

## **Chapter 1**

# **Introduction and Findings**

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Each year, more than 4 billion tons of hazardous products and waste are transported throughout the United States.\* The safe handling and carriage of these materials—which include explosives, flammables, corrosive or toxic chemicals, poisons, spent reactor fuel and low-level waste, and disease-causing biological agents—are of major concern to Federal, State, and local agencies charged with public safety and to the industries that produce, ship, and use hazardous materials.\*\*

The safe and efficient transport of hazardous materials depends on three principal activities: accident prevention (including regulation and enforcement), emergency response when accidents occur, and research and planning. While emergency response activities arouse the most intense public interest, all three activities are interdependent and necessary. Maintaining transport safety and efficiency is technologically demanding—a task made complex by the variety and volume of materials transported and by the interlocking responsibilities of Federal, State, and

local governments and the multitude of private firms involved.\*\*\*

Historically, the Federal Government has taken a lead role in regulation of hazardous materials transportation and safety enforcement. State and local governments, however, are assuming greater responsibilities in this area, prompted by a growing awareness of the dangers posed by hazardous materials transportation and recognition that emergency response—at least initially—almost always falls to State and local agencies. The Senate Committee on Commerce, Science, and Transportation, mindful of heightened public concern about chemical spills and accidents involving radioactive materials and toxic substances, requested that the Office of Technology Assessment (OTA) undertake a study of hazardous materials transportation. The study, directed specifically at the issues of container technology, accident data collection and recordkeeping, and training programs for personnel involved in hazardous materials transportation or in emergency response to hazardous materials accidents, will be completed in early 1986. This review of State and local activities provides background information for analysis of the issues to be addressed in the larger study.

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\*This estimate includes hazardous materials carried in pipelines.

\*\*Hazardous materials are substances or matter transported in commerce that pose risks to human safety, property, and the environment if accidentally released. Hazardous materials transported by pipeline or generated or used in military or other defense-related activities are similar in nature and pose similar risks but are excluded from this discussion.

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\*\*\*This document summarizes Federal programs and identifies State and local concerns. The OTA Final Report will examine in detail Federal regulations and technical programs and assess the extent to which they meet the needs identified in this report.

## HAZARDOUS MATERIALS TRANSPORTATION

Statistics gathered by the Office of Hazardous Materials Transportation (OHMT)\* of the U.S. Department of Transportation (DOT) indicate that there are more than 180 million shipments of hazardous materials in the United States each year. The variety of these substances is enormous and growing. Currently, more than 2,400 substances are listed in the Federal Code of Regulations as hazardous commodities; many of the more than 70,000 chemical

products on the market today have not been reviewed for inclusion.<sup>1</sup>

Chemical products are but one kind of hazardous material. There are also biological products, fuels, petroleum products, explosives, acids, fertilizers, gaseous substances, and various forms of industrial waste. Radioactive substances are another major form of hazardous materials. More than 20,000 medical and academic institutions, laboratories, government agencies, industrial enterprises,

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\*Until Nov. 1, 1985, OHMT was called the Materials Transportation Bureau (MTB); OHMT is a part of the DOT's Research and Special Programs Administration.

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<sup>1</sup>See 49 CFR 172.101.

and utilities operating nuclear powerplants generate low-level radioactive waste, amounting to an annual volume of 77,000 cubic meters and containing 500,000 curies of radioactive material.<sup>2</sup> A recent study by the Department of Energy (DOE) projects that this volume could double by 1990.<sup>3</sup> These figures do not include the high-level radioactive waste now shipped by utilities, the Department of Defense (DOD), and DOE. They also do not include the increased high-level radioactive commercial waste that will be shipped in the late 1990s once Federal storage facilities have been established or the low-level waste that will be generated as present nuclear reactors are decommissioned and dismantled. According to a recent estimate, the remains from decommissioning a single large reactor would fill well over 1,000 trucks, equaling one-quarter of all the low-level nuclear waste now generated yearly in the United States.<sup>4</sup>

