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U.S. DEPARTMENT OF TRANSPORTATION

Federal Railroad Administration

Safety Advisory 2023-02; Train Makeup and Operational Safety Concerns

AGENCY: Federal Railroad Administration (FRA), U.S. Department of Transportation (DOT).

ACTION: Notice of Safety Advisory.

SUMMARY: FRA is issuing Safety Advisory 2023-02 to emphasize significant concerns related to train makeup and to ensure that all railroads exercise due diligence and recognize the importance of taking proactive measures to address potential safety risks related to operating train builds with varying configurations, load and empty placement, distributed power arrangements, and other factors. FRA has noticed a rising trend in recent incidents where train build and makeup have been identified as a potential cause or contributing factor. In response, FRA incorporates train simulations into its investigative process when it is suspected that high in-train forces may have contributed to train accidents. To address these concerns, FRA is providing recommendations for freight railroads to improve the safety of their train build processes and practices.

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SUPPLEMENTARY INFORMATION:

Significant Incidents

On March 4, 2023, in Springfield, Ohio, a Norfolk Southern Railway (NS) 210-car mixed freight train totaling 17,966 trailing tons with Distributed Power Units (DPU) experienced a derailment involving 28 cars, including 21 empty and 7 loaded cars. The train had 82 cars equipped with end-of-car cushioning devices, and 18 of those derailed. The locomotives were arranged in a 3x2x0 configuration,[1] with one headend locomotive offline. The train was traveling on an ascending 0.6% grade with a heavier part on a 0.7% downhill grade. The weight was mostly concentrated at the head and rear ends of the train. During the accident, dynamic braking was applied only to the headend locomotive consist, while the DPUs were idle, making it function like a conventional train. The derailment happened at the sag between ascending and descending grades, with short, empty rail cars designed to ship coiled steel being the first to derail. Buff forces peaked as the downhill portion of the train ran-in, causing the derailment of cars 70-72 and the subsequent pile-up. The train was classified as a Key Train,[2] with 28 loaded hazardous materials (hazmat) cars distributed throughout. No hazmat cars derailed.

On September 19, 2022, in Albers, Illinois, a NS train derailment occurred involving a 131-car mixed freight train (41 empty and 90 loaded) with a DPU and totaling 11,392 trailing tons. The first derailed car was empty and 27 cars derailed in total. Fifty-six. cars were equipped with end-of-car cushioning devices. The locomotives were arranged in a 3x0x2 configuration, and Energy Management System (EMS) was active during the

[1] 3x2x0 represents 3 headend locomotives, 2 mid DPU's, 0 rear DPU's.
[2] As defined by Association of American Railroads (AAR) Circular OT-55, available at https://public.railinc.com/sites/default/files/documents/OT-55.pdf, a "Key Train" is any train with: (1) One tank car load of Poison or Toxic Inhalation Hazard1 (PIH or TIH) (Hazard Zone A, B, C, or D), anhydrous ammonia (UN1005), or ammonia solutions (UN3318); (2) 20 car loads or intermodal portable tank loads of any combination of hazardous material; or (3) One or more car loads of Spent Nuclear Fuel (SNF), High Level Radioactive Waste (HLRW).

incident. The derailment occurred as the train traversed a slight descending grade and a 2-degree curve. Among the train's cars, 21 were carrying hazmat. Two of these hazmat cars derailed, and their contents were released. The assigned cause for the accident was excessive lateral drawbar force on the curve due to the train's makeup.

On September 5, 2022, in Hampton, Iowa, a Union Pacific Railroad Company (UP) 165-car mixed freight train (34 empty and 131 loaded) with a total trailing weight of 18,479 tons experienced a derailment involving 44 cars. The train had 26 cars equipped with end-of-car cushioning devices and a 2x0x1 locomotive configuration. The head end of the train was ascending a 1% grade, while the rear end was descending a 1% grade during the incident. The derailment took place at the sag between the ascending and descending grades, with much of the train's weight concentrated at the head and rear ends. The train was a Key Train, carrying 26 loaded hazmat cars, of which 14 derailed and 5 released their contents. At the time of the derailment, EMS technology was operating the train. The assigned cause of the incident was excessive buffing or slack action due to train makeup.

On May 16, 2022, in Gravette, Arkansas, a Kansas City Southern Railway DPU train with a total of 125 cars (one empty and 124 loaded) with a total trailing weight of 17,113 tons experienced a derailment, which involved one car. The locomotive configuration was 2x0x3. The incident occurred while the train was moving uphill and negotiating a curve, resulting in the derailment of the single empty car on the high side of the curve. The root cause of the derailment was identified as improper train makeup.

