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Report to the Administrator of the Environmental Protection Agency

June 1996

CHEMICAL ACCIDENT SAFETY

EPA's Responsibilities for Preparedness, Response, and Prevention

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Program Evaluation and
Methodology Division

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The Honorable Carol M. Browner
Administrator, Environmental
Protection Agency

Dear Ms. Browner:

Over 10 years ago, a catastrophic chemical accident occurred in Bhopal, India, which claimed the lives of thousands of residents, injured many others, and displaced many more from their homes and businesses. The magnitude of this event, coupled with an identified potential for similar accidents in the United States, were catalysts for strengthening national policy on chemical accident preparedness and response. Several specific laws were passed, giving the Environmental Protection Agency a central role in the implementation of chemical accident safety policy. The National Response Team, chaired by EPA, provides support for local and state officials who respond to chemical accidents. EPA also conducts accident preparedness and prevention activities.

EPA's role has been central in these areas. However, efforts to implement chemical accident safety policy have not been comprehensively evaluated. We examined the extent of EPA's role in accident preparedness, response, and prevention. Specifically, we assessed (1) EPA's databases on accident occurrence and impact, (2) EPA's chemical accident preparedness activities, (3) the effectiveness of EPA's response to chemical accidents, and (4) the steps EPA has taken to help prevent the occurrence of chemical accidents.

Background

Federal policy on chemical accidents has chiefly been formulated over the last 25 years and is administered under five major specific acts. They are the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, the Hazardous Materials Transportation Uniform Safety Act of 1990, the Emergency Planning and Community Right-To-Know Act of 1986, the Clean Air Act Amendments of 1990, and the Clean Water Act as amended by the Oil Pollution Act of 1990. Table 1 summarizes this legislation and EPA's responsibilities for chemical accident safety.

Table 1: Environmental Legislation and EPA's Chemical Accident Safety Responsibilities

Legislation	Responsibilities
Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), P.L. 96-510	Clean up of hazardous waste sites and land and inland waterway spills of hazardous substances
Emergency Planning and Community Right-To-Know Act of 1986 (EPCRA), P.L. 99-499	Facilitate state and local accident contingency planning, public participation, and access by individuals and communities to information regarding hazardous materials in their locales
Hazardous Materials Transportation Uniform Safety Act of 1990 (HMTUSA), P.L. 101-615	Participate in the oversight of grants awarded for the training and education of hazardous materials employees
Clean Water Act as amended by Oil Pollution Act of 1990 (OPA), P.L 101-380	Facilitate contingency planning for the petroleum industry including issuing regulations for tank vessel and facility response plans
Clean Air Amendments of 1990 (CAA), P.L. 101-549	Develop a list of at least 100 chemicals that may result in significant harm to human health or the environment Develop accident prevention programs

EPA's chemical accident planning and prevention responsibilities are conducted by the Chemical Emergency Preparedness and Prevention Office. The Office of Emergency and Remedial Response provides resources for responding to accidents involving hazardous substances and for those involving oil releases. (Oil accident planning and prevention responsibilities are also the responsibility of this office, although these issues are not addressed in detail in this report). While several federal agencies have responsibilities for chemical accident safety policy, EPA (along with the Department of Transportation [DOT] and the Occupational Safety and Health Administration [OSHA]) has the primary regulatory authority. Other EPA responsibilities include facilitating the efforts of local emergency planners and assisting at accident sites when local resources are insufficient. EPA provides training to local emergency responders and works with Local Emergency Planning Committees (LEPCs) to share information with communities.

Objectives, Scope, and Methodology

In designing our evaluation, we found that EPA's chemical accident safety activities include accident preparedness, response, and prevention, and thus we examined the following evaluation questions:

1. What have been the recent trends in accident occurrence and impact?

2. What are EPA's accident preparedness activities?

3. How effectively does EPA respond to chemical accidents?

4. What steps has EPA taken to prevent the occurrence of chemical accidents?

Many federal agencies play a role in chemical accident preparedness, response, and prevention; however, our study is limited to EPA's role. It is also limited to accidents involving hazardous chemicals (including petroleum products) produced by private industry. Radiological substances are not included. A portion of the report is based on case studies of six accidents that have occurred since January 1993. These cases constitute significant accidents with major impact on human health or the environment; EPA coordinators were on-site in each case. The criteria for case selection included the occurrence of at least 5 injuries, 1 death, 100 evacuees, or $50,000 in property damage. The cases were evenly split between fixed-facility and transportation accidents and included urban and rural communities. We identified these cases through the assistance of officials at the EPA regional offices.

We used multiple sources of information to address our four evaluation questions. We synthesized information from EPA documents, legislation, and National Response Team publications. We also utilized data from three national accident databases: the Accidental Release Information Program (ARIP), the Hazardous Materials Information System (HMIS), and the Emergency Response Notification System (ERNS). In addition, we obtained data from accident case site visits, including interviews with state, local, and industry officials. Finally, we reviewed EPA's Chemical Safety Audit (CSA) Program database and interviewed pertinent federal officials.

We conducted our evaluation between July 1994 and December 1995 in accordance with generally accepted government auditing standards.

Results in Brief

We found that EPA has vigorous programs for accident preparedness and response. Legislation enacted during the last several years, however, has shifted the agency's primary focus to the prevention of chemical accidents. Through risk management planning, the agency has conducted a number of efforts to further the prevention of accidents, including collaboration with industry and professional associations.

EPA has developed a large repository of information on accident prevention. A major barrier to the prevention of accidents, though, remains the relative lack of involvement of community residents and some sectors of industry. To maximize the potential for accident prevention, information that facilitates prevention must be made available and used by industry and the local level.

Principal Findings

Accident Occurrence and Impact

The available data on chemical accidents do not provide clear evidence on accident trends. While accidents do not appear to be getting more severe, neither is there a downward trend pointing to effective accident prevention activities. The data do suggest that the total number of chemical accidents has been increasing over time, peaking at over 40,000 incidents occurring in 1994, but this may be attributable to more aggressive reporting and increased economic activity.

For example, we found that as industrial production increases, the number of fixed-facility accidents also increases. Similarly, for transportation accidents, even after accounting for the increasing mileage being driven by trucks, there is an increase in the reported number of chemical accidents. Assuming continued economic growth, then, we can assume an increase in the number of accidents, unless specific prevention measures are implemented. However, the impact of fixed-facility and transportation accidents, which includes deaths, injuries, and property damages, have changed little over time. (Appendix I provides a complete discussion of these results.)

Making definitive conclusions about how and why chemical accidents occur is hindered by data quality problems. Unverified data are reported, causal factors are not always included, and underreporting of accident data exists. As shown in table 2, each of the databases used to chronicle chemical releases has significant limitations.

These limitations include unverified data, underreporting, and the unavailability of data on the causes of accidents. (Appendix I provides a full discussion of these limitations.)

Table 2: Information Included and Limitations of Chemical Release Databases

Database	Information included	Database limitations
Emergency Response Notification System (ERNS)	Initial reports of release data submitted to the National Response Center, EPA regional offices, and until 1989, U. S. Coast Guard field offices.	Release data are reported when events occur and before they are verified, hence, ERNS is prone to inaccuracies about the number of deaths, injuries, economic damage, and chemicals involved. An estimated 5 percent of reports are duplicated. Causal information not always included.
Accidental Release Information Program (ARIP)	Information on the causes of the most serious or potentially serious releases and preventive practices before and after a release. Cases are identified through ERNS, and data are collected through a questionnaire.	Includes only accidents at fixed facilities and is limited to those releases that involve injury and have off-site impact, which are not representative of all release cases. The vast majority of cases are excluded. Database has not always been updated on a timely basis.
Acute Hazardous Events (AHE)	Accident information from secondary sources, including newspapers, state government office files, and EPA office files.	Information, collected from secondary sources, has not been verified. (EPA cautions that such sources are particularly prone to error.) Database was developed only over a 5-year time frame and is no longer active.
Hazardous Materials Information System (HMIS)	Chemical release data from transportation incidents. The data are used to monitor DOT's hazardous materials transportation program.	Limited to the information that a transportation carrier has knowledge of and reports. In some cases, information on chemicals may be destroyed during the events surrounding the incident, and it is likely that the carrier does not know what material was being shipped. There is no assurance that DOT is receiving all incident reports as the reporting burden is placed upon carriers.

Accident Preparedness

EPA administers programs to help local communities prepare for chemical accidents, and one way the agency does this is by training local and state responders. EPA exceeds its requirements by offering this training. Most of those trained find it useful, but relatively few local responders have taken the training, and state and local agencies may not have the resources to provide it internally. However, national firefighter associations do provide a significant amount of such training, thereby filling some of the gaps.

Under the Emergency Planning and Community Right-To-Know Act of 1986, EPA assists in developing accident preparedness programs for industry, the states, and local communities. The act requires that state and local communities be involved in emergency planning and response with EPA in a facilitative role. Under the act, EPA was given a lead role in making it possible for community residents to obtain information about community chemical hazards. The provisions of the legislation rely on public awareness to encourage the minimization of accident risks. Specifically, Local Emergency Planning Committees are responsible for informing community residents about the potential accident risks, but a sizable number of them were not actively disseminating this information. However, EPA has made accident data available to the public, industry, and local and state governments through several sources, including the Internet. (Appendix II discusses this issue in more detail.)

Accident Response

EPA is required to assess the nature and seriousness of chemical accidents. If neither the party responsible for the accident nor the locality or state can handle the incident, EPA is required to take charge of response operations. We examined a variety of chemical accident cases in which EPA played a major role. The fixed-facility cases include chemical explosions at plants in Ohio and Pennsylvania, while the transportation accidents involved truck and train cases in Texas, California, and Connecticut. (See appendix III for descriptions of these cases.)

One of EPA's key functions is to assess the facts about a chemical accident, such as the probable cause or causes and effects upon human health and the environment. Typically, these efforts are used to facilitate accident response by local or state authorities who are likely to have immediately responded to the accident.[1] In the accident cases we examined, EPA officials performed these functions and were commended for their efforts by local responders.

[1]As discussed previously, EPA has the authority to take control of accident response functions if local, state, or other authorities are unable to handle an incident. However, in our cases, this did not occur.

As noted in the National Contingency Plan, EPA on-scene coordinators are required to assess whether or not responsible parties or local and state officials can handle incidents.[2] The length of response time varied considerably (from fairly immediate to approximately 15 hours), but EPA officials coordinated with on-site responders by telephone to ascertain whether or not they were needed. In the case with the longest response time, EPA coordinated with state officials and discovered that an immediate response was unnecessary. In one transportation case, an EPA coordinator arrived at the accident site 3 hours after it occurred and met with the local fire department incident commander to discuss options for managing the case. In this case, before the arrival of the EPA coordinator, the local responders had immediately taken command of the incident by alerting area residents and applying response procedures to contain the accident.

The capabilities of local responders are very important, given that, depending on the location of an incident, an EPA coordinator could take several hours to reach the accident site. While on-scene coordinators are stationed at the 10 EPA regional offices and at smaller facilities, they cannot always be on-site immediately. As a result, local responders must usually make initial assessments about the need for evacuation, containment, and treatment technologies. Local authorities told us that they usually do not have the chemical training or equipment to perform these tasks, and they rely highly on EPA resources. As one local responder noted, his background was in firefighting, not chemicals.

