



Log R-650E

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: March 2, 1995

In reply refer to: R-95-18 and -19

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President and Chief Executive Officer
Association of American Railroads
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On June 6, 1994, a conductor for the Norfolk Southern Railway Company detected product leaking from the bottom of tank car UTLX 79211 in the Norfolk Southern Harry deButts yard in Chattanooga, Tennessee. The tank car contained 12,184 gallons of a 75-percent concentration of arsenic acid, which is classified as a poisonous material and also designated as a marine pollutant under the Department of Transportation (DOT) Hazardous Materials Regulations.

A total of 3,079 gallons of arsenic acid was released from UTLX 79211. An undetermined amount of the arsenic acid entered the storm drain system for the yard. Although the sluice gate for the storm drain system was closed, arsenic-contaminated water from the storm drain system was discharged into Citico Creek about 1 1/2 miles upstream of the mouth of the creek into the Tennessee River. The intake pipes for the city's municipal water supply cross the mouth of the creek and extend about 175 feet into the Tennessee River. Cleanup, containment, and disposal costs were estimated at \$8.77 million as of January 31, 1995. There was no evacuation, and no injuries were attributed to the release.¹

The tank car involved in the release of arsenic acid was tank car UTLX 79211, a DOT specification 111A100W1 tank car, built by the Union Tank Car Company (Union) in March 1966. The tank car was owned by Union but was leased to Koppers Company, Inc., on March 31, 1988. The Hickson Corporation (Hickson) assumed operational control of the tank car in February 1989. Since that time, Hickson used UTLX 79211 to ship arsenic acid; prior to the accident on June 6, 1994, the tank car

¹ National Transportation Safety Board. 1995. Tank car failure and release of arsenic acid in Chattanooga, Tennessee, on June 6, 1994. Hazardous Materials Accident Report NTSB/HZM-95/01. Washington, DC.

was used for shipments of arsenic acid in July and October 1993 and March and April 1994. Hickson leased eight other tank cars from Union for arsenic acid service, but it did not own or lease any additional tank cars.

Although UTLX 79211 had a bottom outlet valve, Hickson transferred arsenic acid to and from the tank car through a 2-inch-inner-diameter (2.4-inch-outer-diameter) grade 316L stainless steel eduction pipe. In March 1988, Union, at the request of Koppers, modified the eduction system in UTLX 79211 by replacing the original 3-inch-diameter eduction pipe with the 2-inch-diameter eduction pipe. The original eduction pipe guide was also replaced. The sump and the housing at the top of the tank car were not replaced and were installed when the tank was constructed.

Safety Board investigators first examined the tank car on July 23 at the deButts yard in Chattanooga.² When Safety Board investigators examined the tank car, the jacket and insulation on the bottom of the tank car had been removed along the length of the tank car inboard of the trucks to expose the tank shell, including the sump and bottom outlet valve. An oval-shaped hole was observed at the interface between the bowl-shaped sump and the bottom of the tank at the bottom centerline facing the A-end of the tank. The hole was about 1 inch long and 0.25 inch to 0.50 inch wide at its widest point.

UTLX 79211 was moved to Lynchburg, Virginia, where external and internal examinations of the tank car were performed on September 7, 1994. The internal examination of the tank car revealed an area of corrosion where the sump was welded to the tank at the bottom centerline of the tank car. The hole observed during the external examination of the tank car was located within this area of corrosion. The corroded area formed an arc about 3 inches long and extended through the tank shell to create the hole.

The internal examination of the tank car also revealed that the alignment of the saddle-shaped pipe guide was not concentric to the sump, which had an inside diameter of 5.75 inches. The distance from the exterior side of the eduction pipe to the edge of the sump along the centerline of the tank car was 0.35 inch toward the A-end and 3.0 inches toward the B-end. With the eduction pipe positioned in the pipe guide, there was enough longitudinal movement of the eduction pipe toward the A-end and the area of corrosion to extend at least 0.1 inch beyond the edge of the sump.

² The Safety Board initiated an investigation after a Safety Board investigator learned of the circumstances of the accident on July 19, 1994, while attending a meeting of the Association of American Railroads' Tank Car Committee. Initial information indicated that the spill of arsenic acid had been contained within the yard. When the Safety Board was informed on July 22 that the spill extended outside the yard, investigators from headquarters in Washington, D. C., and the regional field office in Chicago, Illinois, were sent to Chattanooga.

