



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: March 12, 2001

In reply refer to: R-01-03, I-01-01, and
I-00-06 (Reiteration)

Mr. Edward A. Brigham
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Research and Special Programs Administration
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About 12:05 a.m. on February 18, 1999, railroad tank car UTLX 643593, which was on the west unloading rack at the Essroc Cement Corporation cement plant near Clymers, Indiana, sustained a sudden and catastrophic rupture that propelled the tank car's tank about 750 feet and over multistory storage tanks.¹ There were no injuries or fatalities. Total damages, including property damage and costs from lost production, were estimated at nearly \$8.2 million. The National Transportation Safety Board determined that the probable cause of the accident was the failure of Essroc Cement Corporation (Essroc) and CP Recycling of Indiana management to develop and implement safe procedures for offloading toluene diisocyanate (TDI) matter wastes, resulting in the overpressurization of the tank car from chemical self-reaction and expansion of the TDI matter wastes.

The catastrophic rupture of UTLX 643593 is the fifth nonaviation accident investigated by the Safety Board since June 1998 in which deficient offloading procedures or operations caused or contributed to an accident and the release of hazardous materials. The first of the five accidents took place on June 29, 1998, at Stock Island, Key West, Florida.² A Dion Oil Company driver was on top of a straight-truck cargo tank checking its contents and preparing to transfer cargo from a semitrailer cargo tank when explosive vapors ignited within the straight-truck cargo tank. The ignition caused an explosion that threw the driver from the truck. The fire and a series of at least three explosions injured the driver and destroyed the straight truck, a tractor, the front of the semitrailer, and a second nearby straight-truck cargo tank. Damage was estimated at more than \$185,000.

The Safety Board concluded from its investigation that (1) the carrier did not have written procedures to ensure safe cargo handling, (2) the carrier did not adequately train its drivers to

¹ For more information, see forthcoming Hazardous Materials Accident Report NTSB/HZM-01/01: *Catastrophic Rupture of a Railroad Tank Car Containing Hazardous Waste Near Clymers, Indiana, February 18, 1999* (Washington, DC: National Transportation Safety Board, 2001).

² National Transportation Safety Board, *Fire and Explosion of Highway Cargo Tanks, Stock Island, Key West, Florida, June 29, 1998*, Hazardous Materials Accident Report NTSB/HZM-99/01 (Washington, DC: NTSB, 1999).

ensure safe cargo handling, and (3) Federal training programs for Federal and State motor carrier inspectors did not adequately address the need for inspectors to evaluate the training that motor carriers give their drivers on loading and unloading cargo tanks. Consequently, the Safety Board recommended on October 1, 1999, that the Federal Highway Administration's (FHWA's) Office of Motor Carrier Safety (now the Federal Motor Carrier Safety Administration [FMCSA]):³

H-99-30

Add elements to training programs for Federal and State inspectors that include instruction on determining whether motor carriers have adequate written procedures for and driver training in loading and unloading cargo tanks.

H-99-31

Evaluate the adequacy of cargo-tank loading and unloading procedures of and driver training for hazardous-materials motor carriers and require changes as appropriate.

To date, the Safety Board has not received a response to either recommendation from the FMCSA. On December 14, 2000, the Safety Board sent a follow-up letter to the FMCSA requesting an update on the status of these two recommendations.

Another accident concerning a transfer of hazardous materials took place on August 9, 1998, in Biloxi, Mississippi.⁴ A truckdriver was transferring gasoline from a highway cargo tank to underground storage tanks at a gasoline station-convenience store when an underground storage tank containing gasoline overflowed. An estimated 550 gallons of gasoline flowed from the storage tank, across the station lot, and into the adjacent highway and intersection. The gasoline ignited, and fire engulfed three vehicles near the intersection. Five occupants of the vehicles were killed, and one occupant was seriously injured. Property damages were estimated at \$55,000.

As a result of its Biloxi investigation, the Safety Board concluded that the carrier's operating manuals for its new employees and driver-trainers lacked the specificity that employees need to ensure that they practice correct and safe cargo unloading procedures. The Safety Board also concluded that to help drivers follow safe loading and unloading procedures, Federal regulations should require carriers that transport hazardous materials in cargo tanks to have specific, written procedures for loading and unloading. Consequently, the Safety Board recommended that the Research and Special Programs Administration (RSPA):

H-99-57

Promulgate regulations requiring motor carriers that transport hazardous materials in cargo tanks to develop and maintain specific written cargo loading and unloading procedures for their drivers.

