Issued: April 10, 2025 Railroad Investigation Report: RIR-25-06

Norfolk Southern Railway Multitrain Collision and Derailment

Location	Easton, Pennsylvania
Date	March 2, 2024
Accident type	Multitrain collision and derailment
Eastbound striking train	Freight train NS268H429 2 crewmembers 2 locomotives, 39 intermodal railcars
Stopped train	Freight train NS24XH101 2 crewmembers 3 locomotives, 27 intermodal railcars
Westbound striking train	Mixed freight train NS19GH501 3 crewmembers 3 locomotives, 199 mixed manifest railcars
Track	Main track, signalized
Hazardous materials	Ethanol residue and butane residue
Fatalities	0
Injuries	4
Damages	$2.5 million

Summary

On March 2, 2024, about 7:11 a.m., eastbound Norfolk Southern Railway (NS) intermodal train NS268H429 collided with the rear of stationary NS intermodal train NS24XH101 on main track 2 on the Allentown Road Subdivision on the Lehigh Line near Easton, Pennsylvania.[1] As a result of the first collision, train NS268H429 derailed three railcars that then fouled the adjacent main track 1.[2] Just over 1 minute later, a second collision occurred when train NS19GH501 struck the derailed equipment while traveling westbound on main track 1. As a result of the second collision, train NS19GH501 derailed six railcars and two locomotives. Three of the six derailed railcars were

[1] (a) Visit ntsb.gov to find additional information in the public docket for this NTSB accident investigation (case number RRD24FR009), including detailed factual reports about the circumstances of the accident. (b) All times in this report are local times. (c) An *intermodal train* carries shipping containers used in intermodal freight transportation. (d) A *mixed freight train* includes several types of railcars and commodities.

[2] *Fouling a track* means the placement of an individual or equipment in such proximity to a track that the individual or equipment could be struck by a moving train or on-track equipment.

placarded as hazardous materials tank cars: one containing ethanol residue and two containing butane residue.[3] The tank cars did not breach or release hazardous materials. The two derailed locomotives partially submerged in the Lehigh River and discharged locomotive diesel fuel into the water. (See figure.) Four crewmembers from the accident trains were transported to a local hospital, treated for minor injuries, and released. At the time of the collisions, visibility conditions were daylight and overcast; the weather was 35°F with light rain.