All of these hazardous materials move by land, sea, and air modes of transportation at a rate of about 500,000 shipments per day. Truck transport accounts for about half of all hazardous materials shipments. The types of vehicles carrying hazardous materials on the Nation's highways range from tank trucks, bulk cargo carriers, and other specially designed mobile containers to conventional tractor-trailers and flat beds that carry packages, cylinders, drums, and other small containers. Rail shipments (equaling about 80 million tons a year) are commonly bulk commodities, such as liquid or gaseous chemicals and fuels, carried in tank cars. Most hazardous materials transported by barge on inland waterways are also bulk cargo. The Corps of Engineers estimates that the total inland waterborne volume is approximately 60 million tons a year. Coastal and inland waterborne volumes, combined, reach 550 million tons annually. DOT estimates that

<sup>2</sup>Under the present classification system, low-level waste includes dry trash; used equipment; and solidified and absorbed liquids, gases, and sludges. Items range from spent resins from ion-exchange processes, filter materials, lubricating oils, and contaminated tools, clothing, and packaging (all of which have relatively low levels of radioactivity); to sealed sources such as Cobalt 60 for radiation treatments; to irradiated reactor components such as in-core instrumentation and control rods (which typically have higher levels of radioactivity). Taylor Moore, "The Great State of Uncertainty in Low-Level Waste Disposal," The Electric Power Research Institute (EPRI) Journal, March 1985, p. 24.

<sup>3</sup>U.S. Department of Energy, *Spent Fuel and Radioactive Waste: Inventories, Projections and Characteristics*, DOE/RW-0006 (Washington, DC: September 1984).

<sup>4</sup>Steve Olson, "Nuclear Undertakers," *Science* 84, vol. 5, No. 7, September 1984, p. 57.

about 600,000 vehicles and vessels are regularly used to transport hazardous materials in bulk, and 700,000 carry portable containers. The transport of hazardous materials by air (either in all-cargo aircraft or in belly compartments of passenger aircraft) is insignificant in tonnage—an estimated 175,000 tons annually—but constitutes a high number of shipments. A 1980 Federal Aviation Administration study found that roughly 5 percent of air cargo at 39 major airports (amounting to 300,000 packages) contained hazardous materials, typically rather small parcels of high-value or time-critical material.

The safety record of hazardous materials carriers, as reported to the Office of Hazardous Materials Transportation, is summarized in table 1-1. For the period 1973-83, there was an annual average of 11,462 reported incidents—a rate of 1.25 incidents per 10,000 shipments.\* Most of these were accidental releases during handling and loading and not vehicle accidents en route. The reported deaths and injuries caused by exposure to hazardous materials are similarly low, equaling about two fatalities per 1,000 incidents, a result both of the regulations governing hazardous materials transportation and the degree of care exercised by shippers, carriers, and others involved in accident prevention and response.\*\* The

\*These figures are for incidents reported to OHMT. Some experts estimate there may be as many as three to four times as many incidents that are unreported.

\*\*In recent years, there has been an annual average of 24 deaths and 663 injuries in hazardous materials accidents reported to DOT. Even taking into account evidence of incomplete data, to be addressed in OTA'S Final Report, the death and injury toll in automobile accidents in the same period was 2,000 times greater.

**Table 1-1.—Incidents Involving Transport of Hazardous Materials, 1973-83 (as reported to DOT)**

Mode	Annual average			Damages <sup>a</sup> (millions of dollars)
	Incidents	Deaths	Injuries	
Highway	10,289	19.3	419.2	\$8.15
Rail <sup>b</sup>	975	4.0	221.8	4.67
Water	26	0	3.3	0.07
Air	150	0.4	9.0	0.43
Freight forwarder	2	0	1.9	
Other	20	0	7.8	0.01
Total	11,462	23.7	663.0	\$13.33

<sup>a</sup>Property damage estimates reported to MTB within 15 days after an accident.

