DEPARTMENT OF TRANSPORTATION

Federal Railroad Administration

[Safety Advisory 2015-01]

Mechanical Inspections and Wheel Impact Load Detector Standards for Trains Transporting Large Amounts of Class 3 Flammable Liquids

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

ACTION: Notice of Safety Advisory.

SUMMARY: Recent derailments have occurred involving trains transporting large quantities of petroleum crude oil and ethanol. Preliminary investigation of one of these recent derailments involving a crude oil train indicates that a mechanical defect involving a broken tank car wheel may have caused or contributed to the incident. FRA is issuing this Safety Advisory to make recommendations to enhance the mechanical safety of the cars in trains transporting large quantities of flammable liquids. This Safety Advisory recommends that railroads use highly qualified individuals to conduct the brake and mechanical inspections and recommends a reduction to the impact threshold levels the industry currently uses for wayside detectors that measure wheel impacts to ensure the wheel integrity of tank cars in those trains.

FOR FURTHER INFORMATION CONTACT: Ron Hynes, Director, Office of Safety Assurance and Compliance, Office of Railroad Safety, FRA, 1200 New Jersey Avenue, SE, Washington, DC 20590, telephone (202) 493- 6404; or, Thomas Herrmann,

Assistant Chief Counsel for Safety, Office of Chief Counsel, FRA, 1200 New Jersey Avenue SE., Washington, DC 20590, telephone (202) 493-6036.

SUPPLEMENTARY INFORMATION:

Background

The overall safety of railroad operations, including shipments of hazardous materials, has improved in recent years. However, the July 2013 derailment in Lac-Mégantic, Quebec, Canada, demonstrates the potentially catastrophic consequences of a railroad accident resulting in the sudden release of large quantities of Class 3 flammable liquids. Since that accident, there have been a number of derailments with subsequent fires and evacuations in the United States involving trains transporting large quantities of Class 3 flammable liquids (specifically, crude oil and ethanol). Although none of the recent derailments in this country have resulted in the tragic loss of life that occurred as a result of the Lac-Mégantic derailment, recent events have led DOT and FRA to thoroughly evaluate and address the unique risks associated with the growing reliance on trains to transport large quantities of Class 3 flammable liquids.

For example, in the last two years, DOT (including FRA and the Pipeline and Hazardous Materials Safety Administration (PHMSA)) has taken numerous actions to address the safe transportation by rail of Class 3 flammable liquids. Among other actions, DOT has issued three emergency orders[1] and several safety advisories, reached voluntary agreements with the railroad industry[2], and undertaken several separate

[1] DOT Emergency Restriction/Prohibition Order, Docket No. DOT-OST-2014-0067 (May 7, 2014); DOT Amended and Restated Emergency Restriction/Prohibition Order, Docket No. DOT-OST-2014-0025 (March 6, 2014); and, FRA Emergency Order No. 28, 78 FR 48218, Aug. 2, 2013.

[2] http://www.dot.gov/briefing-room/letter-association-american-railroads.

rulemaking proceedings to address the transportation and handling of trains transporting large quantities of Class 3 flammable liquids. Notably, PHMSA, in cooperation with FRA, is nearing completion of a comprehensive final rule that will enhance the safe transportation of large quantities of Class 3 flammable liquids by rail. The final rule will build on proposals contained in the Notice of Proposed Rulemaking (NPRM) in the HM-251 rulemaking proceeding (79 FR 45016, Aug. 1, 2014)[3]. The final rule was submitted to the Office of Management and Budget (OMB) for review pursuant to Executive Order 12866 on February 5, 2015 (http://www.reginfo.gov/public). A chronology of various DOT actions to address safe transportation of flammable liquids is listed on PHMSA's Internet website.[4]

Despite ongoing efforts by DOT, the railroad industry, tank car manufacturers, and other interested parties, the United States has experienced the derailment of several trains transporting large quantities of Class 3 flammable liquids (i.e., "high-hazard flammable trains" or HHFTs) over just the past three months. (For purposes of this Safety Advisory a HHFT is a train comprised of 20 or more loaded tank cars of a Class 3 flammable liquid in a continuous block or 35 or more loaded tank cars of a Class 3 flammable liquid across the entire train.) These incidents occurred in Iowa, West Virginia, and Illinois. FRA's preliminary investigation indicates that the recent derailment in Illinois may have occurred as a result of a wheel break occurring on a railroad tank car loaded with petroleum crude oil.

Galena, Illinois Derailment

[3] http://www.gpo.gov/fdsys/pkg/FR-2014-08-01/pdf/2014-17764.pdf.

