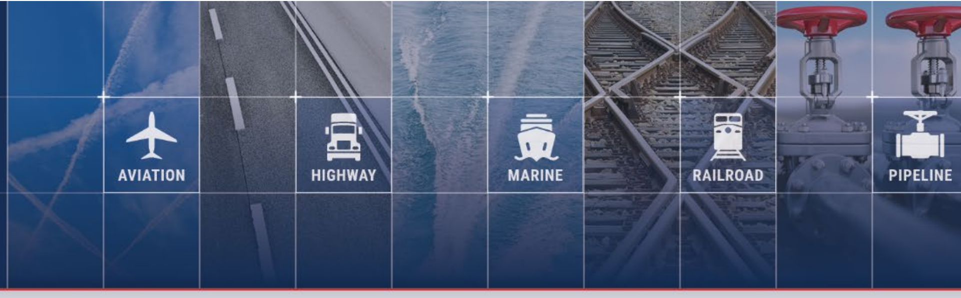

Issued: June 18, 2025 Hazardous Materials Investigation Report: HZIR-25-01

BNSF Railway Derailment and Hazardous Materials Release from DOT-112A340W Tank Cars

Location	Manuelito, New Mexico
Date	April 26, 2024
Accident type	Container failure
Train	BNSF Railway freight train H-BELPHX1-25 1 conductor, 1 engineer 4 locomotives, 97 mixed freight cars
Hazardous materials	Liquefied petroleum gas (propane) shipped as UN1075
Fatalities	0
Injuries	0
Property Damage	$5.9 million

Summary

On April 26, 2024, about 12:37 p.m. local time, westbound BNSF Railway (BNSF) mixed freight train H-BELPHX1-25 derailed 35 railcars at milepost 178.6 on the BNSF Gallup Subdivision near Manuelito, New Mexico.[1] The derailed equipment included six Department of Transportation Specification 112A340W (DOT-112) tank cars loaded with UN 1075, liquefied petroleum gas (LPG), a Division 2.1 flammable gas.[2] Four of these tank cars were breached (punctured or torn) during or after the derailment and released lading, which ignited. A fifth LPG tank car was exposed to postderailment fires and released vapor through its pressure relief device (PRD) but was not otherwise breached. About 180,000 gallons of LPG were released from breaches, PRD activity, and flaring

[1] (a) All times in this report are local. (b) Visit ntsb.gov to find additional information in the public docket for this NTSB accident investigation (case number HMD24LR001), including detailed factual reports about the circumstances of the accident.

[2] (a) This report uses DOT-112 as an abbreviation for the specific type of tank car involved in this release, but the DOT-112 class also includes other types of tank cars. The class and exact specifications are defined in Title 49 *Code of Federal Regulations* (*CFR*) Part 179, Subpart C. (b) The specific LPG involved in this accident, propane, is a colorless and odorless gas at atmospheric temperature and pressure; it can be liquefied under higher pressures or lower temperatures. (c) Division 2.1 flammable gases are defined in 49 *CFR* 173.115.

operations.[3] (See figure 1.) The train was not carrying other hazardous materials. Because tank cars carrying LPG can explode when exposed to fire, the local fire department ordered an evacuation within a 2-mile radius of the derailment; 52 people were evacuated, and Interstate 40 was closed in both directions from milepost 10 to milepost 126. Sections of Interstate 40 remained closed for about 48 hours. The local fire department allowed the LPG tank cars to burn overnight, and the fires were extinguished on April 27.[4] The evacuation and road closure were lifted on April 28. No injuries were reported. The weather at the time of the derailment was 78°F with no precipitation. The National Transportation Safety Board (NTSB) launched an investigation into the thermal protection performance of the tank cars involved in the release.[5]

[3] *Flaring* is a method of unloading a tank car by burning off the lading in a controlled manner. In this case, emergency responders used flaring to unload the two intact tank cars after the postderailment fires were extinguished.

[4] The 2024 *Emergency Response Guide* published by the US Department of Transportation advises against extinguishing fires fed by leaking flammable gases unless the leak can be stopped. Emergency responders also considered performing a vent and burn (a method of unloading a tank car by puncturing its shell with explosive charges) to prevent a boiling liquid expanding vapor explosion (BLEVE). In a BLEVE, a tank car loses the ability to hold pressure, and its liquid contents flash into vapor, rapidly releasing the tank car's entire remaining cargo and potentially propelling tank car components and other debris significant distances. Responders concluded that a BLEVE was unlikely and, because the surrounding area had already been evacuated, would not pose a danger to the public. Responders chose to allow the tank cars to burn overnight instead of approaching them to attach explosive charges for a vent and burn. No BLEVE occurred.

