to the first two questions. Training is necessary to provide answers to the third.

Although each hazmat incident is unique, hazmat incidents may be broken down into four basic types of releases: air release, groundwater plumes, land spills, and water discharges.

Highway maintenance personnel should leave the first two basic types to response experts. Proper containment of the latter two depends on the material and on knowing whether or not the material presents undue risk. The most common materials that could be handled by knowledgeable highway personnel without undue risk are oils, where there is little danger of fire. Petroleum products with low flashpoints, explosive vapors, and other dangerous materials all require additional training or equipment. Policy and instructions should be clear.

Land Spills

Drainage into water supplies or drainage channels should be avoided at all costs, if possible. The simplest containment device for a land spill is an earthen dike, the most basic of which is easiest to build, sometimes requiring only a shovel. Earthen dikes are temporary barriers, but they allow vertical migration into the groundwater and horizontal seepage through the dike in a short time. Disadvantages can be alleviated by combining with other methods, e.g., a gully could be diked until a larger pool lined with a suitable material such as polyethylene is constructed downstream. It should be kept in mind that the principle objective of a highway maintenance crew is usually to buy time until a more experienced, better equipped response team arrives.

Other materials are more effective, the most common being polyurethane foam, foamed concrete, inflatable dikes and pools, and mechanical containment devices. Whether highway maintenance crews have these materials available would depend on a policy decision.

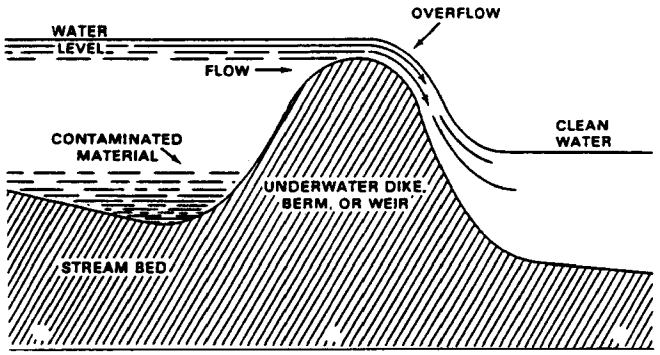

Figure 4 Overflow dam to contain pollutants. (*48*)

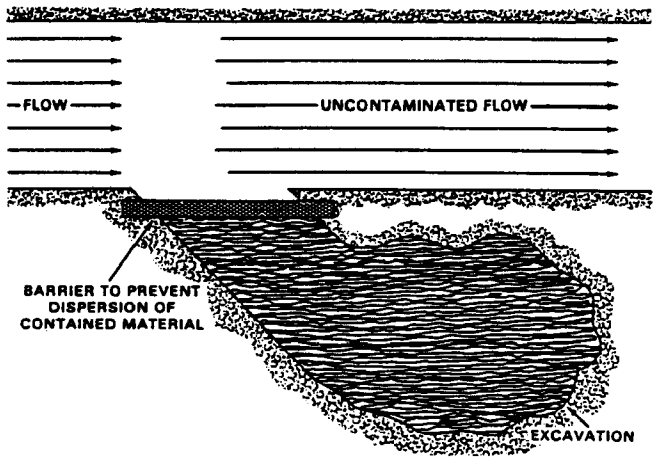

Figure 5 Bank excavation to collect pollutants (plan view). (*48*)

It should not be overlooked that potential danger can be reduced by containing the problem. Depending on the material, this can be done by eliminating ignition sources; treating the material, e.g., neutralizing an acid; cooling containers with water; and evacuating all persons at risk.

Water Spills

There are many ways to contain pollutants in water. The method generally depends on whether the pollutants are soluble or insoluble and whether they sink or float.

Insoluble: Heavier Than Water

For these materials there are generally four containment methods.

Overflow dam. An underwater dike or other barrier is placed in a stream (see Figure 4). The spilled material will collect on the upstream side. A series of these dams is usually best. The first should be constructed far enough downstream so as to be in place before the majority of the spill arrives. This method is most effective in slow-moving water. The dams are inexpensive and easy to build, usually with readily available materials.

Pneumatic barrier (bubble barrier). A pipe or rigid hose with a line of closely spaced holes is anchored to the bottom of a shallow, slow-moving, calm stream. An air compressor forces air bubbles through the pipe, creating a bubble barrier. Expertise is critical because if the pipe is not compatible with the spilled material, or if the turbulence causes the material to go into solution, additional problems will be created. The method is limited to materials that are not soluble in water and should not be used without expert knowledge of the materials.

Excavation on bank. Sometimes excavating a depression in a moderate- to slow-moving stream or pool on the same bank as the spill will cause the pollutant to naturally collect there (see Figure 5). A semipermeable, one-directional barrier can be placed across the opening, if available.

Containment. If all else fails, or if the pollutants are in fast moving waters, reduce the potential danger by considering the following methods (*48*): (1) close down water intake, barricade sensitive areas until the pollutant has passed, and/or chart known depression in the stream bed.

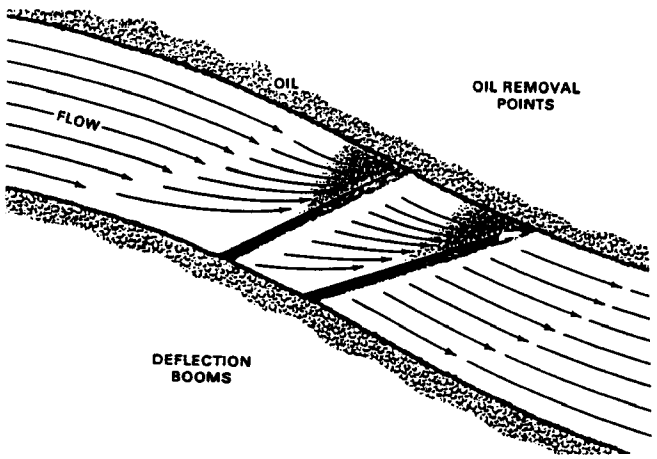

Figure 6 Deflection boom to contain floating pollutants. (*48*)

Insoluble: Lighter Than Water

There are many containment strategies for insoluble or only slightly soluble materials that have specific gravities near or greater than 1.0 (meaning that they will float). Oils and diesel fuels are examples; these are the materials that highway maintenance forces would most likely be called upon to contain.

Floating boom. The floating boom is the most common containment method, with several types and methods of deployment. Popular methods are illustrated in Figures 6 through 8. These booms are usually available in cities near rivers and lakes and are generally easy to use. One precaution should be noted: they are generally ineffective against light petroleum products such as gasoline in choppy, wave, or fast-current conditions.

Sorbent booms. Sorbent booms are similar to floating booms, but they absorb the material. They are effective in containing light petroleum products, but, like the floating boom, they also are not effective in fast or choppy waters. Sorbent booms are most effective when used in conjunction with a floating boom, and are relatively inexpensive, easy to use, and disposable.

Underflow dam. A dike is placed in the stream with a pipe in it that is lower at the upstream end and submerged. (See Figures 9 and 10.) This allows the water to flow through the dike while

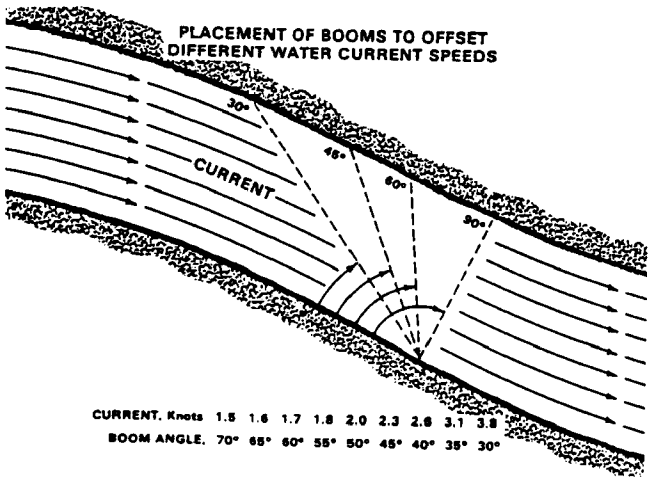

Figure 7 Proper placement of booms for various current speeds. (*48*)

