

State and Local Issues in Transportation of Hazardous Materials: Toward a National Strategy

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Findings of a recent conference whose objective was to identify effective state and local methods for managing hazardous materials transportation within an evolving national system are described in this paper. The conference was organized into five major themes: community preparedness and emergency response, evaluating and communicating risk, routing and siting considerations, data collection and information management, and inspection and enforcement. Although consensus was reached on several recent developments, several critical needs were identified, which form a future research and program policy agenda. A detailed discussion of recent accomplishments and proposed future initiatives by theme, leading to a general assessment of the effort required to maintain a level of adequacy necessary to manage the safe movement of hazardous materials, is presented.

The transportation of hazardous materials is inherent in any advanced and technologically complex society. A number of industrial processes of vital economic importance are dependent on the uninterrupted flow of hazardous materials shipments. However, when these shipments are made, there is significant potential danger to the population and the environment in the event of a release. The risks associated with the transportation of hazardous materials have drawn considerable attention at local, national and international levels, resulting in the development of a regulatory framework to enhance operational safety.

Many responsibilities associated with the safe transport of hazardous materials have been placed with state and local governments. Such tasks include community preparedness and emergency response, evaluating and communicating risk, routing and siting considerations, data collection and information management, and inspection and enforcement. The extent of assumption of these responsibilities varies across the country, and jurisdictional purview in some areas is subject to debate. Nevertheless, several exemplary activities have been undertaken by state and local governments that are compatible with the development of a national strategy, and which

have been beneficial in managing the safe transport of dangerous goods.

To address these considerations, a national conference, sponsored by the Transportation Research Board (TRB) and many other organizations, was held in St. Louis in May 1990. The principal objective of this conference was to enhance the exchange of information concerning effective state and local methods for managing hazardous materials transportation within an evolving national system. Although state and local agencies were the primary consideration in this forum, industry, the federal government, and other affected parties attended and participated actively to provide a broader perspective of the complexity involved in the safe transport of hazardous materials.

The conference itself was organized into five major themes:

1. Community preparedness and emergency response,
2. Evaluating and communicating risk,
3. Routing and siting considerations,
4. Data collection and information management, and
5. Inspection and enforcement.

What follows is a summary description, by theme, of the major conclusions reached through the conference proceedings.

COMMUNITY PREPAREDNESS AND EMERGENCY RESPONSE

From the conference, it became apparent that a growing consensus is forming on the work needed to improve emergency preparedness across the nation, yet there is basic disagreement over the degree to which we are or are not adequately prepared.

The conference participants concluded that there is greater awareness of the need to get people involved and to maintain adequate emergency preparedness. Significant actions are being taken to help resolve some of the major roadblocks preventing overall emergency preparedness capability. They include the following:

1. Title III of the Superfund Amendments and Reauthorization Act (SARA) has been enacted and is being implemented by a number of states and localities;

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2. Greater efforts are being made by the Federal Emergency Management Agency (FEMA) to focus on preparing communities for all types of emergencies;

3. A five federal agency cooperative has encouraged Congress to allocate funds for more flexible purposes and that FEMA's role be strengthened and clarified;

4. National competency standards for responders have been prepared;

5. The U.S. Department of Transportation (U.S. DOT) is spending more time on hazardous materials transportation management issues than ever before;

6. The U.S. Department of Energy (DOE), with respect to radioactive waste transportation, is making a concerted effort to develop open, two-way communication with affected parties, and has outlined a number of specific initiatives; U.S. DOE has recognized that the greatest obstacle the radioactive waste program faces is public perception about the danger of radioactive waste;

7. States have increased their enforcement efforts as a result of SARA Title III, resulting in 30 states having their own fee system. Almost all states have adopted federal regulations on hazardous materials.

