



4910-06-P

DEPARTMENT OF TRANSPORTATION

Federal Railroad Administration

[Safety Advisory No. 2015-05]

Addressing Rail Head Surface Conditions Identified during the Internal Rail Inspection Process

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

ACTION: Notice of safety advisory.

SUMMARY: On February 16, 2015, a derailment occurred in West Virginia due to a broken rail that resulted from an internal rail defect, specifically a vertical split head (VSH). Although rail flaw detection equipment had indicated rail flaw conditions at the location of the failure in December 2014 and January 2015, the operator of the equipment failed to carry out an on-ground examination of the defect. The operator later claimed that he believed the reading on the monitor was a false-positive due to rail head surface conditions. FRA believes that if the operator better understood the indications for various rail flaw conditions, including the rough rail surface conditions he was to look for and properly identified the rail flaw indications, the operator would have reported the defect to the track owner. Upon reporting, the track owner would have been alerted to its duty under the Track Safety Standards (49 CFR part 213) to take remedial action (either repair or replacement of the rail or reduction of the maximum authorized train speed over the rail to the specified level). Had the track owner then taken proper remedial action, that action may have prevented the broken rail and the derailment.

In response, FRA is issuing this Safety Advisory No. 2015-05 to remind track owners (typically railroads), their track maintenance personnel, and their rail flaw detection equipment operators of the importance of complying with their rail management programs and engineering procedures that address rail with rail head surface conditions while performing rail flaw inspections and track inspections generally. This is particularly vital on track carrying passengers and hazardous materials due to the catastrophic consequences that may result from a derailment. This Safety Advisory also contains recommendations to track owners to ensure their rail flaw detection equipment operators are properly trained and exercise due diligence when a rail head surface condition interferes with a valid rail inspection.

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SUPPLEMENTARY INFORMATION:

Background, including Accident Summary and Regulatory Context

The overall safety of railroad operations has improved in recent years. However, a February 2015 accident highlights the need for additional focus on detection of internal rail flaws by each track owner responsible for compliance with the Track Safety Standards, and its respective employees and internal rail inspection service providers, particularly on track that carries passengers or hazardous materials. See relevant sections of the regulations, for example, 49 CFR 213.5, Responsibility for compliance; 213.113,

Defective rails; 213.237, Inspection of rail; and 213.238, Qualified operator. The following section summarizes the circumstances of this train derailment based on FRA's internal investigation and findings to date.

Accident Summary

At 1:15 p.m., Eastern Standard Time, on Monday, February 16, 2015, CSX Transportation, Inc. (CSXT) Train K08014, a loaded unit train transporting Bakken crude oil, traveling eastward at 33 miles per hour (mph) on the railroad's Huntington Division, New River Subdivision, experienced an automated emergency brake application in Fayette County, west of Mt. Carbon, WV, as a result of a derailment. The derailment occurred on Class 4 track due to a VSH rail defect. See 49 CFR 213.09. Twenty-seven tank cars derailed, and 20 of the derailed tank cars released approximately 362,300 gallons of crude oil that immediately ignited. The resulting fire burned for four days, requiring an evacuation approximately 1,100 residents within a half-mile of the accident site. One occupant of a house located adjacent to the accident site reported an injury due to smoke inhalation, and a resident outside the evacuation zone was also injured (hypothermia due to a lack of heat from power loss). A small amount of the crude oil entered the Kanawha River. As a precaution, officials closed downstream water treatment intakes at Montgomery, WV, approximately three miles west of the accident site. A one-half-mile evacuation zone around the derailment site affected approximately 1,100 residents

Prior Rail Inspections

As part of its derailment investigation, FRA reviewed the rail test data from CSXT's two most recent rail inspections in the area where the derailment occurred. The

two most recent inspections occurred on December 17, 2014, and January 12, 2015, and were conducted by a CSXT contractor, a rail inspection provider. Those inspections included ultrasonic and induction equipment specially designed for the detection of internal rail flaws.