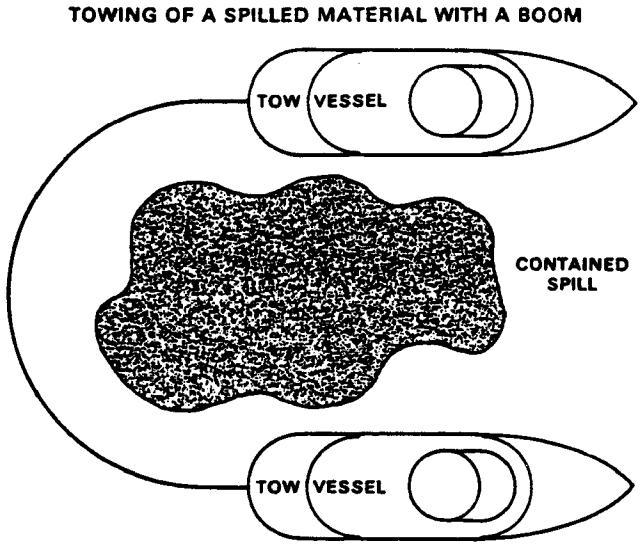

Figure 8 The use of a floating boom on a lake or pond. (*48*)

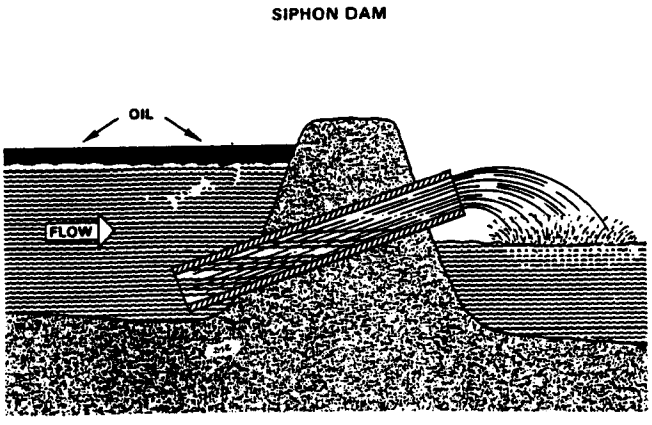

Figure 9 A siphon dam to contain floating pollutants. (*48*)

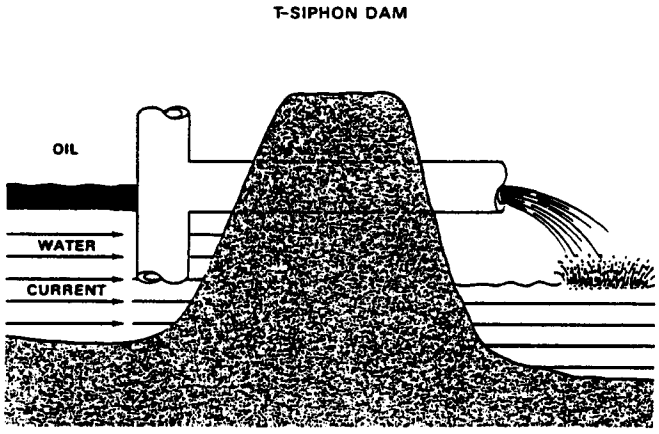

Figure 10 A T-siphon dam to contain floating pollutants. (*48*)

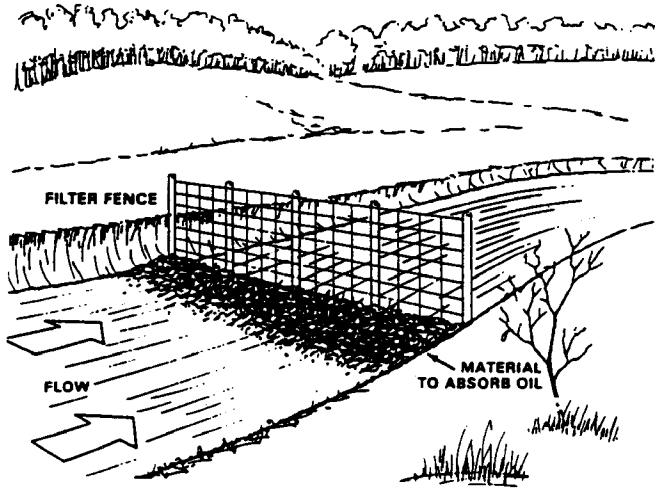

Figure 11 A fixed barrier of chicken wire and straw. (*48*)

trapping the pollutants behind it. Failure of the dam will be less likely if it is keyed into the banks and the stream bed. Care must be used to ensure that oil does not flow through the pipe.

Pneumatic barrier (bubble barrier). The previously described pneumatic or bubble barrier can also be used. Expert knowledge of its effects on various materials is important.

Water spray. Sometimes a water spray can be used to collect and hold materials in an artificial or natural catchment along the shore. This is effective only in slow-moving or still waters.

Fixed barrier. A fixed barrier, made of materials found in most farming communities, can be effective for temporary containment. A typical example would be a chicken-wire fence with hay or straw on the upstream face. These barriers are generally limited to small streams. (See Figure 11.)

Soluble or Insoluble: Specific Gravity = 1

These are materials with specific gravities that are the same as water. The material may be soluble (miscible) or insoluble. Most inorganic acids fit into this category, e.g., sulfuric acid. The basic procedure is to dike the entire water column in a natural or con-

structed (dug) collection point or pool. A diversion canal is constructed to divert the flow of the stream away from or around the polluted portion. A classic example is to dam the upstream and downstream portions of a bend, and then cut a canal around the dams.

Chemical products. Many chemical products that gel or disperse oil are available. However, these products can themselves cause damage and are therefore strictly regulated. EPA permission must be obtained for use of these products.

Summary

It is important to keep in mind that all methods and all materials are stop-gap measures. They are temporary and will all, in time, fail. If a containment operation is to be considered a success, the hazmat must be removed to more-secure containers before the emergency measure fails.

Table 15 summarizes the above material on containing releases on land. Table 16 summarizes the material on containing releases on water.

TABLE 15
SUMMARY: METHODS TO CONTAIN RELEASES ON LAND (*48*)

Technique	Application or Construction Method	Use	Advantages	Disadvantages
Earthen Dikes	Compact earth with earth-moving equipment (height depends on earth type)	Flat or sloped surface	Material is on site Equipment is common	Liquids seep through soil Some surface soils are suitable
Foamed Polyurethane	Use trained personnel to construct	Hard, dry surfaces	Dike holds up to 3 feet of water	Dike leaks on wet ground Equipment is not common Equipment is not common
Foamed Concrete	Use trained personnel to construct	Flat ground; slow-moving spill	Concrete adheres well to substrates (clay/shale/grass)	Concrete must set for a time; will not hold high hydraulic heads 15 feet
Excavation	Use earth-moving equipment; line if possible	Soft ground; natural cavity	Material is on site Equipment is common	Large amounts of material must be moved Liquids seep through soil Some surface soils are not suitable
Excavation and Dikes	Use earth-moving equipment; line if possible	Soft ground	Technique needs less space than separate operations Material is on-site soil Equipment is common	Large amounts of material must be moved Liquids seep through Some surface soil not suitable in all cases

TABLE 16
SUMMARY: METHODS TO CONTAIN RELEASES OF MATERIALS THAT FLOAT (*48*)

Technique	Application or Construction Method	Use	Advantages	Disadvantages
Booms	Varies; needs deployment device	Water with not too much current	Can be used on large area; many varieties available	Useful only in waves less than 2 to 4 feet and 0.7 knots
Weirs	By boat	Calm water	Is not easily clogged; collects and contains	Not useful in rough water
Pneumatic barriers	Use air compressor or diffuser to deploy	Shallow water only	Does not create a physical barrier to vessels	Useful in rough water Useful only in shallow water and thin layers of contaminants
Herding	Apply chemicals on water	Rough water such as shore lines	Useful in rough water	Chemicals hard to obtain Is not 100% effective

CHAPTER SIX

SUMMARY OF STATE RESPONSES TO THE SURVEY

Finding the best person in a state to answer questions on response to hazmat emergencies can be problematic. Key organizations and titles usually differ from state to state. Pinpointing maintenance departments and personnel would have served the survey's purposes in many states; however, in many other states, maintenance forces have minimum roles. Thus, information was sought on the overall state response organization because only by looking at the overall organization could the role of highway maintenance forces be clearly portrayed. All states were contacted for the survey and answers to the survey questionnaire (Appendix D) were obtained from all but two states. The range and deviation of answers was quite large. Again, this illustrates the highly elusive nature of the subject. More differences than similarities exist among the states.

The information in this chapter is taken from the 48 responses to the survey of states. It must be noted that there was no way to check the accuracy or interpretation of the answers. The information considered most relevant to this synthesis was extracted and summarized.

State Plans

Of the responding states, 47 (98 percent) have a state plan that covers hazmat spill response. Forty-four states (92 percent) indicated that they have a formal, written plan approved by the agencies involved and, in some cases, by higher authority such as the legislature or governor. The same number of states responded that they have implemented the plan. Out of 41 responses, 32 states (78 percent) responded that they hold regular training exercises; 9 states (22 percent) responded that they did not.

