

National Transportation Safety Board

Washington, D. C. 20594

Safety Recommendation

LDG B-1109B

Date: October 24, 1988

In reply refer to: R-88-58 through -64

Honorable John H. Riley
Administrator
Federal Railroad Administration
Washington, D.C. 20590

On September 8, 1987, a New Orleans Terminal (NOT) crew moved six tank cars of butadiene from the NOT's Oliver Yard in New Orleans, Louisiana, and at 7:35 p.m. placed them on track No. 3 of the CSX Transportation's (CSXT) Terminal Junction Interchange Yard (interchange yard) for delivery to the CSXT. About 1:50 a.m. on September 9, 1987, butadiene leaking from the bottom manway of a tank car was ignited and the resulting flames rising about 100 feet into the air engulfed both bridge spans of Interstate 10. The fire receded to the leaking tank car where it burned beneath the tank car until 1:55 p.m. on September 10, 1987. During the emergency, more than 200 city blocks were evacuated affecting 800 to 1,000 residents.¹

Title 49 Code of Federal Regulations (CFR) 179.102-11 states that cars used in transport of liquefied petroleum gas, anhydrous ammonia, and butadiene must have manway gaskets of asbestos or an approved high-temperature equivalent. Although the CFR specifies "an asbestos type" gasket for tank cars carrying liquefied petroleum products and other hazardous materials, this regulation does not provide:

- criteria or other direction on the manufacture, composition, or thermal performance of gaskets;
- the types of gasket materials which are high-temperature equivalents to asbestos; or
- direction as to the acceptability of using sealants for installing gaskets.

When the manway access cover of the accident tank car GATX 55996 was opened after the accident, it was evident that approximately 40 percent of the manway gasket was displaced from the manway gasket ring. The manway gasket ring was

¹For more detailed information, read Hazardous Materials/Railroad Accident Report--*Butadiene Release and Fire from GATX 55996 at the CSX Terminal Junction Interchange, New Orleans, Louisiana, September 8, 1987* (NTSB/HZM-88/01).

welded to the tank car shell and served as a seat for the manway cover. When the bottom manway was opened and the manway and gasket examined, substantial amounts of silicone sealant were prevalent inside the tank car near the manway flange. The sealant was identified by the Phillips 66 representative as Dow-Corning 732 Sealant, which was used in its Elkhart, Texas, facility and commonly used by its other tank car repair shops. When the National Transportation Safety Board conducted a physical examination of the gasket material which was freshly lubricated with silicone sealant, it was noted that the silicone sealant would act as a lubricant, especially with a "rubber" gasket. Until the sealant had completely set, its lubricity would further aid in the lateral displacement of the gasket material.

A sample of the gasket from GATX 55996 was removed and sent to the U.S. laboratory, Department of the Treasury, for detailed analysis. The laboratory also conducted a thermal analysis² of the gasket material and reported that no degradation of the gasket material was noted up to 360° C, but above this temperature, the sample degraded fairly rapidly. On exposure to an open flame, the gasket material would not support combustion and resisted the effects of heat and flame. Although liquid butadiene was not readily available for compatibility testing of the gasket, solvent testing³ was performed. Based on the solvent tests, the laboratory surmised that the gasket would not degrade in the presence of butadiene.

After the Safety Board provided the Federal Railroad Administration (FRA) with all factual information obtained during its investigation of this accident, the only formal action taken to date has been a March 4, 1988 letter from the FRA associate administrator for safety to the Association of American Railroads (AAR) mechanical division which advised, in part:

A preliminary investigation has revealed the potential source of the incident to be an improperly applied gasket on the self-energizing manway. In addition, it was determined that the self-energizing manway was not constructed in accordance with the original Certificate of Construction Application (D-16735-A, submitted by NATX) approved by the Tank Car Committee [TCC] on March 8, 1967.

Even though an inspection in October 1987 disclosed that the bottom manway tank cars presently in the General American Transportation Corporation (GATC) fleet deviated from the AAR-approved design and that a design problem which could cause gasket displacement was apparent in all cars inspected, the FRA letter stated:

It is our understanding that TCC has identified an additional 150 tank cars constructed with a similar type of self-energizing manway. FRA is concerned that some of these tank cars might have been built in noncompliance with the original TCC approval.