³ The December 9, 1999, enactment of the Motor Carrier Safety Improvement Act of 1999 established a new U.S. Department of Transportation (DOT) agency, the FMCSA, to oversee and enforce motor carrier safety regulations, which had previously been handled by the FHWA.

⁴ National Transportation Safety Board, *Overflow of Gasoline and Fire at a Service Station-Convenience Store, Biloxi, Mississippi, August 9, 1998*, Hazardous Materials Accident Report NTSB/HZM-99/02 (Washington, DC: NTSB, 1999).

In a February 24, 2000, response to Safety Recommendation H-99-57, RSPA stated it is evaluating options to amend the general training requirements and the current specialized requirements for motor carriers in the DOT *Hazardous Materials Regulations*. On April 4, 2000, the Safety Board classified Safety Recommendation H-99-57 “Open–Acceptable Response,” pending RSPA’s development of regulations that meet the intent of the recommendation. On January 5, 2001, the Safety Board sent a letter to RSPA requesting an update on the actions RSPA has taken on this recommendation since February 2000.

Following the Biloxi accident, the Safety Board also recommended that the FHWA:

H-99-59

Once the Federal regulations requiring motor carriers that transport hazardous materials in cargo tanks to provide written cargo loading and unloading procedures are promulgated, ensure that the motor carriers are in compliance with the regulations.

The FHWA’s Office of Motor Carrier Safety stated in a November 23, 1999, response to Safety Recommendation H-99-59 that it would develop procedures to ensure that motor carriers comply with regulations promulgated to address Safety Recommendation H-99-57. The Safety Board classified Safety Recommendation H-99-59 “Open–Acceptable Response” on February 22, 2000. On January 10, 2001, the Safety Board sent a letter to the FHWA requesting an update on the actions taken on this recommendation since February 2000.

On November 19, 1998, at the Ford Motor Company truck plant in Louisville, Kentucky, a cargo tank truck arrived with a delivery of a liquid mixture of nickel nitrate and phosphoric acid. A plant employee inadvertently connected the truck’s transfer hose to the wrong connection and then departed the area, leaving the truckdriver to complete the delivery alone. The truckdriver did not check that the connection was correct and began unloading the product into a storage tank that contained a chemically incompatible material. The resulting chemical reaction generated a vapor cloud of toxic gases that forced the evacuation of 2,400 plant employees and caused \$192,000 in damages.⁵ Another transfer-related accident occurred in Whitehall, Michigan, on June 4, 1999, after a cargo tank truck arrived at the Whitehall Leather Company with a delivery of sodium hydrosulfide solution. At the direction of a Whitehall shift supervisor, the truckdriver connected the transfer hose from the cargo tank truck to the wrong storage tank; the tank contained a chemical that reacted with the solution in the cargo tank truck. The resulting chemical reaction released hydrogen sulfide gas that resulted in the death of the truckdriver and \$411,000 in damages.⁶

The Safety Board’s investigation of both the Louisville and Whitehall accidents showed that the companies had significant problems with their loading and unloading processes for hazardous materials. The Whitehall Leather Company did not have written instructions and procedures for unloading hazardous materials from bulk cargo tanks and did not have a training program for those employees who might be involved in loading and unloading such materials. The Ford Motor

⁵ National Transportation Safety Board, *Chemical Reaction During Cargo Transfer, Louisville, Kentucky, November 19, 1998*, Hazardous Materials Accident Brief HZB/00/02 (Washington, DC: NTSB, 2000).

⁶ National Transportation Safety Board, *Chemical Reaction During Cargo Transfer, Whitehall, Michigan, June 4, 1999*, Hazardous Materials Accident Brief HZB/00/03 (Washington, DC: NTSB, 2000).

Company had written instructions and procedures for unloading hazardous materials and maintained a training program on these procedures, but Ford failed to provide the plant employee involved in the Louisville accident with the latest unloading instructions for hazardous materials, which might have prevented the accident.

As a result of its investigations of the Louisville and Whitehall accidents, the Safety Board determined that safety requirements were needed for loading and unloading hazardous materials involved in transport and recommended on June 29, 2000, that RSPA:

I-00-06

Within 1 year of the issuance of this safety recommendation, complete rulemaking on Docket HM-223, “Applicability of the *Hazardous Materials Regulations* to Loading, Unloading, and Storage,” to establish, for all modes of transportation, safety requirements for loading and unloading hazardous materials.

