U.S. Department of Transportation
Federal Railroad Administration

High-Hazard Flammable Train Route Assessment & Legacy Tank Car Focused Inspection Program

Summary Report

January 2024

TABLE OF CONTENTS

List of Figures

List of Tables

EXECUTIVE SUMMARY

This Federal Railroad Administration (FRA) report responds to two directives from U.S. Department of Transportation (DOT or the Department) Secretary Pete Buttigieg resulting from the February 3, 2023, Norfolk Southern Railway (NS) freight train derailment in East Palestine, Ohio. Following the accident, Secretary Buttigieg committed the Department to (1) conducting a focused inspection program on routes over which high-hazard flammable trains (HHFTs) and other trains carrying large volumes of hazardous material travel; and (2) initiating a focused inspection program of legacy DOT-111 tank cars and the shippers and car owners that have not upgraded to the more robust, DOT-117 specification tank cars.

FRA conducted these reviews between March 1, 2023, and August 31, 2023. This included a focused inspection and evaluation of routes in the national rail network over which the largest volumes of hazardous materials are transported (the "HHFT Route Assessment" or Assessment). This Assessment also included a review of industry practices, processes, and procedures related to wayside detector technology, which FRA currently does not regulate. Together, this Assessment covered a broad range of rail infrastructure and operations, including hazardous materials transportation, motive power and equipment, track, signal and train control, and operating practices. Although FRA identified some conditions not in compliance with Federal regulations (described later in this report), generally, FRA found that the railroads' infrastructure, equipment, and processes were in compliance with applicable Federal regulations. FRA did, however, identify areas where improvements are needed to ensure effective use of wayside detector technology.

FRA's focused inspection of tank car phase out (Legacy Tank Car Focused Inspection Program) reviewed the largest tank car owners (those that collectively own and control almost 85% of the North American tank car fleet), finding they are on target to meet the May 2029 FAST Act-mandated DOT-111 phase out requirements,[1] and that economic and practical challenges remain that prevent the full-scale, immediate phase out of the cars.

INTRODUCTION

On the evening of February 3, 2023, an eastbound NS freight train derailed in East Palestine, Ohio.[2] The train consisted of three locomotives (two head-end locomotives and one distributed power locomotive) and 149 railcars carrying general merchandise. Among the 149 railcars were 20 placarded hazardous materials tank cars.[3] The incident resulted in 38 railcars derailing,

[1] *See also* Bureau of Transportation Statistics, U.S. Department of Transportation, *Fleet Composition of Rail Tank Cars Carrying Flammable Liquids: 2023 Report* (available at https://www.bts.gov/sites/bts.dot.gov/files/2023-09/BTS_Tank_Car_Report_To_Congress_9_13_2023.pdf) (discussing industry's progress in upgrading rail tank car fleet to the DOT-117 standard).

[2] National Transportation Safety Board, *Preliminary Report: Norfolk Southern Railway Train Derailment with Subsequent Hazardous Material Release and Fires (Feb. 23, 2023)* (available at https://www.ntsb.gov/investigations/Documents/RRD23MR005%20East%20Palestine%20OH%20Prelim.pdf).

[3] Three of the 20 placarded tank cars contained only a residue of hazardous materials.

including 11 of the hazardous materials tank cars.[4] The derailment caused a massive fire and environmental damage to the East Palestine community. FRA and the National Transportation Safety Board are both investigating the derailment.

On February 21, 2023, DOT Secretary Pete Buttigieg issued a three-part push to improve rail safety. Secretary Buttigieg called on the rail industry and Congress to take specific actions to improve community safety and rail worker conditions and committed DOT to furthering its work on certain freight rail safety initiatives.[5] Among other initiatives, Secretary Buttigieg committed the Department to conducting the HHFT Route Assessment.[6] The Secretary also committed the Department to initiating the Legacy Tank Car Focused Inspection Program, a program focusing inspection resources on legacy DOT-111 tank cars and the shippers and car owners that have not upgraded to the more robust, DOT-117 specification tank cars.[7]

In response to the Secretary's directive, on March 1, 2023, FRA initiated a focused inspection program to assess HHFT routes and routes where large quantities of hazardous materials travel. FRA designed this HHFT Route Assessment as an approximately 180-day focused inspection and investigation program to assess the condition of track and signal and train control infrastructure along HHFT routes, the condition of rolling stock that are part of HHFTs and otherwise used to transport hazardous materials, critical requirements related to the transportation of hazardous materials, and relevant operating practices and procedures of railroads. In June 2023, FRA made the ongoing results of this Assessment public through an online dashboard.[8]

As part of the Assessment, FRA conducted two surveys related to railroads' use of wayside detector information. FRA directed the first survey to operating employees to determine if the employees are aware of the processes and procedures associated with wayside detector alarms and associated notifications. FRA directed the second survey to dispatch center personnel to evaluate the processes individual Class I railroads use to address alarms from wayside defect