Despite this progress, states still believe that existing regulations are too complicated and restrictive; the federal government provides too few resources; federal training must be more comprehensive and coordinated; and there is a need for preemption of state and local activities. Fortunately, Congress is showing a greater awareness of problems that are technical and administrative as opposed to those that are political in nature, including the need for providing adequate training and an equitable method for distributing financial assistance.

An additional conference finding is that there is greater agreement among parties involved as to what constitutes adequate emergency preparedness. Encouraging examples of coordinated planning and response were described as part of the TRANSCAER program, developed by the Chemical Manufacturers Association (CMA). The key ingredient appears to be that industry works closely with local officials and then succeeds in having the locality make planning and response mechanisms their own. CMA is also preparing stringent disposal codes under its Responsible Care program, and the American Petroleum Institute has also adopted a set of operating procedures.

The two most popular words used during the conference to characterize successful emergency preparedness were *cooperation* and *communication*. The point was repeatedly made that if these two ingredients are present, then response will be successful. It may not be pretty or perfect, but it will suffice.

To have adequate cooperation and communication, however, the people involved must pursue information; it does not come to them without effort. Information has also progressed beyond the basics. There is growing knowledge as to the resources and system needed to respond to an incident, including:

1. Development of a good plan,
2. Ultimate authority in one place during an incident,
3. Proper basic equipment,
4. Proper technical communication equipment,
5. Quick access to experts, but final control over their differing views,

6. Ability to use media effectively to help,

7. A basic level of knowledge at dispatch, police, fire fighter, and local elected official levels.

8. A satisfactory decision-making process, and

9. Knowledge of what to look for and how to identify products.

A final finding emanating from the conference is that adequate preparedness on a national basis is still a long way off, primarily because many of those involved in this effort are volunteers. Volunteerism, for all it merits, presents problems, particularly in a discipline such as hazardous materials emergency preparedness, in which advanced communication, information gathering, and response capabilities are needed to ensure public health and environmental safety.

U.S. DOT has worked hard to expand its training network, but getting those who need the training to spend time away from their jobs is a problem. Although more information is available than ever before, additional guidance is needed for volunteers. Time may also be a problem for advanced levels of training, however, as these courses can exceed 200 hours of commitment.

Beyond these general conclusions, several other noteworthy observations were made:

1. More work is needed by state government, local authorities and industry in understanding what cooperation among sectors means.

2. More work is needed nationwide at the sub-state level to ensure that integrated broad base planning exists such as is required under SARA Title III.

3. Liability problems continue for industries and local responders arriving on the scene.

4. Most communities will not budget money for hazardous materials transportation preparedness; consequently it takes a long time for plans to develop. A \$400 budget commitment per year by a locality is typical.

5. One interesting revelation is that those involved have learned that a farm community of 4,000 residents faces the same risk considerations as a larger municipality.

6. A special area of concern was raised as to how one assesses the capabilities of carriers prior to transport; greater emphasis will have to be placed on this task by industry in the future.

7. Conference participants agreed that since current legislation introduced to monitor hazardous materials shipments may not provide an adequate solution to the real or important problems, further study is needed.

8. Confusion remains as to what materials are considered toxic or nontoxic; greater information on the nature of chemicals needs to be provided to those involved in order to allow for effective treatment.

A fitting summary, perhaps, to this area are two revealing quotes which emerged from the conference proceedings and shed appropriate light on the subject matter. They are, "a little hazardous materials knowledge is a bad thing," and "we must be prepared with the best we have to handle the worst that can occur."

EVALUATING AND COMMUNICATING RISK

Risk evaluation is part of a necessary process for making rational decisions on how to move hazardous materials. Risk

communication refers to a method of conveying and gaining public acceptance of the decisions which have been made. In the following discussion summarizing conference findings, these subjects are treated separately.

Risk Evaluation

Risk evaluation generally involves conducting a risk assessment. When risk assessment is performed, a number or a set of numbers expressing risk severity are typically generated. This process is often repeated for several alternatives to identify the best option when all issues are considered.