In its July 21, 2000, response to Safety Recommendation I-00-06, RSPA stated that it is drafting a notice of proposed rulemaking (NPRM) under Docket HM-223 and expects to publish the NPRM in early 2001. RSPA anticipates issuance of a final rule by the end of 2001. The Safety Board wrote to RSPA on September 25, 2000, indicating its concern over the slow progress of the rulemaking and urging that a final rule be issued by July 2001. In light of the continuing slow pace of action on this important safety issue indicated by RSPA’s letter, the Safety Board classified Safety Recommendation I-00-06 “Open–Unacceptable Response.”

The rupture of UTLX 643593 at the Essroc cement plant near Clymers and the accidents in Stock Island, Biloxi, Louisville, and Whitehall can all be attributed to deficient unloading operations that occurred because of inadequate training, or a lack of comprehensive, specific, and written unloading procedures, or both. In the Clymers accident, the failure of the producer/shippers and end-users to collaborate in the development and implementation of comprehensive, written loading and offloading procedures, customized to the characteristics of the TDI matter wastes and the specific facility, resulted in the use of unsafe unloading practices that ultimately caused the tank car to rupture.

Although the DOT *Hazardous Materials Regulations* include general and mode-specific requirements about the loading and unloading of bulk containers such as tank cars, highway cargo tanks, and intermodal tanks, the current requirements only address procedures common to most loading and offloading operations, such as which personnel must attend the transfer, when brakes must be set on the tank car, when tank car wheels must be blocked, and when and how warning signs must be placed. The DOT *Hazardous Materials Regulations* do not include requirements for loading and unloading procedures to be written based on any unique or particular properties of the hazardous materials that would necessitate the implementation of special handling requirements or on the conditions specific to an individual facility. As demonstrated in the Clymers accident, the use of unloading practices that are not based on such thorough and comprehensive standards can have catastrophic consequences. Therefore, the Safety Board concluded that the DOT *Hazardous Materials Regulations* are deficient because they fail to require the development and implementation of comprehensive, written loading and unloading procedures for hazardous materials.

The Stock Island, Biloxi, Louisville, Whitehall, and Clymers accidents all involved the loading and unloading of transport containers carrying hazardous materials. Of the five accidents, however, only the Clymers accident involved rail rather than motor carrier transportation. Recently, therefore, the Safety Board's safety recommendations concerning loading and unloading regulations have focused primarily on highway transportation. The Clymers accident, however, showed that swift action is needed to improve the safety of hazardous material loading and unloading operations involving rail tank cars as well as highway cargo tanks. Therefore, to ensure that loading and unloading safety provisions are equivalent throughout transportation modes, the Safety Board considers that action is needed to address the deficiencies in the loading and unloading regulations for rail transport of hazardous materials. Such multimodal action is implicit in Safety Recommendation I-00-06, which the Safety Board issued following the Whitehall and Louisville accidents, which called for RSPA "to establish, *for all modes of transportation*, safety requirements for loading and unloading hazardous materials." (Emphasis added)

Despite the need to carry out this recommendation promptly, as evidenced by the Stock Island, Biloxi, Louisville, Whitehall, and Clymers accidents, RSPA has not yet completed action on it or indicated that RSPA intends to accomplish the recommendation before the end of 2001. The Safety Board is concerned that such slow progress on Safety Recommendation I-00-06 could negatively affect the safety of hazardous materials transportation in all modes. Therefore, to ensure that comprehensive, written safety requirements are established without delay for all carriers, including rail carriers, that transport hazardous materials in cargo tanks, the Safety Board reiterates Safety Recommendation I-00-06.

Among other issues raised by the investigation of the Clymers accident was the adequacy of inspection and testing requirements for pressure relief devices on railroad tank cars. After the Clymers accident, the Federal Railroad Administration (FRA) mandated that the pressure relief valves from 4 of 24 tank cars containing TDI matter wastes in storage near Clymers be pressure-tested in accordance with the DOT *Hazardous Materials Regulations* before any of the tank cars could be transported for unloading. When these tests were performed in March 1999, three of the four valves were not due for retesting until 2003. Each valve had 4 years remaining of its 10-year test cycle. The fourth valve, also on a 10-year test cycle, was due for a retest in 1999. The pressure relief valve from UTLX 643593 was on a 10-year test cycle and not due for a retest until 2003. This valve was also examined and tested in May 1999. All five pressure relief valves failed to meet the tolerances for the start-to-discharge pressure and vapor-tight pressure as required under the regulations.