Lead Organizations

All states have been mandated to name a lead agency and/or a designated member of regional response teams. Responses regarding the lead agency appear to have been given in the context of the lead state agency in charge of an incident. In all or most cases, these should be the same agency. There is more diversity than commonality in this regard. A breakdown by organization types from 42 responses follows:

Lead Agency		
State Police Agencies	10	(24%)
Environmental and/or Natural Resources Agencies	7	(17%)
Local Fire Dept. or Other Local Agency	7	(17%)
Emergency and/or Response Teams	6	(15%)
Varies by Response Type	4	(10%)
Public Safety Agencies	3	(7%)
Adjutant General or Military Affairs	2	(4%)
Health Departments	1	(2%)
DOT or Highway Dept.	1	(2%)
State Fire Marshal	1	(2%)
	42	100%

Other Responding Organizations

State police agencies are the responding organizations in 10 of the 48 states (17 percent) that answered this question. A great many state and local organizations of many types and with many different names may respond. Local organizations lead in "home rule" states (17 percent). State DOTs were named in 17 of 48 responses (35 percent). Although DOTs probably have some role in all states, the responses elucidate that they are not considered as having a major *support* role in the most states.

Note that in only one state (Illinois) is the Division of Highways the lead response organization. The organization has 70 trained state police officers within the traffic division whose role is primarily in the area of regulation and enforcement — not emergency response.

Typical Responsibilities

Overall incident control. The responsible agency is generally the same as the state lead organization, although more-minor incidents (that might not escalate) are actually controlled by local fire and police officials. Highway or maintenance forces are mentioned as being responsible for overall control in only one state. Their policy is not to expose any maintenance employees; they handle traffic control and then arrange for an outside contractor to handle response, evaluation, and disposal on short notice.

Evacuation. The majority of responses indicated that the state law enforcement agencies or local agencies (usually law) were responsible for evacuation.

State Law Enforcement	17	(40%)
Other (No DOT/Highway)	13	(30%)
Local Agencies (usually law)	9	(21%)
Fire Departments	4	(9%)
	43	100%

Traffic control devices (e.g., barricades). In this area, DOTs, highway departments, and/or departments of public works have almost exclusive responsibility. A majority of the responses mentioned some aspect of traffic control. In many states, traffic control is done in cooperation with other agencies, particularly local traffic or police agencies. Maintenance departments generally provide the traffic control devices.

Handling spilled material. Of 46 responses, a majority of 28 (61 percent) answered that the "spiller/owner of material or hired contractors cleaned up the spilled material."

Handle Spilled Materials		
Miscellaneous Agencies	16	(34%)
Contractor	13	(28%)
Spiller	12	(26%)
Contractor & Public Agency	3	(7%)
Highway Dept. Involvement	2	(5%)
	46	100%

Two states mentioned highway department involvement. In one state, the department assists with equipment and operators, and in the other, the highway department would spread sand, construct a dike, or take other measures if a petroleum product were involved.

Although a number of other states likely provide such assistance when asked, and probably under supervision, the survey shows that for them it is neither a designated responsibility nor a primary mission.

Disposal of spilled material. The responses to this activity were basically the same as the responses to handling spilled material—the spiller/owner is responsible. Only two states listed DOT or highway department involvement.

Area cleanup. Area cleanup is also primarily the responsibility of the spiller or a contractor hired by the spiller, or the public agency in control of the incident in cases where the spiller is incapable. Possible state DOT or highway agency involvement was mentioned in only three states.

Inspection, damage evaluation, approval of cleanup. In this activity, state DOTs and/or highway agencies are mentioned more frequently than above, usually in conjunction with the agency (lead agency). Six states responded that their DOTs perform this function.

Investigation of incident. Five states responded that the state DOT performs this function.

Enforcement actions. Only two responses indicated DOT involvement in enforcement. In Illinois, the highway department is the lead agency and has enforcement responsibilities related to hazmat transportation. In Utah, the DOT has a Motor Carrier Regulations Division, which is responsible for enforcement actions.

Health and safety issues. Only three states mentioned having the state DOT/highway department involved in this area.

Reporting and records. Six states mentioned that state DOT/highway agencies were responsible for reporting or recording. In each case (except Illinois), these agencies are not the primary agency for reporting or recording hazmat incidents.

DOT Role

Responders were asked to write out the formal role of DOT or highway personnel within the context of the entire response action encompassing all activities under responsibilities of responding agencies. Of the 46 states that answered this question, 21 (46 percent) mentioned "traffic control" as their role; 12 (26 percent) had the words "assist," "support," or "identify" in their answer; and only 2 (4 percent) responded "no role." Other specific response roles reported were as follows:

- Isolate spill, construct dikes or dams
- Provide diking material
- Provide road blocks, equipment, and materials
- Provide emergency equipment
- Perform as first responders and traffic control
- Clean up or assist cleanup contractor
- Protect water supply
- Coordinate equipment support and cleanup
- Perform radiological monitoring
- Make manpower and materials available
- Obtain damage estimates
- Supply and apply abrasive to road surface.

It can be seen that the majority of the DOT roles consists of providing (1) materials, equipment, and manpower under direction of others; (2) limited containment with dams, dikes, etc.; and (3) some cleanup. The general concept is to "observe, report, and standby to give assistance."

Effect of Location (Urban, Suburban, and Rural)

The majority of responses indicated that location has little effect on emergency response procedures. In urban areas, local forces (fire, police) are more likely to be in charge. DOT/highway roles, which are mostly support roles, do not differ. In some states, DOT/highway forces will be involved only if the incident is on a state highway. Thus, a more logical breakdown could be "on-system" or "off-system."

Effect of Size of Hazmat Incident

Most state plans have a defined breakdown of magnitude, generally defined in terms of response level required: Minor—local response; Medium—state response team; and Major—state response with regional response team assistance.

There appears to be no universal definition of minor, medium, or major. (Note that in some states there are more than three categories, and these are sometimes given other names.)

The majority of responses, however, did not particularly support the need for such a breakdown; most indicated that there would be no difference. Because their support roles are similar in both large and small incidents, what would likely change are the lead organization, incident commander, and number of support agencies involved.

Responses appeared consistent with roles as previously answered. A few responses differentiated between an oil or petroleum product spill and a hazardous chemical spill. In a few states, maintenance forces are more likely to be involved in containment and cleanup of an oil spill. However, as noted previously, this does not appear to be a common role.

Specific Policies, Practices, and Procedures

State agencies were asked to address policies, practices, and procedures tied to recommended levels of response. Responses were not much different from those previously reported. Some gave more in-depth answers as to what is expected of their personnel, training, and instructions, and their problems. The following individual responses are informative:

- The constant turnover of personnel makes adequate training

difficult. Only key state and local managers participate in drill exercises.
- For Level 1 (minor) incidents, all field maintenance forces are in first-responder awareness level.
- Response is limited to controlling traffic and occasionally providing sand. DOT workers are not trained to manage hazmat incidents.
- Current policies provide only for the delivery of diking material and traffic control; personnel have been informed to keep a safe distance from the spill.
- The department provides a guidebook and training sessions to employees of area maintenance facilities.
- Personnel are provided with the USDOT Emergency Response Guidebook (ERG) and are periodically schooled in its use.
- We are training personnel to be incident reporters.
- Employees are trained in recognition.
- Personnel are trained to be aware of and/or identify potential hazmat situations.
- Personnel may use materials and equipment to clean up spills that will not adversely affect the health of personnel or require protective clothing or equipment. Personnel are specifically prohibited from handling, cleaning up, or coming into contact with hazmats.
- Personnel are instructed in accordance with the USDOT ERG and informed not to do anything without instructions from someone trained in its use.
- Involvement is limited to observing and reporting incidents, then waiting at the perimeter to assist as required.
- We probably should have an awareness-level training program.
- Until properly trained, DOT maintenance personnel contain spills and control traffic only.
- Personnel do not get directly involved in response and are trained to awareness level only.
- In the event of a radiological spill, DOT has trained radiological response teams.
- DOT responds with state or county crews only when the incident is sufficiently minor so as not to require specific and detailed hazmat training.
- Responses should be performed by the private sector. It would be an enormous undertaking, and not a good use of personnel, to be prepared for all incidents.

Communication of Procedures

State agencies were asked to describe the main forum used to communicate procedures they were to follow, e.g., manuals, verbal instructions, courses. The variety of answers by respondents to this question showed a mix of "all of the above." Some states seemed to rely on verbal instructions, some on manuals, and some on training. Some mention all three. It is interesting to note that only 13 of 46 responses (28 percent) mentioned training. Eight (17 percent) mentioned verbal only, and eight (17 percent) of the agencies gave no answer. Less than one-third of the responses reported formal training for maintenance personnel. Based on these results, training for maintenance personnel does not appear to have a high priority.