Under the National Contingency Plan, EPA is responsible for coordinating response efforts among appropriate federal, state, and local agencies and officials. In one transportation case, EPA participated in a meeting attended by local, state, and other federal officials. The group decided to let a fire burn out rather than treat it with materials that would contaminate a nearby creek. In another case, EPA oversaw a cleanup function of hazardous chemicals, but (as described by a local responder) did not micromanage the event. For another transportation case, EPA was described by a local fire department official as acting in a "support role," while state and local authorities conducted the direct response functions. A road that was likely to be closed for a week was reopened within 72 hours because of the coordination efforts of EPA with those of the state and other federal officials.

[2]The National Contingency Plan is a federal preparedness plan developed over a number of years that attempts to deal comprehensively with oil spills and hazardous substance accidents.

In all the cases, EPA and the technical assistance teams were heavily involved in monitoring activities to ascertain the effects of the accident upon the area's environment. In accordance with the contingency plan, this monitoring supported the local responders, who generally had less expertise in this technical area. While local responders are usually able to control some of the more obvious effects of an accident (such as fire), they are less likely to have the expertise to mitigate such effects as groundwater pollution and air emissions.

In summary, EPA was effective in assessing the incidents we studied and coordinating response efforts. As noted by local responders, the EPA officials were quite skilled at providing needed expertise and coordinating response options, while not micromanaging any of the cases.

Under the National Contingency Plan, EPA is also responsible for ensuring that local responders can handle the responsibility of making area residents aware of accident risks and protecting natural resources from harm. (The local responders' inability to do so would effectively shift the responsibility to EPA.) EPA was not involved in evacuating residents and handling their concerns. Local officials directed evacuation efforts since EPA officials often did not arrive on-site until several hours after the incident. In the cases we examined, local resources were quite sufficient for these efforts. However, in two cases, EPA officials did attend public meetings following the incidents to advise citizens about accident preparedness and prevention.

For one fixed-facility case, the head of the EPA regional office that had jurisdiction for the accident personally attended a public meeting regarding response and cleanup concerns. According to a local responder in this case, the citizens were positively impressed that an official of this rank attended the meeting. In the cases with natural resources at risk, EPA officials contacted the appropriate trustees as required by the contingency plan. For example, in one transportation case where a creek was contaminated, an area water quality control board, the local county water district, and the department of fish and game were contacted.

Given that community residents were at risk, media outlets were interested in covering some of these cases. According to one local responder, media representatives were very impatient with him in their quest to obtain information. This responder relied upon the public relations expertise of EPA. This responder noted that, in working with the media, EPA was able to garner respect.

In summary, EPA was also able to ensure timely communication of accident risks to the public. The agency's ability to deal with the public and media representatives was appreciated by local responders.

As noted above, EPA is charged with ensuring that the entity responsible for the accident provides cleanup and pays associated costs. For all cases in our study, we found that EPA was successful in meeting this requirement. In most cases, those responsible engaged contractors who worked with government officials to clean up the accidents.

Two of the cases we reviewed occurred in rural areas, which are unlikely to have the technical resources to manage the response to chemical accidents.[3] Furthermore, Local Emergency Planning Committees in rural areas tend to be inactive or quasi-active, according to a recent study.[4] However, in our cases, we found a high level of assistance given to such areas by neighboring community fire departments, state officials, and ultimately, EPA staff members and technical assistance teams. While such assistance networks may not be formalized (as demonstrated by the weak rural LEPC system), in the cases we examined, the assistance was important in providing response resources to these areas, facilitating risk communication, and following other mandated response procedures.

Accident Prevention

As mandated by the Clean Air Act Amendments of 1990, EPA has developed a risk management planning program regulation that requires facilities to identify and plan for the possibility of chemical accidents. In developing this program, EPA has conducted a number of efforts to obtain information on accident prevention. The agency has worked with industry and professional associations to understand the basics of process safety management issues, which show that accidents are best prevented by comprehensive management systems. The agency has also conducted a number of outreach efforts. However, the agency has noted that the level of demand for accident prevention information should be increased at the industry and community levels.

The Clean Air Act Amendments of 1990, which added section 112(r), require facilities handling regulated substances in quantities that exceed specified thresholds to develop integrated plans for managing accidents, which must be registered with appropriate parties and be made available

[3]"Rural" is defined as an area with fewer than 2,500 residents.

[4]See Nationwide LEPC Survey (Washington, D.C.: George Washington University Department of Public Administration, Oct. 1994).

to the public. Facilities must identify chemical hazards, design and maintain safe operating procedures, and minimize the consequences of releases when they occur. EPA is required to develop a list of at least 100 substances that cause, or may be reasonably anticipated to cause, death, injury, or serious adverse effects to human health or the environment when released in the air. In addition, the act requires EPA to develop "reasonable regulations and appropriate guidance" to provide for the prevention and detection of accidental releases and for responses to such releases. These regulations are required to include, as appropriate, provisions concerning the use, operation, repair, and maintenance of equipment to monitor, detect, inspect, and control releases, including training of personnel in the use and maintenance of equipment or in the conduct of periodic inspections. The regulations, issued in May 1996, require covered facilities to prepare and implement risk management plans that include a hazard assessment, a prevention program, and an emergency response program. Specifically, the hazard assessment must analyze the off-site consequences of the worst possible accident. In addition, the risk management planning will improve accident information reporting.

EPA has conducted several main activities geared toward risk management planning efforts. These include conducting a review of emergency systems, operating the Accidental Release Information Program and the Chemical Safety Audit Program, initiating process safety management activities, and conducting outreach efforts. These are described in greater detail in appendix IV.

The Clean Air Act Amendments of 1990 required the establishment of the Chemical Safety and Hazards Investigation Board to obtain information about accidents that could be used to prevent future occurrences. Modeled after the National Transportation Safety Board (NTSB), the CSHIB was to consist of five members, nominated by the President and confirmed by the Senate. The functions of the Board were to investigate the causes of any fixed-facility accidental releases resulting in a fatality, serious injury, or substantial property damage and to publicize results of the investigations.[5]

The CSHIB has never become operational. The Senate has confirmed three nominees; however, none has been sworn in. The administration proposed rescinding the Board's funding for fiscal year 1995, and its proposed

[5]The Board was to enter into a memorandum of understanding with NTSB to ensure coordination of functions and to limit duplication of activities, allowing NTSB to investigate transportation-related chemical releases.

budgets for fiscal years 1996 and 1997 requested no funds for the Board. The administration stated it was including in its budget requests additional funds for EPA and OSHA to enhance their investigation and prevention efforts.

In January 1995, EPA and OSHA developed a memorandum of understanding outlining their accident investigation program.[6] To carry out their responsibilities, these agencies are undertaking joint accident investigations and, on the basis of their experience, are developing an investigation protocol. The memorandum of understanding will be reexamined in light of their joint experience. The agencies will develop criteria for selecting accidents for both joint and individual agency investigations.[7] Public reports will detail findings on the causes of accidents and provide safety recommendations.

The agencies also agreed to continue staff training in accident investigation and to train staff on the new investigation protocol. Training will be made available to other federal agencies, industry, labor, and other interested parties. In addition, EPA and OSHA will establish an internal and external expert review process, including "blue ribbon" panels of stakeholders for reports and recommendations.

EPA can use information obtained in accident investigations in legal proceedings brought against alleged industry violators, and the public, in turn, could use this information in tort liability cases. However, if the CSHIB conducted investigations, the public would be prohibited under the law from using information in this manner, effectively weakening the "public pressure" provisions of Community Right-To-Know legislation.

In summary, to prevent accidents, industry must be able to obtain quality information. The replacement of the CSHIB with joint EPA/OSHA oversight may meet this need if industry fully cooperates and if the agencies undertake to fulfill the mandates of the Board.

Conclusions

In this report, we examined several components of EPA's chemical accident safety policy, including accident preparedness, response, and prevention.

[6]See EPA/OSHA Joint Accident Investigation Program (Jan. 18, 1995).

[7]OSHA currently investigates incidents in which a worker is hurt; EPA investigates fixed-facility environmental accidents with impacts outside of facilities. The joint accident investigation protocol currently being developed will more specifically delineate each agency's investigatory responsibilities. As noted, transportation accident investigation is NTSB's responsibility.

Arguably, the prevention of accidents is the ultimate goal of agencies and other organizations concerned with chemical accident safety policy. Accident prevention activities, if effective, reduce risks to communities and lower costs to municipalities and private organizations. As noted in a report prepared for EPA by the Massachusetts Institute of Technology, accident mitigation systems are expensive, while accident prevention can be much less costly.[8]

One of the major barriers to accident prevention is inadequate information and, perhaps most importantly, lack of demand for that information at the local, state, and industry level. Information from prior accidents is essential to take a "lessons learned" approach in preventing future accidents. Furthermore, this information must be disseminated to community residents, state governments, and industry. However, as noted by EPA, the major challenge is to stimulate interest in accident prevention at these levels. Oftentimes, community residents and industry officials do not consider the importance of accident prevention until after an accident occurs, which severely limits the extent of accident prevention activities.

As noted above, EPA directs several efforts to advance accident prevention activities. For the risk management planning process, the agency has developed a large repository of information on accident prevention issues, especially on safety management procedures. EPA has utilized ARIP and the CSA Program to support this effort. By working with industry, professional associations, and academia, the agency has built a large amount of expertise in this area.

However, a notable amount of this knowledge is not being utilized at the community level. While EPA has outreach efforts, agency officials have noted that some community residents and industry officials remain unconvinced about the possibility of the occurrence of a chemical accident.[9] As a result, the agency could improve the extent to which "lessons learned" are provided to the local level.

Recommendations

Based on these findings, we recommend that the EPA Administrator (1) initiate improvements in prevention activities by increasing the extent to which the "lessons learned" from risk management planning efforts are

[8]See The Encouragement of Technological Change for Preventing Chemical Accidents: Moving Firms From Secondary Prevention and Mitigation to Primary Prevention (Cambridge, Mass.: MIT Center for Technology, Policy, and Industrial Development, July 1993).

[9]One example of outreach efforts is EPA, Managing Chemicals Safely: Putting It All Together (April 1992).

conveyed to industry, state and local government and the public, and (2) work with industry, state and local government, and the public to stress the importance of how this information can be used to facilitate the prevention of accidents.

Agency Comments

EPA provided comments on a draft of this report. Most of the agency's concerns pertained to our findings on EPA accident prevention activities. EPA suggested that our discussion of accident prevention did not provide sufficient information on recent agency programs and activities. We agreed with these comments and made appropriate changes.

EPA made several comments about the Accidental Release Information Program. We had noted that accident trend information cannot be developed from the program, and the agency responded that this is not the program's intent. However, we believe that trend information is a vital part of understanding the causes of accidents. We had noted the program's bias toward larger events, and EPA told us that agency resources limit its coverage. We concurred with this point and made the appropriate change in the report. Several other technical changes were made throughout the report where appropriate.