[4] *Id.*
[5] U.S. Department of Transportation Fact Sheet: Steps Forward on Freight Rail Industry Safety & Accountability (Feb. 21, 2023) (available at https://www.transportation.gov/briefing-room/us-department-transportation-fact-sheet-steps-forward-freight-rail-industry-safety).
[6] Federal regulations define an HHFT as "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." The HHFT designation also includes "high-hazard flammable unit trains" which Federal regulations define as a "single train transporting 70 or more loaded tank cars containing Class 3 flammable liquid." Although the train that derailed in East Palestine was not an HHFT, the train was traveling over a route HHFTs commonly traverse and was carrying several carloads of hazardous materials, including carloads of a Class 2.1, flammable gas.
[7] In addition, Secretary Buttigieg committed the Department to (1) advancing the Train Crew Staffing Rule; (2) deploying Bipartisan Infrastructure Law (BIL) funding resources to fund projects that modernize and improve rail tracks, eliminate at-grade crossings and improve rail safety; and (3) pursue further rulemaking related to high-hazard flammable trains and electronically controlled pneumatic brakes. For more details see: https://www.transportation.gov/briefing-room/us-department-transportation-fact-sheet-steps-forward-freight-rail-industry-safety.
[8] The dashboard is available at the following link: *See* https://explore.dot.gov/t/FRA/views/High-HazardousFlammableTrainRouteAssessmentHRA1_1/PublicDashboard?%3Aembed=y&%3AisGuestRedirectFromVizportal=y.

detectors and the railroads' subsequent responses through their dispatching or network operations centers.

Concurrently with this Assessment, FRA conducted a focused inspection program of legacy DOT-111 tank cars and the shippers and car owners that have not yet upgraded to DOT-117 tank cars. FRA gathered data from the Nation's largest tank car owners[9] regarding the use, phase out, and transition to DOT-117 tank cars.

This report summarizes FRA's inspections and findings of the HHFT Route Assessment as well as FRA's analyses of its Legacy Tank Car Focused Inspection Program.

HHFT ROUTE ASSESSMENT

Background and Scope of Assessment

FRA promulgates and enforces the Federal rail safety regulations.[10] The Pipeline and Hazardous Materials Safety Administration (PHMSA) promulgates the Federal Hazardous Materials Regulations (HMR) that govern the rail transportation of hazardous materials.[11] FRA enforces the HMR as applied to the rail transportation of hazardous materials.

FRA routinely inspects the infrastructure, equipment, and processes and procedures of railroads and the owners of tank cars designed to transport hazardous materials by rail for compliance with FRA safety regulations, the HMR, and relevant underlying laws.

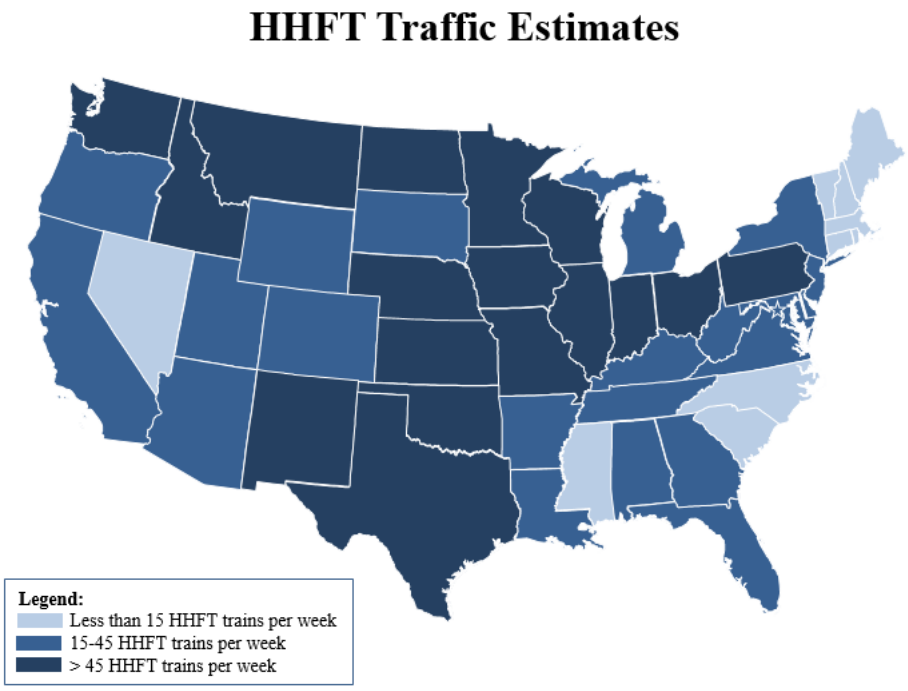
The HMR define an HHFT[12] as "a single train transporting 20 or more loaded tank cars of a Class 3 flammable liquid[13] in a continuous block or a single train carrying 35 or more loaded tank cars of a Class 3 flammable liquid throughout the train consist." The designation of HHFT was first adopted into the HMR in 2015 to address the unique risks associated with the transportation of large quantities of flammable liquids by rail.[14] HHFTs are subject to various operating restrictions (e.g., a speed limit of either 40 or 50 miles per hour depending on the operating conditions; braking requirements; and route analysis requirements).[15] The HMR also