[4] http://phmsa.dot.gov/hazmat/osd/chronology.

The following is an overview of the circumstance surrounding the most recent notable derailment involving a HHFT. The probable cause of this derailment has not yet been established by FRA. Accordingly, nothing in this Safety Advisory is intended to attribute a definitive cause(s) to this incident, or to place responsibility for the incident on the acts or omissions of any specific person or entity.

On March 5, 2015, an eastbound BNSF Railway Co. (BNSF) train consisting of 103 tank cars loaded with Bakken crude oil (petroleum crude oil, UN 1267, 3, PG I) derailed near Galena, Illinois, resulting in a fire. The train was traveling from North Dakota to Philadelphia, Pennsylvania. The train was traveling at an approximate speed of 23 mph when 21 loaded tank cars derailed. As a result of the derailment, petroleum crude oil was released and a fire ensued. Seven cars experienced catastrophic thermal tears, three cars released product through their bottom outlet valves, and two cars released product from their top fittings. The derailment occurred in a rural area only a few hundred feet from the Mississippi River. FRA's preliminary investigation indicates that a broken wheel on one of the loaded tank cars in the train may have caused the derailment.

In addition to the above-described incident, previous publicized derailments resulting in releases of crude oil or ethanol and/or resulting fires have occurred with increasing frequency (e.g., Dubuque, Iowa; Mt. Carbon, West Virginia; Casselton, North Dakota; Aliceville, Alabama; Lynchburg, Virginia; Columbus, Ohio; Cherry Valley, Illinois; Arcadia, Ohio; New Brighton, Pennsylvania). Since February 2015, an additional three incidents occurred in Ontario, Canada, two of which involved HHFTs.

In light of FRA's preliminary findings with respect to the Galena, Illinois derailment (described further below), FRA believes that further industry action is

necessary to ensure public safety. One area that FRA believes needs further industry consideration is the general mechanical condition of the equipment used in HHFTs. Thus, FRA is issuing this Safety Advisory to recommend that railroads take certain actions to ensure the safe mechanical condition of the tank cars used in HHFTs to prevent or identify defects that could lead to derailments.

Derailment Causes

As discussed above, the most recent crude oil derailment occurred in March near Galena, Illinois. FRA's preliminary investigation indicates that a broken wheel on a tank car loaded with petroleum crude oil may have caused that derailment. Federal railroad safety regulations prohibit the use of railroad freight cars with certain wheel defects. 49 CFR 213.103. For example, flat spots on any freight car wheel that exceeds 2.5" in length, or with two adjoining flat spots, each of which is more than two inches in length, would prohibit that car from being placed in a train and transported. 49 CFR 215.103(f). This safety requirement is intended to prevent derailments and damage to other mechanical or track components that might occur as a result of moving a railroad car with flat spots in a wheel(s).

With regard to wheels with flat spots, wheels with that particular defect impact the rail each time the flat portion of the wheel meets the rail as the wheel rotates. Flat spots or other wheel defects (built up tread) cause freight car wheels to be out-of-round and may ultimately cause a wheel to break. Further, excessive wheel impacts caused by out-of-round wheels can cause rails to crack or break. Track defects are one of the leading causes of derailments. Several other notable derailments involving large quantities of flammable liquids that have occurred in this country so far this year (near

Dubuque, Iowa and Mt. Carbon, West Virginia, respectively) are believed to have been track-caused, as was the 2014 crude oil train derailment that occurred in Lynchburg, Virginia. FRA is not asserting that these incidents were caused by flat spots on wheels or other mechanical defects, but only that that wheel defects can cause derailments and can damage track to the point that a rail breaks and causes a derailment. FRA's intent in publishing this Safety Advisory is to address the mechanical condition of tank cars used in HHFTs to avoid or identify mechanical defects that may lead to derailments, regardless of whether the ultimate cause of an accident is the result of a mechanical, track, or other defect.

Wheel Impact Load Detectors

Technology has enabled railroads to use additional means to learn of defects to freight cars and railroad track structures than were previously available. In relation to the issues in this Safety Advisory, the use of wayside detectors has specifically enabled railroads to identify certain wheel defects and prevent derailments before they occur. For example, hot wheel/box detectors have long been used to alert railroads and their train crews about potential wheel or axle problems while a train is enroute, such that the train can be inspected and cars with dangerous conditions removed from the train. Railroads also employ Wheel Impact Load Detectors (WILD) along their rights of way. These detectors identify wheels on a railcar that may have flat spots or other defects before a wheel can cause damage to railroad track structures.[5]

The Association of American Railroads (AAR) has established industry-wide standards regarding how freight cars with wheels that have peak vertical load (kips) above certain thresholds should be handled. See e.g., 2015 Field Manual of the AAR

[5] See http://freightrailworks.org/wp-content/uploads/safety2.pdf.