There is no question that making decisions on routing is the most frequent use of risk assessment. This was evident by the number of papers presented at the conference, including issues concerning rail routing, software applications that perform computerized routing, and routing issues involved at the state and regional level.

Several trends were identified in risk assessment, whether used for routing or some other application. First, people tend to prefer the use of local data for performing risk assessment rather than national data, when it is readily available. Examples of this trend were demonstrated by presentations on recent risk assessments performed in Pennsylvania, California, and Arizona using site-specific data. Secondly, the analysts are devoting more effort to factors other than cost and risk in developing risk assessments; in particular, risk aversion, risk equity, emergency response, and the proximity of sensitive facilities are emerging as other factors to consider. Finally, the trend to develop models on the basis of relative risk indexes instead of absolute risk continues.

A consensus is also forming that development of risk assessment methodology has been overemphasized, in comparison with practical implementation issues. Many believe that simpler models are better, serving as screening methods to support local decision making. It may be time to shift our focus to other areas instead of developing new ways to quantify risk, such as:

1. What is acceptable risk in a national framework? Are the comparisons to being struck by lightning or killed in a car accident reasonable or should some other benchmark be found?
2. There is a need to review and evaluate all of the risk models that are available, and assist decision makers in selecting a standardized approach to risk assessment.
3. Effort must be expended on understanding human factors and their effect on risk (e.g., effects of training on safety, acceptability of technological aids by drivers, etc.).

Ultimately, of course, even if transportation professionals become convinced that the risk assessment is accurate and the level of risk is acceptable, the public needs to become equally convinced. Hence, we must consider communication.

Communication

At the moment, risk communication poses a formidable challenge. There is a basic mistrust in the public mind of both big business and government that must be overcome. There is no question that additional resources must be devoted to this

topic so that rational decisions are made quickly, and the balance between risk and the need to move hazardous materials cost-effectively is preserved.

Of the several presentations made in this area, a number of noteworthy quotes emerged:

- "Educating the public comes after educating yourself."
- "The best way to gain trust and credibility is to be forthright—tell people what the risk is and what you are doing to bring it down."
- "Get people involved up front—not when the draft report is prepared."
- "Make sure that the key people in the community are informed prior to giving a story to the media."
- "People tend to focus on consequences even though they know that the chances are small."
- "Lack of control over decision-making is what bothers people most."
- "Risk equity and fairness are very important."
- "Risk communication is still an art, not a science."

There is no question that a lot of good work has been conducted, yet much more needs to be done. Ideally, one day, the level of communication will be so good that there will be no discernable difference between estimated or measured risk and the risk perceived by the public.

ROUTING AND SITING CONSIDERATIONS

Routing and siting issues in the transportation of hazardous materials were the principal topic of discussion in the following areas:

1. State and regional routing concerns,
2. Community awareness and participation in routing decisions,
3. Rail routing of hazardous materials,
4. Routing regulation and enforcement, and
5. The state of the art in highway routing models.

Siting of facilities that handle hazardous materials was addressed as a secondary issue relative to the subject of routing, in part because of the conference theme, which stressed transport, and perhaps, in part, because of a greater concern expressed by governments and the public regarding transportation issues. Furthermore, siting of fixed facilities has long involved the National Environmental Policy Act process, with participation from area governments, affected interest groups, and the public.

Transportation, on the other hand, is increasingly becoming a high-profile, public-awareness issue. Public, local, state, national, and industry concerns regarding transport activities have resulted in varying regulations and operational constraints being placed on the movement of these materials. The reason for this concern, however, is not entirely clear. Indeed, little evidence appears to exist that the threat to the public of hazardous materials transportation movement is higher than for many common activities.

It was apparent from the conference dialogue that U.S. DOT clearly will be gaining increasing authority in overseeing hazardous materials transportation issues, including issuance

of a new routing workbook and associated software to assist state and local agencies in determination of routing alternatives. The U.S. DOT maintained an active presence at the conference, permitting access and interchange with interested participants.