[9] These tank car owners own almost 85% of the North American tank car fleet.
[10] 49 CFR Parts 200 – 272.
[11] 49 CFR Parts 171-180.
[12] 49 CFR § 171.8.
[13] With certain exceptions, the HMR define a Class 3 flammable liquid as a liquid having a flash point of not more than 60°C (140°F), or any material in a liquid phase with a flash point at or above 37.8°C (100°F) that is intentionally heated and offered for transportation or transported at or above its flash point in a bulk packaging. 49 CFR § 173.120(a). Examples of Class 3 flammable liquids commonly transported by rail include crude oil, ethanol, and refined petroleum products.
[14] 80 FR 26644 (May 8, 2015).
[15] *See* 49 CFR § 174.310.

require railroads operating HHFTs to provide certain information about those trains to specified state and tribal emergency response agencies.[16]

In conducting this HHFT Route Assessment, FRA prioritized inspection and evaluation of routes over which the largest volumes of hazardous materials are transported. According to Surface Transportation Board (STB) waybill data, in calendar year 2022, approximately 688,000 shipments of Class 3 flammable liquids were transported by rail in the U.S.[17] Statistically, this volume equates to approximately 1,885 carloads of flammable liquids traveling by rail daily and 95 or fewer trains per day operating under the HHFT designation.[18] Using that same STB data, FRA estimated that HHFTs are most commonly operated over approximately 22,000 miles of track, spanning 39 states. *See* Figure 1.

Figure 1. HHFT Traffic Estimates



[16] 49 CFR § 174.312. The train involved in the East Palestine derailment included 20 placarded hazardous materials tank cars, including seventeen loaded tank cars and three residue cars. The 17 loaded tank cars were comprised of 4 tank cars of combustible liquids (a classification with hazards similar to flammable liquids but with flash points between 140°F and 200°F), 6 tank cars of flammable gases, 2 tank cars of flammable liquids, and 5 tank cars of corrosive liquids. Because the train did not contain 20 or more loaded tank cars of a Class 3 flammable liquid, the train did not meet the regulatory definition of an HHFT.

[17] https://www.stb.gov/reports-data/waybill/.

[18] FRA's estimate of the number of HHFTs operating daily is based on the daily statistical number of rail Class 3 hazardous material shipments (1,885), divided by 20 (by definition, a train must have at least 20 carloads of a Class 3 hazardous material in its consist to be designated an HHFT). For purposes of this Assessment, FRA considers the states with an estimated 15-45 or over 45 HHFT trains per week to be the states with the highest volumes of HHFT traffic.

FRA focused its inspection efforts on the States with the largest estimated volumes of HHFT traffic and expanded this effort to routes throughout the U.S. where large quantities of hazardous materials are transported by rail.[19]

Between March 1, 2023, and August 31, 2023, FRA Federal and State inspectors conducted approximately 7,500 inspections.[20] Those inspections covered a broad range of rail infrastructure and operations, including track, signal and train control, mechanical, operating practices, and hazardous materials transportation. FRA uses its oversight and inspection processes to identify and seek corrective actions of any safety issues as effectively, quickly, and efficiently as possible. During the Assessment, inspectors documented almost 26,000 defects and recommended over 770 violations. *See* Table 1.

When performing these focused inspections, FRA field staff followed routine FRA inspection procedures and documented instances of non-compliance with applicable Federal law or regulations. FRA's inspectors exercised their normal discretion as to when identified instances of non-compliance were considered "defects" (i.e., instances of technical non-compliance with the regulations for which no enforcement action was justified at the time) or "violations" (i.e., when specific instances of non-compliance justified the recommendation of civil penalties or other enforcement action). Generally, FRA exercises its enforcement authority, including its authority to issue violations leading to civil penalties, when FRA determines that enforcement is the best method of gaining compliance and correcting underlying causes of non-compliance.

Table 1. Number of Defects and Recommended Violations Identified

Discipline	Number of Defects	Number of Recommended Violations
Grade Crossing	6	0
Hazardous Materials	4,117	460
MP&E	8,605	71
OP	642	115
S&TC	1,530	107
Track	10,792	21
Total	25,692	774

In deciding when to recommend enforcement action, FRA policy requires inspectors to consider the following factors:

(1) The inherent seriousness of the condition or action;
(2) The kind and degree of potential safety hazard the condition or action poses in the immediate factual situation;

[19] FRA conducted these inspections under its general inspection and investigation authority, 49 U.S.C. § 20107.
[20] Throughout this document, unless otherwise specified, references to "FRA inspectors" or "inspectors" refers to both federally employed FRA safety inspectors and inspectors employed by the States participating in FRA's State Safety Participation Program under 49 CFR Part 212.