<sup>b</sup>The rail safety record improved during the period because of an increase in the number of Federal rail inspectors and equipment improvements during the early 1980s.

<sup>c</sup>Less than \$0.01 million.

SOURCE: U.S. Department of Transportation, Materials Transportation Bureau, *Annual Report on Hazardous Materials Transportation, Calendar Year 1983*

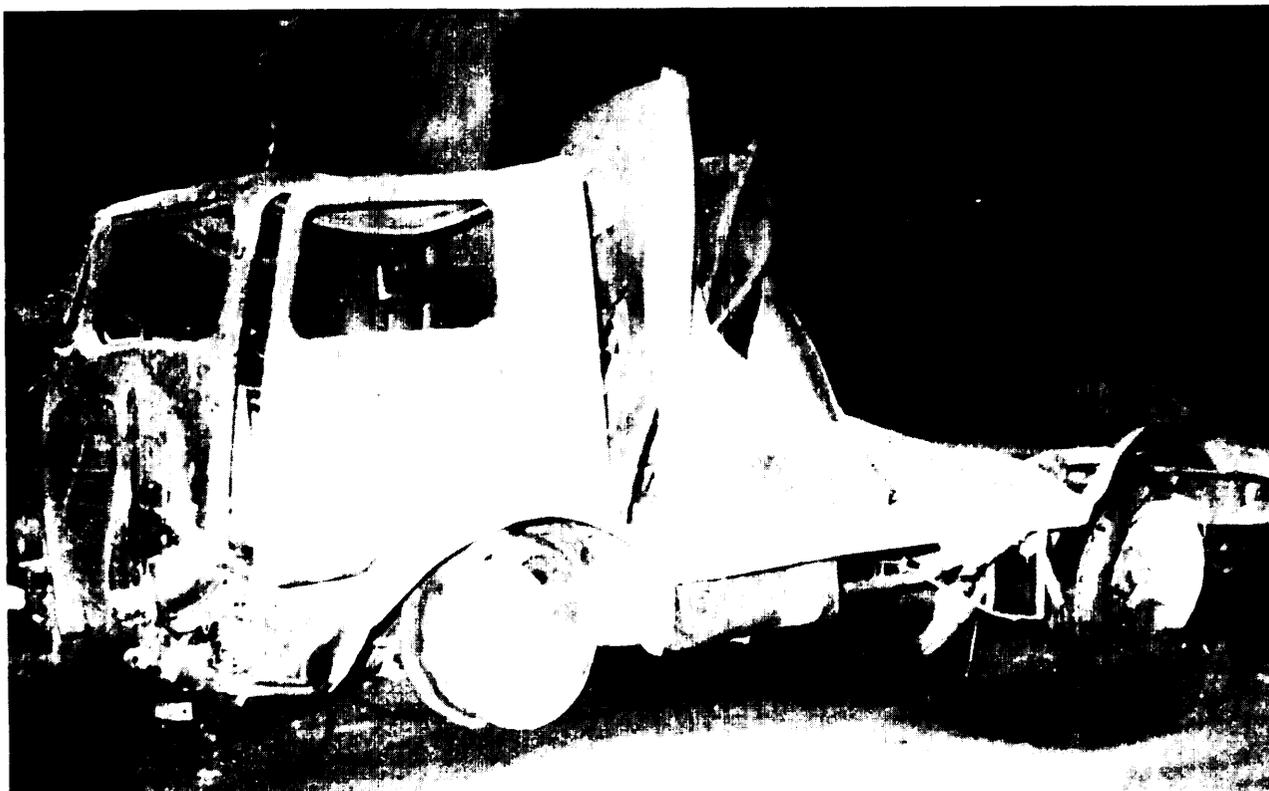
true costs of hazardous materials accidents are difficult to determine. A large number of incidents are not reported to OHMT, and the costs of those that are appear to be greatly underestimated. Interstate carriers are required to report any spill except those of certain consumer goods and paints and batteries to DOT within 15 days, usually long before full costs are known. Typically, carriers report only their direct costs. The annual damage cost for incidents reported to OHMT from 1973 to 1983 was \$13 million. This figure is undoubtedly too low, perhaps by a factor of as much as 10,<sup>5</sup> if all costs associated with hazardous materials accidents are considered, including long-term cleanup costs.