Types of Training

The majority of training mentioned by respondents was awareness training. Three responses mentioned OSHA right-to-know training requirements. (See Appendix A for an overview of OSHA worker protection standards.)

It appears that about 10 of the 46 responding states (22 percent) provide regular refresher or update courses.

Practice Exercises and Emergency Preparedness Drills

A majority (25 of 46 agencies [54 percent]) of respondents reported that exercises and drills are held.

Equipment Used by DOT/Maintenance Personnel

Most frequently used equipment. Of the 45 states responding to this question, trucks were mentioned by the most states (21 [47 percent]), particularly dump trucks (11 [24 percent]). One state mentioned that dump trucks are specifically used for containment. Various loaders, backhoes, graders, and dozers were also listed, as were a variety of traffic control signs, flashers, barricades, and arrow boards. Three or four states noted the use of heavy equipment such as cranes. Several states mentioned sand and shovels. One state answered that it has routine equipment for minor to medium petroleum spills. Three states mentioned using absorbent material. Only two states identified the use of protective equipment or clothing.

Special hazmat equipment. The majority of states (32 [72 percent]) gave no response or responded "none" or "NA" (not applicable). The others primarily mentioned special equipment supplied by contractors. Only seven states answered that their state supplies special equipment, one saying that it stores specialized equipment at DOT garages. The special equipment mentioned was as follows:

- Various protective equipment and clothing,
- Radiological measuring equipment,
- Spill response kit, plastic, and sand,
- Drag lines,
- Oil spill rigs, tractor trailer loaded with absorbent material, pumps, booms, outboard motor boat, sand bags, etc., and
- Absorbent booms and pads (in some vehicles).

Storage and Distribution of Equipment

Routine maintenance equipment. This question was asked to determine if equipment was dispersed throughout the state. Of 46 respondents, 22 (48 percent) indicated no response or NA. The majority of the remaining 24 indicated that equipment was dispersed throughout the state. One state reported stockpiling absorbent materials at various locations. Any available special equipment is generally dispersed throughout a state; however, the practice of having equipment to specifically address hazmat incident response does not appear to be widespread.

Special Hazmat Response Equipment. No additional information on special hazmat response equipment was reported.

Need for Special Equipment. Only a few state agencies re-

sponded that they knew of cases where needed special equipment was not available. Items mentioned appeared to be very specific, e.g., cranes and other special heavy equipment and personnel protective equipment.

Although not widespread, especially considering the fact that most maintenance departments are not heavily involved in response mitigation and cleanup, there appear to be situations for which the agency may not be adequately equipped.

Comments on Specific Topics

The final question invited comment on seven topics. Some respondents made comments as follows:

1. Comments on the topic of federal, state, and local regulations generally pointed out that regulations were becoming more numerous and difficult to keep up with (11 comments).
2. Comments on the methods used (or problems encountered) in identifying types of hazmats indicated that this is a problem. However, because DOT/highway maintenance response is limited, it generally was not the agency's problem (8 comments).
3. Comments on the storage of hazmats (temporary storage, availability of disposal sites) indicated that this is becoming a serious problem. Cost-effective disposal is difficult. Drums and containers are sometimes left for several months in unsafe areas, which could be hazardous to the traveling public (7 comments).
4. Comments on the use of private contractors did not appear to be particularly significant (9 comments). Those using private contractors feel that may be the best option.
5. Comments were made on obtaining settlements from parties involved in incidents (7 comments). Four respondents reported success; no one reported that it was a problem.
6. Comments on the number of incidents or amount of money budgeted for responding to hazmats did not indicate that the respondents were a good source of these data (8 comments). However, most thought funds should be increased.

A few respondents made general comments that did not address any particular topic. These comments are summarized as follows:

- It is difficult to remain current on federal standards. We have basically told our employees that if they see a hazmat incident (especially traffic accidents), they are to stay away, contact the nearest supervisor, and cordon off the area.
- The state Department of Health (DOH) and DOT prefer to use contractors with trained hazmat personnel to perform cleanup and disposal. The state DOH has a small superfund for use in hiring contractors.
- Our state is currently developing a memo of understanding with several agencies to address hazmat scenarios. We are reviewing our operating procedures to decide if training is necessary or if the DOT wants to maintain a hands-off policy to ensure the safety of its employees.

CHAPTER SEVEN

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Based on the surveys conducted for this synthesis, it may be concluded that highway maintenance departments and personnel play a support role in hazmat incident response, mitigation, and cleanup. In some cases, they may be instructed to handle a very minor incident or a small to medium oil spill, but their primary role is to provide traffic control, equipment, and supplies. Other conclusions that may be drawn are as follows:

- All states provide training, but it ranges from excellent to questionable and does not appear to occur on a regular basis. Most states have clear-cut policy and procedures that are incorporated in adequate (or better) training that is consistent with the policy and procedures. However, this appears not to be true in all states, according to questionnaires and other documents returned therewith.
- The "home rule" states, where state government cannot dictate policy to local government entities, have more problems with incident command, as well as the old "who's in charge?" issue.
- A few states use area highway maintenance facilities to preposition emergency response supplies and some special equipment. In addition to prepositioning, there are other sources of emergency equipment. The need and benefits of prepositioning should be studied.
- Most states use contractors for major cleanup jobs; at least one state has a policy to use contractors as much as possible—for response, mitigation, and cleanup. This state's survey response made an interesting point concerning its philosophy in this regard: "[It] would be [an] enormous undertaking and not a good use of personnel to prepare for all incidents. Then what about disposal? Where does it end?"

The final conclusion that may be drawn is that one aspect appears to be ignored or underestimated, particularly by states with noninvolvement policies: most highway maintenance personnel spend the majority of their time on the highways where hazmat incidents occur. Thus, the probability is high that at some time in their careers (perhaps several times), they are going to be involved in a hazmat incident. Irrespective of state policy and procedures, and whether they want to or not, they then become de facto first responders. Being prepared could mean the difference between life and death for these personnel.

RECOMMENDATIONS

The following recommendations are the result of both the literature review and the response to the questionnaire concerning hazmat incidents on highways:

- All states should have clear, written policies and specific procedures that highway maintenance personnel are expected to follow.
- Maintenance personnel should receive appropriate training courses and annual refresher courses consistent with the state policy and procedures.
- All maintenance personnel should at least receive hazmat *awareness* level training, including training in the use of the USDOT ERG and supplementary material.
- Copies of state hazmat incident policy and response guides should be in all highway field personnel vehicles. Binoculars should be provided.
- Supervisory maintenance personnel should receive a higher level of training than awareness training, preferably a hands-on response course.
- Highway maintenance departments should be involved whenever there is a multiagency training exercise.
- States should have inventory lists of equipment that may be needed in response to hazmat incidents.
- States should consider storing prepositioned spill containment materials and equipment throughout the state.
- There should be a comprehensive study of the cost-effectiveness of using private contractors vs. state forces for all response, mitigation, and cleanup of hazmat incidents.
- There is a need for better dissemination of information. State technology transfer (T^2) centers should publicize state policies and procedures regarding hazmat incidents, assist local agencies in keeping up with federal regulations, and provide a forum for information exchange on the subject through the T^2 clearinghouse.

Need for Research or Special Studies

In the early stages of the research for this synthesis, the scope included a recommendation for "an ideal maintenance organization that would be best structured, equipped, and trained to provide the support services they are expected to perform." Now that the research is concluded and information from every state has been studied, it is clear that not only is a single "ideal" organization not possible, it is not desirable.

It is clear that highway maintenance organizations provide a support role and must fit into their state hazmat response organizations. Although there are some similarities between certain state plans, in practice there is so much diversity that the ideal in any state is the one that best serves that state's response operation. Generalization could be self-defeating, even dangerous.

The most important questions regarding highway maintenance personnel are as follows:

- When a hazmat incident occurs in their vicinity, are they sufficiently trained to minimize risk to the public, as well as to personnel, and to properly assess and report the situation?
- Is full use being made of the potential to mitigate, within the limits of personnel safety, certain incidents where immediate action could save lives or minimize environmental damage?
- No matter what their role, whether by plan or by chance, is it clear through written and posted instructions?
- Are they adequately trained and equipped for their roles?
- Are they adequately trained to protect themselves (and possibly others) in the event that they are the first on the scene by chance?

These questions warrant study, but on a state-by-state basis. Effective methods of training highway maintenance personnel for whatever roles are required or expected, efficient ways of communicating policies and procedures to the personnel on a regular basis, and the cost-effectiveness of using contractors for hazmat response, support, and cleanup activities that highway maintenance forces become involved in are also areas that deserve further study.