The teardown and inspection of the pressure relief valves from these five tank cars (the four cars that the FRA required to be tested and UTLX 643593) demonstrated that the valves were in a deteriorated condition. The ethylene propylene rubber O-rings showed evidence of swelling, hardness, and brittleness, and the metallic components exhibited varying degrees of rust, scale, pitting, and grit. Replacement of the deteriorated O-rings in the pressure relief valve from UTLX 643593 with new O-rings did not, by itself, bring about proper operation of the valve. Even with the new O-rings, the pressure relief valve from UTLX 643953 was within the tolerances for the start-to-discharge and vapor-tight pressures only after all dirt, grit, and other debris had been removed from the sealing surfaces of the valve. Consequently, it appears that the accumulation of rust, scale, and dirt caused the five pressure relief valves to fail to meet the required start-to-

discharge and vapor-pressure standards. Therefore, the Safety Board concluded that, based on the deteriorated condition of the pressure relief valves examined in this investigation and the failure of these valves to activate as required, the pressure relief valves on tank cars that transport hazardous materials may require more frequent and rigorous testing to ensure that they remain functional.

The testing interval for a tank car and its components under the DOT *Hazardous Materials Regulations* depends in part upon the types of products that are transported in the tank car. Tank cars that transport corrosive materials must be inspected and retested every 5 to 10 years, whereas tank cars that transport noncorrosive materials must be inspected and retested every 10 years. The regulations also require testing and inspection if there is evidence of damage, corrosion, cracks, dents, or deformation or if the tank car is involved in an accident and is repaired. However, the deterioration of the pressure relief valves from UTLX 643593 and the other four tank cars was only detected when the valves were disassembled and inspected. The Safety Board believes that RSPA and the FRA should, with the assistance of the Association of American Railroads and the Railway Progress Institute, evaluate the deterioration of pressure relief devices through normal service and then develop inspection criteria to ensure that the pressure relief devices remain functional between regular inspection intervals. They should also incorporate these inspection criteria into the DOT *Hazardous Materials Regulations*.

A third issue that the Safety Board pursued during the Clymers accident investigation was the adequacy of the DOT *Hazardous Materials Regulations* pertaining to the notification and reporting of hazardous materials incidents. When the Clymers accident occurred, the Essroc plant manager immediately notified the National Response Center (NRC) by telephone, in compliance with Federal regulations, about the releases of hazardous wastes. According to 40 *Code of Federal Regulations* 264.56(j) the owner/operator of a transfer, storage, and disposal (TSD) facility that experiences a hazardous waste incident must also submit a written report to the Environmental Protection Agency (EPA) regional administrator within 15 days of the incident. Essroc sent a report concerning the Clymers accident to the EPA Region 5 office on March 4, 1999. However, neither the written report to the EPA required under 40 *Code of Federal Regulations* 264.56(j) nor the immediate telephone report to the NRC comprise the high level of detail regarding a hazardous materials incident reflected in the DOT Hazardous Materials Incident Report form. Neither would contain, as would the DOT Hazardous Materials Incident Report, detailed information concerning the container and packaging used to transport the hazardous material, the specific circumstances of the failure, or the transportation environment in which the incident occurred. Consequently, neither could provide the in-depth information that RSPA needs to maintain its Hazardous Materials Information System, which is crucial to RSPA's ability to carry out meaningful analyses of reported accident data.

The requirements in 49 *Code of Federal Regulations* 171.16 of the DOT *Hazardous Materials Regulations* place the responsibility for submitting the written DOT Hazardous Materials Incident Report on the carrier. The requirements apply to releases of hazardous materials that occur during the course of transportation, which has been defined under 49 *United States Code* Section 5102 to include "the movement of property and the loading, unloading, or storage incidental to the movement."