During the December 17, 2014, inspection, the rail inspection provider's test equipment recorded indications with an icon on the display screen showing a vertical ultrasonic channel equipment response and induction test-channel responses at the point of derailment (POD). The test equipment recorded a similar but more significant indication at the same location during the next test on January 12, 2015. During both inspections, the test equipment also responded to a potential longitudinal-type rail head condition with multiple "boxed" equipment responses. The rail inspection data produced during the two inspections exhibited equipment responses typically indicating the presence of a significant rail head surface anomaly or longitudinal rail head defect such as the VSH defect that would become the POD on February 16, 2015.

Despite the indications of a defect that was becoming more significant over time, the rail flaw detection equipment operator did not conduct a visual ground examination and/or hand test to meet the 49 CFR 213.113(b) requirement to verify the multiple VSH defect indications the test equipment identified. Instead, the rail inspection operator told FRA that he looked out the window of his test equipment, decided a "dirty rail"¹ had caused each indication.

¹ During the interview of the operator, he used the term "dirty rail." In this context, FRA believes the operator was referring to a rail that exhibits a top of rail surface condition that could account for the inspection equipment response. However, FRA notes that the term can also mean that the rail contained an internal metallurgical impurity that is inherent from the manufacturing process.

VSH Rail Defect

A VSH rail defect is a progressive longitudinal fracture in the head of the rail (i.e., the upper part of a rail, used for supporting and guiding the wheels of railroad cars), where separation along an internal seam, segregation, or inclusion propagates vertically through the rail head. The formation of a VSH defect is found predominantly in locations where the train wheel stress loads are off center on the rail head. Separation progresses longitudinally and vertically along the rail length, typically for some distance before turning to the gage or field side of the rail head and often progresses rapidly before failure. FRA's investigation confirmed there was evidence of multiple, centrally located VSH defects at the derailment site.

Use of Rail Flaw Detection Equipment

The railroad industry primarily uses ultrasonic test equipment to conduct non-destructive testing (NDT) for internal rail flaw inspection. As with any NDT method, ultrasonic technology contains physical limitations that allow certain types of rail head surface conditions to influence the proper transfer of sound into the rail and impede detection of rail flaws. The predominant types of these mechanically-formed conditions are referred to as shells, engine-driver burns, spalling, flaking, corrugation, and head checking. Other conditions that are encountered are heavy lubrication or debris on the rail head. Indeed, track owners and rail inspection providers should be aware that the NDT system is designed to perform optimally on an ideal test surface (i.e., no rail head surface conditions). Conditions such as extreme cyclical loading can result in head wear and rail head surface conditions that affect the integrity of these rail flaw inspections.

Any type of surface condition can impede the transfer of sound from a rail inspection transducer into the rail being tested and the proper transfer of sound from a reflector in the rail back to the transducer. If the rail flaw detection equipment operator has any doubt or uncertainty about the integrity of the test process because of surface conditions, the operator should record the rail section searched as an invalid search for internal defects, and the track owner must take appropriate action under paragraph (h) of 49 CFR 213.237. Briefly summarized, paragraph (h) requires the track owner to conduct a valid search, reduce operating speed to a maximum of 25 mph until a valid search can be made, or replace the rail that had not been inspected.

General Responsibilities of Rail Flaw Detection Equipment Operators

The rail flaw detection equipment operator must have the knowledge and experience to proficiently identify the types of rail head surface conditions that can result in an improper or invalid test of the rail section where the condition is located. See 49 CFR 213.237(i). Unless a rail flaw detection equipment operator has already demonstrated proficiency operating the equipment before January 24, 2014, and, therefore, satisfied the qualified operator requirement under 49 CFR 213.238(f),² FRA requires them to be specifically trained and have written authorization from his or her employer to: (1) conduct a valid search for internal rail defects that is continuous and completely covers both rails of the track; (2) determine that the rail inspection equipment is operating within manufacturer guidelines and settings and performing all its required functions as designed; and (3) conduct the inspection according to established track owner and regulatory procedures and guidelines, including determining that all

² The operator of the rail flaw detector equipment that performed the December 17, 2014, and January 12, 2015 internal rail inspections was deemed a qualified operator under 49 CFR 213.238(f).

equipment responses are interpreted and attributed to a known condition that is not considered a rail defect. 49 CFR 213.238. Indeed, it is essential that the rail inspection's test integrity not be influenced by surface contamination, rail condition, or environmental conditions that can result in changes to the operational settings of the test equipment beyond allowable tolerances, changes to the equipment's alignment, or diminished equipment responses. Therefore, it is imperative that the track owner or rail inspection provider perform a hand test or visual on-ground examination of these suspect conditions to verify whether a defect is present.