We are sending copies of our report to interested congressional committees and to officials in EPA's Chemical Emergency Preparedness and Prevention Office and the Office of Emergency and Remedial Response. We will also send copies to other interested parties, and we will make copies available to others upon request. If you have any questions, please call me at (202) 512-3092. Major contributors to this report are listed in appendix V.

Sincerely yours,

Kwai-Cheung Chan
Director for Program Evaluation
in Physical Systems Areas

Contents

Abbreviations

AHE	Acute Hazardous Events
ARIP	Accidental Release Information Program
CAA	Clean Air Act Amendments of 1990
CAMEO	Computer Aided Management of Emergency Operations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CSA	Chemical Safety Audit
CSHIB	Chemical Safety and Hazards Investigation Board
DOT	Department of Transportation
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-To-Know Act of 1986
ERNS	Emergency Response Notification System
HMIS	Hazardous Materials Information System
HMTUSA	Hazardous Materials Transportation Uniform Safety Act of 1980
LEPC	Local Emergency Planning Committee
NTSB	National Transportation Safety Board
OPA	Oil Pollution Act of 1990
OSHA	Occupational Health and Safety Administration
SARA	Superfund Amendments and Reauthorization Act
SERC	State Emergency Response Commission

Trends and Impact of Accident Occurrence

Below, we examine the recent trends in accident occurrence and impact. Within the limitations of the available data on chemical accidents, we profile the frequency of chemical accidents between 1987 and 1994 and their seriousness (as measured by deaths, injuries, and property damage.)

Accident Occurrence

Chemical Incident Releases

Table I.1 and figures I.1 through I.3 display information on initial notifications of chemical incident releases reported to the Emergency Response Notification System.[1]

Table I.1: Incidents Reported to Emergency Response Notification System[a]

Year	1987	1988	1989	1990	1991	1992	1993	1994
Total reports	26,662	28,554	33,337	34,185	35,483	35,693	37,204	39,817
Reports involving deaths	84	110	128	99	124	126	122	134
Total deaths[b]	1,147[b]	455[b]	201	148	162	163	159	185
Deaths per thousand total reports	43	16	6	4	5	5	4	5
Reports involving injuries	520	569	751	688	732	690	772	921
Total injuries	2,673	1,656	2,360	1,963	1,933	1,743	2,025	2,730
Injuries per thousand total reports	100	58	71	57	54	49	54	69

[a]The search for this information, which is based on initial notification data and may be subject to change, was performed on May 1, 1995, and reflects data as of that date.

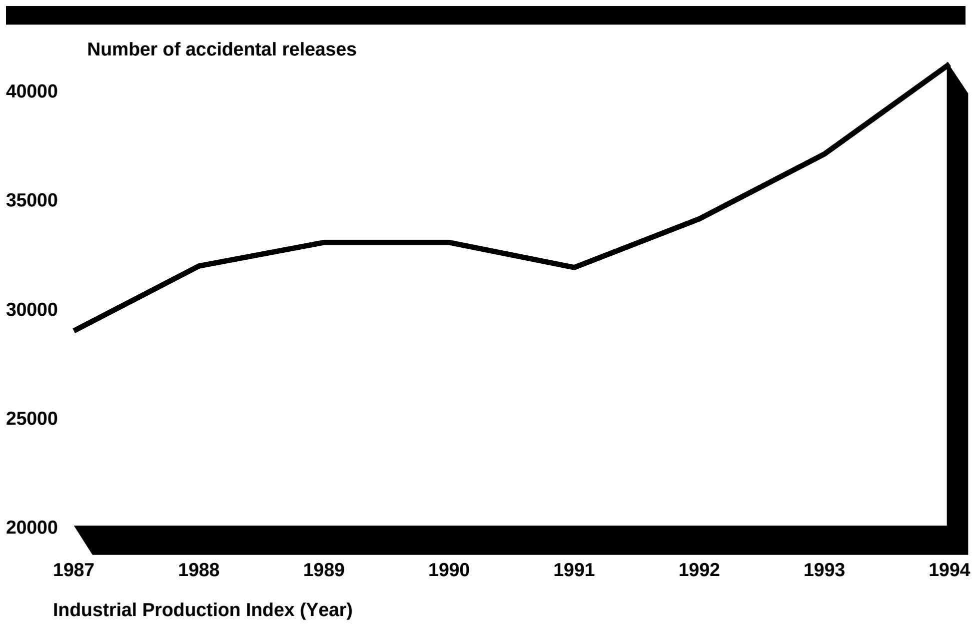
[b]Figures for 1987 and 1988 include human and animal deaths.

As shown in table I.1, the number of fixed-facility accident reports has been rising steadily over the period 1987 to 1994, from 26,662 to 39,817. However, according to EPA officials, more aggressive accident reporting may have contributed to this increase. In addition, industrial activity has steadily increased over this time frame; as a result, the level of accident frequency also rose.

[1]ERNS data are gathered as a part of initial accident notification.

Figure I.1 presents the results of a model where a measure of economic activity (an industrial production index developed by the Federal Reserve Board) is used to test the effect upon accident frequency.[2] The figure demonstrates that as industrial production increases, the number of accidents also increases as more opportunities exist for such events to occur. Thus, without specific interventions aimed at accident prevention, the number of accidents would be expected to increase in the future, assuming continued economic growth.

Figure I.1: Total Incidents Reported to ERNS Compared to Industrial Production

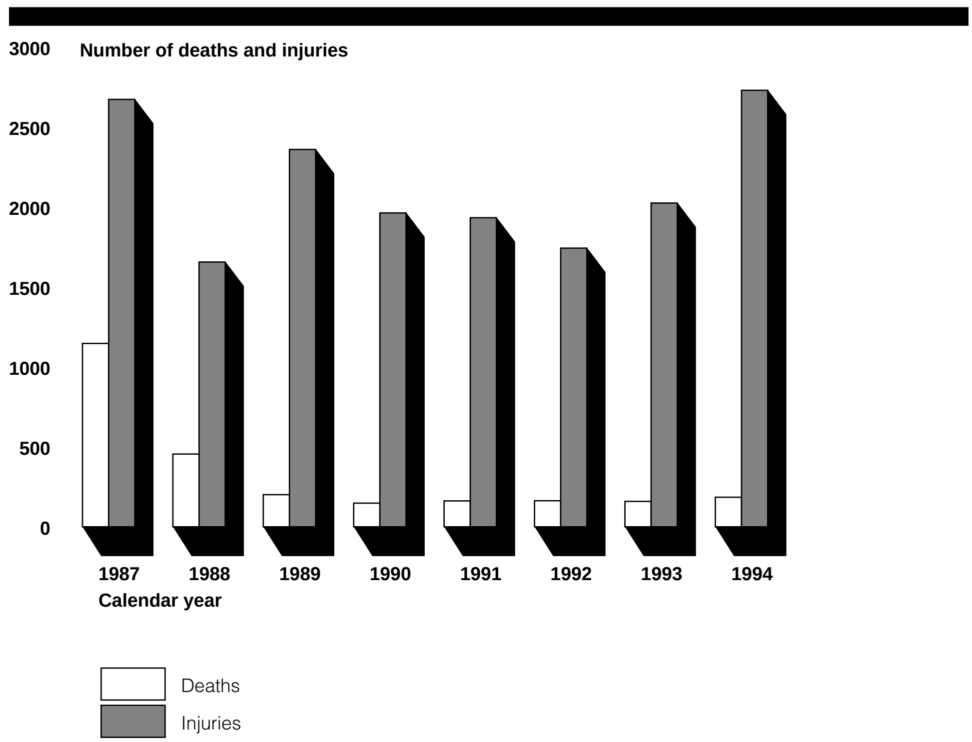


Source: EPA and Federal Reserve Board.

[2]We conducted a statistical analysis utilizing a regression model that demonstrated that, on average, a 1-percent increase in economic activity (as measured by an industrial production index) was associated with a 2.24-percent increase in the number of accidental releases.

Reported incidents can vary greatly in their severity. The number of initial reports of accidents involving deaths has varied between 84 and 134. These reports have not followed a clear trend from 1987 to 1994, although the number of reported deaths has remained in a fairly narrow range since 1989 (prior to that year, ERNS data included nonhuman deaths as well as human deaths). The number of initial reports involving injuries has ranged from 520 to 921, while the number of total injuries has ranged from 1,656 to 2,730. Figure I.2 chronicles the numbers of deaths and injuries reported to ERNS.

Figure I.2: Deaths and Injuries Reported to ERNS[a]

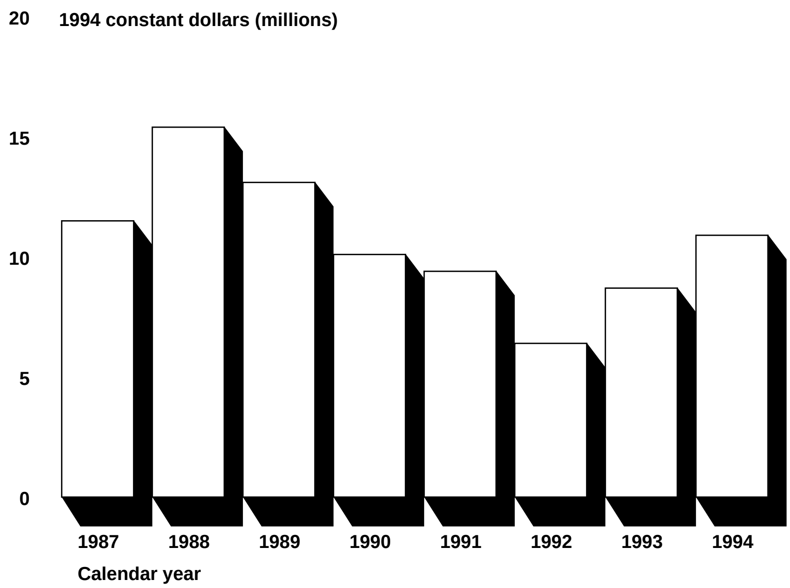


[a]Calendar years 1987 and 1988 include human and nonhuman deaths.

Source: EPA.

As shown in figure I.3, initial reports of total property damage (standardized to 1994 dollars) have ranged from approximately $6 million to slightly over $15 million.