[5] The NTSB investigated this hazardous materials release under the authority of 49 *United States Code* 1116(b)(5), which states that the NTSB shall "evaluate the adequacy of safeguards and procedures for the transportation of hazardous material and the performance of other departments, agencies, and instrumentalities of the government responsible for the safe transportation of that material." The investigation was focused only on the performance of the DOT-112 tank cars and did not determine the probable cause of the derailment.

Figure 1. Derailment pileup. (Courtesy of McKinley County Office of Emergency Management.)

All six DOT-112 tank cars were equipped with ceramic fiber thermal protection blankets and PRDs.[6] Based on the shipper's records, each tank car had at least 11% outage (space not filled by liquid lading) as calculated at 110°F. Federal regulations at Title 49 *Code of Federal Regulations* (*CFR*) Part 173.31(b) require a minimum of 1% outage at this temperature for LPG. The investigation found no evidence of pre-derailment tank car damage or defects.

Postaccident on-scene examinations found damage consistent with mechanical breaches (punctures or tears created by outside forces) on two tank cars: UTLX952565 and UTLX955642. For these two tank cars, the investigation found evidence of lading loss only through mechanical breaches. The released LPG ignited and contributed to postderailment fires near other derailed tank cars, including other LPG tank cars.

Two other derailed LPG tank cars (UTLX 954193 and NATX 40068) were not mechanically breached during the derailment but released lading from shell tears after being exposed to fire. The duration of fire exposure before these releases was not recorded. The Federal Railroad Administration (FRA) recovered the panels of tank car

[6] Under 49 *CFR* Part 179, DOT-112 tank cars must have PRDs and thermal protection systems, such as ceramic fiber blankets. PRDs and thermal protection systems are intended to reduce the risk of a BLEVE by preventing lading from heating rapidly when a tank car is exposed to fire and by allowing the tank car to gradually release vapor rather than building up dangerous internal pressures. The Pipeline and Hazardous Materials Safety Administration maintains a list of approved thermal protection system materials and designs; the tank cars involved in this derailment used one of these approved materials.

shell material containing tears for examination in coordination with the NTSB. Ultrasonic measurements showed that the shell wall had thinned and cracked near the tears. (See figure 2.)

