DEPARTMENT OF TRANSPORTATION
HAZARDOUS MATERIALS REGULATIONS BOARD
WASHINGTON, D.C. 20590

Title 49—TRANSPORTATION

Chapter I—Hazardous Materials Regulations Board, Department of Transportation

[Docket No. HM-38; Amendment No. 179-4]

PART 179—SPECIFICATIONS FOR TANK CARS

Restriction of Capacity of Tank Cars and Interlocking Couplers

The purpose of this amendment to the Hazardous Materials Regulations of the Department of Transportation is to restrict the gross weight and volume capacity of, and require interlocking couplers on all new tank cars used to transport hazardous materials.

On December 11, 1969, the Hazardous Materials Regulations Board published Docket No. HM-38; Notice No. 69-31 (34 F.R. 19553) proposing to amend Part 179 of the Hazardous Materials Regulations as indicated above. In that notice, the Board stated its concern with the increasing number of railroad accidents involving tank cars transporting hazardous materials in which the tank released its contents, through either puncture or rupture. Reference was made to the mounting death and personal injury rate resulting from these accidents, as well as the property loss. Interested persons were afforded an opportunity to participate in this rule making.

Regarding the imposition of a capacity limitation of 34,500 gallons, many respondents noted that large capacity tank cars tended to reduce the hazard to the public by reducing the number of cars required for a given volume movement. No consideration was expressed for the fact that increased capacity will result in a greater hazard in the event that the tank car is punctured or ruptured in a derailment. Large capacity tank cars also increase the hazard of soil, water and air pollution.

Many responses were addressed to the question of limiting the total gross weight on rail to 263,000 pounds. Some of the data discussed the validity of a weight limitation as a control measure to improve railroad safety, focusing primarily on weight-related causative accident factors and the effects on kinetic energy of the tank car.

Causative accident factors show that stress failures in track and car parts account for approximately 50 percent of all rail accidents. The Board believes that the relationship between such stress failures and car weight is direct.

In every example offered citing rail loads in excess of the proposed limit, particular mention was made of the special routing clearances and controls exercised over the movement of these cars. Such special measures are not present in normal tank car movement, which is the situation to which the Board must address itself. Only one response offered design data which showed that due consideration had been given to overbuilding a tank and running gear to obtain the margin of safety which is required by good engineering practice.

Weight related stress failures are known to have occurred in existing "100 ton" capacity, 263,000 pounds gross weight tank cars which have been in service for a period of years. "Fix" programs to correct buckling and fatigue cracking at both ends of stub sills on underframeless cars have been underway for several years. It is necessary to have an upgrading of the present tank car fleet in order to withstand the rigors of the normal railroad environment over the expected life of the tank cars. This upgrading must be accomplished before considering allowing increase of the stress loads on equipment and the rail plant caused by heavier cars.

One respondent addressed himself to the influence of weight on kinetic energy of the tank car and mentioned the ability of a larger mass to absorb a larger amount of kinetic energy. Increasing the weight of the tank car produces a linear increase in its kinetic energy at equal velocity. This increased kinetic energy increases the likelihood that the tank will be punctured or will rupture in an accident. Therefore, the Board believes that limiting the maximum weight of a tank car will reduce incidents of puncture and rupture.

Inadequate consideration has been given in current design practice to the selection of material thicknesses to compensate for greater kinetic energy levels encountered as tank car weight increases. As train operating speeds increase, this kinetic energy increases exponentially.

Sill design has been held nearly constant despite change in tank car weight and capacity, and shell thickness has varied only as a function of the tensile strength of materials and tank diameter. It is apparent that the weight (stress) related elements have not been strengthened as a direct function of capacity. The Board believes that this, in effect, results in a lower factor of safety in larger capacity tank cars as related to smaller capacity cars.

Virtually all respondents mentioned the economic impact of the proposed weight-capacity limitations. It must be recognized that the cost of accidents is also a part of the national distribution costs and is reflected in freight rates.