Two areas that could be studied on a general basis are (1) mitigation of petroleum product spills and (2) the value of prepositioning a range of supplies and equipment at area maintenance garages both to enhance the capability of maintenance forces to mitigate nondangerous spills and to better support trained response teams.

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APPENDIX A

OSHA AND EPA WORKER PROTECTION STANDARDS

This appendix presents an overview of health and safety regulations that protect workers engaged in hazardous waste operations and emergency response. The information is excerpted from three Environmental Protection Agency (EPA), Quick Reference Fact Sheets (*39–41*). The excerpts were taken verbatim except for a few minor editorial comments shown in brackets. Only those sections relevant to this synthesis were quoted. The reader who needs more detailed information should obtain and study the complete fact sheets and/or other guidance materials described in the last section of this appendix, which were taken from the fact sheet on available guidance (*41*). Various U.S. codes and acts are also referenced.

INTRODUCTION

Under the authority of Section 126 of the Superfund Amendments and Reauthorization Act of 1986 (SARA Title I), the EPA and the U.S. Occupational Safety and Health Administration (OSHA) issued identical health and safety standards to protect workers engaged in hazardous response. The OSHA regulations, codified at 29 CFR 1910.120, became effective on March 6, 1990 (54 *FR* 9294). Corrections to these regulations were published on April 13, 1990 (55 *FR* 14,072) to clarify certain medical surveillance requirements and to identify which employers must comply with 29 CFR 1910.120(p). The EPA regulations, published on June 23, 1989 (54 *FR* 26,654), incorporate the OSHA standards by reference and are codified as 40 CFR Part 311.

The EPA and OSHA worker protection standards for hazardous waste operations and emergency response (HAZWOPER) affect employers whose employees are engaged in the following activities:

- Cleanup operations at uncontrolled hazardous waste sites when a government authority requires the cleanup (29 CFR 1910.120(a)(i))
- Corrective actions at treatment, storage, and disposal (TSD) facilities regulated under the Resource Conservation and Recovery Act (RCRA) (29 CFR 1910.120(a)(ii))
- Voluntary cleanup operations at uncontrolled hazardous waste sites (29 CFR 1910.120(a)(iii))
- Hazardous waste operations conducted at RCRA TSD facilities (29 CFR 1910.120(a)(iv))
- Emergency response operations without regard to location, where there is the release or a substantial threat of release of a hazardous substance (29 CFR 1910.120(a)(v)).

OVERVIEW OF EPA AND OSHA WORKER PROTECTION AUTHORITY

The Occupational Safety and Health Act of 1970, as amended (OSH Act), established health and safety standards for the American workplace. Section 6 of the OSH Act established federal authority to issue general health and safety standards for private industry; Section 19 addresses standards for federal government employees. Under the authority of Section 6 of the OSH Act, OSHA promulgated general industry standards and standards that apply specifically to the construction industry; these standards are codified at 29 CFR Parts 1910 and 1926, respectively, which set forth the minimum health and safety requirements necessary to ensure protection for all private sector employees in the United States. The scope of the coverage of the standards set forth in 29 CFR Parts 1910 and 1926 changed dramatically on February 26, 1980, when President Carter signed Executive Order 12,196, requiring the federal government to comply with the more stringent general industry standards issued under Section 6 of the OSH Act.

SARA Section 126(a) requires the Secretary of Labor to issue health and safety standards under Section 6 of the OSH Act for the benefit of private sector employees—and through the Executive Order, federal employees—engaged in hazardous waste operations and emergency response. Federal OSHA has no authority to enforce regulations protecting state and local government employees.

Under Section 18 of the OSH Act, a state may elect to develop and implement its own occupational safety and health program if (1) the state is willing to document its program in a state plan, and (2) the state's requirements are at least as stringent as the federal regulations. Before a state program can become effective, however, OSHA must review and approve the state plan. Through its review and approval authority, OSHA requires states to extend occupational safety and health protection to state and local government employees, as well as to private sector employees, within the state's jurisdiction. Currently, 23 states and two territories have delegated OSHA programs. These state plans must be amended to incorporate the newly promulgated standards in 29 CFR 1910.120 to address the safety and health of employees engaged in hazardous waste operations and emergency response.

SARA Section 126(f) requires the EPA Administrator to issue standards for hazardous waste operations and emergency response that are identical to OSHA's standards. Although the two sets of standards contain identical substantive provisions, EPA and OSHA address different audiences. EPA's authority extends to state and local government employers conducting hazardous waste operations and emergency response in states that do not have a delegated OSHA program in effect. Currently, 27 states, one territory, and the District of Columbia fall under EPA's authority. The EPA regulations cover both compensated and uncompensated state and local government employees engaged in the covered activities. Therefore, the EPA standards protect volunteers, such as volunteer firefighters who are responding to hazardous substance emergencies. Although federal OSHA recommends that delegated state programs also cover uncompensated employees, not all states have followed this recommendation.

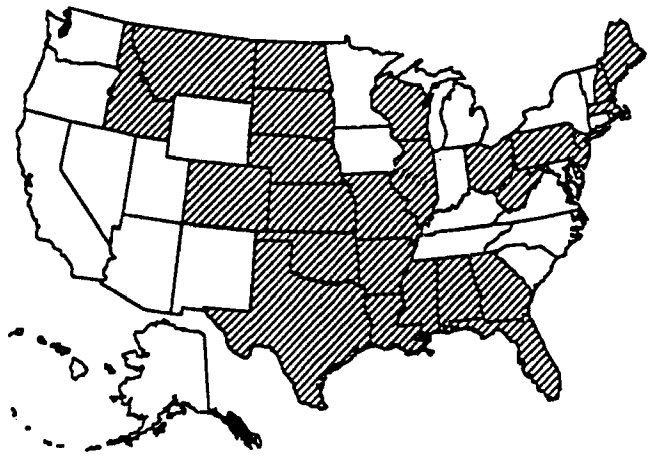

FIGURE A-1 States without an OSHA-delegated program (shaded).

In summary, in states without an OSHA-approved plan, federal OSHA standards protect all private sector and federal employees engaged in hazardous waste operations and emergency response; the EPA worker operations and emergency response; the EPA worker protection standards protect all state and local government employees, including volunteer workers. In states with an OSHA-approved plan, the state program covers all private sector employees, as well as state and local government employees; federal OSHA covers federal employees in those states. The shaded area in Figure A-1 shows jurisdictions without an OSHA-delegated program.

Questions on the substance of the workers protection standards for hazardous waste operations and emergency response can be addressed to any regional OSHA office or OSHA's Office of Health Compliance Assistance in Washington, DC.

Comparing Regulatory Requirements Under SARA Title I, SARA Title III, and OSHA's Proposed Rule of Highly Hazardous Chemicals

SARA Title I

Under the authority of Title I, Section 126 of SARA, EPA published worker protection standards for hazardous waste operations and emergency response (HAZWOPER). HAZWOPER specifies certain health and safety requirements to ensure the protection of employees engaged in hazardous waste operations and emergency response during five specified activities (listed previously in this appendix). HAZWOPER does not address emergency responders who engage only in handling traditional fire and medical emergencies; other OSHA programs protect these employees. HAZWOPER, however, requires that an employer provide, among other things, proper emergency response planning, training, and medical surveillance. Affected workers must be protected during the entire remedial process, from the preliminary evaluation and initial site entry to final closure of the site.

Emergency Response Planning

An employer must develop an emergency response plan to protect workers in an emergency resulting from the release of all kinds of hazardous substances, including extremely hazardous substances (EHSs), Comprehensive Environmental Response Compensation and Liability Act (CERCLA) hazardous substances, RCRA hazardous wastes, and any substance listed by the U.S. Department of Transportation (USDOT) as a hazardous material (hazmat).

Training

An employer also must ensure that workers receive the kind of training specified in the regulation. The standard reflects a tiered approach to training, linking the amount and type of training to an employee's potential for exposure to hazardous substances and to other health hazards during a hazardous waste operation or an emergency response. The greater the potential hazard, the more extensive and stringent are the training requirements.

Medical Surveillance

HAZWOPER establishes a framework for a medical monitoring program for certain workers engaged in hazardous waste operations and emergency response. The medical surveillance requirements include provisions for a baseline, periodic, and termination medical examination for specific groups of employees. HAZWOPER also requires that employees receive a medical examination as soon as possible if they are injured or become ill from exposure to hazardous substances on-site or during an emergency, or develop signs or symptoms that indicate a possible overexposure to hazardous substances. Although an attending physician may determine the content of medical examinations required under the standard, the examination must address key elements related to handling hazardous substances.