Figure I.3: Total Property Damage Reported to ERNS

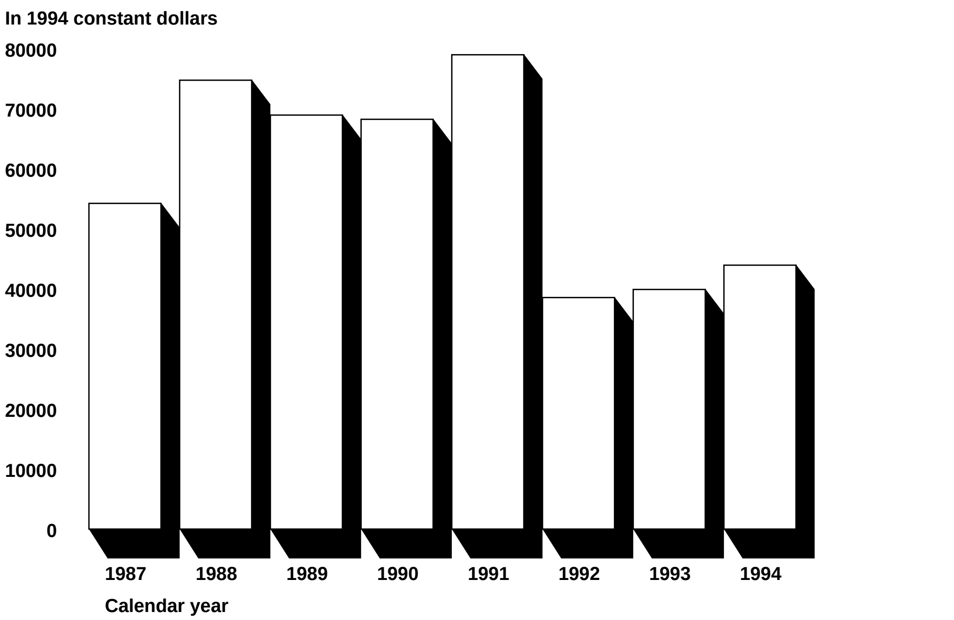


Source: EPA.

To demonstrate the seriousness of these chemical accidents, we developed the following two ratios for each year: deaths per thousand total reports and injuries per thousand total reports. The results of those calculations, also presented in table I.1, show that while the number of reported cases has been increasing over time, the number of deaths per thousand reports has remained fairly constant since 1989. The estimated number of injuries per thousand reports reached a high point in 1987, but has remained fairly constant since then.

We also calculated the average cost of property damage (as estimated in initial reports) per report involving such damage. Figure I.4 provides the results. The average cost has varied from slightly less than $40,000 to well over $70,000, dropping significantly in 1992 and remaining fairly steady in 1993 and 1994.

Figure I.4: Average Cost of Property Damage per Damage Incident



Source: EPA.

Therefore, while the number of reported chemical accidents has been increasing, overall—with the exception of property damage costs—their outcome, as measured by initial reports, has changed little over time. Furthermore, the apparent increase in accident occurrence may partially be the result of more aggressive reporting of these accidents and increasing levels of production.

The above analyses focus upon actual accident impacts. We also analyzed the extent to which populations were at risk during chemical accidents. To accomplish this, we obtained data from ERNS on the number of people evacuated (by the time of the initial report) between 1991 and 1994.[3] In

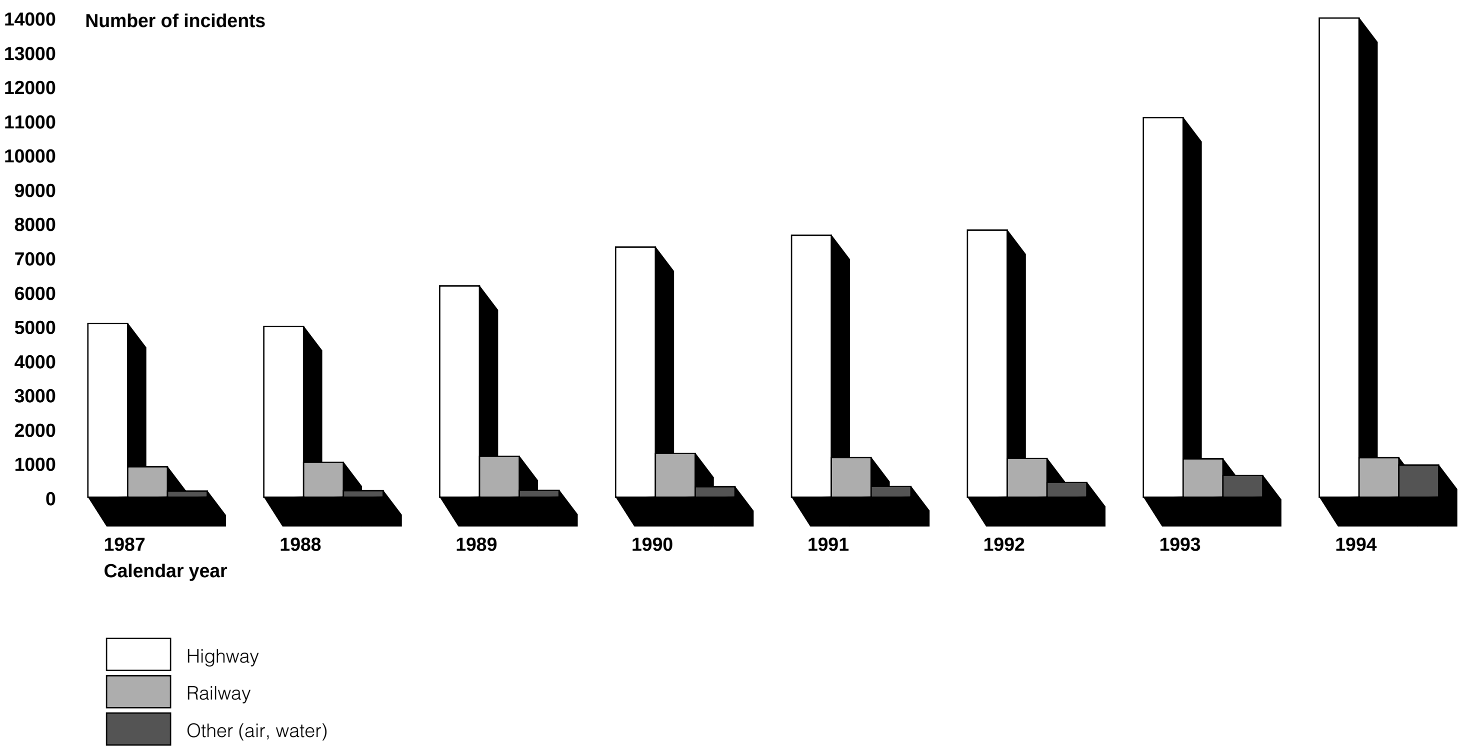
[3]This information was not collected before 1991.

1991, approximately 34,000 people were evacuated. This decreased to 19,000 in 1992, grew to 28,000 in 1993, and fell back to about 17,000 in 1994. While chemical accidents have maintained relatively low actual impact, these evacuation figures suggest that, in the judgment of those responsible for evacuations, the potential for harm is fairly high.

Transportation Accidents

Figures I.5 through I.12 summarize information about chemical accidents from 1987 until 1994 for highway, railway, and "other" (including air and water) transportation modes. These data are adapted from the Hazardous Materials Information System, maintained by the Department of Transportation. As shown in figure I.5, highway accidents have been the most common and have risen fairly steadily from about 5,000 to 14,000 incidents over this time frame.

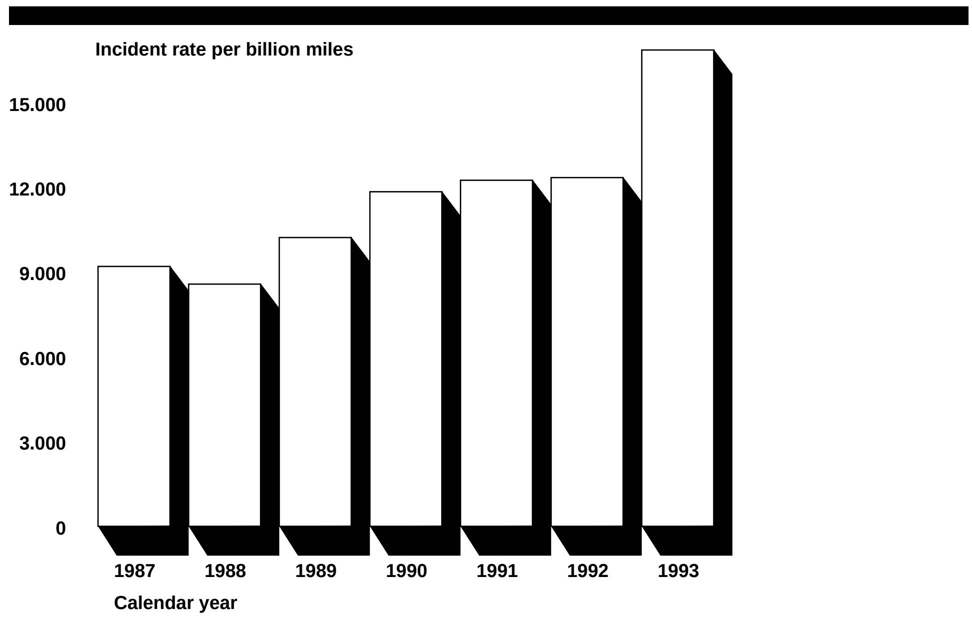
Figure I.5: Incidents by Transportation Mode



Source: DOT.

As demonstrated in figure I.6, even after accounting for the increasing mileage being driven by trucks (rates per billion truck miles), there is an increase in the reported number of chemical accidents.

Figure I.6: Chemical Incident Rates—Highway[a]

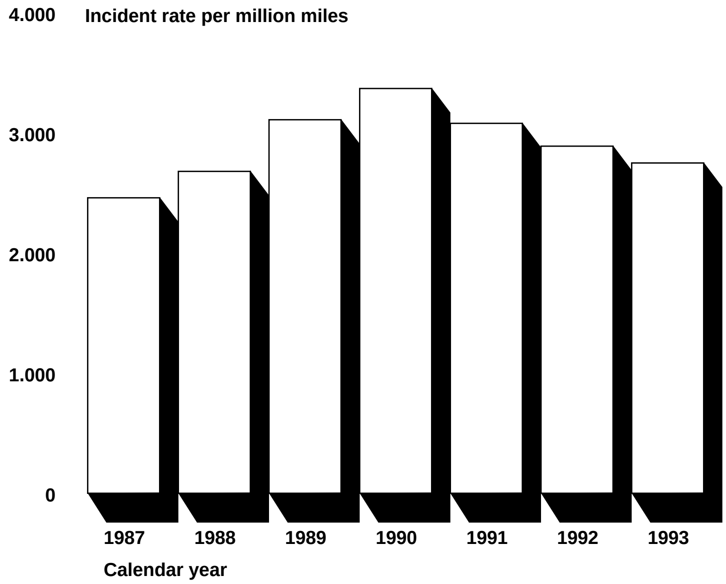


[a]Data for 1994 are not available.

Source: DOT.

Railway cases have held fairly constant (approximately 1,000 per year), while other accidents have slightly risen in recent years to approach the number of railway cases. After accounting for mileage for railway cases (figure I.7), a slight downturn in incident rates is found.