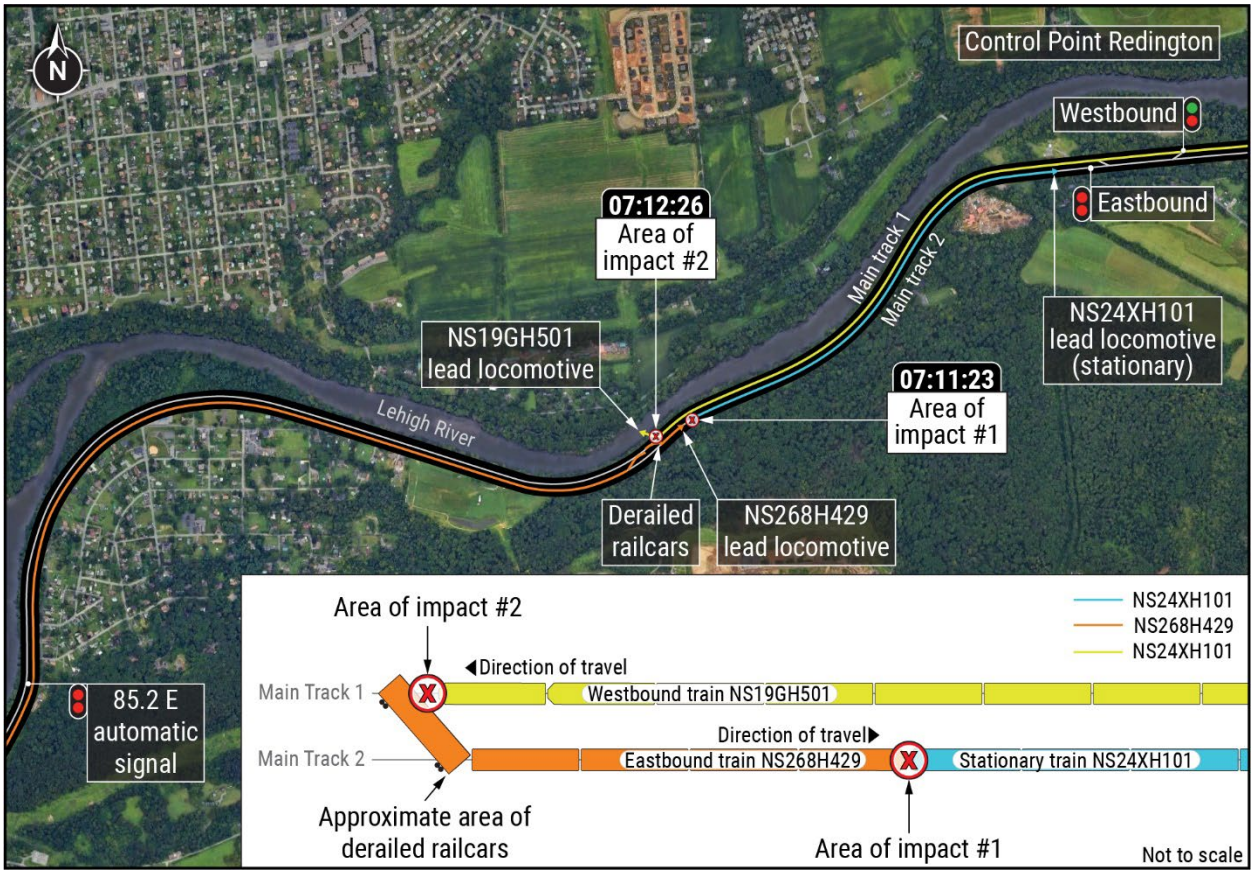

Figure. Graphic showing aerial view of train routes and derailment illustration. (Source: Google Earth.)

Before the accident, eastbound train NS268H429 was operating within the same signal block as eastbound train NS24XH101, which had stopped on main track 2 because of additional train traffic in the area, short of Control Point Redington (crossover)

[3] The three hazardous materials tank cars were offered for shipment as having last contained UN1170, Ethanol Solutions, a Class 3 flammable liquid in packing group II, and UN1075, Liquefied Petroleum Gas, a Division 2.1 flammable gas, as specified in Title 49 *Code of Federal Regulations (CFR)* Part 172.

where the home signal was displaying a stop signal.[4] Eastbound train NS268H429 operated past the automatic signal at milepost 85, where the signal was indicating for the train to proceed at restricted speed and be prepared to stop.[5] Train NS268H429's maximum speed was authorized by wayside signal indications and enforced by a positive train control (PTC) system.[6] In an interview with investigators, the engineer said that he knew that the rear of train NS24XH101 was in the signal block that his train was entering and assumed it was continuing to move. The train was operating in an area with limited visibility because of elevated terrain and vegetation along the curved tracks that ran on river grade and parallel to the Lehigh River, causing the train's engineer to only be able to see train NS24XH101 for the first time when it was about eight railcar-lengths away. The train was rounding a 4° curve when it collided with the rear of train NS24XH101.[7] Before the collision, the engineer attempted to slow the train primarily through the use of the locomotive's dynamic and independent braking systems. However, these braking efforts did little to reduce the train's speed in the 17 seconds leading up to the collision.

Analysis

The collisions involved eastbound train NS26811429 striking the rear of stationary train NS24XH101, and then westbound train NS19GH501 subsequently colliding with derailed railcars from eastbound train NS26811429, which were on the tracks. Westbound train NS19GH501 was not required to operate at restricted speed and was traveling about 22 mph, which was below the maximum authorized speed, at the time of the second collision.

The use of restricted speed to permit following trains to enter an occupied signal block is a frequent practice within the railroad industry. Railroads place trains within the

[4] (a) In signaled territory, a *signal block* is the track section between two consecutive block signals governing movement in the same direction. (b) A *home signal* is a fixed signal at the entrance of a route or block to govern trains or engines entering and using that route or block.

[5] *Restricted speed* is defined by Federal Railroad Administration regulations in 49 *CFR* 236.812. Restricted speed operations occur when a train operates below 20 mph (or at a lower limit set by operating rules) and at a speed that will allow it to stop within one-half the range of the vision of the operator.

[6] Train speeds are *authorized* by rules, special instructions, train documents, dispatcher messages, or signal indications. Authorized train speeds must not be exceeded, apply to the entire train unless otherwise specified, must be observed, and must be the lowest of the specified speeds if a conflict exists between authorized speeds.

[7] The curvature of track is measured in degrees per unit length, typically expressed as degrees per 100 feet.

same signal block for operational flexibility when coordinating the traffic flow of multiple trains merging into a particular area, such as rail yards, terminals, sidings, or control points. Placing these trains within the same signal block allows for closer train spacing, which helps to decongest rail traffic on tracks (particularly near switches at control points or interlockings), manage the flow of trains entering or leaving a yard, and clear road crossings to prevent vehicular traffic blockages. While train crews are not typically given reasons for the signals they receive, they are expected to adhere to all wayside signals as displayed. The restricting signal aspect with corresponding indication was the operator of train NS268H429's authority for movement into the block at restricted speed.