(3) Any actual harm to persons or property already caused by the condition or action;
(4) The offending person's (i.e., railroad's or individual's) general level of compliance as revealed by the inspection as a whole;
(5) The person's recent history of compliance with the relevant set of regulations, especially at the specific location or division of the railroad involved;
(6) Whether a remedy other than a civil penalty (ranging from a warning up to an emergency order) is more appropriate under all of the facts; and
(7) Other factors relevant under the circumstances.[21]

Accordingly, enforcement action will typically be recommended if an identified defect is safety-critical, or if FRA identifies a pattern of non-compliance by the railroad. An FRA inspector may not recommend a civil penalty if an extensive and detailed inspection reveals a minor, technical non-compliant defect. FRA expects defects to be addressed promptly and thoroughly by the responsible railroad. This assessment has identified defects across each discipline and, in doing so, has provided railroads an opportunity to address such defects and contribute to a safer railroad environment.

Although FRA routinely inspects HHFT trains and analyzes the processes and procedures railroads follow when operating those trains, in this Assessment, FRA expanded its review to include an evaluation of wayside detectors. Signal and train control and operating practices inspectors evaluated railroads' use of wayside detector technologies. FRA regulations do not require the use of wayside detector technology. FRA regulations do not apply to the use of wayside detectors unless the detectors are tied into a railroad signaling system.[22] However, recognizing the railroad industry's increased use of and reliance on such technologies, FRA sought to better understand the extent to which railroads already use wayside detectors and industry processes and procedures governing their use.

According to data the Association of American Railroads shared with FRA at the beginning of this Assessment, Class I freight railroads and Amtrak have installed almost 16,000 wayside detectors (the bulk of which are hot bearing detectors (HBDs) and dragging equipment detectors (DEDs)). FRA surveyed both railroad operating employees (engineers and conductors) and dispatch center employees to determine the level of employee training and familiarization with various wayside detectors, and employee familiarization with operating rules, practices, and procedures associated with wayside detector data. FRA also surveyed the railroads to identify the processes, procedures, and resources that railroads employ in monitoring and acting on the data collected by wayside detectors.

FINDINGS

Hazardous Materials (HMT)

[21] 49 CFR Part 209, App. A, *Statement of Agency Policy Concerning Enforcement of the Federal Railroad Safety Laws*.
[22] *See* 49 CFR § 236.601 (addressing signals controlled by devices used to protect against unusual contingencies such as landslides, dragging equipment, or washouts).

FRA's Federal and State HMT inspectors conducted over 2,700 inspections to verify compliance with 49 CFR Part 174, including compliance with the hazardous material packaging requirements; marking, labeling, and other hazardous materials communication requirements; emergency response information sharing requirements; requirements for consist accuracy; and safety and security inspection requirements.

During the Assessment, FRA found that consistent with past inspection results, railroads generally complied with the rail specific requirements of 49 CFR Part 174.[23] The two most frequent defects inspectors identified were train consist inaccuracy, followed by not meeting safety and security inspection requirements at the time of a shipment's pick-up or interchange, both of which are responsibilities of the railroad.

FRA also evaluated railroads' processes for providing the information required by 49 CFR § 174.312 to State Emergency Response Commissions (SERCs) and Tribal Emergency Response Commissions (TERCs).[24] FRA found that railroads provided the information to the SERCs and TERCs as required, but FRA noted that further dissemination of the information from the SERCs to local first response organizations did not always occur. FRA attributes this finding to the fact that Federal regulations require the SERCs and TERCs to distribute the information provided by the railroads only when local first response or emergency planning organizations request the information. Notably, on August 14, 2023, FRA and PHMSA sent a joint letter to Fusion Center Directors, State Emergency Response Commissioners, and Tribal Emergency Response Commissioners throughout the United States encouraging the Fusion Centers, SERCs and TERCs to share information with local governments and emergency responders so that they have the necessary information to develop emergency preparedness plans.[25]

FRA also verified that the Class I railroads voluntarily make comprehensive commodity flow information available to first response and emergency planning organizations upon written request. These detailed commodity flow reports identify the hazardous materials that are transported on the individual track segments within each organization's jurisdiction.

Additionally, FRA verified that railroads reference and incorporate safety training elements required by other Federal agencies (e.g., the Occupational Safety and Health Administration) into their hazardous materials training required under 49 CFR § 172.704(b), but FRA notes that these specific training and plan requirements are enforced by Federal and State OSHA oversight personnel, not FRA.

[23] Part 174 sets forth general and commodity-specific operating, handling, and loading requirements for the rail transportation of hazardous materials.

[24] Section 174.312 of Part 174 requires railroads, prior to operating any HHFTs, to share with the relevant SERC, TERC, or other appropriate state-designated entity, the estimated number of HHFTs that it expects to operate each week through each county within a state or tribal jurisdiction.