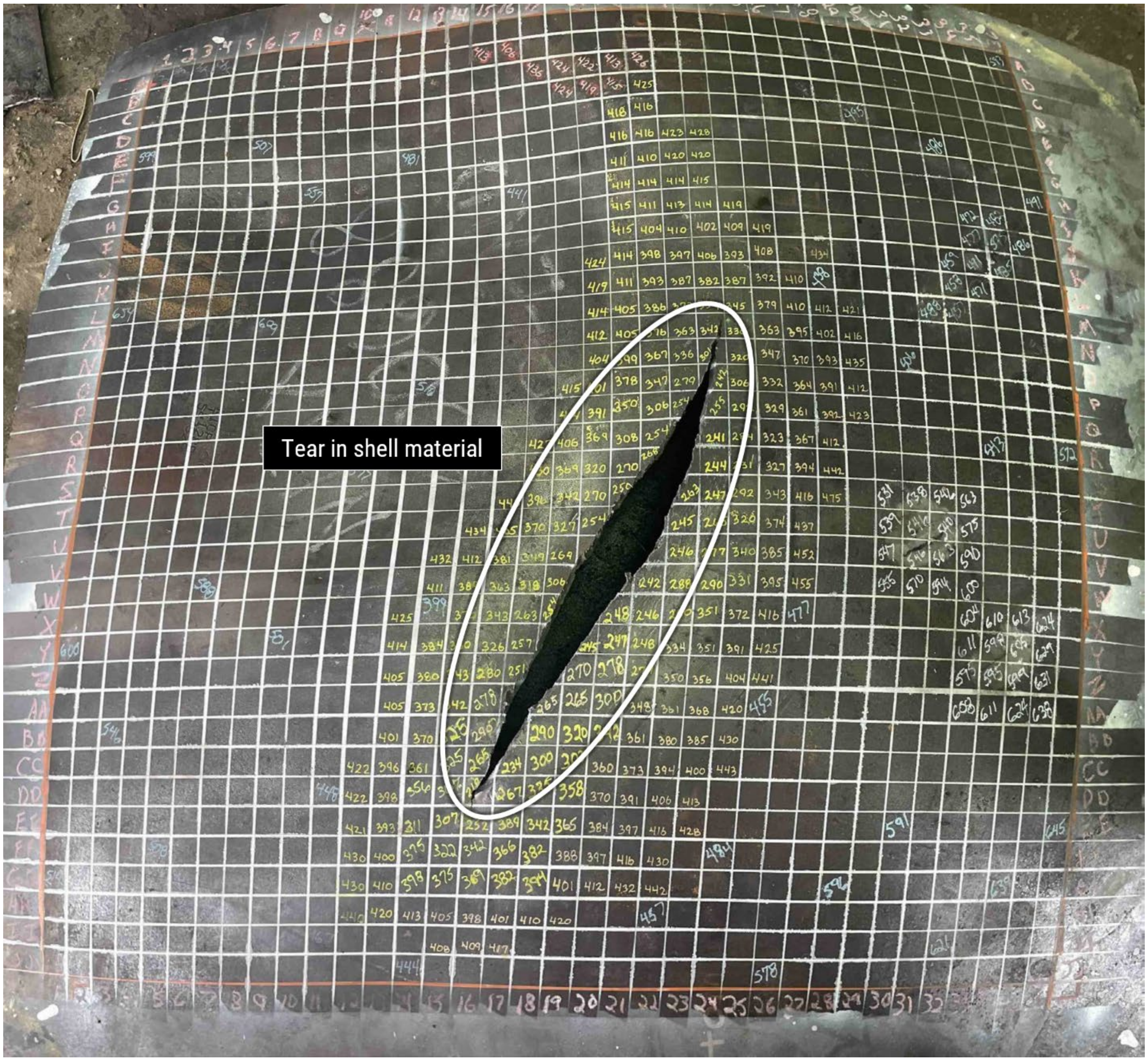

Figure 2. Tear in shell material recovered from tank car with ultrasonic thickness measurements.

The NTSB also recovered PRDs from all six derailed DOT-112 tank cars for examination and testing to determine whether they functioned as designed. Five PRDs were sufficiently intact to test safely; the sixth had sustained thermal damage severe enough that it could not be disassembled or tested. The severely damaged PRD came from a mechanically breached tank car. Test results are summarized in the table below.

Table. PRD test results.

Tank car	Design start-to-discharge pressure (psig)*	Tested start-to-discharge pressure (psig)
UTLX 953969	280.5	280
NATX 400688	280.5	80
UTLX 959911	280.5	70
UTLX 954193	280.5	80
UTLX 955642	280.5	272
UTLX 952565	280.5	Untested

*Pounds per square inch, gauge

Analysis

Two derailed DOT-112 tank cars were not breached mechanically during the derailment but released material from thermal tears after being exposed to fire. The NTSB had not previously observed thermal tears in DOT-112 tank cars required to have thermal protection systems.[7] There were no indications that tank cars had been improperly loaded or damaged before the derailment, meaning that the design and fabrication of the tank cars were the main factors of interest in understanding the hazardous materials release. The investigation therefore focused on whether the tank cars' thermal protection systems and PRDs performed as designed after the derailment.

Under federal regulations in 49 *CFR* Part 179, a thermal protection system is required to prevent lading release from a tank car, except through PRD activity, during 100 minutes of exposure to a pool fire or 30 minutes of exposure to a torch fire.[8] There was not enough evidence to determine whether the thermally breached tank cars involved in the Manuelito release met this performance standard, so the FRA, in coordination with the NTSB, examined the tank car shell panels containing suspected

[7] The NTSB is currently investigating a hazardous materials release involving DOT-112 tank cars that occurred on July 7, 2024, in Bordulac, North Dakota. The investigation is ongoing. Further information is available in the public docket and on the NTSB web page for that investigation.

[8] The 100-minute performance standard was intended to provide time for the tank car to release its contents through its PRD before tank integrity fails, which also provides emergency responders time to assess the accident and initiate remedial actions, such as evacuating an area. US Department of Transportation research found that the severity of tank car failure is proportional to the amount of liquid lading remaining inside when the tank fails. The 30-minute torch fire performance standard was based on the probable duration of a torch fire fueled by a single nearby tank car releasing burning lading through a coupler-sized puncture. See 41 *Federal Register* 52324 and 60 *Federal Register* 49048 for further information.

thermal tears for material or manufacturing defects that could have increased their susceptibility to thermal damage.

The laboratory examinations found that the tears resulted from the shells thinning and cracking. This confirmed the presence of thermal tears, which occur when the pressure within a tank car exceeds the tensile strength of its shell. As the temperature of a tank car increases, the volatility (and pressure) of the lading tends to increase as the tensile strength of the steel shell and head decreases until the steel tears. The postaccident examinations and laboratory testing did not indicate that the tank car shells failed as a result of a flaw in design or fabrication.