The alignment of the housing located at the top of the tank car with the sump was checked by measuring the vertical alignment of the eduction pipe. Measurements indicated that the eduction pipe, over a 5-foot section of its length, was vertically misaligned in both the longitudinal and transverse planes by 0.25 to 0.50 inch.

Because of the misalignment between the sump and the housing for the eduction pipe at the top of tank car UTLX 79211, the eduction pipe was not concentrically positioned with the sump as it was designed to be. As previously noted, the clearance between the eduction pipe and the edge of the sump in the corroded area was about 0.35 inch. If the 2.4-inch-outer-diameter eduction pipe had been concentrically aligned with the sump (inside diameter of 5.75 inches), the clearance should have been 1.675 inches.

Further, the lower end of the eduction pipe that was facing the corroded area of the sump was slightly deformed and abraded in a manner that was consistent with mechanical contact or impact with another object. Given the reduced clearance between the eduction pipe and the edge of the sump, the forces normally encountered in train movement, coupling, and switching operations likely were sufficient to cause movement of the eduction pipe to strike the edge of the sump. Multiple impacts of the eduction pipe against the edge of the sump eventually damaged the phenolic Plasite 3066 coating and compromised its integrity. The arsenic acid penetrated the damaged coating and corroded the steel tank and the sump.

The Safety Board determined that the release of the arsenic acid from UTLX 79211 was caused by misalignment of the sump and the housing for the eduction pipe, which resulted in mechanical damage to the coating of the tank car at the sump and the subsequent corrosion and failure of the tank shell. The inside diameter of the bowl-shaped sump relative to the outside diameter of the eduction pipe did not provide sufficient tolerance to accommodate misalignment between any of the components of the eduction pipe system without causing mechanical damage to the protective coating in the tank car.

Union has indicated that a significant number of its tank cars have the same configuration of sump, housing, and eduction pipe and that this configuration is still an option for newly constructed tank cars. Four of the eight other Union-built and owned tank cars leased to Hickson (UTLX 79204, 79206, 79209, and 75951) had the same configuration of sump, pipe guide, and eduction pipe as UTLX 79211, and all four had similar alignment problems as UTLX 79211, which could have occurred at the time of construction or modifications. The Board is concerned that other Union-built tank cars with this style sump and eduction pipe may have similar alignment problems and be prone to fail in the same manner as UTLX 79211. Therefore, the Safety Board is recommending that Union inspect a representative sample of Union-built tank cars equipped with the same configuration of housing for the eduction pipe and bowl-shaped sump as UTLX 79211, and based on the results of its inspections,

modify all tank cars as necessary to ensure that the eduction pipe cannot contact the sump.

Surveys of other tank car manufacturers found that this configuration of sump and eduction pipe system has been used on tank cars for several years and can still be used at the option of the manufacturer. The DOT hazardous materials accident data base indicated that from January 1991 through August 1994 there had been 28 releases of hazardous materials from the sump areas of railroad tank cars (including that from UTLX 79211). Because the DOT data base was not designed to identify the specific mode of failure or the design of the failed component, the magnitude of sump area failures resulting from misaligned components of the eduction pipe housing system cannot be readily determined. The Safety Board is concerned that tank cars built by other manufacturers may also have problems with the alignment of eduction pipes and sumps and eduction pipe bracing systems that could result in mechanical damage to tanks. The alignment problems found by the Federal Railroad Administration (FRA) in 1993 in the 13 tank cars built by the North American Transportation Company and the December 1994 failure of an ACF-built tank car in Newark, New Jersey, in which the rubber lining on the interior of the sump had been worn away sufficiently to expose and corrode the underlying metal sump/tank shell, suggest that tank cars built by other manufacturers do have similar alignment problems. Therefore, the Safety Board believes that the FRA, with the assistance of the Railway Progress Institute and the Association of American Railroads (AAR), should evaluate the failure rate and the mode of failure of bowl-shaped sumps and eduction pipe bracing systems in tank cars transporting hazardous materials, and based on the results of this evaluation, require repairs or modifications to prevent mechanical damage to coatings or linings and subsequently to the tanks.