Interchange Rules. AAR guidance (Rule 41) states that when a freight car's wheel registers an impact on a wayside WILD of 65 kips or more, that the car's owner receives notification of that reading. When a wheel registers from 80 to 89 kips on a WILD, that wheel is condemnable and may be replaced when the car is on a shop or repair track for any other reason. Any wheel that registers over 90 kips is condemnable and may be replaced at any time. FRA also understands that some railroads have adopted procedures that set an additional upper threshold whereby a reading above a certain level (140 kips) would require the train in which the car is traveling to be stopped, and the car removed from the train to be repaired immediately before further movement. FRA's investigation of the recent incident near Galena, Illinois indicates that the train in question had passed over a WILD within approximately 130 miles before derailing. It appears that the car that potentially caused the derailment registered 83.87 kips on that WILD (while another car in the train registered 96 kips). A month earlier, on February 2, 2015, the car that potentially caused the derailment also registered over 80 kips while passing over two separate WILDs. Under AAR interchange rules, the option existed for the car to have had a problematic wheel replaced when the car was next on a repair track, while the car that registered 96 kips could have continued in transportation but been replaced at any time.

FRA continues to encourage the industry to implement this type of advanced wayside detection equipment and applauds the industry for its continued efforts to utilize the technology across the rail network. However, in light of the significant increases in the amount of Class 3 flammable liquids being transported by rail over the last few years and because wheel defects are known not only to cause derailments but also to cause

significant damage to rails, FRA is recommending that railroads (and AAR via amendment to its interchange rules) lower the impact threshold for action to replace the wheels on any car in a HHFT specified below. FRA is recommending adjustment to the following threshold levels:

- 60 kips - issue maintenance advisory for the affected car;
- 70 kips - change the wheel at the tank car's next visit to a repair or shop track;
- 80 kips - condemn the wheel and replace at the first opportunity; and
- 120 kips - immediately stop the train to inspect the wheel and remove the car from service at the first available location.

FRA believes that in light of the significant increase in the number of HHFTs and the catastrophic consequences that can result when one of these trains experience a derailment, the industry needs to provide special attention to the mechanical condition of the tank cars being hauled in these trains. This is especially important while newer, more robust tank car standards are being developed. The adjustments recommended above may enable railroads to identify and replace wheel defects that could cause derailments much sooner than under the existing industry guidelines. FRA also continues to encourage the installation of additional WILD and other wayside detectors that might help prevent train derailments.

FRA is aware that the speed at which a train travels over a WILD may impact the readings that are generated (e.g., a car traveling at lower speed may result in a much lower WILD reading than when the same car travels over a WILD at a higher speed). However, railroads should not operate HHFTs over a WILD below normal operating

speeds to avoid an elevated WILD reading. FRA also encourages railroads to use electronic data interchange so that a railroad transporting a tank car in an affected train would have access to WILD readings generated by other railroads that have previously transported that car.

Mechanical Inspections

Another area FRA believes industry could address to ensure the safe mechanical condition of rail cars used in HHFTs is mechanical inspections. Existing Federal railroad safety regulations that address mechanical and inspection requirements for freight cars are primarily found in 49 CFR parts 215 and 232. To detect mechanical defects such as wheels defects (before trains depart a terminal or point of origin) railroads are required to inspect railroad freight cars prior to transporting them in a train. 49 CFR 215.13. These inspections are referred to as pre-departure inspections and are typically performed by a designated inspector under § 215.11. Section 215.11 requires that a designated inspector demonstrate the knowledge and ability to inspect railroad freight cars to determine compliance with 49 CFR part 215, including the ability to detect wheel defects under § 215.103. However, if a designated inspector is not on duty, a railroad may use another person, often a train crew member, to perform an abbreviated inspection intended to detect readily discoverable defects (such as a cracked or broken wheel). These inspections are often referred to as "Appendix D" inspections. See appendix D to 49 CFR part 215.

