



National Transportation Safety Board

Washington, D.C. 20594
Safety Recommendation

Date: JUL 1 1991

In reply refer to: R-91-12 and -13

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The Safety Board's past investigations of railroad accidents revealed several safety issues concerning the transport of hazardous materials. As a result of those investigations and the Board's subsequent safety recommendations, Federal and State agencies and some railroads took various actions to bring about improvements in the safe transport of hazardous materials by rail. Results of the Board's recent safety study indicate, however, that improvements are still needed in the protection provided by some tank cars for certain products transported in them and in the hazardous materials training of railroad personnel.¹

Transport of Hazardous Materials in DOT-111A Tank Cars

Although DOT² specification 111A tank cars generally do not contain protection similar to that of the DOT-105, -112, and -114 tank cars, they are, nevertheless, used to carry hazardous materials that can pose a substantial danger to life, property, and the environment.³ Further, because the shells of DOT-111A tank cars are thinner than the shells of DOT-105, -112, and -114 tank cars, the DOT-111A tank cars are more susceptible to

¹ National Transportation Safety Board. 1991. Transport of hazardous materials by rail. Safety Study NTSB/SS-91/01. Washington, DC. 187 p.

² U.S. Department of Transportation.

³ The DOT-111A tank cars, which are still being manufactured, are general service, non-pressure tank cars made of steel, nickel, or aluminum. Generally, DOT-111A tank cars are non-insulated, have bottom outlets and multiple fittings, and do not have jacketed thermal protection or head shields. Thermal protection and head shields are required on most DOT-105 tank cars, as well as on DOT-112 and -114 tank cars.

damage than are DOT-105, -112, and -114 tank cars, even when those tank cars are not protected by head shields and thermal protection.⁴

The inadequacy of the protection provided by DOT-111A tank cars for certain dangerous products has been evident for many years in accidents investigated by the Safety Board. The release of products from the DOT-111A tank cars observed in those investigations were also observed in the 45 rail accidents (hereinafter called cases) investigated by the Safety Board from March 1988 through February 1989 as part of its recent safety study.⁵ These 45 cases involved 149 tank cars: 84 cars (57 percent) were DOT-111A tank cars, 32 cars (21 percent) were DOT-105 tank cars, 29 cars (19 percent) were DOT-112/114 tank cars, and 4 cars (3 percent) were other specifications.

Of the 61 DOT-105, -112, and -114 tank cars involved, 14 tank cars (23 percent) released products: 11 leaked (18 percent), and 3 ignited or exploded (5 percent). The products were released as a result of head punctures or failures in two of the tank cars and shell punctures or failures in five (a total of 11 percent).

Of the 84 DOT-111A tank cars involved, 46 tank cars (54 percent) released product: 31 leaked (37 percent), and 15 ignited or exploded (18 percent). The products were released as a result of head punctures or failures in 5 of these tank cars, and shell punctures or failures in 13 (a total of 22 percent).

These data indicate that 23 percent of the DOT-105, -112 and -114 tank cars involved in the 45 cases released product whereas 54 percent of the DOT-111A tank cars released product. Further, the rate at which the DOT-111A tank cars experienced head or shell puncture or failure was also double that of the DOT-105, -112 and -114 tank cars. Although the cases were not selected on a basis such that they are statistically representative of hazardous materials accidents, the rate of failure of the DOT-111A tank cars (double that of the non-DOT-111A cars) strongly suggests that DOT-111A tank cars do not provide as much protection for their products in accidents as do the DOT-105, -112, and -114 tank cars.

The 46 DOT-111A tank cars that released hazardous materials were transporting 24 different products, 12 of which (a) could cause serious injury, temporary or long-term, from brief exposure even when medical attention is promptly given; and/or (b) are highly flammable at ambient temperature conditions.

Safety risks posed by the release of hazardous materials from DOT-111A tank cars are illustrated by the accident in Helena, Montana, on February 2,

⁴ DOT-111A tank cars have a minimum shell and head thickness of 7/16 inch; DOT-105, -112, and -114 tank cars have shells and heads with a minimum thickness of 9/16 inch.

⁵ The locations of the accidents comprising the 45 cases are identified in the safety study report (NTSB/SS-91/01).

1989. Two aluminum DOT-111A tank cars containing hydrogen peroxide (a strong oxidizer) and one steel DOT-111A tank car containing acetone and isopropyl alcohol (in dual compartments) were severely damaged and released their products. Fire and explosions resulted, dispersing fragments of one of the aluminum tank cars as far away as 1/2 mile. About 3,500 persons were evacuated, 2 persons were injured, and damage and cost of cleanup exceeded \$6 million.⁶

The Safety Board's investigation determined that the steel DOT-111A tank car sustained a head puncture; the investigation also concluded that one of the aluminum DOT-111A tank cars probably was punctured during the collision and derailment, but the disintegration of the tank car from the explosion precluded an exact determination of the number and locations of the punctures.