SARA Title III

SARA Title III, or the Emergency Planning and Community Right-to-Know Act of 1986, is a law enacted to improve state and local government capacity to respond to an emergency caused by an accidental release of an EHS and to disseminate information to the public on dangerous chemicals made, used, or stored in their community.

SARA Title III has four parts. The one that most closely parallels the SARA Title I worker protection standards deals with emergency response planning (Section 303). There are nine emergency response planning elements in Section 303 of SARA Title III.

There are some important differences in emergency response planning requirements under Title I and Title III. For example, a Title I plan must address a number of chemical hazards, while a Title III plan must cover only those emergencies arising from the release of an EHS. Further, a plan to protect employees under Title I may require far more specificity than a Title III plan. Although a Title III plan may be too general for use as an employer's Title I plan, the Title I plan may reference the Title III plan to avoid any unnecessary duplication of information. If a Title III plan is referenced, a copy of the referenced document must be kept with the Title I plan.

The most important thing to remember in distinguishing the Title I and Title III emergency response planning is that Title I

plans focus on worker safety; Title III plans focus on community safety. The similarities and differences between the Title I and Title III emergency response planning requirements are addressed in greater detail in a paper entitled "SARA Title I/Title III Emergency Response Planning Requirements," which can be obtained from the Environmental Response Team (ERT) of EPA in Edison, New Jersey.

OSHA's Highly Hazardous Chemicals NPRM

On July 17, 1990, OSHA published a Notice of Proposed Rulemaking (NPRM), proposing a new regulation entitled "Process Safety Management of Highly Hazardous Chemicals" (55 *FR* 29,150). The NPRM proposes requirements that will eliminate or mitigate the harm to employees as a consequence of chemical releases during the manufacturing or processing of highly hazardous chemicals. OSHA's proposed rule emphasizes management of hazards associated with highly hazardous chemicals and defines a "highly hazardous chemical" as "a substance possessing toxic, flammable, reactive, or explosive properties."

Comparing General Requirements Under 29 CFR Parts 1910 and 1926 with the Particular Requirements of 29 CFR 1910.120

The occupational safety and health standards published in 29 CFR set out minimum requirements to ensure protection for all private sector employees in the United States. Part 1910 (of Title 29) makes those practices mandatory.

Section 1910.120 (HAZWOPER) contains specific requirements to minimize the health and safety hazards associated with conducting hazardous waste operations and emergency response at uncontrolled hazardous waste sites and RCRA TSD facilities, and performing emergency response operations without regard for location. In some instances, 1910.120 incorporates general worker protection provisions by reference. For example, 1910.120(g), engineering controls, work practices, and personal protective equipment (PPE) for employee protection, requires employers engaged in hazardous waste operations and emergency response to follow the provisions in 1910.94 through 1910.100 in setting up controls to protect employees from exposure to hazardous substances and safety and health hazards. Those referenced sections may apply to other industries and activities as well, but HAZWOPER applies only to hazardous waste operations and emergency response during the covered activities and locations.

In addition to the requirements set forth under Part 1910, OSHA codified regulations in 29 CFR Part 1926 Subpart C that set forth safety and health standards specifically applicable to the construction industry. Part 1926 Subpart C includes safety standards for worker tools and other standards relevant to health and safety in the construction environment (e.g., 29 CFR 1926.21 addresses programs for the education and training of employees and employers). Parts 1910 and 1926 both require employers to provide whatever training and education is appropriate for employees to perform a given task safely.

Requirements for Planning, Training, and Medical Surveillance for Emergency Response Without Regard to Location (29 CFR 1910.120(q))

This section addresses the requirements in 29 CFR 1910.120(q) that apply to emergency responders who respond to hazardous waste emergencies wherever they may occur (i.e., without regard to location). Eleven required elements are specified at 29 CFR 1910.120(q) for protecting workers who perform emergency response operations without regard to location:

- Emergency response plan
- Elements of an emergency response plan
- Procedures for handling emergency response
- Skilled support personnel
- Specialist employees
- Material handling program
- Training based on the duties and functions performed by each level of responder
- Refresher training program
- Medical surveillance and consultation
- Chemical protective equipment clothing
- Postemergency response operations.

Overview of Emergency Response

An "emergency response" is defined in 29 CFR 1910.120(a)(3) as a response effort by employees from outside the immediate release area or by other responders, such as local firefighters, to an incident that results, or is likely to result, in an uncontrolled release of a hazardous substance. A response to an incidental release of a hazardous substance that can be absorbed, neutralized, or otherwise controlled by employees in the immediate area or by maintenance personnel is not considered an emergency response within the scope of this standard.

The worker protection standards contain several requirements that apply to workers engaged in emergency response. These requirements are specified at 29 CFR 1910.120(1) for emergency responders at uncontrolled hazardous waste sites; 29 CFR 1910.120(p)(8) for emergency responders at RCRA TSD facilities; and 29 CFR 1910.120(q) for employees who perform emergency response operations irrespective of location.

The requirements of CFR 1910.120(9) cover a variety of emergency response workers, including public and private hazmat teams, firefighters, and police officers. Examples of emergency response operations that occur irrespective of location could include a fire at a gas station; a transportation accident, such as an overturned tractor trailer or a train derailment; or a chemical spill at a fixed facility, such as a manufacturing plant or a pharmacy, where outside assistance is needed to clean up the spill.

Training Requirements

The purpose of the training requirements for emergency response personnel is to give employees the knowledge and skill to perform an emergency response with minimal risk to their own health and safety and the health and safety of others. Employees who respond to emergencies may become exposed to a hazardous substances. The risks of exposure, however, will vary with each response. As such, the amount and type of training required under the worker protection standards for employees who perform emergency response operations is linked directly to an employee's potential for exposure to hazardous substances and to other health hazards during an emergency response. No employee may partici-

pate in an emergency response activity unless he or she has been adequately trained.

The specific training requirements for employees who perform emergency response operations without regard to location are specified at 29 CFR 1910.120(q)(6). These training requirements are based on levels that are generally recognized in the hazmat response industry. There are five levels of emergency response personnel; each level specifies unique training requirements.

Level 1 Responders are most likely to witness or discover a hazardous substance release and initiate an emergency response sequence by notifying the proper authorities. Police officers (and maintenance workers) who do not actually respond to a release are good examples of Level 1 Responders. For example, a state trooper (or a maintenance worker) who responds to an overturned truck carrying hazmats on a highway, contacts the police dispatcher (DOT Supervisor) to report the location and type of accident, and uses his or her patrol car (DOT vehicle) to block lines of traffic, would be a Level 1 Responder, so long as he or she does not try to contain the release. (All maintenance personnel can potentially be Level 1 responders.)

Level 1 Responders must have sufficient training or experience to demonstrate competency in the following areas:

- Understanding hazardous substances and their risks
- Understanding the implications of hazardous substance emergencies
- Recognizing the presence of hazardous substances
- Identifying hazardous substances
- Understanding the first responder role
- Recognizing the need for additional resources.

Level 2 Responders are part of the initial response to a release or potential release of hazardous substances. Local police officers, firefighters, and rescue personnel who try to contain the effects of a release without necessarily stopping it are typical Level 2 Responders. Specifically, a Level 2 Responder may assist with evacuation proceedings, contain the release from a safe distance, and prevent further exposures. (In certain situations, maintenance workers may be de facto Level 2 Responders.)

Level 2 Responders must have Level 1 competency and a minimum of 8 hours training or sufficient experience to demonstrate competency in the following areas:

- Understanding basic hazard and risk assessment techniques
- Selecting and using PPE
- Understanding basic hazmat terms
- Performing basic control, containment, and/or confinement operations
- Implementing basic decontamination procedures
- Understanding the relevant standard operating procedures and termination procedures.

It is unlikely that state maintenance personnel would ever be used in or forced into a situation more critical than Level 2. However, to emphasize the specialized nature of these levels and their training requirements, brief descriptions follow.

Level 3 Responders are Hazmat Technicians responsible for attempting to stop the release, as compared to Level 2 Responders who attempt only to contain the release and contact the appropriate authorities. Level 3 Responders must have a minimum of 24 hours of training at Level 2 and sufficient experience to demonstrate competency in several specified areas related to emergency responses.

Level 4 Responders are Hazmat Specialists. They respond with and provide support to the Hazardous Materials Technicians (Level 3). Level 4 Responders are expected to be more knowledgeable about hazardous substances than are Level 3 Responders. Hazmat Specialists will sometimes act as liaisons with government authorities, explaining site activities and associated risks. Level 4 Responders must have a minimum of 24 hours of training at Level 3 and sufficient experience to demonstrate competency in several specified areas related to emergency responses.

