NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

R-279

ISSUED: March 12, 1980

Forwarded to:

Honorable Neil Goldschmidt
Secretary
Department of Transportation
400 Seventh Street, S.W.
Washington, D.C. 20590

SAFETY RECOMMENDATION(S)

R-80-10 through -16

In its continuing effort to ensure the safe transportation of hazardous materials, the National Transportation Safety Board has conducted a special investigation of a train accident to determine if the shelf couplers, head shields, and thermal protection required by 49 CFR 179.105 to be on certain tank cars do, in fact, provide the added protection they were intended to provide. 1/

The derailment of Southern Pacific Transportation Company freight train (chemical) Extra 1291 East SRASK near Paxton, Texas, on September 8, 1979, provided the opportunity to observe the behavior of tank cars that were equipped with shelf couplers designed to resist vertical separation, with head shields designed to prevent the likelihood of an end puncture, and with thermal protection intended to reduce the potential for violent tank rupture in a fire. The train also included cars without such protection and, therefore, the Safety Board had the opportunity to compare equipped and nonequipped cars.

The Safety Board's analysis is based on the reconstruction of the events and actions that occurred during the derailment of 2 locomotive units and 33 cars of the 53-car, 3-locomotive train. The Safety Board was assisted in the reconstruction of the events by the Federal Railroad Administration, the Association of American Railroads, the Railway Progress Institute, tank car manufacturers, shippers, and the Southern Pacific Transportation Company.

By comparing the coupler performance of the cars which were equipped with protective couplers with those which were not so equipped, it was determined that all of the car ends with protective couplers stayed together during the initial run-in. There were no punctures or dents attributable to overriding coupler strikes on tank heads on these cars. In contrast, 96 percent of the car ends connected with couplers that would be expected to separate vertically did uncouple and resulted in four punctured heads and nine dented heads. Clearly, protective couplers provided significant protection against end penetration during initial run-in.

1/ For more detailed information, read "Special Investigation Report--The Accident Performance of Tank Car Safeguards" (NTSB-HZM-80-1).

Only four cars in the derailment were equipped with head shields. However, none of these cars uncoupled, so the benefit of the head shields as protection against coupler strikes was not tested in the initial run-in. One car of this group was exposed to head damage as a result of subsequent strikes during the derailment, and it was not punctured. Of the 26 car ends that uncoupled in the initial phase of the accident, 7 unprotected cars in 10 suffered a head strike and 3 in 10 were punctured. If head shields and shelf couplers had been in place, the punctures probably would not have occurred. The nine dented heads clearly demonstrated a potential for penetration.

The intention of the requirements of 49 CFR 179.105 for thermal protection is to prevent the release of any of the car's contents (except release through the safety valve) when subjected to (1) a pool fire for 100 minutes, and (2) a torch fire for 30 minutes. Six cars in this accident were in a fire environment that permitted an evaluation of the survivability of these cars. Although the evidence is not conclusive, it indicates that thermal protection and insulation delayed violent ruptures.

While the introduction of the shelf coupler has reduced the likelihood of tank car punctures by maintaining a tight couple during run-in, it also influences the behavior of the cars in the collisions that follow. A closer examination, testing, and detailed documentation of hazardous materials tank car derailments will contribute to the understanding of car reaction and will lead to recommendations for safety improvements.

Segregation of hazardous materials stockpiles is a well-known principle currently used to prevent a chain of undesired events. A "dam" in a chemical freight train derailment can have either beneficial results, as was observed in this accident in that certain cars were not exposed to some hazards, or nonbeneficial results. The placement of cars in a train should be studied to determine if the severity of collision damage can be reduced.

The investigation also showed that (1) 18, or 82 percent, of the breaches resulted from collisions that occurred after the cars left the tracks; (2) 78 percent of the breaches resulted from damage to the top fittings or bottom outlets (a condition that can be corrected by existing design modifications), and (3) large tears in the sides of tank cars resulted from collisions with box cars or other tank cars.

During the investigation it was learned that the Federal Railroad Administration is not currently collecting and reporting information to guide it in its assessment of the safety benefits or liabilities of the regulations for tank car modification. It is apparent that the causes of breaches during accidents need to be fully documented.

Therefore, to improve tank car safety, the National Transportation Safety Board recommends that the Department of Transportation:

Extend the requirements for top-and-bottom shelf couplers to all tank cars used to transport hazardous materials. (Class I, Urgent Action) (R-80-10)

Extend the requirements of 49 CFR 179.105, including those for head shields and thermal protection, to include new and rebuilt specification 105 tank cars. (Class I, Urgent Action) (R-80-11)

Examine specialty products and Class A poisons which are shipped in Type 111 tank cars to determine if the toxicity hazard is sufficient to justify the protection afforded by 49 CFR 179.105. (Class II, Priority Action) (R-80-12)

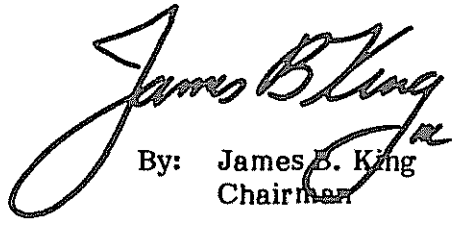
Take immediate steps to cause the modification of both new and existing tank cars so that damage to the top fittings and bottom outlet valves is minimized in train accidents. (Class I, Urgent Action) (R-80-13)

Cause data to be collected on tank car derailment behavior to identify breach mechanisms, analyze these mechanisms, identify control methods, and incorporate findings in new car construction. (Class II, Priority Action) (R-80-14)

Conduct tests of tank cars in freight train derailments to determine if the severity of collision damage can be reduced by tank car placement in trains. Identify and test countermeasures. (Class II, Priority Action) (R-80-15)

Require crashworthiness testing of new hazardous materials tank car designs to resist breaching in the derailment environment. (Class I, Urgent Action) (R-80-16)

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



By: James B. King
Chairman