Compliance with restricted speed requires a consideration of multiple factors. The restricted speed directive includes two threshold criteria for determining the maximum speed a train may travel. A train can travel at a speed no faster than 20 mph and no faster than the train operator's ability to stop the train within one-half the range of vision, whichever is the more restrictive speed limit. The operator of eastbound train NS268H429 failed to operate the train at restricted speed as evidenced by the fact that the train was moving at a speed faster than his ability to stop the train before colliding with stopped eastbound train NS24XH101. Although the train operator was in compliance with the upper-speed threshold defined for restricted speed by operating the train at 13 mph, he did not comply with the more restrictive requirement to operate at a speed that would allow him to stop the train within half his range of vision.

In his interview with the National Transportation Safety Board (NTSB), the operator of train NS268H429 indicated to NTSB investigators that he believed that train NS24XH101 was still moving and that he expected this train to have cleared the signal block they were in before his train reached Control Point Redington (the end of the signal block). The operator's statement, along with the train handling methods employed to control the train in the minutes before the collision, illustrate the risks associated with human factor errors when attempting to operate at restricted speed.[8]

The NTSB has identified that while crew training and operational compliance activities are currently the only safeguards railroads have to mitigate human factor risks inherent in restricted speed collisions, future enhancements to PTC could and should be developed and implemented by the railroad industry to prevent future train collisions and to mitigate the risk of human factor errors while operating trains at restricted speeds.

[8] (a) Estimating restricted speed relies on a train operator's ability, largely based on experience and observed (and varying) conditions (such as train consist, weather, track conditions, and constantly changing line of sight) to gauge what an appropriate speed might be. (b) The NTSB also reviewed work/rest schedules, training, efficiency testing, and postaccident toxicology records and did not find these issues causal to the accident.

To highlight this need, the NTSB discussed the train handling and operational considerations that train crews must undertake to safely operate at restricted speed in the investigation of the June 5, 2018, accident between two trains in Kingman, Arizona.[9] As a result of this accident investigation, the NTSB recommended that the Federal Railroad Administration (FRA) require all railroads to revise training and increase oversight to ensure that operating crews properly use restricted speeds. Restricted speed and the challenges associated with it are discussed further in the 2023 special report, *Beyond Full Implementation: Next Steps in Positive Train Control*.[10] In that report, the NTSB recommended that the FRA complete and publish current research into PTC technologies to prevent train-to-train collisions during restricted speed operations, and to develop and implement a plan based on the results of that research.[11] Although work is ongoing to optimize PTC technology, until it is operational, reliance on PTC-enforced low speeds and the crew's adherence to restricted speed requirements remains a potential safety gap that can be mitigated only through the increased training of train crews and an effective railroad oversight plan that routinely reinforces this training. Further, while PTC is successful at signal enforcement, this accident demonstrates the current limitations in PTC systems' access to train location information, which impede the detection of and response to train-to-train collision threats during restricted speed operations. Restricted speed is not a fixed value; with variables such as the stopping distance of the train, sight distances, conditions affecting visibility, and any speed limits set by the railroad. The effectiveness of restricted speed at preventing collisions depends on the crew's vigilance, awareness, and ability to rapidly evaluate these variables, which can be unreliable.

Probable Cause

The National Transportation Safety Board determines the probable cause of the multitrain collision was the failure of the engineer of train NS268H429 to operate his train in accordance with restricted speed requirements and stop before colliding with train NS24XH101. Contributing to the accident were insufficient safeguards to compensate for human error, including current positive train control systems that do not prevent train-to-train collisions during restricted speed operations.

[9] National Transportation Safety Board, *BNSF Railroad Collision, Kingman, Arizona, June 5, 2018*, NTSB/RAR-21/01 (Washington, DC: National Transportation Safety Board, 2021).

[10] National Transportation Safety Board, *Beyond Full Implementation: Next Steps in Positive Train Control*, NTSB/RIR-23-12 (Washington, DC: National Transportation Board, 2023).

[11] Safety Recommendations R-23-7 and -8.

Lessons Learned

This accident investigation demonstrated vulnerability for single-point human failures that exist when trains are operating at restricted speed with or without PTC. On March 3, 2024, the day after the accident, NS issued a serious incident notice to its employees elevating awareness to the rules associated with restricted speed. In addition, the FRA issued a safety advisory emphasizing the importance of complying with railroad operating rules when a train is operating at restricted speed.[12]

Given the inaccuracies, and hence risks, associated with estimating restricted speed, this accident underscores the importance of the FRA completing research into PTC technologies to prevent train-to-train collisions during restricted speed operations as recommended in the NTSB *Beyond Full Implementation: Next Steps in Positive Train Control report*. In addition, the FRA needs to continue work on analyzing data that will help revise training and increase oversight to ensure that operating crews use restricted speeds correctly, as recommended in the Kingman, Arizona, report. Until the technology is fully developed and implemented, however, the railroad industry will continue to rely on an inherently risky process of estimating restricted speed.

[12] Federal Railroad Administration, *Safety Advisory 2012-02: Restricted Speed* (Washington, DC: US Department of Transportation, Federal Railroad Administration, 2012).

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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 RRD24FR009. 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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