[25] Previous to the FRA and PHMSA joint letter, PHMSA, in coordination with FRA, issued a Safety Advisory on July 11, 2023, urging 9-1-1 call centers to train on and use technologies that are designed to provide critical information to first responders in the event of a rail incident. PHMSA, *Safety Advisory Notice Encouraging the Use of Real-Time Train Consist Information in 9-1-1 Call Centers* (July 11, 2023) (available at https://hazmat.dot.gov/sites/phmsa.dot.gov/files/2023-07/PHMSA%20Safety%20Advisory%20Notice%20-%209-1-1%20Call%20Centers.pdf).

Motive Power and Equipment (MP&E)

For the MP&E portion of this Assessment, FRA conducted inspections of strategically selected trains at initial terminal locations and locations where crew inspections are regularly conducted. FRA also conducted inspections to ensure proper mechanical inspections and class 1 brake tests were performed on placarded freight cars in accordance with 49 CFR Parts 215 (Railroad Freight Car Safety Standards), 231 (Railroad Safety Appliance Standards), and 232 (Brake System Safety Standards for Freight and Other Non-Passenger Trains and Equipment).

Federal and State MP&E inspectors conducted approximately 865 inspections, inspecting over 40,000 individual freight cars (including tank cars transporting hazardous materials) and over 560 individual locomotives. The three most frequently identified mechanical defects related to safety appliances (49 CFR Part 231), freight car air brakes (49 CFR Part 232), and freight car safety standards (49 CFR Part 215). The Part 231 defects included loose safety appliances (e.g., safety appliances not properly attached to equipment) or safety appliances with wrong clearances (e.g., bent safety appliances). The Part 232 defects reflect brakes identified as not being in effective operating condition (e.g., brake shoes were worn to the point of metal-on-metal contact with the wheel tread). The Part 215 defects involved missing or inoperative coupler components.

Often these defects were identified on out-bound trains, meaning the railroad had missed the defect twice: (a) upon the required equipment inspections and (b) that the equipment had been deemed ready for departure.

Track

Using both visual inspections and Automated Track Inspection Program surveys, FRA assessed the track and associated structures for overall condition and compliance with Federal regulations. When wayside detectors were present, inspectors also evaluated whether the condition of nearby track and structures impeded the performance of the detectors.

FRA and State track inspectors conducted almost 1,400 inspections, finding consistent conditions across all Class I railroads, with track defects identified most commonly in track turnouts. Outside of turnouts, the most common defect identified was instances where track ballast did not meet the Federal Track Safety Standards (49 CFR Part 213).

FRA track inspectors routinely inspect culverts under or immediately adjacent to the track roadbed. Given the recent, historic levels of flooding that has occurred in some areas of the U.S. and that the resulting high-water levels can, in some instances, lead to culverts under or adjacent to track overflowing or becoming blocked, FRA track inspectors inspected culverts where appropriate. FRA regulations require that drainage or other water-carrying facilities under or immediately adjacent to the track roadbed be maintained and kept free of obstructions.[26] Many culverts were designed and built over 100 years ago, and the original design capacity may no longer be adequate because of industrial or residential development or outdated storm water

[26] 49 CFR § 213.33.

drainage systems in urban areas. During this Assessment, track inspectors identified close to 120 defects associated with culverts that required railroads to remediate the conditions. Generally, the defects identified were locations where culverts required maintenance to ensure they continued to provide adequate drainage.

Through FRA's Automated Track Inspection Program (ATIP),[27] the agency conducted ATIP surveys on all Class I railroads and 65 Class II and III railroads. ATIP inspections and track surveys identify "exceptions," which are reported via electronic means to the railroads and FRA.[28] Railroads then have qualified track inspectors conduct visual inspections to validate the exceptions. If the exceptions are verified as defects under Part 213, railroads must apply the proper remedial action mandated by the regulation. FRA track safety inspectors also conduct follow-up visual inspections at selected exception locations to verify that railroads applied the proper remedial action.

As part of this Assessment, ATIP surveyed a total of 76,888 miles, of which, 87%, or 66,995 miles, were on routes over which hazardous materials are transported. Track exceptions during the Assessment period totaled almost 4,000 track geometry exceptions, or 4.80 exceptions per 100 miles, which is a 6% reduction from the previous year's rate of 5.13 exceptions per 100 miles, and an overall reduction of 32 percent (on average) over the last 10 years. Notably, however, during this Assessment, FRA found that railroads typically conduct a visual verification inspection with an inspector qualified under FRA's Track Safety Standards[29] on the day they receive notification from FRA's ATIP. In such cases, once the railroad verifies the reported condition is non-compliant with FRA's Track Safety Standards, they apply the appropriate remedial action.

Although, there are no regulatory requirements for railroads to use ATI technology to inspect track, all Class I railroads used ATI technologies on the HHFT routes during this Assessment period. In fact, those railroads inspected a majority of the HHFT routes using ATI technology multiple times during this Assessment. Although most Class II and some Class III railroads inspect their track using ATI technology, not all do. Many of these railroads do not own or operate their own ATI vehicles, and instead rely on contractors for the testing at a much lower frequency as compared to Class I railroads. All railroads rely on the visual track inspections performed by qualified track inspectors, even when supplemented with ATI. FRA had no objections to railroads' use of ATI during this Assessment.