<sup>5</sup>An OTA contractor studying accident report data has found that DOT damage reports are consistently low. For example, the National Transportation Safety Board (NTSB) listed damages of \$597,000 for a February 1978 rail accident; the DOT report of the accident listed damages of \$11,000. For a May 1983 rail hazardous materials accident,

Still, it is the risk of death and injury that causes the deepest concern. Hazardous materials accidents are often spectacular, although loss of life is relatively rare. No State or local official can erase the memory of an overturned load of explosives or tanker of chemicals in an area for which he or she is responsible. These experiences and the almost weekly news reports of a hazardous materials spill somewhere in the Nation, more than the official statistical record, drive the demand for strong enforcement of safety rules and improved emergency response capabilities.

NTSB records showed \$570,000 damages; DOT records did not show the accident at all.

Mark Abkowitz and George F. List, "Hazardous Materials Transportation: Commodity Flow and Information Systems," report prepared for U.S. Congress, Office of Technology Assessment, December 1985.



*Photo credit: Research and Special Programs Administration, DOT*

The remains of a truck that had been carrying chemicals, after an accident.

## GOVERNMENT AND INDUSTRY ROLES

### Federal

The Federal Government has four roles with regard to hazardous materials transportation: regulation, enforcement, emergency response and planning, and data collection. Responsibility for these functions is distributed among numerous departments and agencies. The departments and agencies operate under a complex set of agreements and coordination procedures, with no single agency having sole responsibility or authority over all aspects of hazardous materials production, shipment preparation, and transportation. In some instances, jurisdictions overlap. In others, responsibility is assigned depending on the type of material involved, the mode of transport, or the nature of Federal regulation.

DOT is the designated lead agency for establishment and enforcement of regulations regarding safe transportation of hazardous materials. The DOT Research and Special Programs Administration (RSPA) has authority to issue regulations on most aspects of hazardous materials transportation containers. It must coordinate with the modal administrations, the Federal Highway Administration, the Federal Railroad Administration, the Federal Aviation Administration, the National Highway Traffic Safety Administration, and the U.S. Coast Guard, which have authority over the vehicles or vessels themselves. This intra-agency fragmentation notwithstanding, DOT as an agency is responsible for identification of hazardous materials, regulation of hazardous materials containers, handling and shipments, development of standards and testing procedures, inspection and enforcement, and data collection.

Another group of agencies—DOE, DOD, the Nuclear Regulatory Commission (NRC), and the Environmental Protection Agency (EPA)—has jurisdiction over other aspects of hazardous materials transportation. DOE is largely concerned with fuels; DOD, with materials used for military purposes. NRC has jurisdiction over high-level radioactive substances in the civil sector, while EPA has responsibilities for chemicals and hazardous nonnuclear wastes. These agencies also undertake training activities and safety awareness programs, and provide technical support for State and local governments.

The Federal Emergency Management Agency is responsible for coordinating Federal assistance, planning, and training activities for emergency response with State and local governments. The Departments of Justice and Labor also have designated responsibilities and areas of interest.

The data collection function similarly is spread among several Federal agencies. The various databases maintained by those agencies record accidents and spills and monitor compliance and sometimes carrier performance. OHMT is the principal agency collecting data on hazardous materials transportation spills, but every other Federal entity keeps records pertaining to its area of interest. There is no central clearinghouse to collect and analyze hazardous materials transportation information.