Figure I.7: Chemical Incident Rates—Railway (Freight)[a]

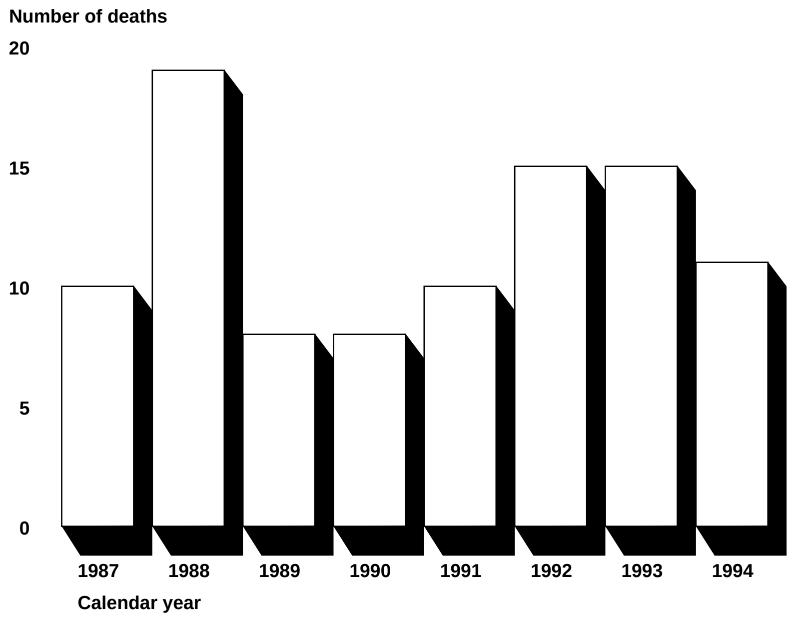


[a]Data for 1994 are not available.

Source: DOT.

Figure I.8 depicts deaths from chemical transportation accidents. These resulted only from highway incidents, peaking in 1988 at 19 and ranging to as low as 8.

Figure I.8: Deaths by Transportation Mode (Highway) and Incident Year[a]

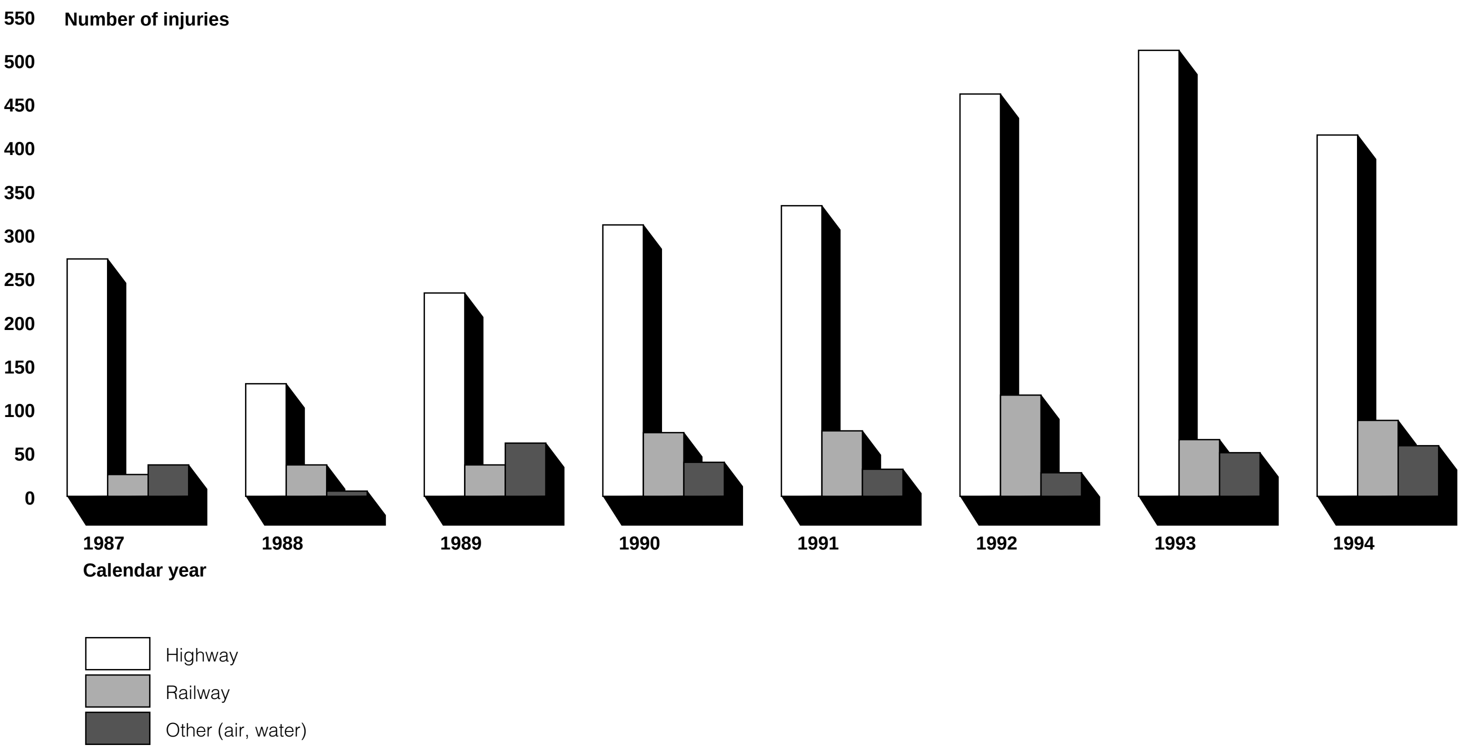


[a]There were no reported deaths for railway, air, or water.

Source: DOT.

As shown in figure I.9, the injury toll for highway accidents involving chemicals has risen markedly since 1988 to as high as 500, although it declined in 1994 to approximately 400. Injuries from railway accidents have generally been increasing over time, while injuries attributed to other modes have remained fairly constant since 1989.

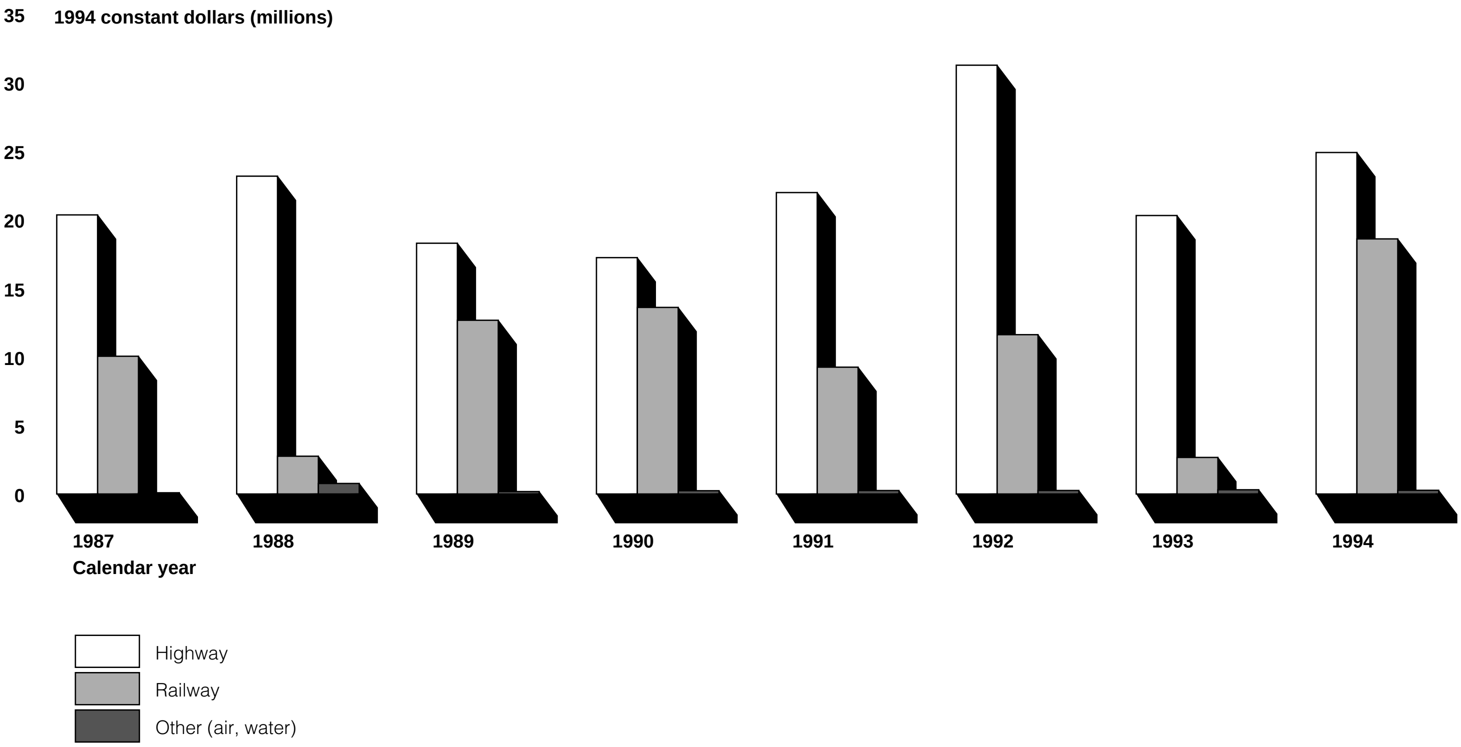
Figure I.9: Injuries by Transportation Mode and Incident Year



Source: DOT.

As shown in figure I.10, property damage estimates show no clear trend for highway and railway chemical accidents, although other modes have consistently caused little damage.

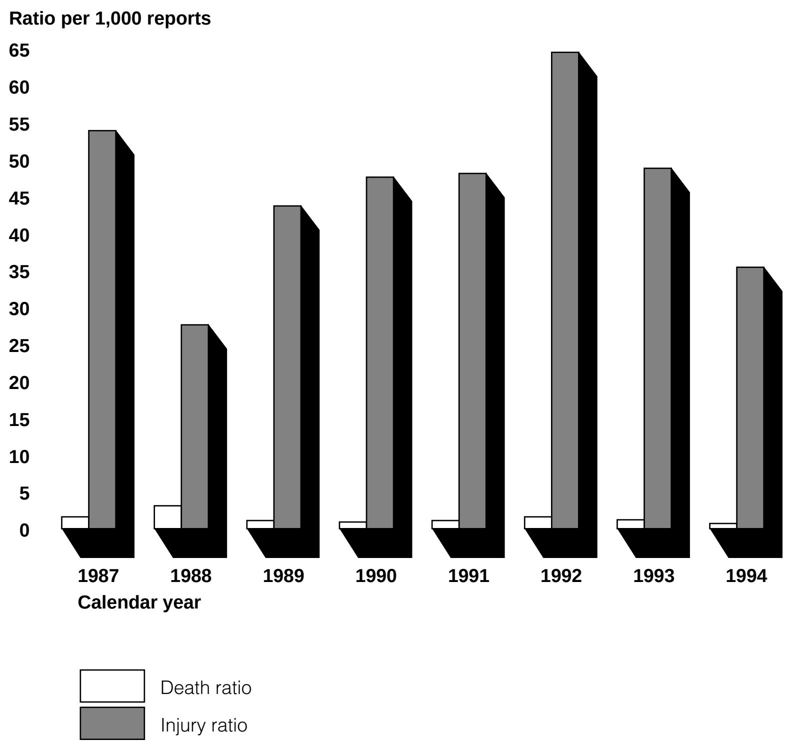
Figure I.10: Property Damage by Transportation Mode and Incident Year



Source: DOT.

To depict the seriousness of these transportation accidents, we calculated ratios that demonstrate the number of deaths and injuries per 1,000 reports. As shown in figure I.11, the ratio of deaths to total reports is fairly flat, while the ratio of injuries to total reports does not follow a clear trend.