²A differential thermal analysis and thermal gravimetric analysis determine the change in temperature and weight of a sample as a function of the rise in the furnace temperature.

³Laboratory solvent testing disclosed that "the main body of the gasket was unaffected by overnight soaking in various solvents: chloroform, xylene, o-dichlorobenzene, or dimethylformamide."

The FRA associate administrator's March 4, 1988 letter to the AAR did not address the safety implications of a similar accident nor did it express any urgency for taking prompt remedial action. Rather, this letter simply requested the AAR to provide information whether the present owners of tank cars with bottom manways had been notified or had their cars inspected, and what action the TCC planned to take concerning the noncomplying cars. The Safety Board believes that the bottom manway should have been designed to require at least a double failure before any product could escape, and it should have provided a ready means for identifying when one of the sealing devices had failed. Each of the bottom manways on the tank cars inspected after the accident contained only one sealing mechanism; consequently, any failure of the sealing mechanism would be catastrophic since no effective action to stop a leak could be taken. The Safety Board is concerned that no action has been taken to prevent these tank cars from continued service in transporting high-risk hazardous materials, such as flammable or poisonous gases, that can endanger large areas when released. The Safety Board urges the FRA to act immediately to prohibit the use for transportation of hazardous materials tank cars that have a manway opening located below the liquid level of the material transported.

North American Tank Car Corporation's (NATX) bottom manway incorporated several unique and critically important safety features in its manway design; however, NATX took no specific action to make known to others essential operating and maintenance information about these unique features. The NATX engineer who approved this design stated that the slotted hinge closure design would be easier to close improperly. Proper closure requires that the closure plate be dropped squarely on the gasket seat before starting to tighten the holddown nuts. He noted that the gasket specified on the AAR-approved drawings constituted the one which NATX believed necessary for providing safe service during transportation. He stated that anyone desiring to use a gasket other than the one specified should have performed some engineering analysis or other evaluation to determine if a gasket of different material or of different dimension would provide an adequate seal. To his knowledge, neither NATX nor any other person had performed any analysis, either initially or later, to define the specific dimensions or range of dimensions required of any type of gasket material to seal the manway safely. NATX did not provide any written maintenance procedure for future owners or tank car repair shops for the proper closing of the manway or the necessity to use a specific gasket. Moreover, the specifications for the gasket were not stenciled or otherwise noted on the tank car to require use of a specific type and size gasket. The lack of this specific knowledge by the tank car owners is responsible for the variations in the gasket sizes and the gasket misalignments found during the inspections performed after the accident. The Safety Board believes that in order to maintain the integrity of the tank cars, special procedures or material specifications on dimensions be permanently and conspicuously affixed to the tank car.

The bottom manway cars were built and approved by the AAR at a time when a record number of tank cars were being built and when the regulatory responsibility for railroad safety was being transferred by the U.S. Congress from the Interstate Commerce Commission (ICC) to the Department of Transportation (DOT).⁴ Because

⁴In April 1967, the ICC relinquished its oversight authority for tank car safety to the DOT. This oversight authority included the delegations to the AAR as the approval authority for tank car design, construction, or alteration.

of the large number of new applications for tank car construction, repair, and modification, the AAR TCC permitted car builders to undertake construction before AAR approval with the understanding that should it require changes to the application, the affected tank cars would be modified to incorporate these changes. Consequently, in 1966, NATX began building the NATX 34000 series tank cars before the final engineering drawings were approved by the TCC. In November 1966, NATX submitted the final design drawings with revisions to the manway design to the AAR. When the cars were ready to enter service, NATX submitted the certificate of construction attesting that the tank car met the AAR-approved drawings. However, this action was taken without checking the cars against the drawings. Later, when these cars were sold (in 1979 and again in 1986), the purchasers required the sellers to furnish only the certificate of construction in accordance with Rule 88 of the AAR *Office Manual of the Interchange Rules*. No purchaser had all of the approved design drawings, and therefore, they were unable to ensure that the cars had a proper certificate of construction or that the certificate matched the actual construction of the car. As a result, the fact that the NATX bottom manway tank cars did not comply with the AAR-approved drawings was not discovered during its more than 20 years of service because each subsequent owner had relied first on the builder's certification and then on the previous owner to provide a proper tank car.

