

I-45

NATIONAL TRANSPORTATION SAFETY BOARD  
WASHINGTON, D.C.

ISSUED: March 12, 1981

Forwarded to:

Honorable Andrew L. Lewis  
Secretary  
Department of Transportation  
400 Seventh Street, S.W.  
Washington, D.C. 20590

SAFETY RECOMMENDATION(S)

I-81-1 and -2

About 9 a.m., e.s.t., April 3, 1980, a Boston and Maine Corporation (BM) Boston switcher (1740) consisting of a locomotive and 38 cars collided, while moving at a speed of 4 mph, with a standing draft of cars in Somerville Yard 8 at Somerville, Massachusetts. The locomotive struck and punctured tank car TLDX 113009, the second car of the standing draft; the tank car contained about 13,000 gallons of phosphorus trichloride ( $PCl_3$ ), a hazardous material classified by the Department of Transportation (DOT) as a corrosive liquid. The product spilled onto the moist ground and created a cloud, which ultimately necessitated an evacuation of a 1 1/2 square mile area containing 23,000 people. During the first 48 hours of the emergency, 418 persons were treated at the Somerville hospital. Damage to train equipment amounted to \$8,100 and cleanup costs were reported to be \$130,253.

A special investigation of this accident <sup>1/</sup> indicates that some of the advice and guidelines provided to emergency response personnel by DOT, carriers, and shippers continues to be inadequate, inconsistent, and confusing. Therefore, the Safety Board concludes that technical advice to local emergency response officials and emergency action guidelines and other advice available to local officials should be reviewed to validate that they are adequate and consistent. The Safety Board further concludes that the guidelines and other advice should be reviewed regularly on the basis of results obtained in actual emergencies, and the advice and information validated or revised as necessary to insure that the prescribed emergency response is appropriate.

For example, the three guides available at Somerville provided conflicting information to the firefighters responding to the scene. The 1978 edition of the DOT guide listed as "potential hazards" fire, explosion, and health hazards, and warned against pollution problems. The Bureau of Explosives (BOE) guide contained similar warnings. The DOT guide did not tell firefighters the magnitude of the chemical cloud that would be generated if a large spill was flooded with water, as it suggested. In contrast, although the BOE guide did not distinguish between a "small" spill and a "large" spill, it advised against the use of water on the material itself. The National Fire Protection Association (NFPA) guide warned of a violent reaction on contact with water, but suggested that flooding amounts of water be applied to the entire spill. This

<sup>1/</sup> For additional information, read Special Investigation Report--"Phosphorus Trichloride Release in Boston and Maine Yard 8 During Switching Operations, Somerville, Massachusetts, April 3, 1980" (NTSB-HZM-81-1).

contradictory and ambiguous advice created uncertainties which onscene firefighters had to resolve quickly because spilled material was flowing toward nearby sewers. Faced with these uncertainties, the firefighters resorted to the tools available, water and shovels, to try to control the spill. They used a hose stream to try to divert liquid runoff from the storm drains. Use of hose streams to keep flammable liquid spills out of sewers is a common practice in the fire service. Thus, in the absence of other advice during the first 30 minutes, the firefighters' first water attack was a logical action, based on the information available to them at that time.

The massive cloud which followed the firefighters' first water attack increased the number of persons exposed to the hazard and provided the firefighters unexpected information about the behavior of the hazardous material they were trying to control. None of the guides warned them of the massive cloud the water would create. This new information, collected through "trial and error," strongly influenced subsequent actions.

The inadequate guides also led to another problem at Somerville. When firefighters later tried to control the spill with hand shovels, they were forced to work within the fuming spill. The guides advised use of "self-contained breathing apparatus and full protective clothing," which to firefighters meant their standard air masks and firefighting uniforms. Their firefighting uniforms, known as turnout gear, did not protect them from injury from the chemical. Their turnout gear included a helmet, coats, pants, rubber boots, and gloves customarily worn by firefighters. Their turnout gear was not designed for protection from corrosive fumes. Since none of the guides in use at the time made any distinction, the firemen were not aware that special clothing was needed for handling phosphorus trichloride. Revised guidance in DOT's 1980 guidebook should reduce injuries of the kind experienced at Somerville during the initial trenching or ditch digging operations and pit excavation.