FRA track inspectors also observed approximately 1,300 wayside detectors and identified instances where the condition of the track or other structures in the vicinity of the detectors minimally impeded the detectors' functioning. For example, in some instances FRA found that

[27] FRA's ATIP program is a federally mandated program in which FRA uses automated track inspection (ATI) technology to survey track throughout the U.S. rail network. Data gathered through FRA's ATIP program is used to assess the effectiveness of railroads' track maintenance and inspection processes, to assess track safety trends, and is provided to railroads to assist in making repairs and improving safety and maintenance quality.
[28] ATIP exceptions are not considered to be FRA defects until they are verified as such by a qualified track inspector.
[29] 49 CFR Part 213. *See specifically* 49 CFR §§ 213.7 and 213.9(b).

mud had splashed on the lenses of detectors potentially limiting the detectors' ability to measure relevant conditions.

Signal and Train Control (S&TC)

According to data the Class I freight railroads and Amtrak provided FRA, those railroads have installed approximately 15,860 wayside detectors of varying types throughout their systems, with approximately 6,400 Dragging Equipment Detectors (DEDs), 5,500 HBDs, 1,600 Hot Wheel Detectors (HWDs), and numerous other types. Throughout the course of this Assessment, Federal and State S&TC inspectors observed 15 different types of detectors in use on the Class I railroads, some passenger operations, and a small number of short line railroads. Appendix A contains a list of the various types of detectors observed and the functions of each type of detector. Class I railroads accounted for approximately 2,400 (93%) of the observed detectors, with DEDs being the most frequent type of detector observed, followed by HBDs and then HWDs.

The S&TC inspectors participating in this Assessment inspected over 2,600 individual wayside detectors on 28 different railroads (approximately 16.6% of all detectors installed), finding approximately 120 detectors with conditions out of compliance with the railroad's standards. The conditions identified included both minor defects and significant safety critical defects, including, for example, loose scanner housings, calibration discrepancies, and inverted transducers (which would tell the system that a train is moving in the opposite direction than it is).

In addition to field identification and evaluation of detector hardware, FRA reviewed issues associated with the use of such detectors, including installation, maintenance, and training processes as well as detector health reporting. FRA found that overall, there appears to be a lack of standardization of installation and maintenance practices among railroads and even within individual railroads, as installation and maintenance practices often varied depending on detector types or who within the railroad organization is responsible for installation and maintenance (e.g., signal employees, mechanical employees).

FRA also found inconsistencies in who performed maintenance and testing of the detectors and the training provided. For example, various groups (mechanical, signal, telecom, and contractors) were found to be responsible for different detector types and most signal apprenticeship classes lacked any formal detector training. FRA observed that as related to wayside detectors, railroads use informal on the job peer-to-peer training.

FRA found that generally railroads closely monitored the performance of the detector network. This includes oversight and monitoring of trending alarms, failed communication issues, and overall detector health. FRA found that all Class I railroads operate a dedicated wayside detector desk,[30] but the responsibilities of personnel staffing that desk and the procedures employed by those personnel vary among railroads. In some cases, employees staffing the wayside detector desks are responsible for monitoring, collecting, and analyzing trending data from those

[30] Some railroads refer their wayside detector desk as the "mechanical desk."

detectors, while others are responsible for taking a more active role in ensuring wayside detector monitoring and health information is shared with operating crews, dispatchers, or others in the railroad organization with a need to know the information. Additionally, some railroads staffed these desks with only one person for the entire railroad for each 12-hour shift, while others had multiple personnel ensuring adequate coverage.

Without an effective detector network monitoring process, detector health status could be unknown. In one example, a railroad had a remote monitoring system for detectors, but that system provided false information on detector health status. In another example, FRA identified several wayside detectors that were out of service for three months or more.

Operating Practices (OP)

FRA's Federal and State OP inspectors conducted two surveys related to railroads' use of wayside detector information. First, FRA conducted a survey of operating employees to determine if railroad personnel are aware of the processes and procedures associated with wayside detector alarms and associated notifications (the "Wayside Detector Survey"). Second, FRA conducted a review of Class I railroads' dispatching center operations (network operations centers) designed to evaluate the processes and procedures used by railroads to report, evaluate, and action wayside detector alarms. FRA found that overall, most operating employees are aware of the relevant processes and procedures for their railroad and that those processes and procedures vary among railroads.

As part of the Wayside Detector Survey, FRA collected 1,086 responses from transportation employees (including locomotive engineers, conductors, and brakemen; trainees for those positions; and managers). The feedback from these railroad employees demonstrates that they were aware of and understand their railroad's rules for responding to wayside detector alerts. The majority of responding transportation employees reported that they strictly follow established protocols, either stopping the train or consulting the necessary resources (e.g., rules books) when they are made aware of a wayside detector alert for equipment in their train. The survey also revealed that individual railroads have their own specific sets of rules and processes applicable to wayside detector alerts. These rules and processes are tailored to each railroad's unique requirements. This Assessment also revealed that railroads typically share limited wayside detector data with other railroads.