Noteworthy presentations included a timely discussion on achieving public acceptance of routing decisions. The difficulty in achieving consensus on routing recommendations was emphasized, because of the emotion-evoking nature of the cargo as well as the involvement of a wide spectrum from the public, interest groups, and policy makers. The misunderstanding regarding true "measures of risk" to the public was underscored, as was the confusion between routing and risk concepts among the various interest groups.

Panel discussions on community awareness and participation in routing decisions, regulation, and enforcement underscored the benefits of understanding and dealing with real world problems and approaches, as well as the need to reflect accurately these experiences in future activities. A conference session on rail routing emphasized the need to develop mode-specific analysis approaches because of the inherent operational and institutional differences between rail and truck transport.

Finally, an excellent overview of the tools and techniques available to the hazardous materials transport analyst was presented, focusing not only on the individual methods available, but also on the similarities and differences in the approaches available. Several of these methods were either demonstrated or presented during the conference.

A major concern that surfaced at the conference is the complex relationship between routing and risk analysis. Commonly used risk surrogates such as population density (as a measure of potential population exposure) are often factored into route selection models. Risk communication, perceived risks, and absolute risks as topics of concern also overlapped into the routing analysis area.

Because the processes used to analyze routing alternatives and risk assessment methodologies are fundamentally different, the technical approaches to model development appeared to emphasize the inclusion of vast amounts of data without a strong justification. How to weigh the various factors relative to one another, questions regarding the individual assumptions used, and uncertainty or sensitivity analysis left a number of unresolved issues.

From these presentations it appears that there is a continuing need to answer a number of basic questions:

1. What is the federal role? Where should routing decisions be made and routing criteria established?
2. How does industry participate in this process?
3. Risk versus routing, which leads the other?
4. Are route analysis methods and quality of the data scientifically credible? Are the outputs understandable?
5. Are computer routing models a tool or a crutch?
6. Who will fund the development of more comprehensive methods?

To answer these questions in a timely fashion, it was clear that transportation professionals must become more pragmatic in their approach, recognizing that many of these needs require responsive action.

DATA COLLECTION AND INFORMATION MANAGEMENT

During the conference, statistics were presented relative to the magnitude of hazardous materials transportation activity. For example, there are over 2,300 different substances being handled daily, and that in 1982 alone, more than 1.5 billion tons of hazardous materials were transported by rail, highway, water, and air.

As the transportation of hazardous materials has emerged as a major concern for federal, state, and local agencies, it has also become imperative that data used to draw general conclusions on safety issues at the national, regional, and local level be credible. To be able to conduct responsible risk or vulnerability analyses at any level, one must have a comprehensive information system as a basis.

Conference discussion included both federal and state efforts. At the federal level, the Hazardous Materials Incident Reporting System (HMIRS) was presented as a unique source of information on hazardous materials transport incidents in the United States. Follow-up reports by telephone and in writing collectively provide information on incident types and severity, danger to the public and environment, impact on operation of major transportation arteries, contamination to certain areas, and possible evacuation. This system is made available to federal, state, and local agencies by means of special computer accounts. In Ontario, Canada, the Risk Management Branch of the Transport Dangerous Goods Directorate reported on their data collection and analysis system for commodity flow and incidents. Three types of data bases are maintained: (a) an accident data base, (b) a commodity flow information system, and (c) a cost file. Mandatory reporting requirements are imposed on all provinces in Canada.

A presentation on the Radioactive Materials Incident Reporting data base, managed by Sandia National Laboratory, exemplified material-specific information systems that are available. It includes information on three accident types, namely transportation accidents, handling accidents, and in-transit incidents. Data are secured from federal agencies, states, and media reports.