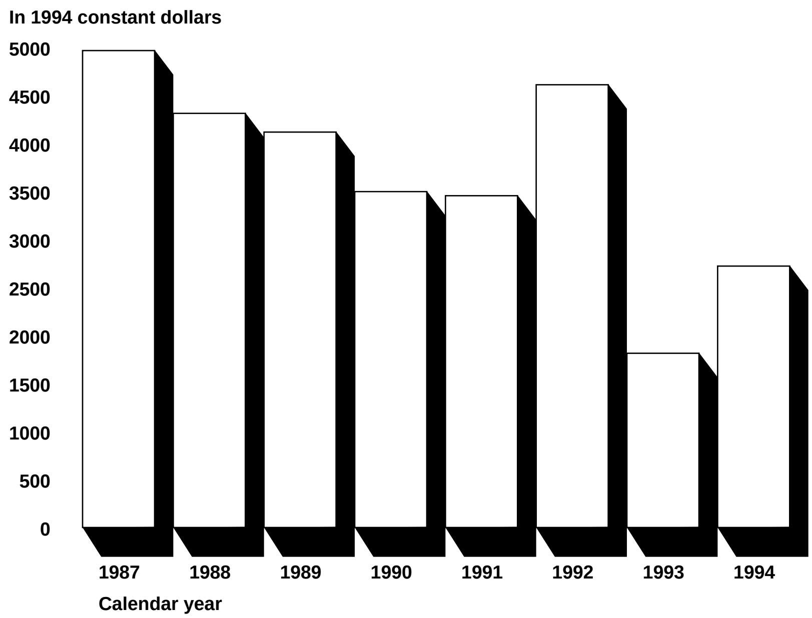
Figure I.11: Ratio of Deaths and Injuries to Total Transportation Accident Reports



Source: DOT.

We also calculated the average cost (in dollars) of property damage per report involving such damage. Figure I.12 shows that the average property damage for transportation accidents has ranged from approximately $1,800 to $5,000, peaking in 1987.

Figure I.12: Average Cost of Property Damage per Incident Report[a]



[a]Includes highway, railway, air, and water.

Source: DOT.

Database Limitations

ERNS data are compiled from initial reports of accident data submitted to the National Response Center, EPA regional offices, and until 1989, U.S. Coast Guard field offices.[4] ARIP data are gathered by sending survey questionnaires to facilities that have reported serious chemical releases through ERNS. This information is gathered to develop accident prevention programs. The AHE database contains accident information from secondary sources, including newspapers, state government office files, and EPA office files. HMIS contains chemical accident data from

[4]Typically, the National Response Center is contacted by a representative of the party responsible for the accident, local response personnel, individuals that notice the consequences of a release, or a witness to the accident.

transportation incidents; the information is used to monitor DOT's hazardous materials transportation program.

EPA has identified several factors that seriously limit the extent of chemical accident data reliability and validity.[5] The agency has noted that there is significant evidence of data underreporting. Many accidents are not reported to federal authorities. In some cases, those involved in accidents have been unaware of reporting requirements.

There has been no independent verification of information provided from industry; much of the data are based upon estimates that cannot be readily validated. Reports and surveys completed by facilities may not disclose what could be self-incriminating information. There are inconsistencies among various industry officials who report information: questions are not uniformly interpreted among all respondents and technical expertise varies. Thus, information about accidents is largely incomplete, often lacking details regarding such basic technological issues as type of production process involved.

Situational factors, such as management issues and policies, are not routinely reported. These could provide unique reasons as to why accidents occur, and accident scenarios could then be developed. Having incomplete data makes it difficult to learn about accidents.

Information is not systematically gathered on “near misses,” which eliminates a wide range of knowledge on accident potential. According to a recent study on accident prevention conducted by the Massachusetts Institute of Technology, the data reporting systems that exist are somewhat duplicative and also incompatible.[6] Terms differ among databases, such that variables cannot be linked or otherwise combined for analysis. This problem is compounded by the different time periods that the databases cover. For example, ERNS has been in existence since 1986, while AHE data were compiled for only 5 years (1982-86).[7]

In response to these problems, EPA published, in September 1995, a users' guide to federal accident release databases. This document describes each database, including the data fields, reporting criteria, and points of

[5]See A Review of Federal Authorities for Hazardous Materials Accident Safety, EPA (Dec. 1993).

[6]See The Encouragement of Technological Change for Preventing Chemical Accidents, MIT (1993).

[7]See Environmental Protection: EPA's Problems With Collection and Management of Scientific Data and Its Effort to Address Them (GAO/T-RCED-95-174; May 12, 1995) for a general overview of EPA's problems with gathering and managing data on pollutants.

contact. It also identifies common information among the databases to allow users to cross-search for information on a particular accident. EPA has also made accident databases accessible via the Internet.

Trend analyses with these accident data are difficult to construct. While the existing databases give frequency counts of accidents, they do not allow us to determine how these counts relate to changes in industrial production. For example, an increase in the number of accidents could be a result of increased levels of production rather than a marked decrease in factory safety.[8]

The accident databases have specific inherent problems. The ERNS database is prone to inaccuracies. Accident data are reported to ERNS when events occur and before the information is verified.[9] As a result, at the time of reporting, it may be unclear how many casualties resulted, the extent of economic damage, or the types of chemicals involved. Duplicate reports may also exist within ERNS, estimated at 5 percent of the total cases.

The ARIP database depicts a limited subset of accidents.[10] Cases meeting specific criteria are included, but the vast majority of cases are excluded, and the cases included are not statistically representative of all accident cases.

At one point, ARIP was not updated on a timely basis. Until July 1995, the most recent data that could be accessed from ARIP were from 1993. As noted by an EPA official, contractual problems involving a private company delayed the updating of the database, which generally maintains a 6-month to 1-year lag time. However, according to EPA, that problem has now been resolved.

The AHE database, compiled from secondary sources, has not been verified. EPA cautions that such sources are particularly prone to error.

[8]Companies generally produce a mix of product types. Different products utilize different types of chemicals, and the “product mix” changes over time. Assuming that chemical types are associated with varied levels of accident risk, an increase in the use of certain chemicals may result in a greater risk of an accident. Currently available accident data do not account for the extent of product mix.

[9]EPA has noted that ERNS does have the capability to capture follow-up information on releases and spills, but more resources would be required to collect such information. Currently, parties responsible for incidents are not required to report updated data.

[10]Generally, accidents are included if significant off-site impact (death, injury, evacuations, shelter-in-place) or environmental damage (wildlife kills, significant vegetation damage, soil contamination, ground and surface water contamination) occur.

Furthermore, the AHE database covers only a 5-year time frame, and it is no longer active.

The HMIS database is limited to the information that a transportation carrier has knowledge of and reports. In some cases, information on chemicals may be destroyed during the events surrounding the accident, and according to a DOT official, a driver or train operator may not know what materials are being shipped. Furthermore, DOT has no assurance that it is receiving all accident reports as the reporting burden is placed upon carriers.

Chemical Accident Preparedness

The national strategy on chemical accident safety policy depends heavily on local communities to prepare for chemical accidents. EPA provides resources aimed at furthering the mission of this strategy. Generally stated, EPA depends upon Local Emergency Planning Committees to prepare communities for chemical accidents and, in turn, provides assistance to them. EPA provides various tools, publications, and technical assistance to LEPCs. However, as noted in a recent national survey of LEPC members, many of them are unfamiliar with these resources.[1] For example, one-third of LEPC members are unfamiliar with the software system that is used to map accident hazards, and nearly 30 percent of the LEPC members are unfamiliar with the most well-known EPA publications, such as NRT1 Planning Book, Green Book and Chemicals in the Community.[2] Other publications, such as Managing Chemicals Safely, Opportunities and Challenges, and Making It Work have even lower familiarity ratings.

Local Emergency Planning Committees are required to maintain a number of functions. They must

- have a chairperson,
- have an emergency coordinator,
- have an information coordinator,
- have members representing local interest groups,
- hold formal public meetings,
- advertise meetings to the public,
- design an emergency response plan,
- have a plan incorporating at least nine key elements, and
- review the plan once a year.

The 1994 survey of LEPCs found that these organizations, generally, have filled the leadership positions, held meetings, maintained committee membership, and correctly developed and maintained their emergency plans. However, the study found that public communications mandates are not followed to a significant extent. For example, less than half of the LEPCs publish newspaper notices of the public availability of their emergency plans, and only 70 percent of them advertise meetings to the public. The study also found that rural and small town LEPCs tend to be quite inactive and could profit from additional resources and guidance.

[1]Nationwide LEPC Survey, GWU (Oct. 1994).

[2]The software system is Computer Aided Management of Emergency Operations (CAMEO).

A study from Tufts University reported that LEPC communication with the public was passive and unidirectional; only modest attempts were made to facilitate citizen understanding of title III data on chemical hazards.[3] One impetus for the passage of EPCRA was the lack of public knowledge about chemical accident safety issues, so this finding suggests that such knowledge could still be limited.

The partnership of EPA and local communities in supporting local preparedness activities is not very strong or consistent. To be effective, local accident preparedness depends upon effective communication between EPA, local and state agencies and departments, and the public. Federal law places a significant responsibility upon LEPCs to prepare communities for chemical accidents, but the LEPCs have not sufficiently communicated the risks associated with such accidents to the public. As a lead federal agency with responsibilities in accident response, EPA has a large role in ensuring that the federal-local relationship works properly. To examine how these linkages could be improved, EPA sought the advice of experts in the field. These experts have suggested that EPA should bolster its efforts to assist the LEPCs in carrying out the requirements of title III of the Superfund Amendments and Reauthorization Act (SARA).[4] They suggested that EPA take an active role in evaluating LEPC performance, in assisting LEPCs in identifying possible funding sources, and in assessing the extent to which LEPCs have utilized information. Overall, the participants stressed the growing importance of LEPCs in managing chemical accident risk, especially as industry is required to develop Risk Management Plans in accordance with the Clean Air Act Amendments of 1990.

Despite these weaknesses, nearly 80 percent of LEPCs are functioning and do execute many of their main responsibilities. Of these functioning LEPCs, a majority have filled their leadership positions and committee appointments. In addition, most hold regularly scheduled meetings and have completed and submitted emergency response plans to the appropriate State Emergency Response Commission, which serves as a link between LEPCs and EPA.[5]

[3]Risk Communication and Community Right-To-Know: A Four Community Study of SARA Title III, Tufts University Center for Environmental Management (Mar. 1991).

[4]The Future of Local Emergency Planning Committees: Report of a September 13-14, 1993 Meeting. Session sponsored by the Center for Risk Management at Resources for the Future, Washington, D.C. (The 30 participants represented federal, state, and local government, labor unions, the press, LEPCs, and State Emergency Response Commissions [SERCs].)

[5]These commissions have the authority and resources necessary to implement federal law for chemical accident preparedness.

Despite the relative weakness of the LEPCs in communicating the risks of accidents to the public, EPA has made accident data from ERNS available to the public, industry, and governmental agencies through three different methods. ERNS data can be obtained by contacting the manager of the database, by calling an information line, or by accessing the Internet.