FRA regulations specify that the rail flaw detection equipment operator must be trained as specified in FRA regulations to interpret the test data and to "demonstrate proficiency in the rail defect detection process" 49 CFR 213.238(c). Test equipment includes all hand-test instrumentation, recording instrumentation, front-end devices (roller search units, skids, induction search units, cabling, etc.), and detection control center (processing computer) equipment.

Under paragraph (a) of 49 CFR 213.238, each provider of rail flaw detection services shall (1) have a documented training program in place and (2) identify the types of rail flaw detection equipment for which each equipment operator it employs has received training and is qualified. Operators who are deemed a qualified operator under paragraph (f) remain subject to paragraph (d), which, in part, requires an employer to "reevaluate the qualifications of, and administer any necessary recurrent training for, the operator as determined by and in accordance with the employer's documented program." This requirement for recurrent training applies to operators who have completed the

initial training program and operators who have been deemed qualified operators under paragraph (f).

FRA determined during its investigation into the February 16, 2015, derailment that the presence of the rail head surface condition was not sufficient to account for the equipment response in its entirety, and that the rail flaw detection equipment operator should have inspected further. FRA believes that a visual ground examination, or hand test, or both, would have identified the presence of the underlying VSH defect at the time of the test on January 12, 2015, at what would become the POD.

Recommended Action: In light of the discussion above, and to instill a heightened sense of vigilance in track owners and their rail inspection provider(s), FRA recommends that each track owner:

1. Review with its employees and its rail inspection provider(s) the circumstances of the derailment described above and ensure its employees and rail inspection provider(s) carefully scrutinize occurrences of localized areas containing rail head surface conditions that may impede detection of an internal rail flaw and result in an invalid inspection;
2. Ensure its rail inspection procedures contain specific instructions that make clear what its rail inspection provider(s) are responsible for (for example, including identifying and reporting defects and invalid searches) and that incentivizes its rail inspection provider(s) to identify and report areas where a valid search could not be conducted;
3. Ensure that its employees and its rail inspection provider(s) follow the requirements of its own engineering instructions and ensure that the employees

and rail inspection provider(s) can identify locations that exhibit excessive rail head wear and rail head surface conditions;

4. Ensure that its rail flaw detection equipment operators perform an on-ground examination of any suspect rail defect location in conformance with 49 CFR 213.113(b). The operators should verify the suspect locations by hand as necessary, using a hand-held ultrasonic instrument or comparable device;
5. Ensure that its rail flaw detection equipment operators have been adequately trained on its procedures, are fully capable of performing proficient inspections, and are fully capable of determining whether a rail inspection is valid;
6. Continue the research and development of technology that will permit real-time comparison of the inspection data from the most current rail inspection with inspection data from the previous rail inspection to enable the operator to identify rail conditions that have significantly changed between inspections;
7. Review its current engineering instructions to ensure that the procedures are consistent with the industry standard for rail replacement and repair, particularly in track over which passengers or large quantities of ethanol, crude oil, or other hazardous materials are transported;
8. In applying appropriate slow orders, focus on locations that exhibit rail head surface conditions and rail head wear loss approaching the limits specified in its own engineering instructions until the rail is replaced or repaired; and
9. Aggressively monitor and evaluate its rail inspection provider's or providers' performance through a quality control program.

FRA encourages railroad industry members and other track owners to take actions consistent with the preceding recommendations and to take other complementary actions to help ensure the safety of the Nation's railroads, its employees, and the general public. FRA may modify this Safety Advisory No. 2015-05, issue additional safety advisories, or take other appropriate actions it deems necessary to ensure the highest level of safety on the Nation's railroads, including pursuing other corrective measures under its rail safety authority.

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