### State

The States mirror Federal functions and responsibilities to a degree, but the structure is by no means uniform or even comparable from State to State. Some States have extensive programs of regulation, enforcement, emergency planning, and training. In others, programs are still in a formative stage. The functions and activities listed in table 1-2 indicate the range and nature of State involvement, not the situation in every State. State programs, like their Federal counterparts, are characterized by a multiplicity and diversity of activities and areas of jurisdiction, complicated in many instances by differences between Federal and State agencies as to definitions of hazardous materials, regulatory requirements, transportation restrictions, and stringency of enforcement.

Regulatory activities are a major feature of many State programs. State regulations may require licensing or registration of hazardous materials transporters, imposition of fees and taxes (often as an extension of the licensing function), prenotification, and routing restrictions. States also maintain inspection and enforcement programs and may require special safety procedures.

Other important State functions are planning and training for emergency preparedness and response. Training is conducted in cooperation with local

**Table 1.2.—Hazardous Materials Assistance Commonly Available From State and Local Agencies**

**State:**

*Civil Defense:* Communications, coordination, evacuation, radiological monitoring.

State Police: Traffic control, communications, evacuation.

*Environmental:* Chemists, environmental scientist meteorologists, lab services, some equipment, knowledge of contractors.

*Public Work* Construction equipment and operators.

*Public Health:* Health specialists.

Agriculture: Pesticide and/or fertilizer experts.

*Fire Marsha/ or Fire Academy:* Fire suppression advice.

**Local:**

*Fire Department:* Trained firefighters and specialized equipment for: 1) suppressing fires, 2) rescuing injured or trapped persons and 3) dealing with select hazardous materials.

*Public Works:* Equipment and personnel to contain spills by digging trenches or constructing dikes. Can usually provide sand—an excellent sorbent for spilled hazardous materials.

*Police:* Communications equipment and traffic/crime control at scene of spill.

*Civil Defense:* Equipment for monitoring radioactivity. Will usually coordinate the response of various agencies.

*Public Health Agency:* Advice on the chemical properties of the materials and human health effects.

SOURCE: U.S. Department of Transportation, Research and Special Programs Administrator, *Community Teamwork: Working Together to Promote Hazardous Materials Transportation Safety: A Guide for Local Officials*, May 1983, p. 58.

agencies and often with some technical assistance and financial support from the Federal Government and industry. Since States are also responsible for emergency programs, civil defense, police, fire, environmental, and public works agencies may all play roles in State hazardous materials activities, making program coordination difficult. In rural areas and small towns, State agencies may constitute the first response team. \* In metropolitan areas, local governments usually assume this function.

### Local

Diversity of function and concern also exists at the regional and local levels of government. Some major cities and metropolitan areas exercise regulatory, inspection, enforcement, and licensing functions akin to those of Federal and State agencies. Many have undertaken emergency planning and training activities, either on their own or with assistance from Federal and State hazardous materials offices. The most important and most nearly uni-

\*First responders are those agencies, such as police or fire, that are called initially when an accident involving hazardous materials occurs. They may be followed by State and local health authorities and environmental cleanup crews.

versal local function, however, is emergency response.

Almost 75 percent of the U.S. population lives in metropolitan areas, where the majority of hazardous materials are produced, transported, and used. Local fire and police departments constitute the first line of response in the event of a hazardous materials accident, and local hospitals and health officials bear the brunt of treating accident victims. Local resources are also the first used to prevent the spread of contamination or to evacuate the area around an accident site.

The diversity of local functions is equaled by a wide range of capabilities. Some locales have well-developed emergency plans, adequately trained and equipped response teams, and sufficient resources for hazardous materials containment and cleanup. Others, particularly small urban and rural jurisdictions, must rely on local fire and police departments that most often have little or no training or experience in dealing with hazardous materials.

### Industry

An important adjunct to Federal, State, and local government resources are the safety-related programs and capabilities of the industries that produce and transport hazardous materials. Some of the more than 50 national industry associations are made up of hazardous materials producers and users—e.g., the Chemical Manufacturers Association, the National Agricultural Chemicals Association, and the American Petroleum Institute. Others are transportation associations such as the American Trucking Associations, the American Waterways Operators, the Association of American Railroads, and the Air Transport Association.