Accident Case Study Descriptions

Below, we present detailed information about the accident cases examined for this report. Cases 1 through 3 involve fixed facilities, while cases 4 through 6 are transportation accidents.

Fixed-Facility Accidents

Case 1

In summer 1993, a building exploded at a chemical plant in Elyria, Ohio. This plant produces organic peroxides used as catalysts in plastic production. These peroxides are highly flammable and very reactive. The explosion occurred as workers combined two chemicals, which ruptured two tanks of sulfuric acid. The accident was caused by an overheated pump that went dry and ignited a nearby chemical tank. A fire followed the explosion and burned down the building and an adjacent one. Local and state officials were immediately dispatched to the scene. About 30 minutes after the first explosion, a second one occurred, severely damaging another building in the same plant.

A chemical cloud was released after the explosions, and several thousand area residents were evacuated from area neighborhoods.[1] The chemical cloud resulted from the release of two chemicals from ruptured supply pipes. Although no deaths resulted from the incident, approximately 75 people were treated for minor respiratory difficulties and acid vapor burns.

The EPA on-scene coordinator and technical assistance team arrived on the site within 5 hours of the first explosion.[2] At the time of their arrival, the chemical cloud was drifting in a northern direction, toward a housing development. The EPA official and technical assistance team monitored the air, and results suggested that area residents were not in danger. Within 10 hours of the first explosion, the fire was extinguished and no contaminants were found in the air. Cleanup efforts began, and residents were allowed to return to their homes.

[1]Estimates range from 4,000 to 7,000.

[2]The teams are comprised of EPA contractors that assist in emergency response functions, such as sampling and monitoring.

Case 2

In spring 1994, an explosion occurred in a plant processing area at a large petroleum plant in Bel Pre, Ohio, and three employees were killed. It caused two buildings and a tank farm to catch fire.

Several EPA regions became involved in the response effort. Within 2 hours of the incident, the EPA on-scene coordinator arranged for a technical assistance team to fly over the area to assess the situation. The team discovered that several 300,000-gallon styrene tanks were on fire, with flames shooting as high as 400 feet. Foam was used in an attempt to suppress the fires.

Additional technical assistance teams were dispatched by the EPA staff. The smoke plume was observed approximately 25 miles north of the accident site. However, evacuation efforts were limited to the immediate area, where 1,500 people were temporarily displaced.

Within 8 hours of the incident, significant progress had been made in extinguishing the fires. Air monitoring continued until most of the fires had been contained, while water sampling continued for several more hours. Samples were submitted for analysis.

Case 3

In summer 1994, an explosion occurred at a chemical manufacturing plant in Bristol Township, Pennsylvania. Local responders arrived within a few minutes and found heavy smoke and employees trapped inside. Within 30 minutes, the county hazardous materials team was requested to respond, and the county emergency management coordinator was en route to the scene. Approximately 150 area residents were evacuated.

Within 2 hours, all victims were removed; these included three employees of the plant who were injured. Forty others were taken to the hospital as a precaution. Within 2 hours, EPA officials and contractors had begun to monitor the air and water quality. EPA was assisted by the U.S. Coast Guard and county officials. The incident did not escalate beyond the initial explosion and fire, although the scene was secured by the local responders for 2 days.

Transportation Accidents

Case 4

In spring 1994, an 18-wheel tractor-trailer truck carrying a large quantity of the chemical aldicard veered off the road, struck a highway sign, and caught fire. This accident, which occurred in a suburb of Dallas, killed the driver of the vehicle. No other casualties were reported.

An EPA regional office, in the vicinity of the accident, received word of the accident through media reports. Within 2 hours, an EPA on-scene coordinator and technical assistance team were at the site conducting monitoring activities. These officials worked with state, county, and local officials to contain the accident.

Because of a toxic plume, city fire department officials evacuated at least 5,000 residents downwind of the site. Early the next day, sampling results confirmed that no danger existed for the area, so the evacuation order was lifted.

Case 5

Early in 1994, a freight train derailed in Fremont, California. Because of poor lubrication, the railcars were unable to negotiate a curve and the train derailed. The derailed cars struck a large beam and two containers of hazardous materials fell into an adjacent creek, which serves as a source of drinking water for area residents. One of the containers caught fire and burned for several hours. An estimated 3 million gallons of water were contaminated. Within 4 hours, an EPA on-scene coordinator arrived and met with the local responders. Several other government officials were involved in the case, including state, county, and federal responders in addition to EPA. A railway representative was also on-site. No injuries were reported.

Within 10 hours, the fire burned out. The responders implemented a plan to flush the contaminated water into the sewer. Within 2 days, the sampling of surface water revealed no detection of chemicals. Groundwater was sampled for a much longer period of time; by the end of the third month, the concentration of chemicals was below the maximum contaminant levels for drinking water.

Case 6

In spring 1994, a dump truck collided with a gasoline tanker in Montville, Connecticut. The dump truck gouged a large hole in one of the gasoline tanker's fuel compartments. The accident caused an explosion and fire, resulting in the death of the dump truck driver and injuries to five people. Two of the injured were hospitalized. Several homes and a small motel were evacuated. The escaped gasoline went into a brook and ignited, burning about half an acre of wetlands. Several telephone poles and utility lines were burned down, and five other vehicles were severely damaged. Several area fire departments responded quickly, and the fire was extinguished within 2-1/2 hours. Later, state officials arrived to supervise cleanup operations. Early the next morning, an EPA on-scene coordinator arrived along with a technical assistance team. Groundwater and air monitoring was initiated, and the tests indicated no contamination. However, the soil was contaminated; it was excavated and replaced with clean soil within 2 days of the accident.

EPA Prevention Activities

This appendix provides an elaboration on EPA's accident prevention activities. These activities include a review of emergency systems, ARIP and CSA Program, process safety management, and outreach efforts conducted by the agency.

Emergency Systems Review

Before the enactment of the Clean Air Act Amendments of 1990, EPA conducted a review of emergency systems used to monitor, detect, and prevent chemical accidents.[1] The review focused on 21 chemicals chosen from the list of extremely hazardous substances developed under SARA.[2] A panel of experts reviewed the preliminary findings and made suggestions. The findings and recommendations were submitted to the states for comment and were also reviewed by officials from industry, trade associations, other Federal agencies, and environmental interest groups. EPA found that prevention of chemical accidents requires a comprehensive, integrated approach. Such an approach must consider the hazards of the chemicals in question, the process' hazards, the capabilities of the site's personnel, and the possible impact on the community.

A comprehensive approach requires that management be committed to installing, maintaining, and updating appropriate technologies and providing personnel training. In addition, the facility should be involved with the local community, with industry, and with professional groups in order to show its commitment to safety. These findings were consistent with those of industry and professional organizations, including the Chemical Manufacturers Association, American Petroleum Institute, and the Center for Chemical Process Safety.[3] On the basis of this report, EPA recommended that industry take the primary responsibility for preventing accidents and ensuring the safety of its workers and the public health of the community. In addition, a recommendation was made to form a Chemical Accident Prevention advisory committee to develop a strategy for implementing the prevention of chemical accidents.

[1]See Review of Emergency Systems, Report to Congress, Section 305(b) Title III Superfund Amendments and Reauthorization Act of 1986, EPA Office of Solid Waste and Emergency Response (June 1988).

[2]In order to begin identifying facilities to be covered by the new SARA requirements, EPA was directed to develop a list of extremely hazardous substances. Facilities using certain threshold quantities of such substances are covered.

[3]In addition to EPA's programs, private industry has established various initiatives geared toward accident prevention. The Chemical Manufacturers' Association, a trade group representing the chemical industry, utilizes their "Responsible CARE" program to promote safe chemical manufacturing, transportation, and disposal. The American Petroleum Institute, through the "Strategies for Today's Environmental Partnership" program, promotes the reduction of accidental petroleum spills, fires, and explosions.

The emergency systems review study (completed in 1988) recommended that LEPCs increase public awareness of accident prevention issues. However, as discussed in the letter, studies of LEPCs completed as recently as 1994 find that accident risk issues are not well communicated to community residents. Placing accident prevention responsibilities upon industry does not complete the other important link of community involvement. Such an approach to accident prevention is less likely to be effective if risks are not communicated to the public.

ARIP and CSA Program

Accidental Release Information Program

Both ARIP and the CSA Program are based on findings from the emergency systems review. ARIP focuses on accident prevention by collecting data on the causes of accidents, and the CSA Program is used to encourage accident prevention and identify problem areas that may result in accidents.[4] ARIP is an information collection tool begun by EPA in 1986 to obtain data on accidents so that past history could be used to prevent such incidents in the future. As noted by EPA, this program is designed to serve many purposes, including

- Identifying problems (that is, facilities showing a persistent pattern of small releases that may foreshadow more severe future releases) and alerting facility management to the problem;
- Heightening corporate awareness and involvement in preventing accidental releases through a thought-provoking questionnaire;[5] and
- Providing LEPCs and SERCs with important information useful both in preparing emergency response plans mandated by title III and in working with facilities to reduce hazards through prevention.[6]

As EPA has recently noted, ARIP provides significant information in the risk management planning process required by the Clean Air Act Amendments

[4]In addition, EPA maintains an oil pollution prevention team, which is charged with preventing petroleum accidents in underground storage tanks.

[5]EPA sends ARIP questionnaires to facilities that report significant or frequent releases to the National Response Center, if these releases fit under the confines of the program.

[6]See Why Accidents Occur: Insights From the Accidental Release Information Program, EPA Office of Solid Waste and Emergency Response (July 1989).

of 1990. To that end, ARIP serves to provide data in the development of risk management plans for accident prevention.

With ARIP, information on the causes of serious accidents and preventive practices before and after an accidental release is collected. ARIP includes information on the most serious or potentially serious releases.[7] Generally, accidents are included if significant off-site impact (death, injury, evacuations) or environmental damage (wildlife kills, significant vegetation damage, soil contamination, ground and surface water contamination) occurs.[8] ARIP information is combined into a national database, and analyses are disseminated to personnel involved in chemical accident activities in industry, in EPA regional offices, and in the community. The ARIP database contains information on approximately 4,700 serious chemical incidents that have occurred since 1987. The overall response rate to the questionnaire is nearly 100 percent.

After identifying an incident that meets the criteria, EPA sends a questionnaire to the facility, requesting the following information: the chemical and amount released; the environmental media affected; and the number of injuries, evacuations, and deaths.[9] In addition, information is gathered on the duration of the release, the conditions preceding the release, the existence of any hazard assessment, and actions taken to prevent a recurrence.

EPA distributes bulletins to state and local officials that present ARIP data. This information includes discussions of accident causes and the steps taken to prevent them. EPA regions use ARIP data as one of the bases for selecting facilities for the Chemical Safety Audit Program (see below). Finally, analyses of ARIP have also been used to set policy and prepare legislation. For example, ARIP data were used by EPA headquarters to prepare the list of facilities that will be required to comply with the Risk Management Plans mandated under the Clean Air Act Amendments of 1990, section 112(r).