The Level 5 Responder is the On-Scene Incident Commander (OIC) or Senior OIC. The Senior OIC assumes control of the emergency response incident scene. Senior OICs coordinate the activities of all emergency responders and ensure that open lines of communications exist among them. The OIC is usually a generalist with broad knowledge in managing emergency incidents. Level 5 Responders must have a minimum of 24 hours of training at Level 2 and additional competency in several specified areas related to managing an incident.

In addition to the aforementioned training requirements, each emergency responder must either receive annual refresher training or demonstrate sufficient competency in the relevant areas on a yearly basis. Refresher training has no specific hourly requirements but should be of sufficient content and duration to enable responders to maintain their competencies. If an employee does not submit to refresher training but can demonstrate competency in the relevant areas, the employer must annually document the statement of competency and maintain a record of the method used to determine competency.

There are two types of workers who may be needed during an emergency response but are not covered by the training requirements in 29 CFR 1910.120(q)(6). These employees are skilled support personnel and specialists. Skilled support personnel are trained in the operation of specialized mechanical equipment, such as crane and hoisting equipment or backhoes, and generally are not employed by the same organization as the other emergency response personnel at the scene. They may be exposed to hazards during an emergency response, but they are only at the scene temporarily to perform immediate emergency support work that cannot reasonably be performed by fully trained hazardous response personnel. The only training such skilled personnel require is an initial briefing of the site, which must include instruction on the proper use of PPE, a review of the potential hazards at the site, an overview of the duties to be performed, and an overview of other safety and health precautions. The briefing must occur at the site prior to their participation in any emergency response operations.

An employer may also call upon specialists, who have specialized knowledge about some aspect of emergency response of hazardous substances, to assist in an emergency response effort. They are called upon as needed to provide technical advice or assistance to the individual in charge. For example, if an emergency release involves two of more hazardous substances, a chemist may be called in to predict the potential reactivity of the agents involved at the scene.

HAZARDOUS WASTE OPERATIONS AND EMERGENCY RESPONSE: AVAILABLE GUIDANCE

This information is taken directly from an EPA Quick Reference Fact Sheet of the same title (48). The guidance material available from EPA is briefly outlined below.

Computer Software

Health and Safety Planner

- Identification of chemical hazards
- Selection of monitoring devices
- Identification of likely routes of exposure
- Selection of personal protective equipment

Field Certification Tracking System

- Simplification of record-keeping for field personnel
- Creation of personnel files for health and safety requirements
- Updating of personnel files

HAZWOPER Fact Sheets

1. Hazardous Waste Operations and Emergency Response: General Information and Comparison (U.S. EPA, 1991, Pub. No. 9285.2-09FS)

   - Overview of EPA and OSHA Authority
   - Comparing regulatory requirements
   - Comparing general requirements
   - National Fire Protection Association's (NFPA's) Hazardous Materials Incidents Publications
   - Sources of additional information

2. Hazardous Waste Operations and Emergency Response: Uncontrolled Hazardous Waste Sites and RCRA Corrective Action (U.S. EPA, 1991, Pub. No. 9285.2-08FS)

   - Planning requirements
   - Training requirements
   - Medical surveillance requirements
   - Other requirements
   - Employee rights
   - Sources of additional information

3. Hazardous Waste Operations and Emergency Response: RCRA TSD and Emergency Response Without Regard to Location (U.S. EPA, 1991, Pub. No. 9285.2-07FS)

   - Requirements for planning, training, and medical surveillance for emergency response without regard to location
   - Requirements for planning, training, and medical surveillance at RCRA TSD Facilities
   - Sources of additional information

4. Establishing Work Zones at Uncontrolled Hazardous Waste Sites (U.S. EPA, 1991, Pub. No. 9285.2-06FS)

   - Definitions of work zones
   - Data collection requirements
   - Selection of work zones
   - Ensuring integrity of work zones
   - Consultation and references

Guidance Documents

Five major ERT guidance documents are currently available for HAZWOPER:

1. Hazmat Team Planning Guidance (U.S. EPA, 1990, Pub. No. EPA/540/G-90/003)

   - Do you need a hazmat team?
   - Training and equipping your hazmat team
   - Preparing response plans and standard operating procedures

2. Occupational Medical Monitoring Program Guidelines for SARA Hazardous Waste Field Activity Personnel (U.S. EPA, 1990, Pub. No. OSWER Directive 9285.3-04)

   - General requirements
   - Baseline examination
   - Periodic examination
   - Unscheduled examination
   - Termination examination
   - Reporting requirements
   - Special requirements
   - Relationship between occupational medical monitoring and workers' compensation
   - Minimum examination types and requirements
   - Guidelines for immunization requirements

3. EPA Health and Safety Audit Guidelines (U.S. EPA, 1989, Pub. No. EPA/540/G-89-010)

   - Preliminary evaluation
   - Written health and safety plan review
   - Health and safety field review
   - Off-site emergency response review

4. Standard Operating Safety Guides (U.S. EPA, 1988, OSWER Directive 9285.1-0IC)

   - Environmental incidents
   - Standard operating procedures
   - Health and safety requirements
   - Site safety plan
   - Initial site survey and reconnaissance
   - Levels of personal protective equipment
   - Effects of stress
   - Work zones
   - Decontamination
   - Air surveillance

5. Field Standard Operating Procedures

   - Site entry
   - Work zones
   - Decontamination of response personnel
   - Air surveillance
   - Site safety plan

Training

As part of EPA's comprehensive program for protecting the public and the environment from releases of hazmats, ERT developed the Hazardous Materials Incident Response Training

(HMIRT) Program. A list of the HMIRT courses is provided below:

- Personal Protection and Safety
- Hazardous Materials Treatment Technologies
- Air Surveillance for Hazardous Materials
- Hazardous Materials Incident Response Operations
- Risk Assessment Guidance for Superfund
- Introduction to Groundwater Investigations
- Safety and Health Compliance for Managers
- Sampling for Hazardous Materials
- Radiation Safety at Superfund Sites
- Emergency Response to Hazardous Materials Incidents
- Advanced Air Sampling for Hazardous Materials
- Removal Cost Management System

More details on all of the above materials can be found in reference 48. This EPA Quick Reference fact sheet also contains addresses and telephone numbers helpful for obtaining information on these topics and others.

APPENDIX B

ACCESSING THE HAZARDOUS MATERIALS INFORMATION EXCHANGE (HMIX)

- The necessary tools: A computer
  communications software
  a modem capable of transmitting at 2400,
  1200, or 300 baud

- The modem setup: No parity
  8 data bits
  1 stop bit
  VT-100 or TFY emulation

- Specific instructions for some of the more common communications software packages can be provided by the system operators by calling the toll-free number listed.

- Dial the HMIX through your computer.

  COMMERCIAL ACCESS (708) 972-3275
  FTS ACCESS 972-3275

- From 5:00 pm to 8:30 am (Central time), one node of the system is available on the toll-free assistance line listed. During business hours, that number is a voice line.

- Having problems accessing the system?
  For technical assistance, contact the system operator on the toll-free number, Monday through Friday between 8:30 am and 5:00 pm Central Time.

  1-800-PLAN-FOR or
  1-800-752-6367

  Illinois residents dial **1-800-3670-9592**

- SUCCESS!!! This message indicates that you have successfully accessed the HMIX.

  HAZARDOUS MATERIALS INFORMATION EXCHANGE
  PCBoard (R) Version 14.0/E9
  Do you want color (Enter) = no

- Do you want color screens? (***To view the colors, you must have a graphics card and color monitor***)

  If NO, press the <ENTER> key

  If YES, enter "Y" or "Yes" and you will be in the color mode. When in color mode, more characters are being transferred and transmission of data will be somewhat slower.

APPENDIX C

FACT SHEET ON PUBLIC LAW 101-615: HAZARDOUS MATERIALS TRANSPORTATION UNIFORM SAFETY ACT OF 1990 (HMTUSA)

Research and Special Projects Administration (RSPA)
SECTION 117 A PUBLIC SECTOR TRAINING AND PLANNING GRANTS

BACKGROUND

- The Hazardous Materials Transportation Uniform Safety Act (HMTUSA) §117A, evolved from a proposal developed by the Department of Transportation (DOT), the Federal Energy Management Agency (FEMA), the Environmental Protection Agency (EPA), the Department of Labor/Occupational Safety and Health Administration (DOL/OSHA), and the Department of Energy (DOE). It was presented to Congress during the legislative process to reauthorize the Hazardous Materials Transportation Act of 1975. This section of the amended Act creates an appropriate role for the federal government: to provide financial, technical assistance, national direction, and guidance to enhance state and local hazardous materials emergency planning and training.
- HMTUSA is carefully crafted to build upon existing programs and relationships. It will increase the emphasis on transportation in ongoing efforts—improving the capability of communities to plan for the full range of potential risks they face—regardless of source. Section 117A, "Public Sector Training and Planning," was designed to support the framework and working relationships established within the National Response System and the Emergency Planning and Community Right-To-Know Act of 1986 (Title III) infrastructure (including National Response Team [NRT], Regional Response Teams [RRTs], the Federal Radiological Preparedness Coordinating Committee [FRPCC], and the Title III State Emergency Response Commission [SERC]/Tribal Emergency Response Commission [TERC]/Local Emergency Planning Committee [LEPC] structure).