Industry programs provide employee, client, and contractor training in the handling and transport of hazardous materials and in emergency response. Some industries maintain special response teams to aid State and local authorities at an accident site; others offer funding for training and equipping State and local first response teams. Industry associations and individual firms also contribute to State and local planning, prevention, and education efforts, either by underwriting part of the cost of such programs or by providing technical support. Voluntary standard setting in support of hazardous materials safety varies widely from company to company.

## ORGANIZATION AND SCOPE OF REPORT

This special report, which documents findings pertaining to State and local activities, is the outgrowth of an OTA workshop held on May 30, 1985, and a series of meetings between OTA and government, industry, and academic experts on hazardous materials. The workshop examined the results of OTA's initial research and literature review of State and local capabilities and activities in the areas of accident prevention and emergency response. The comments of workshop participants, supplemented by follow-up interviews and analysis of key points by OTA staff and an extensive review process, form the basis for the material and findings presented here.

Concerns of State and local governments about the transportation of hazardous materials focus on accident prevention and enforcement, emergency response, and collection of information to support planning for emergency preparedness. OTA found that while a hazardous materials accident in any mode of transportation will involve State and local public safety officers, highway and rail hazardous materials accidents tend to concern public officials the most. No other public organization, such as a port authority or the Coast Guard, is likely to be available to provide immediate assistance to State and local public safety personnel for either truck or rail accidents.

This report will emphasize truck transportation because it is of greatest concern to State and local officials. Trucks carry more hazardous materials than any other mode of transportation, and there are many more trucks than other vehicles or vessels carrying hazardous materials. Finally, trucks travel on public rights of way through every jurisdiction, mingling with other traffic and thus increasing spill and accident risks.

Three subjects are addressed in the chapters that follow:

- State prevention and enforcement programs; emergency response training, planning, and implementation; and
- information collection for State and local planning.

General findings are presented below. Detailed findings and supporting material are contained in each chapter. It should be noted that the findings presented in this special report will be considered in the context of Federal programs and other resources in a second OTA report to Congress, *Transportation of Hazardous Materials*. The second report will include policy options for consideration by Congress in 1986.

## GENERAL FINDINGS

**Financial assistance for enforcement and response training and planning activities is needed by many localities.** Potential sources of funds include Federal, State, or local assistance, cooperative programs with industry, and registration or user fees.

**Movements of gasoline and petroleum products, by far the most frequently transported hazardous materials, \* account for more hazardous materials transportation accidents, injuries, and damage than transport of any of the other classified commodities. State and local enforcement, emergency response, and planning personnel should focus on this problem in cooperation with industry representatives.** Attention should be given to developing additional safety measures and programs to pro-

mote better awareness and training of drivers, handlers, and enforcement personnel. Generally, emergency response personnel are already trained to handle gasoline incidents.

**State and local enforcement and emergency response personnel are dissatisfied with the information accompanying hazardous materials shipments. Placarding requirements should more accurately reflect the degree of hazard of the material, and shipping papers should include more information on the nature of the hazard posed and accident mitigation techniques.**

### Prevention and Enforcement

**National standards establishing uniform State hazardous materials requirements and regulations would simplify and improve compliance by shippers, carriers, and State and local enforcement**

\*According to data provided by the American Petroleum Association and OTA calculations, these products comprise about 50 percent of total hazardous materials movements.

activities. State, regional, and local agency concerns as well as those of industry should be considered in formulating standards. The areas where uniformity is most needed are:

- Licensing to ensure that drivers and others handling hazardous materials are qualified and have been properly trained. Some form of a national truck driver's license is favored by many State, local, and industry officials.
- Permit or registration requirements to obtain information and collect fees in a coordinated manner that does not unduly burden transporters and ensures that money collected is used to meet related needs.
- Shipment notification systems that provide useful information for localities without unduly burdening carriers.