At the state level, Arizona, Illinois, and Pennsylvania reported on their experience with incident data bases. In Arizona, a statewide post-incident hazardous materials reporting system is being developed using an incident report form similar to one developed by California. This form has been distributed to over 300 fire departments, sheriff's offices, local emergency planning committees, emergency management agencies, and state hazardous materials response agencies to solicit their comments and, more importantly, to seek their commitment of participation. In this proposed program, the Arizona Division of Emergency Services will supply incident report forms and maintain a computerized data base system for incident reports. Statewide participation in Arizona will continue to be irregular under a voluntary submittal program; however, new legislation mandating reporting is being explored.

In Illinois, a Hazardous Materials Advisory Board has been established, composed of the directors of twelve state agencies, representatives from the major statewide response organizations, and four individuals appointed by the governor. Participation in the data collection process is voluntary, and

the Board has recommended that the Illinois Department of Transportation be given the responsibility of managing data collection and analysis. The program has been viewed as a success in Illinois simply because more information is now available about the severity and frequency of hazardous materials incidents.

A study sponsored by the Pennsylvania Department of Transportation has investigated three data bases for risk assessment: the HMIRS, the Office of Motor Carrier Safety, and State of Pennsylvania accident data. The comparison concluded that no correlation among the three systems exists, which is somewhat surprising since, in principle, many of the same accidents in Pennsylvania should be tracked by all three systems. Since the analysis being conducted applied to the state level, Pennsylvania state-specific data was consequently recommended. Subsequently, it was discovered that the state system was not comprehensive and suitable for segment level risk analysis, forcing a more aggregate study approach.

In reviewing the presentations involving hazardous materials data bases accessed from both federal and state sources, it is apparent that the top-down approach is not sufficient for conducting comprehensive risk analysis. Instead, a bottom-up approach is essential in generating credible data. What this means is that each state likely will have to create a comprehensive hazardous materials data base that includes both flows, incidents, and consequences related to hazardous materials shipments.

To accomplish this task, the use of geographical information systems (GIS) was identified as a promising technology, enabling different agencies to store data and conduct "what if" type analyses efficiently. The graphical displays generated by GIS for hazardous materials routing or to identify vulnerable areas in a region would assist planners and top administrators in making intelligent decisions.

INSPECTION/ENFORCEMENT

Issues relating to hazardous materials transportation inspection and enforcement were addressed in panel format. Discussion focused on measuring the importance of inspection/enforcement to state and local officials, and identifying future needs related to the inspection/enforcement function. Among the questions raised were:

1. What strategies promote effective and efficient hazardous materials transportation inspection/enforcement programs?
2. How does inspection/enforcement of hazardous materials transportation interact with broader state and local hazardous material planning and emergency response activities?
3. How can state and local officials help the hazardous materials transportation inspection/enforcement community?
4. How can the federal government help state and local governments improve their hazardous materials inspection/enforcement capabilities?
5. What should be the future of the Cooperative Hazardous Material Enforcement Development Program (COHMED) and the federal/state/local enforcement partnership embodied in the Motor Carriers Safety Assistance Program (MCSAP)?

6. Is self-inspection an effective option?

Key themes expressed by various panel members can be summarized in three words: cooperation, communication, and training. Cooperation is needed to ensure that there are active, ongoing positive relationships among the state and local emergency planning communities and those enforcing the hazardous material transportation regulations. Although the relationship between these two groups has improved in some jurisdictions because of the requirements of Title III of SARA, there are substantial opportunities to continue to improve cooperation in many jurisdictions. One way to promote cooperation is to name representatives of the enforcement community to the State Emergency Response Commissions and Local Emergency Planning Committees.

A variety of strategies to reduce interagency conflict, especially those between the fire services and enforcement communities, may be especially helpful in improving cooperation. Another aspect of cooperation that was identified is the need for political support for effective enforcement of the hazardous materials transportation regulations. The program participants stated that political "interference" can adversely affect efforts to promote compliance with the hazardous materials transportation regulations.