GENERAL PROGRAM REQUIREMENTS

- The planning and training grant programs are authorized for 6 years and will begin in FY93.
- By law, the program is reimbursable.
- There is a required 20 percent grantee match.
- Funding will come from a registration fee on shippers and carriers of certain hazardous materials.
- Grant recipients must certify that they are complying with §301 and §303 of Title III.
- The law gives us the opportunity to enable states and localities to take full advantage of existing courses that will help the response community comply with OSHA and EPA regulations and NFPA standards.
- The law requires the federal agencies to monitor public sector emergency response training and planning for hazmat incidents and provide appropriate technical assistance.

PLANNING GRANTS

- The law provides for $5 million in annual planning grants to states—with a required 75 percent pass-through of funds to LEPCs.
- The planning grants are to be used for 1) developing, improving, and implementing emergency plans under Title III; 2) conducting commodity flow studies; and 3) determining the need for regional hazardous materials response teams. Other allowable uses of funding will be identified through rulemaking.

TRAINING GRANTS

- The law provides for $7.8 million in annual training grants to states and Indian tribes—with 75 percent of the funding used to provide training to local responders, including volunteers.
- Training grants are to be used for training public sector employees to respond to incidents involving hazardous materials.

CURRICULUM DEVELOPMENT

- Working with other agencies and organizations, DOT will establish a Curriculum Committee. This committee will develop and update a "curriculum," which is defined as a "list" of courses necessary to train public sector emergency response and preparedness teams.
- The focus will be on delivery—not development.
- Once it is developed, FEMA will disseminate the curriculum and updates to the RRTs, SERCs/TERCs, and LEPCs established under Title III.

MONITORING

- FEMA, in coordination with the other federal agencies, is responsible for monitoring public sector emergency

response training and planning for accidents and incidents involving hazardous materials.

TECHNICAL ASSISTANCE

- DOT and the other federal agencies involved in implementing this section will provide technical assistance to states, political subdivisions, and Indian tribes to support those efforts.
- This assistance will be coordinated through the NRT and the FRPCC.

COORDINATION

An Interagency Coordination Group (ICG), chaired by DOT and currently representing FEMA, EPA, DOE, OSHA, NIEHS, and the Bureau of Indian Affairs, is developing proposals and recommendations for implementing §117A. These proposals will then be presented to those involved/affected organizations and agencies, including, but not limited to, those listed below. In addition, the ICG intends to use a variety of mechanisms to solicit responses/input, such as Federal Register Notices, public meetings, workshops, and roundtables of experts.

The following organizations (and others) will have a role to play in implementing §117A.

- NRT agencies
- FRPCC
- Other federal agencies (e.g., Department of Education)
- NRT Training, Preparedness, and Response Committees
- FRPCC Training and Transportation Committees
- RRTs
- Regional Assistance Committees (RACs)
- SERCs
- TERCs
- LEPCs
- Federally recognized Indian tribes
- Public health and safety agencies
- First responders (fire services, law enforcement, etc.)
- Trainers/academia
- States and state associations
- Local government associations
- Emergency management organizations
- Environmental organizations
- Enforcement associations
- Others as identified (e.g., member organizations of the National Task Force on Hazardous Materials Emergency Preparedness)

The full capabilities of HMIX will also be used to coordinate/facilitate the implementation process of the HMTUSA.

APPENDIX D

HIGHWAY MAINTENANCE PROCEDURES DEALING WITH HAZARDOUS MATERIALS

INCIDENTS

Main Focus: Procedures currently used by highway maintenance workers to deal with emergencies involving hazardous material incidents.

Scope: Examine these procedures as they related to the type of area (urban, suburban or rural), the organizations that respond to hazmat incidents and their respective responsibilities; and applicable regulations, equipment, training and cost.

Objective: To develop a comprehensive synthesis of current practices and procedures used by highway agencies to deal with emergencies involving hazmat, and to identify recommended procedures. This effort will prepare highway maintenance workers to safely deal with the incidents as well as specify training, equipment and expertise that are needed to improve efficiency and insure greater safety.

Survey:

1. Is there a current plan in existence covering hazardous materials spill response in the state?
   yes ____ no ____
   a. Formalized (written, approved by cooperating agencies)?
   b. Practiced (training exercises)? _____
   c. Implemented (actually used)? _____

2. Organizations that respond
   a. Specified Lead organization(s)
   b. Other responding organizations
      (1)
      (2)
      (3)
   c. Specify responsibilities of the responding organizations, e.g., What organization would be responsible for the following? (Be as specific as possible.)
      control of the overall incident
      evacuation
      traffic control devices, barricades, etc.
      handling spilled material
      disposal of spilled material
      area cleanup
      inspection/evaluation of damage/approval of cleanup
      investigation of incident
      enforcement actions
      health & safety issues
      reporting/records
      other

3. DOT Role:
   a. If not specifically addressed in the response to question 2, what is the formal role of DOT or Highway personnel?
   b. If DOT or Highway personnel have no formal role, are they called on to assist in certain situations?

4. Describe how the roles of the responding organizations and DOT/Highway personnel vary by location, such as:
   (1) Urban
   (2) Suburban
   (3) Rural

5. Describe how the roles vary by size of hazmat incident; such as (if applicable explain how each category is defined or if your state has similar terms and definitions. Please specify.)
   (1) minor
   (2) serious
   (3) catastrophic

NOTE: In number 6, Please comment about the adequacy of your states' current procedures. Should they be revised, expanded, or modified?

6. In regard to the roles assigned to DOT agencies, as specified in previous questions, are there specified policies, practices and procedures to be followed by personnel, such as:

a) Are there recommended personnel procedures for various levels of response by DOT/Highway maintenance personnel to hazmat incidents?

COMMENT

b) Are personnel procedures broken down by area (urban, suburban, rural)?

COMMENT

c) Are personnel procedures broken down by degree of incident severity (minor, serious catastrophic)?

COMMENT

d) Discuss the authority for the procedures.

COMMENT

e) How are the above procedures communicated? e.g,, verbal by supervisors (specify title), manuals, directives (such as letters) formal training (type), training aids (specify), or other (specify).

COMMENT

f) What types of training or indoctrination are used for:

- New Employees or Transfers
- Continuing Employees

COMMENTS

g. Are practice exercises or Emergency Preparedness Drills ever run or do DOT/Highway personnel participate in exercises of any other agency, or state-wide planning? (Type, and specify the frequency)

COMMENT

7. Equipment (used by DOT/Maintenance personnel)

a. Most used equipment (usual maintenance equipment)

b. Special hazmat equipment

c. Storage and distribution of equipment normally used in incident cleanup, e.t., centralized or dispersed.

- Routine maintenance equipment
- Special hazmat response equipment

d. Do you know of a case where there was a need for special equipment that was not available?

8. Please send copies (or ordering information and cost) of any available state plans, or DOT or Highway Dept./Div. literature relating to any of the above.

9. Please specify a telephone number and best time to call to discuss the above answers or a more in-depth discussion of these or similar questions.
Telephone: Area Code _____ Number _____

10. If you know specific persons who could better discuss any of the above items in more detail please specify the specific item and the contact's name and telephone number.

Item	Person	Telephone No.
____	_____	_____
____	_____	_____
____	_____	_____
____	_____	_____
____	_____	_____
____	_____	_____

11. In your opinion, considering the main focus, scope and objective, does the above questionnaire leave out any points that should be included? Please comment.

12. The last page contains topics that would give us important additional information. Would you please comment on these items.

Please feel free to call me, Gene Russell, at (913) 532-5862 if you have questions or would prefer to discuss the above by phone. Replies will be kept strictly confidential. For categorizing responses, your name and title (or job description, if not reflected in the title) would be appreciated.
Name _____ Title _____

ITEMS FOR ADDITIONAL COMMENTS

- Impacts of Federal, State and local regulations.
- Methods used (or problems encountered) to identify the types of hazardous materials.
- Impacts of union agreements or other personnel initiatives on involvement of maintenance workers with hazardous materials.
- Storage of hazardous materials (temporary storage, availability of disposal sites).
- Use of private contractors.
- Success in obtaining settlements from parties involved in incidents.
- Number of incidents or amount of money devoted to responding to hazardous materials.

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