Penalties for regulatory violations, including failure to report hazardous materials incidents, should be consistent across governmental and jurisdictional levels and sufficiently large to discourage future infractions. An effective enforcement program requires that legislatures, enforcement agencies, and courts be aware of the death, injury, property damage, and environmental harm that could result from accidental release of hazardous materials and set penalties accordingly.

State and local enforcement personnel need additional training and current information on hazardous materials regulations for all modes of transportation. Methods used by the Federal Government to deliver this information to State and local officials need to be improved and strengthened. Programs to educate shippers and carriers on safety measures and regulatory compliance need strengthening as well.

## Emergency Response

An effective way to deliver hazardous materials training to first responders is the most pressing national need in emergency response. Many different and successful training programs exist, but they are not reaching sufficient numbers of first responders, especially in the smaller urban and rural areas. Moreover, some training programs are simply inadequate.

Maintaining existing response programs through refresher training and training of new personnel to fill vacancies created by turnovers in response teams is financially difficult for most jurisdictions.

National guidelines for different levels of training and national certification standards for responders are needed. Advanced hazardous materials training is appropriate for personnel in large jurisdictions, along major transportation corridors, or in States with heavy concentrations of hazardous materials industries. The numerous existing training programs need to be systematically examined and evaluated.

National equipment guidelines for emergency response are needed to assist response organizations in equipment selection.

When formulating hazardous materials emergency response plans, communities should consider formal, written mutual aid agreements with regional and adjacent local jurisdictions and Good Samaritan laws to protect first responders from liability when they respond to incidents for which they are not responsible.

## Planning and Data Collection

Improved data on hazardous materials storage and commodity flow is needed by State and local governments for analyzing accident prevention techniques such as routing and planning for emergency response. Federal databases pertaining to commodity flow are kept by a wide variety of Federal agencies, but the agencies do not use the same commodity identification codes, and the databases are not interactive. The data are not useful to State and local governments, some of which have undertaken data collection on their own. Data collection efforts would be improved by coordinating existing Federal data resources and providing State and local access to them. National guidelines on hazard assessment data collection for local government would also be valuable. In the absence of national legislation, right-to-know laws should be considered by jurisdictions. Such laws are an important aid in gathering information on the identities and associated hazards of the chemicals most likely to be encountered.

**A reliable, comprehensive Federal accident record system is essential.** Current Federal efforts are too fragmented to be useful to State and local agencies, or to carriers, which could use the findings to develop or modify their own safety programs. Existing Federal databases that record data on accidents, violations, and shippers and carriers that do not comply with regulations would be more useful if they were interactive and were made accessible to State enforcement personnel. The SAFETYNET Program, being developed by the Federal Highway Administration, and the National Driver's License Registry, being developed by the National Highway Traffic Safety Administration, should help, but their full implementation is at least a decade away.

A more clearly defined and smoothly functioning Federal authority for hazardous materials transportation is needed. The current designation of DOT as lead agency and RSPA as lead group within DOT has not resulted in clear lines of authority or intermodal coordination for transporting hazardous and radioactive commodities and wastes. While a number of federally sponsored activ-

ities have made important contributions to the development of municipal and State programs, the absence of effective Federal program coordination means that jurisdictions have difficulty gaining access to available information, planning, and financial resources.

**The lack of interagency coordination at the Federal level is often replicated at the State level, compounding the difficulties of regional and local jurisdictions.**

**Up-to-date technical information is needed for planning emergency response.** Current toxicological, chemical, and health data should be compiled, updated regularly, and made accessible to planners and responders.

**State and local officials are concerned about shipments of chemical weapons and explosives or radioactive materials by DOD and DOE.** While these officials understand the need for secrecy about such shipments, they seek guarantees that Federal enforcement will be stronger and when an accident occurs, emergency response efforts will be adequate.