As a result of the Helena accident, the Safety Board issued the following safety recommendation to the Research and Special Programs Administration (RSPA):

R-89-80

Evaluate present safety standards for tank cars transporting hazardous materials by using safety analysis methods to identify the unacceptable levels of risk and the degree of risk from the release of a hazardous material, then modify existing regulations to achieve an acceptable level of safety for each product/tank car combination.

On June 13, 1990, the DOT replied that a working group, comprising representatives of the RSPA and the Federal Railroad Administration (FRA), has developed a course of action to address the Safety Board's concerns: a safety analysis will be initiated using "deterministic risk analysis methods" to classify high-risk materials and to analyze postaccident histories. Upon completion of the effort, the RSPA and the FRA will review the results of the analysis to determine if rulemaking action is necessary to shift the transport of hazardous materials to improved tank cars. Based on the response from the DOT, the Safety Board classified Safety Recommendation R-89-80 as "Open--Acceptable Response." The need for evaluating present safety standards for tank cars that transport hazardous materials is so important that the Safety Board has placed Safety Recommendation R-89-80 to the DOT on its "Most Wanted" list of safety improvements.⁷

⁶ National Transportation Safety Board. 1989. Collision and derailment of Montana Rail Link freight train with locomotive units and hazardous materials release, Helena, Montana, February 2, 1989. Railroad Accident Report NTSB/RAR-89/05. Washington, DC. 112 p.

⁷ In October 1990, the Safety Board adopted a program to identify the "Most Wanted" safety improvements. The purpose of the Board's "Most Wanted" list, which is drawn up from recommendations previously issued, is to bring special emphasis to the safety issues the Board deems most critical.

While the Safety Board is extremely concerned about the level of protection provided by tank cars which transport materials that are potentially hazardous to human life and property, the Board is also concerned about the level of protection provided to the hazardous materials that can harm humans through deleterious effects on the environment. According to the Association of American Railroads (AAR), the railroad industry has recognized this issue and, in conjunction with the chemical and tank car industries, is developing a "quantitative risk assessment methodology" that incorporates chemical risks to the environment as well as other risks. The industries have also developed a list of hazardous materials that, because of their potential to contaminate soil and ground water, would be candidates for early action for improved packaging. The list includes many products released in accidents investigated by the Safety Board, such as perchloroethylene, cyclohexane, and xylene; however, action for improved packaging has not been initiated. Further, the U.S. Environmental Protection Agency has identified perchloroethylene and xylene as being among the hazardous materials most likely to cause a serious threat to human health and has banned land disposal of materials contaminated with perchloroethylene, xylene, and cyclohexane.⁸ Because the release of hazardous materials can also threaten health through contamination of the environment, the Safety Board urges the DOT to consider environmental hazards when conducting its deterministic risk analysis.

Rulemaking activity for tank cars is currently underway by the RSPA: Performance-Oriented Packaging Standards (Docket HM-181) and Specifications for Tank Car Tanks (Docket HM-175A). Both rulemaking actions address the protection needed for some hazardous materials now being transported in DOT-111A tank cars. Additional rulemaking will probably be needed after the DOT completes its deterministic risk analysis (in response to Safety Recommendation R-89-80). However, the Safety Board is concerned that it may take several years until final rules are issued as a result of Docket HM-175A and even longer until final rules are issued in response to Safety Recommendation R-89-80. Thus, the Board is concerned that, in the interim, many hazardous materials that pose severe threats to public safety will continue to be transported in tank cars with inadequate protection.

Following its investigation of the 1985 derailment at Jackson, South Carolina, the Safety Board issued Safety Recommendation R-85-105 to the RSPA to require that all tank car shipments of hazardous materials with an isolation radius of 1/2 mile or more, as recommended by the U.S. Department of Transportation Emergency Response Guidebook, be transported in tank cars equipped with head shield or full tank head protection.⁹ However, in replies to the safety recommendation, the RSPA pointed out that head protection might

⁸ 52 FR 12866-12874 (1987), 53 FR 41280-41285 (1988), and 40 CFR 268.35(a).