Through the review of dispatching center operations (Dispatch Center Wayside Detector Survey), FRA evaluated the processes individual Class I railroads use to address alarms from wayside defect detectors and the railroads' subsequent responses through their dispatching or network operations centers. Through this survey, FRA identified several variations in the processes individual Class I railroads use to address alarms from wayside defect detectors and variations in each railroad's subsequent responses through their dispatching centers. For example, railroads have varied methods of notifying dispatchers of wayside detector alarms. Some railroads have integrated their dispatching system with the wayside detector alarm systems (e.g., dispatchers receive audible or visual notifications of wayside detector alarms on their consoles, or dispatcher consoles effectively "freeze" upon receiving an alarm, requiring the dispatcher to manually acknowledge the alarm to deactivate it and regain access to their

console). Other railroads employ a separate "Wayside Detector Desk" to inform dispatchers of alarms, either verbally or electronically, without impacting their dispatching consoles. Additionally, some dispatcher console screens display the wayside detector locations and some do not. Despite these differences, railroads have specific rules that dispatchers must follow when addressing different types of alarms, including protocols for when a detector does not properly inspect a train.

As noted above, each Class I dispatching center surveyed reported relying on Wayside Detector Desks or Mechanical Desks within the dispatching center to play some role in the wayside detector data analysis and notification process. In some cases, personnel serving at these desks performed data analysis of detector information and played a role in notifying dispatchers and/or operating crews of alarms, or they verified that operating crews and/or dispatchers received the alarms. FRA found that each railroad had developed unique processes and procedures based upon the wayside detector technology involved and required reporting frequency, the interaction between the wayside detector reports and the dispatch system, and the methods used to communicate detector alerts to railroad operating personnel. FRA found that some railroads' processes and procedures are designed to identify and address defects prior to the catastrophic failure of equipment, while other railroads' processes are designed to identify conditions requiring immediate attention.

Notably, neither survey identified any processes or procedures for railroads to share wayside detector defect data or information with each other. This lack of information sharing prevents the identification of trends (e.g., comparing data collected by a series of detectors) as equipment is interchanged from one railroad to another. FRA finds that it is essential for industry to share defect information to ensure that defective equipment is repaired prior to a catastrophic failure.

LEGACY TANK CAR FOCUSED INSPECTION PROGRAM

Background and Scope of Focused Inspection Program

As described above, at Secretary's Buttigieg's direction, FRA conducted a focused review of industry's progress to phase out the use of legacy DOT-111 tank cars in hazardous materials service (particularly flammable liquids service), and instead use DOT-117 cars in such service.[31]

Section 7304 of the FAST Act required DOT to implement a rulemaking that would improve the safe transportation of flammable liquids by rail. In coordination with FRA, PHMSA initiated a series of rulemakings to adopt requirements designed to reduce the consequences and, in some instances, reduce the probability of accidents involving trains transporting large quantities of

[31] A DOT-111 tank car is a general service tank car that has historically been used for the transportation of hazardous materials in the U.S. (including Class 3 hazardous materials). The DOT-117 tank car is a more robust tank car as compared to the DOT-111 and is built with a thicker tank shell, steel jacket, head and thermal protection, and improved top fittings rollover protection.

Class 3 flammable liquids.[32] Among those requirements encapsulated by rulemaking is adoption of the DOT-117 tank car specification and mandated phase out of DOT-111 tank cars in flammable liquids service. Currently, DOT-111 tanks cars in such service must be phased-out by May 1, 2029.

The use of and phaseout of DOT-111 tank cars from flammable liquids service is the sole responsibility of shippers and car owners who own and use these tank cars in that service. FRA focused this assessment on the nine largest tank car owners whose fleet represents almost 85% of the tank cars used in flammable liquids service.

FINDINGS

Among the tank car owners FRA assessed, FRA found that the large tank car fleet owners have taken action to ensure they meet the FAST Act May 2029 deadline. FRA found that some large tank car fleet owners have established retrofitting programs based on regulatory compliance dates, to retrofit, scrap, and retire DOT-111 cars by the deadline and, in some cases, are implementing programs to move DOT-111 cars into services other than the transportation of flammable liquids.

While certain industry participants have taken actions to minimize their use of legacy DOT-111 tank cars in flammable liquids service, economic and practical challenges remain that prevent full-scale, immediate phase out. For example, the cost and limited manufacturing capacity of new DOT-117 cars and corresponding lease rates of DOT-117 cars provides a disincentive for car owners and shippers to phase out the use of DOT-111 cars faster than required, and, in some cases, existing long term lease agreements between car owners and shippers are not subject to revision. FRA notes, however, that the Railway Supply Institute has previously indicated that that it may be technically and operationally feasible to accelerate the May 2029 phase out deadline by one year.