[7]ARIP is intended to include reported incidents of CERCLA hazardous substances or EPCRA extremely hazardous chemicals. Further details on ARIP can be found in EPA's Federal Authorities for Hazardous Materials Accident Safety (Dec. 1993).

[8]See Accidental Release Information Program (ARIP) Fact Sheet, EPA (Nov. 1993).

[9]Facilities are initially identified from data provided to ERNS.

Since no other accident databases provide comprehensive information on the causes of accidents, EPA relies heavily on ARIP to help meet its prevention responsibilities. EPA refers to the program as "the best available database on the causes of, and means of preventing, chemical accidents."[10]

The Accidental Release Information Program exhibits three major limitations in furthering the EPA accident prevention goals. The first limitation is the fairly narrow scope of the program. The database includes only a limited subset of accidents. Reports are biased toward larger, more severe, and more frequent releases.[11] While these requirements include "extremely hazardous" substances, some problematic chemicals are still ignored, increasing the accident vulnerability of industries with less common production processes. For example, accidents associated with flammable or petroleum products are excluded. As noted above, one of the purposes of ARIP is to uncover national trends of accidentally released chemicals and how they happen. However, since ARIP exclusively focuses on serious releases, any national trends in accidents that may be widespread but that are not considered "serious" will not be documented. EPA has noted that ARIP is not designed to obtain national trends on accident occurrence. In addition, no other databases provide trend information. We believe that this greatly limits the extent to which accident occurrence can be understood.

The second limitation stems from the point, noted above, that a major purpose of ARIP is to provide information for Local Emergency Planning Committees to use to promote accident prevention by industry. However, LEPCs are quite weak in carrying out their public communications responsibilities. The Community Right-To-Know provisions of SARA title III provide the mechanism to increase the public's awareness of chemical hazards, thereby encouraging community involvement in responding to and preventing chemical accidents by, for example, lobbying industry to take the necessary preventive steps.[12] However, three major studies have shown fairly weak communications between LEPCs and the community.[13]

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[10]Why Accidents Occur (July 1989), p. 13.

[11]EPA has noted that ARIP's bias toward more serious releases is intentional. Agency resources do not allow smaller events to be included, therefore larger accidents are surveyed to maximize the amount of information obtained from each facility.

[12]As a result of the Community Right-To-Know provisions, information on toxic chemicals is made available to the public. These provisions authorize public involvement in emergency response planning. They require that the public have access to data that allows them to take appropriate actions.

[13]See Communicating With the Public About Hazardous Materials: An Examination of Local Practice, EPA (Apr. 1990); Risk Communication and Community Right-To-Know, Tufts University (Mar. 1991); and Nationwide LEPC Survey, GWU (Oct. 1994).

With such weak linkages, the public is unlikely to be aware of the important prevention data gathered by ARIP, especially given the reliance that EPA has on the program to promote accident prevention. However, as EPA has noted, the risk management planning process requires the use of accident history data that may be used to encourage local action on accident hazards.

Finally, on at least one occasion, data gathered for ARIP were not updated on a timely basis. Because of organizational difficulties, the lag time in obtaining the data can be as great as or longer than 1 year. Until July 1995, the most recent data for ARIP were from 1993, limiting the extent to which new information on accident prevention can be quickly disseminated. Recently, however, this situation has been corrected, and the data are being updated regularly. Furthermore, EPA is providing accident data online through the Internet.

Chemical Safety Audit Program

The Chemical Safety Audit Program was started by EPA in 1988 as a means of identifying the causes of accidental releases of hazardous chemicals and ways to prevent them. The program seeks to obtain information about industrial safety practices; promote safety awareness among industry; share safety information with communities, companies, and other interested groups; and develop a database with the results of safety audits.[14]

Under CERCLA, EPA has the authority to enter a facility and obtain information. Between the beginning of fiscal year 1989 (the beginning of the CSA Program) and the close of fiscal year 1994, EPA had undertaken 281 chemical safety audits and completed 270 audit reports and was conducting as many audits as agency resources allowed.[15] Audit teams have reviewed more than 175 hazardous chemicals, including 159 CERCLA hazardous substances and 69 listed in EPCRA as extremely hazardous substances.

An important element of the CSA Program is the development of personnel with the expertise to conduct safety audits. EPA has trained about 800 people in the analysis of process hazards, standard operating procedures, prevention and mitigation systems, safety audits, incident investigation, and interview techniques. These training sessions include EPA personnel as

[14]See Chemical Safety Audit Program: FY 1994 Status Report, EPA (May 1995).

[15]An EPA official stated that agency resources allow approximately 60 safety audits to be completed each year.

well as state and local staff.[16] Audited facilities are selected in various ways; EPA does not require regions to select audit sites in a prescribed manner.[17] Selection factors, to a certain extent, depend on the priorities of the region.[18] Nationwide, about 50 percent of the facilities targeted are identified through the ARIP database because of their history of accidental releases. Proximity to sensitive populations, high population density, or an industry's concentration in an area are also considered in the selection of audit sites. EPA regional offices may target certain processes or chemicals. Furthermore, an audit might be initiated at the request of a citizen or state or local government or from other agency referrals.

The audit entails a review of facility process characteristics, emergency planning and preparedness activities, hazard evaluation, release detection techniques, and several other areas. In particular, the facility's community emergency response planning procedures for public notification of releases are studied.[19]

Results of the audit are detailed in a report that is available to other facilities, trade associations, community groups, and state and local officials. Weaknesses as well as strengths in preventive practices (both operational and managerial) are discussed, along with recommendations for improvement.

Facilities are also chosen for audit under the CSA Program based on public requests and local concern. For example, citizens in a community can work through their LEPC to request an EPA audit. This procedure is authorized under the Community Right-To-Know provisions of SARA title III. However, citizens are unlikely to realize the risks associated with facilities in their communities, and LEPCs are not very effective in promoting the availability of this information. As noted in a recent study, most functioning LEPCs receive few inquiries from community residents.[20]

[16]This program is designed to develop chemical safety audit expertise both within and outside EPA, although only EPA staff are authorized to enter facilities.

[17]There are two important requirements for audit site selection: (1) A facility may be entered only if there has been a release outside facility walls, or if there is "reason to believe" that there is a threat of a release of a CERCLA hazardous substance; and (2) A facility with pending or active legal actions against it must be identified through the Office of the Regional Counsel and the SERC to ensure that an audit would not interfere with such actions. (See Chemical Safety Audit Program [May 1995].)

[18]For example, EPA Region 6 (which includes Texas, Oklahoma, Arkansas, New Mexico, and Louisiana) has concentrated on facilities on the gulf coast because of their potential for incidents associated with natural disasters such as hurricanes.

[19]The Chemical Emergency Preparedness and Prevention Office has provided regions with a Guidance Manual for EPA Chemical Safety Audit Team Members (June 1993), which details the elements of the audit and has a framework for the report.

[20]Nationwide LEPC Survey, GWU (Oct. 1994).

During a 12-month period (June 1993-June 1994), more than 40 percent of the LEPCs received no inquiries, while only a quarter received more than six. This apparent lack of public concern can result in fewer requests for audits, which may limit EPA's effectiveness.

EPA makes presentations to trade associations and other industry groups, community groups, and state and local officials on the lessons learned from the CSA Program. However, an EPA official told us that only about 20 such presentations are made each year, which limits the exposure of this information.

EPA follows up on some, but not all, of the safety audits. According to an EPA official, of the 10 EPA regions, five conduct follow-up procedures to some extent, although only three of these conduct this activity extensively. As a result, only about 20 percent of cases are followed up, and the EPA official estimates that 80 percent of audited recommendations in these cases are implemented. While some follow-up does occur, EPA has no formal mechanism to ensure feedback from facilities on their adoption of EPA recommendations. Facility compliance with recommendations is, for the most part, voluntary, so there is no assurance that they will be implemented.[21]

Process Safety Management

Process safety management is used to identify the potential risks at a facility and establish a systematic method for reducing those risks. EPA has incorporated this approach in the risk management planning regulations issued under the Clean Air Act Amendments of 1990. EPA believes that process safety management, over time, will improve facility safety. The agency envisions implementation of the program as a philosophy that must be embraced by both management and workers.[22] Although the chemical safety management program may vary from facility to facility, all programs perform the following:

- Take an inventory of hazardous materials at the site;
- Review the entire production process;
- Undertake studies to identify potential hazards, to assess the likelihood of accidents, to evaluate their potential consequences, and to address the serious problems first;
- Establish and follow a regular program of preventive maintenance;

[21]However, if serious problems are found during the audit, EPA has sufficient authority to remedy them.

[22]See Managing Chemicals Safely, EPA (March 1992).

- Develop standard operating procedures and training programs for employees;
- Manage changes in the operation so that accidents do not occur as a result of changes;
- Investigate and document accidents and near-accidents;
- Develop emergency response plans and coordinate them with local emergency planners; and
- Share information with the local community.

Many of these components of chemical safety management already exist in some facilities (such as training); the idea of chemical safety management is to bring them together into a coordinated policy strongly supported by top management.

EPA provides funding to the American Institute of Chemical Engineers' Center for Chemical Process Safety to conduct projects on process safety management. This center has representatives from 80 companies worldwide.

As stated previously, accident prevention activities undertaken by industry become more effective through strong communication links between industry, LEPCs, and community residents. Industry's commitment to process safety management and communication of risks along with public participation in understanding and acting on the risks are essential.

EPA Outreach Efforts

As noted in a recent study commissioned by EPA, gaps in information severely limit firms' ability to prevent accidents.[23] According to this study, firms tend to lack information on the hazards inherent in current production processes, the alternative technologies that would lessen accident risk, and the costs of serious accidents. However, EPA has been conducting a number of outreach efforts designed to better inform industry about the hazards essential to accident prevention. For example, the agency has produced documents for industry that provide technical guidance for hazard assessment, chemical profiles, and information-sharing requirements.

In addition, the agency conducts special studies of chemicals and writes advisories that are distributed to the LEPCs. A recent example of this practice is the Hydrogen Fluoride Study (on a widely used and highly toxic

[23]See The Encouragement of Technological Change for Preventing Chemical Accidents, MIT (July 1993).

and corrosive substance) reported to Congress in 1993. EPA found that accidental releases of this chemical can be prevented through process safety management principles and recommended that facilities handling this substance work closely with the LEPCs to increase public awareness for adequate emergency response. This report also was distributed to all industries that use this chemical (about 500 facilities).

The agency also works with organizations such as the Center for Chemical Process Safety, an association of 80 chemical companies worldwide. EPA provides the Center with funding to do special projects such as a primer for LEPCs and a book on putting process safety management in nontechnical language. In addition, EPA works closely with the American Institute of Chemical Engineers, which provides technical resources to the agency. Other EPA prevention activities include funding university studies and working with small businesses that have little knowledge of chemicals. EPA advises them on the safe management of hazardous substances.

Major Contributors to This Report

Program Evaluation and Methodology Division

Marcia G. Crosse, Assistant Director
Lawrence S. Solomon, Senior Evaluator
Nila Garces-Osorio, Social Science Analyst
Robert E. White, Project Adviser
Venkareddy Chennareddy, Referencer

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