⁹ National Transportation Safety Board. 1985. Derailment of Seaboard System Railroad train No. F-690 with hazardous material release, Jackson, South Carolina, February 23, 1985, and collision of Seaboard System Railroad train No. F-481 with standing cars, Robbins, South Carolina, February 25, 1985. Railroad Accident Report NTSB/RAR-85/12. Washington, DC. 42 p.

be beneficial for tank cars carrying a broader class of hazardous materials and that many products do not really require greater protection than that provided by DOT-111A tank cars. In its latest reply, dated April 1990, the RSPA indicated that an Advanced Notice of Proposed Rulemaking (Docket HM-175A) addresses head shield protection for new and existing tank cars that are used to transport critical hazardous materials such as flammable gases, certain non-flammable gases, reactive materials, and materials that are poisonous by inhalation. (These products currently may be transported in DOT-111A tank cars.) The RSPA also indicates that it expects to issue a Notice of Proposed Rulemaking for Docket HM-175A in the summer 1991. Safety Recommendation R-85-105 is currently classified as "Open--Acceptable Response."

The Safety Board recognizes there is some merit in RSPA's position that use of the 1/2-mile-radius criteria (per the DOT Emergency Response Guidebook) may not be the most appropriate means to determine which hazardous materials need to be provided full head shield and thermal protection. The Safety Board believes that fulfilling the intent of Safety Recommendation R-89-80, which asks that the RSPA conduct a safety analysis, is the most appropriate way to determine how to properly protect hazardous materials for shipment by rail tank cars.

However, because of the substantial amount of time that will be required to fulfill the intent of Safety Recommendation R-89-80, the Safety Board believes that immediate action is needed to identify the most harmful materials (those that pose the greatest consequences) and to have these materials transported in stronger tank cars that are protected by head shields and thermal jackets. Consequently, the Safety Board classifies R-85-105 as "Closed--Acceptable Action/Superseded" by Safety Recommendation R-91-11 to the RSPA, calling for its leadership in establishing a working group, comprising appropriate agencies and industry organizations, to expeditiously improve the packaging of the more dangerous products (such as those that are highly flammable or toxic, or pose a health hazard through contamination of the environment) by (a) developing a list of hazardous materials that should be transported only in pressure tank cars with head shield protection and thermal protection (if needed); and (b) establishing a working agreement to ship the listed hazardous materials in tank cars that provide adequate protection. The Safety Board urges the FRA to assist the RSPA in the establishment of the working group and to participate in its actions to improve the packaging of the more dangerous products.

Railroad Employee Training for Hazardous Materials Emergencies

In 1980, as a result of its special study on railroad emergency procedures, the Safety Board issued recommendations urging the FRA to develop and establish guidelines for procedures to be used by railroad personnel in the event of an emergency, and to require that railroad carriers test their emergency response procedures using simulated emergencies (Safety

Recommendations R-80-6 and -7).¹⁰ At the time, the Safety Board also reiterated a similar recommendation (R-76-29, issued to the FRA in 1976 as a result of the passenger train collision in Wilmington, Delaware) to address railroad employee training for emergencies. Because the FRA did not take action, in June 1986, the Board classified Safety Recommendations R-76-29, R-80-6, and R-80-7 as "Closed--Unacceptable Action."

The Safety Board has also issued recommendations about railroad employee training to various rail carriers whose personnel were involved in hazardous materials accidents. However, the Board remains concerned about the adequacy of hazardous materials training, especially because interviews with crewmembers involved in 31 of the 45 cases investigated between March 1988 and February 1989 as part of the recent safety study indicate that 16 of 31 conductors and 15 of 31 engineers had not received any hazardous materials training apart from rules examinations.

Discussions between Safety Board staff and personnel of several rail carriers, and evidence from the Safety Board's accident investigations, indicate that the type of training currently provided to employees varies substantially among rail carriers and sometimes varies within the same company. Generally, much of the information provided to railroad employees is through the company's operating rules and timetables.¹¹ Although the FRA requires that railroads file their operating rules with the agency (49 CFR Part 217), the Federal rule does not identify any specific requirements regarding instruction in hazardous materials safety or procedures.¹² Each rail carrier, therefore, determines the types of information its employees are to be provided in the rulebook. Training provided by the carrier may include any or all of these elements as a part of the information provided to employees: classroom instruction on operating rules, procedures, and Federal regulations; efficiency checks, tests, and examinations; videotapes; and simulations and drills. Railroads require that employees be given a test on the information, termed a "rules examination." Most railroads offer a review class to help employees prepare for a rules examination; the class is often held the same day as the test to minimize time away from work. The railroad determines the frequency of the rules examination; generally the examination is given annually.

¹⁰ National Transportation Safety Board. 1980. Railroad emergency procedures. Special Study NTSB/RSS-80-1. Washington, DC. 16 p.

¹¹ Timetables often include safety information about hazardous materials including, but not limited to, placarding, emergency procedures, switching procedures, and other company rules.

¹² The FRA rule requires railroads to have a general program of periodic instruction, operational tests, and inspections. The railroads with more than 40,000 total employee hours are required to report annually a summary of the number, type, and result of each operational test and inspection by operating division and per 10,000 train miles. The rule does not specify any specific hazardous materials program of instruction, operational tests, or inspections.