Improved communications and information sharing also would aid in the coordination process. Emergency response plans developed by various state and local governmental entities need to pay more attention to the enforcement component of an emergency situation.

Much of the attention devoted to future need focused on training of hazardous materials officers and the effectiveness of their efforts. The importance of real world experience as a teaching method was underscored. Training and the effectiveness of many hazardous materials inspection/enforcement officers have been enhanced significantly as a direct result of MCSAP. U.S. DOT is contributing to state activities by substantially increasing its training for state inspectors. The information dissemination efforts of U.S. DOT have also helped improve inspection/enforcement capabilities.

Numerous options to improve the training and effectiveness of state hazardous materials inspection/enforcement activities were presented as a result of the issues raised. These included

1. Providing at least \$1 million of MCSAP funding for training a specialized core of hazardous materials inspectors. It was noted that several states have successfully instituted specialized units of hazardous materials;
2. Increasing the involvement of local government enforcement officers in hazardous materials transportation. This would need to be accompanied by increased training to ensure quality and uniformity with accepted practices approved by the Commercial Vehicle Safety Alliance. This objective also could be furthered by increased local agency involvement in COHMED and U.S. DOT training activities;
3. Defining better the roles of state and local governments in hazardous materials transportation inspection/enforcement, and improve communication among all levels of government; and
4. Requiring certain levels or standards of training for hazardous material inspectors.

CONCLUDING REMARKS

The St. Louis conference represented a departure from hazardous materials transport forums held in the 1980s in that the focus shifted from one of issue identification to the establishment of an action agenda on the basis of previously defined issues. Toward that end, many findings emerged to constitute a research and program policy agenda for the next few years.

Emergency response is becoming a dominant area of concern, particularly for the need for better and more interagency cooperation, communication, and training. Additional resources, simplified rules, and greater political support characterize the needs of the response community at this time, including the enforcement component of emergency situations. Methods for evaluating emergency response capability are also desperately needed at this time, to enable the allocation of available resources according to priority.

With risk assessment maturing as a field, it is apparent that many factors require explicit consideration as part of this process, including risk perception, risk equity, and determination of a reasonable definition for what constitutes adequate safety. With the proliferation of various risk estimation techniques and the trend towards site-specific applications, establishment of standard methods for risk assessment are clearly needed. Equally as important is the need to emphasize risk communication as a vital part of the risk assessment process and to develop procedures for effective communication practice.

According to conference participants, the time has come for the issue of routing to be tackled head-on. Criteria must be established for selecting preferred routes and the interrelationship between risk assessment and routing analysis methodology must be clearly defined. One of the key elements in supporting this process is the availability of credible data. Discrepancies in incident reporting systems and the paucity of well-designed and carefully implemented flow studies makes

it paramount that there be quality improvements in the techniques applied to data collection. Promising approaches in this direction are the use of a bottom-up approach (rather than top-down) to gather site-specific data and the adaptation of GIS as an information technology for storing and managing data for analysis purposes.

EPILOGUE

Several months following the St. Louis conference, the Hazardous Materials Transportation Uniform Safety Act of 1990 (HMTUSA) was signed into law. Many of the provisions contained in this reauthorization address issues identified in this paper. The St. Louis conference may well have provided a forum for advancing the thinking that went into the final legislation. Hopefully, as the initiatives contained within HMTUSA are implemented over the next few years, we will move closer towards an effective national strategy for managing the safe transport of hazardous materials.

ACKNOWLEDGMENTS

The authors would like to recognize the many individuals and organizations who banded together to structure a comprehensive technical conference program in St. Louis. Special thanks are extended to the Transportation Research Board, U.S. Department of Transportation, and American Society of Civil Engineers, for their logistical, technical and financial support, and to members of the Conference Organizing Committee for their time, energy, expertise, and perseverance.

The views presented in this paper are solely those of the authors and not of their employers or sponsoring agencies.

Publication of this paper was sponsored by Committee on Hazardous Materials.