In the case of the Clymers accident, it seems reasonable that the Central Railroad of Indianapolis, the carrier that delivered UTLX 643593 and other tank cars carrying TDI waste

mixtures to the Essroc plant, assumed it was not responsible for filing a written DOT Hazardous Materials Incident Report with RSPA. The railroad had delivered the tank car to the Essroc plant on December 7, 1998, more than 2 months before the accident took place. The accident occurred on the plant property, and the railroad was not involved in the accident. The Central Railroad of Indianapolis thus had good reason to suppose it was no longer responsible for filing a written report with RSPA. Essroc likewise did not provide a DOT Hazardous Materials Incident Report to RSPA because it is a TSD facility operator, not a carrier.

Consequently, no DOT Hazardous Materials Incident Report was filed for this accident with RSPA, even though a DOT specification tank car used in revenue service and containing a regulated hazardous waste catastrophically ruptured. The Safety Board concluded that, because the requirements of 49 *Code of Federal Regulations* 171.16 place the responsibility for filing the written DOT Hazardous Materials Incident Report solely upon the carrier, the current requirements do not ensure that RSPA receives the information the Safety Board believes it needs to develop safe practices.

Of the parties involved, the carrier is least likely to have knowledge of or be involved in an accident or incident that occurs at a shipper or consignee facility where loading and unloading operations are carried out, and where hazardous materials containers are temporarily stored. As a result, many loading and unloading accidents may not be reported to the DOT.

The written DOT Hazardous Materials Incident Reports provide the input for the Hazardous Materials Information System, which is RSPA's accident database. Because this database is used (among other things) to carry out trend analyses, the failure to capture data about incidents at loading and offloading facilities may skew accident analyses conducted using these data and obscure industry performance and operational deficiencies. Further, the Safety Board's review of EPA regulations demonstrated that the comprehensive data required are collected only by the written DOT Hazardous Materials Incident Reports.

The Safety Board has previously expressed its concern about this issue to RSPA, most recently through its July 26, 1999, comments on the March 23, 1999, advance notice of proposed rulemaking that RSPA issued on revising the incident reporting requirements and the DOT Hazardous Materials Incident Report form. Citing reporting deficiencies identified in the Clymers, Louisville, and Biloxi hazardous materials accidents, the Safety Board noted that when accidents involving releases of hazardous materials from DOT specification containers occur at loading or unloading facilities, a carrier may not be directly involved, increasing the likelihood that such accidents will go unreported to RSPA. The Safety Board stated that it believed that "...a complete and accurate accident database requires that incident reports be filed for any failure of hazardous material containers or the unintended release of a hazardous material during any transportation-related operation...."

To repair this gap in the notification and reporting standards, the Safety Board believes that RSPA should take action to ensure that comprehensive reports concerning all significant failures of DOT specification tank cars, highway cargo tanks, and intermodal bulk containers containing hazardous materials are provided in writing to RSPA.

Therefore, the National Transportation Safety Board makes the following safety recommendations to the Research and Special Programs Administration:

Evaluate, with the assistance of the Federal Railroad Administration, the Association of American Railroads, and the Railway Progress Institute, the deterioration of pressure relief devices through normal service and then develop inspection criteria to ensure that the pressure relief devices remain functional between regular inspection intervals. Incorporate these inspection criteria into the U.S. Department of Transportation *Hazardous Materials Regulations*. (R-01-03)

Develop and implement policies and procedures to ensure that comprehensive reports concerning all significant failures of U.S. Department of Transportation specification tank cars, highway cargo tanks, and intermodal bulk containers containing hazardous materials are provided in writing to the Research and Special Programs Administration. (I-01-01)

In addition, the Safety Board reiterates Safety Recommendation I-00-06 to the Research and Special Programs Administration:

I-00-06

Within 1 year of the issuance of this safety recommendation, complete rulemaking on Docket HM-223, “Applicability of the *Hazardous Materials Regulations* to Loading, Unloading, and Storage,” to establish, for all modes of transportation, safety requirements for loading and unloading hazardous materials.

The Safety Board also issued safety recommendations to the Federal Railroad Administration, the Association of American Railroads, the Railway Progress Institute, the Lyondell Chemical Company, the Olin Corporation, the Essroc Cement Corporation, and CP Recycling, Inc., and Affiliated Companies.

Please refer to Safety Recommendations R-01-03, I-01-01, and I-00-06 in your reply. If you need additional information, you may call (202) 314-6170.

Acting Chairman CARMODY and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations.

By: Carol J. Carmody
Acting Chairman