As a result of its accident investigations and its interviews with personnel of several railroads, the Safety Board believes that current employee training, when limited primarily to rules examinations based on classroom instruction, has not adequately prepared railroad employees to handle an accident involving hazardous materials. Railroad employees involved in or responsible for the safe transport of hazardous materials, such as traincrews and first-line supervisors, must not only know the rules, but the employees should also be able to apply the rules in simulated and in actual emergencies. The Safety Board believes that in addition to classroom instruction, railroads that transport hazardous materials should also evaluate the employee's knowledge of emergency procedures and the employee's ability to apply such knowledge in an emergency. Evaluations of employees could be performed during efficiency checks, disaster drills, or simulated emergencies.

Currently, there are no Federal regulations that require specific hazardous materials training for employees in the railroad industry who are involved in the transportation of hazardous materials. However, on July 26, 1989, the RSPA issued HM-126F, Training for Hazardous Materials, as a notice of proposed rulemaking (NPRM) (54 FR 31144-31155). The purpose of the proposed requirements is to reduce the incidence of hazardous materials accidents caused by human error by increasing the awareness of safety considerations through a uniform level of training for persons involved in the transportation of hazardous materials. According to the RSPA staff, a final rule is expected by the end of 1991.

The RSPA defines training as a systematic program that ensures that a person has knowledge of hazardous materials and hazardous materials regulations. The training requirements outlined in the NPRM include three categories of training: general awareness/familiarization, function-specific, and safety training. General awareness/familiarization training has been described in the NPRM to include an understanding of the Federal rules applicable to hazardous materials (such as the hazard communication requirements and the various classes of hazardous materials). Function-specific training has been described to include detailed training on the Federal rules specifically applicable to the functions the person performs. Safety training has been described to include several topics: (1) emergency response information; (2) general dangers presented by the various classes of hazardous materials and how persons can protect themselves from exposure to those hazards; (3) methods and procedures to avoid accidents; and (4) procedures to be followed immediately after an unintentional release of a hazardous material, including any emergency response procedures for which the person is responsible. The NPRM states that, generally, retraining is needed every 2 years, and the employer must keep records on the training received by the employee.

The Safety Board supports the NPRM issued by the RSPA. When the proposed rule becomes final, the Board urges the FRA to require rail carriers to incorporate into their railroad operating practices aspects of the final rule that relate to hazardous materials training.

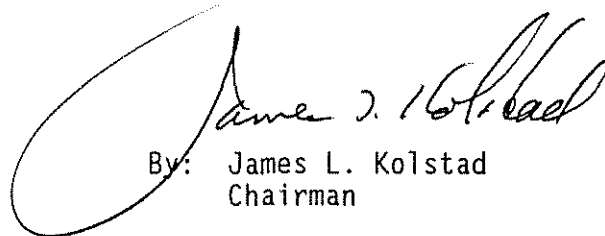
Therefore, as a result of the safety study, the National Transportation Safety Board recommends that the Federal Railroad Administration:

Assist the Research and Special Programs Administration (RSPA) in the establishment of a working group--comprising the RSPA, the Association of American Railroads, the Chemical Manufacturers Association, the American Petroleum Institute, the National Fire Protection Association, and your agency--to expeditiously improve the packaging of the more dangerous products (such as those that are highly flammable or toxic, or pose a threat to health through contamination of the environment) by (a) developing a list of hazardous materials that should be transported only in pressure tank cars with head shield protection and thermal protection (if needed); and (b) establishing a working agreement to ship the listed hazardous materials in such tank cars. (Class II, Priority Action) (R-91-12)

Require, when the Research and Special Programs Administration issues the final rule on HM-126F (Training for Hazardous Materials), that rail carriers incorporate into their railroad operating practices aspects of the final rule that relate to hazardous materials training. (Class II, Priority Action) (R-91-13)

Also as a result of the safety study, the Safety Board issued recommendations to the Research and Special Programs; the Association of American Railroads; Class I railroads and railroad systems; Guilford Transportation, Inc.; MidSouth Rail Corporation; the American Short Line Railroad Association; the Chemical Manufacturers Association; the American Petroleum Institute; the National Fire Protection Association; the National League of Cities; the National Association of Counties; the International Association of Fire Chiefs; the International Association of Chiefs of Police; and the National Sheriffs' Association.

KOLSTAD, Chairman, COUGHLIN, Vice Chairman, and LAUBER, BURNETT, and HART, Members, concurred in this recommendation.


By: James L. Kolstad
Chairman

Member Burnett would classify Safety Recommendation R-85-105 as "Open--Unacceptable Response" because the RSPA has taken no positive action in response to the recommendation; Member Burnett believes the Safety Board should provide an alternative criteria to the isolation radius of 1/2 mile as stated in the recommendation.