Generally, the AAR Bureau of Explosives (BOE) maintains records on AAR Form 4-2--Application for Construction and their related design drawings of tank cars for approximately 5 years, although tank car "life" in active interchange service is frequently 20 years or more. There is no requirement for the AAR or the tank car builder to maintain reference forms or drawings for tank cars. The CFR states that a copy of an approved certificate (AAR Form 4-2) shall be furnished to the AAR BOE and the owner, but it says nothing about keeping, updating, or maintaining such records. Consequently, the history of this tank car is not well documented and the available documentation provides little understanding of the actions taken for its initial design and modification.

It appears that the cars were built in accordance with the unapproved "original" AAR Form 4-2, and the tank cars were subsequently released and accepted into service by the modified AAR Form 4-2. Nothing prohibited a manufacturer from building or assembling a previously-approved specification car before the AAR Form 4-2 was approved by the TCC. It appears that NATX did not check the cars against the approved drawings of the modified AAR Form 4-2. These unapproved tank cars were erroneously allowed to remain in service because the approved design drawings were not required to be given to subsequent owners. Thus, each new owner was placed in the position of relying, first, on the builder to have taken appropriate actions and, second, on previous owners to have taken appropriate actions. The Safety Board believes that all documentation for tank cars should be provided to purchasers before a transfer of ownership is made. Also, a thorough inspection should be required to determine that the tank car conforms to all approved drawings and to applicable Federal regulations. Further, the FRA should establish quality control requirements for tank car manufacturers and operators of tank car repair shops to ensure that their actions comply with Federal regulations and conditions established in AAR approvals for manufacture, repair, or modification of tank cars.

In 1984, Phillips 66 repair shops had written procedures in the form of various memoranda inserted in a notebook for some of the work performed by its employees. However, it did not have specific procedures for working on tank cars with bottom manways nor did it have procedures that discussed sealant materials. Its employees

gained their knowledge about specific procedures primarily through on-the-job training. Since this accident, Phillips 66 has undertaken an evaluation of the various memoranda that constituted its shop procedures and has developed a procedures manual specifically to guide the work of its employees. Phillips 66's tank car repair shops, like all approved repair shops, are inspected and certified by the AAR. This inspection is an indication that the facility has the capability to perform work in accordance with Federal and AAR requirements, but it does not determine if the facility follows Federal and AAR requirements. A certification inspection, intended to verify data submitted to the AAR by the applicant, is performed with respect to welding procedures and qualifications, supervision, quality control, radiography, postweld heat treatment, and other equipment and/or practices employed by the repair facility. If the facility passes that inspection, the facility becomes certified to perform repairs of tank cars for 5 years before another inspection is required. The inspection process was discussed by the Safety Board in its report on the December 31, 1984 accident at North Little Rock, Arkansas,⁵ and the Safety Board pointed out that the FRA performed no routine inspections of tank car repair facilities. Since that time, the FRA has begun to perform some inspections of tank car repair facilities.

NATX and GATC advised the Safety Board that, unlike Phillips, they do not recommend the use of sealants for seating gaskets. Further, without a written policy prohibiting the use of sealants, Phillips carmen have routinely used sealants to aid in sealing manways and have reused gaskets that may not have been in compliance with the design requirements for bottom manways. Phillips has advised that sealant use on gaskets has now been discontinued. Moreover, in January 1987, Phillips revised its shop procedures for servicing manways by directing carmen to remove and replace all gaskets with asbestos gaskets rather than follow the previous procedure of "replace gaskets if necessary."

While these actions will minimize the possibility of using incorrect gasket material, these steps alone will not ensure that the approved gasket size is installed. Unless tank car shops are provided with the proper gasket dimensions from the approved drawings, a carman normally will try to find a close match to the gasket being replaced, which may or may not be the approved size. Consequently, carmen still will not know what size gasket to install unless the tank car manufacturer provides repair shops with the actual gasket dimensions.