Because of the jacket and insulation covering the tank shell of UTLX 79211, Norfolk Southern personnel at the deButts yard were unable to determine the precise location of the leak from UTLX 79211 and assumed the leak was coming from multiple locations. Although the leak was not from multiple locations, the trainmaster correctly concluded by 0330 that the leak could not be stopped without offloading the tank car. The trainmaster also correctly recognized that the tank car, if left in its current location, would not be accessible to emergency responders and the equipment and vehicles that were needed to contain the spill and offload the tank car. Therefore, the trainmaster directed the yardcrew to move the tank car to a location that would be more accessible to emergency responders.

The trainmaster was aware that storm drains were located throughout the yard; however, many of these drains were covered with ballast and were not visible. The movement of UTLX 79211 was also made in darkness. Under these circumstances, the placement of the tank car near the storm drain was unfortunate but was not due to carelessness. However, the placement of UTLX 79211 near a storm drain could have been avoided if there had been designated containment tracks or areas within the yard for leaking tank cars. A 1988 tank car spill in the deButts

yard that resulted in a discharge into Citico Creek and revealed that the sealing capabilities of the sluice gate system were inadequate should have sensitized the railroad to the need for a containment area within the yard. Consequently, the Safety Board concludes that Norfolk Southern failed to adequately anticipate and plan for the best location within the deButts yard to place a leaking tank car. Yard facilities should include designated areas where cars that develop leaks that cannot be readily stopped may be placed to contain the leaking cargo and to provide access for offloading operations. The need for containment areas is especially important when leaking cargoes are environmentally harmful and nearby water supplies can be threatened. The Safety Board, therefore, is recommending that Norfolk Southern identify and designate within the deButts yard, and its other rail yards that handle tank cars carrying hazardous materials, areas where leaking tank cars can be placed to contain the leaking cargo and to provide access for offloading operations.

Although Norfolk Southern knew at 0340 (when the trainmaster made his report to the dispatcher) that the arsenic acid posed an environmental threat and that the leak could not be stopped or contained by yard personnel, Norfolk Southern did not attempt to contact an environmental contractor until 0630. The delay in contacting an environmental contractor, particularly one not in the Chattanooga area and therefore unable to respond to the scene for several hours, indicates that Norfolk Southern did not recognize the seriousness of the environmental threat or appreciate the measures that would have to be taken to clean up the released arsenic acid. Further, although a local contractor was subsequently contacted by Norfolk Southern and obtained the lime, rolls of plastic, absorbent materials, and a child's swimming pool for a catch basin, these actions were taken nearly 5 hours after the leak was first detected. Once these materials were obtained, there was virtually no effort by the fire department or Norfolk Southern to use these materials until the arrival of shipper and environmental contractor personnel between 1100 and 1300.

The incident commander recognized that the fire department had no way to contain the leaking acid and that offloading of the tank car was the only solution to stop the release. Further, he did not believe that the benefit from limited containment actions—such as placing a drum beneath the tank car—were worth the risk to the personnel performing the work. Further, he did not believe that there was a safe means readily available to handle the drums once they became filled with leaking cargo. More importantly, the incident commander, knowing that the acid had already entered the storm drain system, believed that the storm drain system was isolated, and that additional acid spilling into the storm drain system would not adversely affect the situation.

These actions collectively demonstrate that Norfolk Southern and the Chattanooga fire department failed to adequately recognize the potential environmental consequences of not responding more expeditiously to the release. Had Norfolk Southern or the fire department recognized the environmental consequences, they may have been prompted to take more aggressive action to contain the leaking

cargo rather than waiting until the arrival of shipper and environmental contractor personnel.

The circumstances of this accident also raise concerns about the lack of joint training and coordination between the city of Chattanooga and Norfolk Southern. Exercises or drills have not been regularly conducted between the fire department and the deButts yard to assess the effectiveness of their respective emergency action plans. The in-service calls made annually by the fire department to the yard only familiarize firefighters with the physical layout of the yard. Prior to the accident, there had not been any type of regular exchange between the fire department and the deButts yard to discuss the types of hazardous materials releases that could occur at the yard, the consequences of such a release, and the actions each could be expected to take in such an accident. If effective emergency response exercises between the city and Norfolk Southern had been conducted and the other improvements addressed above been in place, a more timely response with sufficient resources to contain the leaking cargo would likely have been initiated.