The NTSB's tests and examinations of the PRDs found no indications that they failed to perform as designed; all testable PRDs discharged near or below the design pressure during tests, and the significantly reduced start-to-discharge pressure of three PRDs was typical of valve springs that have been compressed and subjected to heat during an emergency.[9]

Although two tanks sustained thermal tears, emergency responders did not observe explosions consistent with a boiling liquid expanding vapor explosion (BLEVE). BLEVEs result from fire exposure that raises the temperature and therefore pressure within a tank car until a thermal tear ruptures the shell. Along with the results of the PRD examinations, the absence of a BLEVE suggests that the thermal tears occurred after the tank cars had released most of their lading through PRD activity before the tank shells failed, in accordance with the DOT-112 design.

The thermal breaches that did occur during this accident resulted from fire exposure, and these fires were fueled in part by mechanically breached LPG tank cars. This failure mode, in which tank car failures and hazardous material releases cascade beyond the initial mechanical breaches, is a well-documented phenomenon. For trains carrying large amounts of flammable liquids—high-hazard flammable trains (HHFTs)—federal regulations are intended to reduce the probability of derailments and the severity of consequences, including cascading releases.[10] Required precautions include speed and routing limits, information sharing for local emergency responders, use of survivable tank cars, and two-way braking systems (49 *CFR* Part 174, Subpart G).

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[9] The one untestable PRD was from a mechanically breached tank car and played no role in the performance of the thermally breached tank cars. For more information on PRD performance, see the FRA's 2022 report, *Performance of Tank Pressure Relief Devices Under Derailment Fire Conditions,* DOT/FRA/ORD-22/10.

[10] Under 49 *CFR* 171.8, an *HHFT* is "a single train transporting 20 or more loaded tank cars of a Class 3 flammable liquid in a continuous block or a single train carrying 35 or more loaded tank cars of a Class 3 flammable liquid throughout the train consist."

Freight train H-BELPHX1-25 did not meet the definition of an HHFT because it contained only six tank cars of hazardous material, and the material was a Division 2.1 flammable gas, not a Class 3 flammable liquid. The accident still led to a cascading release that breached mechanically intact tank cars, an outcome HHFT regulations are intended to prevent. The NTSB documented similar safety issues following the February 3, 2023, derailment of a non-HHFT mixed freight train in East Palestine, Ohio.[11] In response to the East Palestine derailment, the NTSB recommended that the Pipeline and Hazardous Materials Safety Administration revise the definition of HHFT to include more trains vulnerable to cascading hazardous materials releases:

> Revise the definition of high-hazard flammable train to account for differences in survivability between tank car specifications and to include hazardous materials other than flammable liquids, such as combustible liquids and Division 2.1 flammable gases, that can contribute to cascading hazardous materials releases; if necessary, obtain legislative authority to act on this recommendation. (R-24-15, Open—Acceptable Response)

The Manuelito derailment provides another example of a non-HHFT exhibiting HHFT-like tank car failures following derailment and underscores the importance of the recommendation.

The emergency response to the derailment and fire, including road closures, evacuation of a 2-mile area, and the decision to allow the tank cars to burn overnight rather than attempting a vent and burn operation that would have placed personnel near the tank cars, was effective in protecting the public.[12]

Lessons Learned

This accident illustrated that cascading hazardous materials releases occur in trains other than HHFTs. The NTSB has previously recommended that the Pipeline and

[11] For more information, see the NTSB's 2024 report on this accident: Norfolk Southern Railway Derailment and Hazardous Materials Release, East Palestine, Ohio, February 3, 2023. RIR-24-05. Washington, DC: NTSB.

[12] Road closures in remote areas are a complex issue. Although the NTSB did not note any adverse safety outcomes from the emergency response to the Manuelito derailment, the NTSB recently investigated a highway accident in which a truck carrying lithium-ion batteries overturned and caught fire on July 29, 2024, leading to the closure of a major California interstate west of Las Vegas, Nevada. Motorists were stranded in summer heat, and the California Department of Transportation noted 80 calls for assistance, including requests for food, water, and medical aid. For more information, refer to the public docket for investigation HWY24IH011.

Hazardous Materials Safety Administration expand the definition of HHFT as described in Safety Recommendation R-24-15.

The NTSB focused its investigation on the performance of the tank cars rather than the emergency response, which was timely and effective in protecting the public from the danger posed by the derailed hazardous materials tank cars. However, the response included significant road closures, and the after-action report created by the McKinley County Office of Emergency Management noted the risks stranded motorists may face during widespread and prolonged road closures. The office is working with state partners to update its road closure plan.

The McKinley County Office of Emergency Management's decision to update its road closure plan even after a successful evacuation is a valuable reminder to emergency response agencies that emergency preparedness is an ongoing task.

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For more detailed background information on this report, visit the NTSB Case Analysis and Reporting Online (CAROL) website and search for NTSB accident ID HMD24LR001. Recent publications are available in their entirety on the NTSB website. Other information about available publications also may be obtained from the website or by contacting–

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