As demonstrated in this accident, while Phillips has made modifications to its shop procedures, many of the procedures being followed were not current and were not being monitored routinely to ensure that the repairs met DOT and AAR requirements. Furthermore, it was noted that Phillips' shops have previously been inspected and approved by the AAR without disclosing any procedural deficiencies. None of the deficiencies identified during the Safety Board's examination of the bottom manways or during the review of Phillips shop procedures were addressed by the AAR shop certification inspections conducted at Phillips' Railcar Maintenance Shop in Elkhart, Texas, before and after the New Orleans incident.

There are no Federal requirements for written procedures that detail the manner for performing maintenance work and inspections critical to the continued safe

⁵Special Investigation Report--Hazardous Materials Release, in Missouri Pacific Railroad Company's North Little Rock, Arkansas Railroad Yard, December 31, 1984 (NTSB/SIR-85/03).

operation of tank cars, and there are no requirements for the qualification and training of persons who perform these critical functions. The Safety Board believes that the lack of sufficient guidance for the tank car repair personnel resulted in tank car GATX 55996 being equipped in 1984 with a gasket not suitable for use in the bottom manway and in this gasket not being replaced when the manway was again inspected in 1986. Additionally, this lack of specific guidance apparently was also responsible for the use of various sealants to hold gaskets in place while a closure device or fitting was tightened as well as for sealing a closure when a gasket was damaged or misaligned. The Safety Board believes the FRA should require tank car repair shops to develop and maintain procedures for performing work on tank cars and to train its employees in those procedures.

Therefore, the National Transportation Safety Board recommends that the Federal Railroad Administration:

Establish performance standards for determining the acceptability of heat-resistant gaskets required to be used on tank cars. (Class III, Longer Term Action) (R-88-58)

Prohibit from hazardous materials service the use of tank cars that have a manway opening located below the level of the liquid being transported. (Class II, Priority Action) (R-88-59)

Evaluate the effect on gasket compatibility and heat-resistance performance of sealants used for installing gaskets on tank cars, and if the use of sealants is allowed, establish performance criteria to determine which sealants are acceptable and the conditions for their use. (Class III, Longer Term Action) (R-88-60)

Where special procedures or material specifications or dimensions are required for maintaining the integrity of tank cars, require such information to be permanently and conspicuously affixed to the tank car. (Class III, Longer Term Action) (R-88-61)

Require tank car owners to be provided with a copy of design drawings and other documentation which is a part of the tank car certification, modification, or repair and require that these documents be maintained for the life of the tank car. (Class II, Priority Action) (R-88-62)

Establish quality control requirements for tank car manufacturers and tank car repair shops sufficient to ensure that actions taken comply with Federal regulations and with any conditions established in Association of American Railroads approvals for manufacture, repair, or modification of rail tank cars. (Class III, Longer Term Action) (R-88-63)

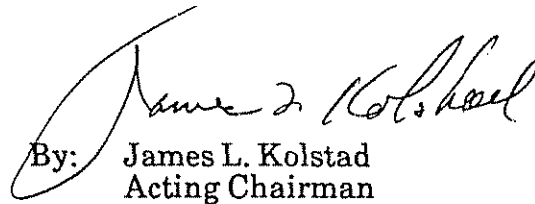
Require that tank car repair shops develop and maintain current written procedures to guide their employees in performing work on tank cars and that their employees be trained on those procedures. (Class III, Longer Term Action) (R-88-64)

Also as a result of its investigation, the Safety Board issued Safety Recommendations I-88-3 and -4 and R-88-55 to the city of New Orleans, R-88-56 and

-57 to the Norfolk Southern, I-88-5 to the New Orleans Public Service, Inc., R-88-65 to the General American Transportation Corporation, R-88-66 and -67 to the Mitsui & Company (USA) Inc., R-88-68 to the GATX Terminals Corporation, I-88-6 to the Research and Special Programs Administration, R-88-69 to the National League of Cities, and R-88-70 to the National Governors' Association.

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "... to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you regarding action taken or contemplated with respect to the recommendations in this letter. Please refer to Safety Recommendations R-88-58 through -64 in your reply.

KOLSTAD, Acting Chairman, and BURNETT, NALL, and DICKINSON, Members, concurred in these recommendations. LAUBER, Member, did not participate.


By: James L. Kolstad
Acting Chairman