In light of recent derailments involving HHFTs and the potential consequences of any future derailments, FRA is recommending that any HHFT traveling long distances have a pre-departure inspection performed by a designated inspector. Designated

inspectors are typically mechanical employees. Unlike train crew members or other railroad employees, designated inspectors' duties primarily relate to the detection and remedy of mechanical defects on railroad rolling equipment. FRA believes that designated inspectors are better trained, equipped, and experienced to detect mechanical defects on rail cars that may lead to derailments than railroad employees whose duties primarily involve other tasks, such as operating trains. Thus, FRA believes safety is improved by using only designated inspectors to perform pre-departure inspections of HHFTs.

In addition to the required pre-departure inspection that is performed on trains to determine compliance with part 215, trains also must undergo an air-brake and other mechanical-related inspections prior to transportation under 49 CFR part 232. In 2001, FRA promulgated a final rule (66 FR 4104) that established minimum inspection standards for "extended haul" trains that travel long distances (up to 1,500 miles). 49 CFR 232.213. Railroads typically use the standards in § 232.213 to identify, inspect, and operate unit trains that travel long distances across the United States, such as coal trains and high priority intermodal trains. FRA believes that trains can be transported safety over such long distances if, among other requirements, quality mechanical inspections are performed to ensure that all air brakes in a train are operative at the point of origin, and that no mechanical defects exist prior to the train's departure. As explained in the final rule, § 232.213 contains "stringent inspection requirements, both brake and mechanical, by highly qualified inspectors" that ensure the safety of trains operated over long distances under that section's requirements. 66 FR 4121.

The brake inspection applicable to an extended haul train must be performed by a "qualified mechanical inspector" (QMI) as defined by § 232.5, while the part 215 inspection is required to be performed by a designed inspector under § 215.11 as discussed above. A QMI is required to receive instruction and training on the "troubleshooting, inspection, testing, maintenance or repair of the specific train brake components and systems for which the person is assigned responsibility." 49 CFR 232.5. FRA believes that QMIs (versus other employees such as train crew members) possess the skill to perform high quality inspections and can identify defective conditions, know how those defects might affect other parts of the freight car's brake or mechanical systems, and know how such defects might be caused. 66 FR 4148.

In evaluating the recent incidents involving HHFTs, many of the trains were traveling uninterrupted (such as for reclassification at a yard) for long distances. For example, the recent crude oil derailments have involved trains transporting product from its source in North Dakota to refineries on the coasts -- in some instances distances of well over 1,000 miles. FRA recognizes that many railroads already move these long distance trains as extended haul trains and conduct the mechanical and brake inspections discussed above. To assure the safety of HHFTs that might travel long distances, FRA recommends that such trains receive mechanical and brake inspections conducted by QMIs and designated inspectors. FRA believes that having these critical inspections conducted by highly qualified inspectors at the point where such trains are initiated will help ensure the safe mechanical condition of these trains.

In seeking the appropriate approach to ensuring safety, FRA has also limited the recommendations in this Safety Advisory to HHFTs only and would have applied to all

of the recent incidents described above. This threshold ensures that FRA is focusing on the highest risk shipments and not unnecessarily making safety-related recommendations that would impose undue burdens on lesser risks that do not represent the same safety and environmental concerns. However, FRA also supports additional safety-related inspections or measures that railroads wish to adopt, irrespective of commodity being hauled or the type of operation.

RECOMMENDED RAILROAD ACTION: In light of the above discussion, FRA recommends for any HHFT that railroads:

1) Continue to install and maintain Wheel Impact Load Detectors (WILD) along routes traveled by affected trains, and adjust the existing industry standards for actions to be taken when wayside WILDs detect an impact above a certain threshold for an affected train. If a railroad receives notification of a wheel impact for a car in an affected train above the below-listed thresholds, at a minimum, take the following actions:
    - 60 kips - issue maintenance advisory to the car owner of the affected car;
    - 70 kips - change the wheel at the tank car's next movement onto a repair or shop track;
    - 80 kips - condemn the wheel and replace it at the first opportunity; and
    - 120 kips - immediately stop the train to inspect the wheel and remove the car from service at the first available location.
2) Conduct initial terminal brake inspections by qualified mechanical inspectors as defined in 49 CFR 232.5 and conduct freight car inspections at initial

terminals with designated inspectors under 49 CFR 215.11 for any affected train that will travel 500 miles or more from its initial terminal to destination.

FRA encourages railroad industry members to take actions that are consistent with the preceding recommendations and to take other complementary actions to help ensure the safety of the Nation's railroad employees. FRA may modify this Safety Advisory, issue additional safety advisories, or take other appropriate actions 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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Sarah E. Feinberg
Acting Administrator
Federal Railroad Administration