The newly revised DOT guidebook also contains revised response guidance for phosphorus trichloride releases. However, the guide does not warn about the chemical cloud formation experienced at Somerville and is still ambiguous on the use of water. The new guidebook warns of violent reaction with water under potential fire or explosion hazards and that runoff to sewers may create fire or explosion hazard, but advises fighting large fires by flooding with water. It warns that runoff or water used for dilution may cause pollution, but advises flushing small spill areas with water and advises, for large spills, dike for later disposal and dilute with large amounts of water. It also advises not to get water inside the container and to use water spray to reduce vapor, but do not put water on leak area. The official responsible for the content of the guidebook reviewed the Somerville accident before the revised guide was published and concluded that the advice, developed for the revised guidebook, was valid and that no changes were warranted. The Safety Board does not agree with this conclusion and knows of no formal evaluation made by the official in arriving at his conclusion. The Safety Board believes that the lessons learned concerning the use of water at Somerville should be incorporated into the guidebook. Informal discussions with an official of the Materials Transportation Bureau indicate that changes to the 1980 guidebook are now being contemplated.

The fire chief met with more than 30 local, State, and Federal safety representatives at the command post at 2, 4, and 6 p.m. to discuss the status of the recovery operations and to plan the next actions to be taken. During the 2 p.m. meeting, representatives of the Environmental Protection Agency (EPA) advised the firefighters to spread a curtain of water downwind of the pit in order to leech out the escaping hydrochloric acid vapors from the air. EPA provided the fire chief with a sketch showing where to locate the water cannons. Because the firefighters had seen earlier the accelerated vapor production caused by water spraying, the fire department strongly opposed the procedure but reluctantly complied with the Federal recommendation.

During this operation, the wind shifted and, as a result, the spray directly hit the pit, where it mixed with the phosphorus trichloride and created additional massive clouds of vapor. The streams of water were terminated immediately, but the clouds quickly spread throughout the area, and at 3:30 p.m., an evacuation of Somerville Central Hills was required.

During the 6 p.m. meeting of officials and experts, State, Federal, and industry advisors suggested to the fire chief three differing approaches for disposal of the 2-inch residue in the pit. One recommended backfilling the pit with sand, another advised drowning and diluting the remaining product with water, and another advised neutralizing the pit with limestone or soda ash. The advisors could not agree which was the best plan to follow. Faced with these disagreements and the continuing chemical cloud, the Mayor of Somerville designated a technical advisory committee with representatives from the shipper (Monsanto), the carrier (BM), and the State of Massachusetts and instructed them to reach unanimous agreement on how to dispose of the remaining chemical in the pit. About 7 p.m., almost 10 hours after the spill, the committee of advisors selected backfilling with sand and the gradual addition of water as the best method because the other two alternatives contained more uncertainties.

By 7 p.m., backfilling operations had begun, with 10 to 15 trucks relaying 60 truckloads of sand to the pit. Small amounts of water were applied from 7:30 to 12 p.m. Three fire hose cannons doused the entire area during the remainder of the night. At 1:30 a.m., April 4, safety officials allowed residents to return to their homes. An estimated 13,000 persons had been evacuated to safe distances in Somerville and an additional 10,000 had been evacuated in East Cambridge. At daybreak, firefighters again washed down residues remaining on the ground. Following this, BM spread 4 tons of soda ash around the area to neutralize any product remaining on the ground.

After more than 7 hours at the scene, technical advisors on whom local officials depended for guidance had not reached agreement about how to handle the emergency. As a result the mayor intervened. While the precise areas of disagreement were not established, the fact that the final action chosen by the "technical advisory committee" was different from the shipper's advice is significant. Rather than duplicate the Manufacturing Chemists Association's Transportation Emergency Center's (CHEMTREC) unique capabilities with respect to dangerous characteristics of chemicals, DOT relies on CHEMTREC to provide additional emergency response advice or shipper assistance to supplement the advice in DOT's guidebook. The guidebook instructs users to contact CHEMTREC for such additional assistance. The CHEMTREC operation is based on advice developed primarily by shippers. The Somerville experience suggests that DOT should not assume that this advice is always completely adequate and that shipper's advice may require reexamination for its technical adequacy.