CONCLUSIONS AND NEXT STEPS

The results of this Assessment demonstrate that compliance with regulatory requirements along routes over which large volumes of hazardous materials is transported is generally consistent with what FRA finds during routine inspections. This Assessment did, however, point to areas where improvements are needed in railroads' practices, processes, and procedures related to the use of wayside detector technology to ensure effective use of that technology. For example, the inconsistencies identified in railroads' processes and procedures for handling wayside detector data and alerts would benefit from the development of shared best practices related to the inspection and maintenance policies and procedures related to wayside detectors. Similarly, the current lack of detector data information sharing among railroads is preventing individual

[32] Prior to enactment of the FAST Act, in coordination with FRA, PHMSA issued 79 FR 45016 (Aug. 1, 2014) (Notice of Proposed Rulemaking), 80 FR 26644 (May 8, 2015) (Final Rule), and 80 FR 71952 (Nov. 18, 2015) (Response to Appeals). To carry-out the revised, later phase out date of May 1, 2029 required by the FAST Act, PHMSA issued 81 FR 53935 (Aug. 15, 2016) (Final Rule).

railroads from identifying trends in equipment condition as equipment is interchanged between railroads. This lack of information sharing may lead to defective equipment continuing in transportation until catastrophic failure. Additionally, this Assessment highlighted the need for railroads to ensure sufficient resources and infrastructure are in place to effectively process and communicate detector data and alerts to all those involved in the movement of trains (including operating employees as well as dispatch center employees).

This Assessment confirms many of the concerns FRA has previously expressed related to industry's use of wayside detector technologies.[33] FRA recognizes the value of wayside detections systems if they are appropriately installed, maintained, and used and if appropriately trained resources and data communication infrastructure are in place to effectively manage and respond to the data the systems produce.

FRA will use the results of this Assessment to further inform the ongoing Railroad Safety Advisory Committee (RSAC) task related to wayside detectors (RSAC Task No. 2023-01).[34] The RSAC working group charged with carrying out this task includes representatives from railroads, suppliers, and labor organizations. The working group will consider not only current railroad processes and procedures, but also current industry standards and historical safety data. This ongoing RSAC task is intended to lead to the development of best practices in the use of wayside detectors that may include recommendations to update existing regulations and guidance, and/or develop new regulations and guidance regarding wayside detector equipment and operations. FRA expects the RSAC task to comprehensively address the installation, maintenance, and calibration of wayside detector technologies, the methods and practices to respond to a wayside detector alert or trend data, and the necessary processes and procedures associated with sharing real time alert or trend data across the railroad network. Additionally, PHMSA will use the results of this Assessment to further inform the ongoing rulemaking efforts to implement regulatory requirements and operational controls on a larger set of newly designated High Hazard Trains. This rulemaking effort is currently under development in RIN 2137-AF65 titled Enhancing Safety for High-Hazard Trains.

[33] *See e.g.*, Safety Advisory 2023–01 (and the Supplement to this Safety Advisory), available online in FRA's eLibrary at https://railroads.dot.gov/elibrary-search.
[34] https://rsac.fra.dot.gov/tasks.

APPENDIX A

Table 2: Summary of Wayside Detector Types Evaluated as Part of the HHFT Route Assessment

Wayside Detector	Functionality
Acoustic Bearing Detector (ABD)	Detecting the internal defects of wheel bearings long before they fail, using acoustic technology
Automatic Cracked Wheel Detector (ACWD)	Identifying wheel flange cracks and internal defects by submerging the wheel tread through water
Dragging Equipment Detector (DED)	Detecting the components of rolling stock that are loose under moving trains
Hot Bearing Detector (HBD)	Detecting the wheel bearings defects, using an infrared thermal detection system
Hot Wheel Detector (HWD)	Detecting hot wheels due to locked or sticking brake shoes, using an infrared thermal detection system
Truck Bogie Optical Geometry Inspection (TBOGI)	Measuring the performance of car axles and wheel suspension using a laser-based technology combined with a high-speed camera along a tangent section of track
Truck Hunting Detector (THD)	Evaluating truck hunting behavior (measuring hunting index) using strain-gages or laser-based technologies
Truck Performance Detectors (TPD)	Evaluating the suspension performance of trucks along a S curve section of track (strain-gages or laser-based)
Weigh-in-Motion Detector (WIM)	Measuring the overload, side-to-side imbalance, or end-to-end imbalance condition of the cars
Wheel Impact Load Detectors (WILD)	Detecting the wheel defects (e.g., flat, shell, thermal cracks) by analyzing the wheel impact loads
Wheel Profile Measurement Systems (WPMS)	Measuring wheel profile defects (e.g., flange height and thickness, rim thickness), using laser and high-speed camera
Wheel Temperature Detector (WTD)	Detecting hot wheels (due to locked or sticking brake shoes) and cold wheels (inoperative brake system), using infrared scanning technology