On February 17, 2022, in Rupert, Idaho, a UP 195-car mixed freight, DPU train derailed 4 cars that consisted of 106 empty and 89 loaded cars with 14,017 trailing tons.

The first car to derail was empty. The locomotives were configured as 3x1x1. The train was in the process of stopping due to a hot box detector warning. It was using dynamic braking on the head and mid locomotive consists while idling down on the rear consist as it traveled down a descending grade. The train contained five HazMat cars, but none of them derailed. Nearby residents were evacuated as a precautionary measure. The incident was attributed to improper train make-up.

On May 16, 2021, in Sibley, Iowa, a UP 159-car mixed freight train (43 empty and 116 loaded), weighing a total of 16,545 tons, with a 2x1x0 DPU configuration experienced a derailment, resulting in 47 derailed cars. The first car to derail was empty and equipped with an end-of-car cushioning device, as were 12 other derailed cars. At the time of the incident, the train navigated a grade, with the front section ascending and the rear section descending a grade steeper than 1%. Dynamic braking was used before the derailment but was switched to idle shortly before the accident. The derailment took place in a curve located in a sag between the ascending and descending grades. This Key Train contained 26 loaded hazmat cars, of which 14 derailed and 5 released their contents. As a result, the nearby town was evacuated for three days. The cause of the derailment was determined to be excessive buffing or slack action due to the train's makeup.

The analysis of the recent train accidents reveals several common characteristics and patterns:

1. Train Length: Each of the accident trains had 125 or more cars.
2. Distributed Power Units (DPUs): The fact that all accident trains featured DPUs underscores the importance of correctly utilizing and managing DPUs to enhance train

handling and minimize the likelihood of accidents. While DPUs can contribute to improved train control, they should not be considered a replacement for proper train car placement and makeup.

3. Trailing Tons: All accident trains far exceeded 4,000 trailing tons, which is the maximum weight threshold established by the AAR's 1992 *Train Make-up Manual,* for considering train makeup for mixed merchandise trains with a grade less than 2.0% and maximum track curvature less than 8 degrees.

4. First Car Derailed: In each accident, the first car to derail was an empty car.

5. Train Type: Five out of the six accidents involved mixed freight trains, which typically require more complex train makeup considerations.

6. Hazmat Cars: Five out of the six accident trains contained hazmat cars, highlighting the potential risks associated with transporting hazardous materials in long, complex consists.

7. Derailed Hazmat Cars: In three of the accidents, hazmat cars were derailed, increasing the risk of hazardous material release and environmental damage.

8. Hazmat Release: Three of the accidents resulted in the release of hazardous materials, posing a threat to public safety and the environment.

9. Evacuations: Two of the accidents led to the evacuation of local populations due to the release of hazardous materials.

10. Key Trains: Three of the six accident trains were classified as Key Trains, which are trains with a higher level of potential risk due to the nature of the cargo they carry or their operational characteristics.

Technologies such as DPUs, energy management systems, and dynamic braking can be used in conjunction with proper train car placement and makeup. While these technologies can improve train handling and fuel efficiency, they cannot replace the need for correct car placement and assembly. Railroads must prioritize proper train makeup to maintain safety, prevent accidents, and optimize train performance. Further, all operating employees must be properly trained in these technologies and the handling of complex trains to ensure safe operation and minimize human error.

Recommended Actions

To improve train safety and reduce the risk of accidents, FRA recommends the following best practices:

1. Review and update train makeup policies, procedures, and guidelines to ensure they are comprehensive, effective, and current.
2. Ensure that all personnel involved in train makeup decisions and operations receive appropriate training, guidance, and supervision to effectively execute train makeup policies, procedures, and guidelines to ensure safe operations.
3. Establish a system to regularly monitor and assess train makeup practices, with a focus on identifying and addressing potential safety risks.
4. Encourage open communication and collaboration among all stakeholders, including train crews, dispatchers, yardmasters, and maintenance personnel, to ensure a comprehensive understanding of train makeup factors and their potential impact on safety. Personnel should be encouraged and empowered to adhere to train makeup policies, procedures, and guidelines, even if it delays a train.

5. Develop and implement strategies to mitigate the risks associated with train build factors, such as the proper use of distributed power, train length limitations, and other operational train handling practices.

6. Enhance incident investigation procedures to specifically address train makeup factors and their potential contribution to the cause of the incident.

FRA encourages freight railroads to take actions consistent with the preceding recommendations. FRA may modify this Safety Advisory 2023-02, issue additional safety advisories, or take other appropriate action necessary to ensure the highest level of safety on the Nation's railroads, including pursing other corrective measures under its rail safety authority.

Issued in Washington, D.C.

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Chief Safety Officer.