In order to accurately determine the economic effect of this rule making, the Board retained an independent expert to analyze the overall costs of "large

capacity" tank cars as related to "smaller capacity" tank cars. The following table summarizes his findings:

SUMMARY OF TANK CAR TRANSPORTATION COSTS

LIQUEFIED PETROLEUM GAS

	Dollars per ton	Cents per gallon
500-mile movement:		
70-ton capacity	8.58	2.0151
100-ton capacity	7.22	1.6957
125-ton capacity	6.71	1.5757
140-ton capacity	7.65	1.7983
1,000-mile movement:		
70-ton capacity	13.52	3.1777
100-ton capacity	11.54	2.7111
125-ton capacity	10.84	2.5465
140-ton capacity	11.98	2.8165
1,500-mile movement:		
70-ton capacity	18.47	4.3403
100-ton capacity	15.86	3.7265
125-ton capacity	14.97	3.5173
140-ton capacity	16.32	3.8347

The table indicates that costs involved in utilizing the "100ton" capacity tank car differ little from those costs involved in utilizing the "125ton" capacity tank car. The "100ton" capacity tank car actually offers some cost savings over the "140ton" capacity tank car. The Board believes public safety warrants the slight reduction in economic efficiency which results from utilizing "100ton" capacity tank cars in place of "125ton" capacity tank cars.

For the above reasons, the Board concludes that the proposed restrictions on tank car weight-capacity are in the public interest. Until the present problems involved in using the "100ton" capacity tank cars are resolved and until evidence is presented to show that increased stress levels associated with higher unit loadings on the rail plant and tank car equipment at prevailing speeds have been adequately compensated for, this will remain the Board's conclusion.

The Board further believes that the application of interlocking automatic couplers on all new tank cars will materially improve safety by reducing the incidence of tank head puncture and tank car pileup.

Since the date of Notice No. 69-31, there have been 19 accidents involving tank cars transporting hazardous materials in which the contents have been released causing severe hazard. One such accident occurred at Crescent City, Ill., on June 21, 1970. The continuing occurrence of accidents of this nature makes evident the need for action. The Hazardous Materials Regulations Board is aware that research efforts are being made by the affected industries, and that the Federal Railroad Administration has entered into contracts to study certain aspects of tank car design and accident behavior. It is hoped that these efforts will develop improved tank designs and methods of construction, including specialized hardware, which will enable all newly built tank cars to be able to safely transport hazardous materials. Until the results of these research activities are known, the Board believes that the proposed steps must be taken to prevent proliferation of the problems resulting from the continued construction of large capacity tank cars exceeding 34,500 gallons. While the Board recognizes that the Crescent City accident involved tank cars having capacities in the 30,000-gallon range, it believes that larger capacity cars would have released much greater quantities of hazardous materials, with consequently increased fire hazard and property damage. In addition, the added weight on rail would have increased the impact forces in the derailment and might well have resulted in additional punctures, fires, and violent ruptures.

Several responses noted the lack of a readily acceptable definition of the term "rebuilt tank car." This term has been deleted from the amendment pending the Board's further review.

The Board believes that by requiring installation of interlocking couplers that will resist car telescoping and jackknifing in derailments and emergency stops, the incidence of tank head and side puncture will be markedly reduced. At Crescent City, a tank head puncture caused the eventual conflagration and violent ruptures.

In consideration of the foregoing and for reasons discussed in the preamble of Notice No. 69-31, 49 CFR Part 179 is amended as follows:

(A) In the table of contents, §§ 179.13 and 179.14 are added to read as follows:

Sec.
179.13 Tank car capacity and gross weight limitation.
179.14 Tank car couplers.

(B) § 179.13 is added to read as follows:

§ 179.13 Tank car capacity and gross weight limitation.

Tank cars built after November 30, 1970, must not exceed 34,500 gallons capacity or 263,000 pounds gross weight on rail. Existing tank cars may not be converted to exceed 34,500 gallons capacity or 263,000 pounds gross weight on rail.

(C) § 179.14 is added to read as follows:

§ 179.14 Tank car couplers.

All tank cars built after November 30, 1970, must be equipped with interlocking automatic couplers that will resist car telescoping and jackknifing in derailments and emergency stops and that are approved by the Federal Railroad Administrator.

This amendment is effective November 13, 1970.

(Secs. 831-835, Title 18, United States Code; sec. 9, Department of Transportation Act, 49 U.S.C. 1657)

Issued in Washington, D.C., on September 2, 1970.

HAROLD C. HEISS,
Acting Administrator,
Federal Railroad Administration.

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