The Safety Board most recently addressed these issues in a 1991 safety study on the transport of hazardous materials by rail.³ The Board concluded in this study that many railroads and community emergency response organizations have not jointly developed written emergency response plans and procedures and have not regularly participated with community emergency response organizations in joint disaster drills of simulated emergencies.

Consequently, the Safety Board recommended on July 1, 1991, that all class I railroads and railroad systems, including Norfolk Southern:

Develop, implement, and keep current, in coordination with communities adjacent to your railroad yards and along your hazardous materials routes, written emergency response plans and procedures for handling releases of hazardous materials. The procedures should address, at a minimum, key railroad personnel and means of contact, procedures to identify the hazardous materials being transported, identification of resources for technical assistance that may be needed during the response effort, procedures for coordination of activities between railroad emergency response personnel, and the conduct of disaster drills or other appropriate methods to test emergency response plans. (R-91-15)

In its initial response to the recommendation, dated July 30, 1991, Norfolk Southern indicated that it had developed an emergency action plan for hazardous materials incidents that was available at all yard facilities and on file with certain company officials. Norfolk Southern also advised the Safety Board that it maintained

³ National Transportation Safety Board. 1991. Transport of hazardous materials by rail. Safety Study NTSB/SS-91/01. Washington, DC.

separate yard plans that included information about hazardous materials passing through the yard, emergency response telephone numbers for local hospitals, the police department, and the fire department. On November 1, 1991, Norfolk Southern provided additional information about its efforts to coordinate with communities along its rail lines. The company indicated that it intended to share copies of the individual yard plans and the emergency action plan with local communities. Norfolk Southern also described training provided to local emergency response personnel, and the participation of Norfolk Southern officials on local emergency planning committees. Based on these responses, the Safety Board classified Safety Recommendation R-91-15 to Norfolk Southern "Closed--Acceptable Action" on December 17, 1991.

The circumstances of this accident suggest that additional efforts are needed to improve Norfolk Southern's response when environmentally harmful materials are involved in accidents. The Safety Board is recommending, therefore, that Norfolk Southern initiate and participate in emergency response drills and exercises with local emergency response agencies at all rail yards within its operating system. The Safety Board is also urging Hamilton County and the city of Chattanooga to coordinate with and involve regional and local transporters of hazardous materials, such as railroads and trucking companies, in planned emergency response drills and exercises.

Although such actions may improve the regional and local emergency response efforts in Chattanooga, the Safety Board is concerned about actions to improve emergency responses to environmentally harmful materials on a national level. The Safety Board believes the circumstances of this accident provide an example of the importance of effective emergency response preparedness. The Safety Board further believes, therefore, that the Association of American Railroads should advise its members of the circumstances of this accident and encourage its members to evaluate their emergency response plans to ensure that the plans adequately address the release of environmentally harmful materials within a yard facility, including the containment of leaking cargo and the procurement of necessary response equipment and personnel.

Therefore, as a result of its investigation of this accident, the National Transportation Safety Board recommends that the Association of American Railroads:

Advise Association members of the circumstances of the June 6, 1994, accident in Chattanooga, Tennessee, and encourage members to evaluate their emergency response plans to ensure that the plans adequately address the release of environmentally harmful materials within a yard facility, including the containment of leaking cargo and the procurement of necessary equipment and personnel to respond. (Class II, Priority Action) (R-95-18)

Assist the Federal Railroad Administration with the evaluation of the failure rate and the mode of failure of bowl-shaped sumps and education pipe bracing systems in tank cars transporting hazardous materials. (Class II, Priority Action) (R-95-19)

Also as a result of this accident investigation, the Safety Board issued safety recommendations to the Federal Railroad Administration, the Research and Special Programs Administration, the Union Tank Car Company, the Norfolk Southern Corporation, the Hickson Corporation, Hamilton County Emergency Services, the city of Chattanooga, and the Railway Progress Institute.

Chairman HALL, Vice Chairman FRANCIS, and Member HAMMERSCHMIDT concurred in these recommendations.

By: 
Jim Hall
Chairman