The disagreement among advisors on the scene and inconsistencies and ambiguities in hazardous materials emergency guides give rise to an even more pressing safety concern. So long as knowledgeable technical advisors cannot agree on a recommended course of action, either in guidance or while they are at the site, the Safety Board does not believe that local firefighters will be provided with reliable, consistent advice for handling such emergencies. Unless technical advice, including that contained in written guides, is consistent, local officials will be forced to continue to depend on trial-and-error procedures, such as those employed at Somerville. Trial-and-error clearly increases the risks to emergency response personnel and the surrounding community.

The local officials' experiences at Somerville, including the mayor's intervention, have convinced the Safety Board that action to resolve differing technical opinions about emergency responses is essential. The diversity of persons and interests involved can be seen in the variety of organizational and agency representatives present and giving advice at Somerville. Their ineffectiveness can be seen in the effects of their advice on the course of events that occurred. The lessons of Somerville should not have to be learned again elsewhere.

The differences stem from differing technical views, which must be reconciled by adequate coordinated technical review of proposed actions that could be taken during hazardous materials emergencies and analysis of their total effects on the response personnel and the community. Their resolution must take into account the uncertainties involved with each alternative. If these differences remain unresolved, they will surface again and again during future accidents. The Safety Board knows of no reason why these differences cannot be resolved beforehand through analysis rather than onscene trial and error. Since shipments of hazardous materials will continue and additional spills can be expected, resolution of technical differences should not be delayed. DOT is charged by the Hazardous Materials Transportation Act to provide emergency response advice to local officials in hazardous materials transportation emergencies. It should take the initiative to get these technical differences resolved. Once the guidance is analyzed and the best handling method established, consistent guidance should be incorporated into emergency response guides. Until DOT assures the adequacy and consistency of the technical guidance provided for emergencies, the Safety Board believes that consistent, adequate hazardous material emergency response guides will not become available.

The continuing ambiguity in the 1980 DOT guidebook and differing advice among the guides, in view of the Somerville experience, again point out the need for a method of incorporating lessons learned into the system that provides technical advice to emergency response personnel in hazardous materials experiences. Therefore, the National Transportation Safety Board reiterates the following recommendations which were made to the Department of Transportation on October 20, 1976, as a result of an accident near Pursley, West Virginia:

Redesign its hazardous materials incident data reporting system so it will generate information about what emergency actions were taken, why they were taken, and what influence they had on the outcome of the emergency, for use in training firefighters and law-enforcement personnel to handle hazardous material transportation emergencies. (Class II, Priority Action) (I-76-9)

Develop a procedure to report such information regularly to Federal and State agencies with responsibilities for developing emergency training programs for law-enforcement and firefighting personnel. (Class II, Priority Action) (I-76-10)

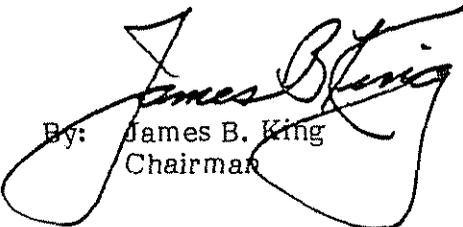
Develop a procedure to use the emergency response information on dealing with emergencies to review periodically the validity of advice which DOT provides to other agencies with regard to hazardous materials transportation emergencies. Periodically review the operational experience in meeting hazardous materials emergencies to assure that the practices recommended are appropriate. (Class II, Priority Action) (I-76-11)

As a result of this special investigation, the National Transportation Safety Board recommends that the Department of Transportation:

Investigate the adequacy and consistency of hazardous materials emergency guides and other advice available to local officials for use in controlling hazardous materials releases during transportation, and take necessary steps to assure that they provide sufficient and consistent guidance and advice to help local officials control hazardous materials spills quickly and effectively. (Class II, Priority Action) (I-81-1)

Revise the advice provided in the 1980 DOT Emergency Response Guidebook concerning phosphorus trichloride to clarify the ambiguous language on the use of water in handling large spills. (Class II, Priority Action) (I-81-2)

KING, Chairman, and McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations. DRIVER, Vice Chairman, did not participate.

By:  James B. King  
Chairman

