NATIONAL TRANSPORTATION SAFETY BOARD
Investigative Hearing
Norfolk Southern Railway general merchandise freight train 32N derailment with subsequent hazardous material release and fires, in East Palestine, Ohio, on February 3, 2023

GROUP	B
EXHIBIT	
8	

Agency / Organization

NTSB

Title

System Safety and Human Performance Group Chair's Factual Report

National Transportation Safety Board
Office of Railroad, Pipeline and Hazardous Materials
Washington, DC 20594

RRD23MR005

SYSTEM SAFETY AND HUMAN PERFORMANCE

Group Chair's Factual Report

May 21, 2023

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A. ACCIDENT

Location: East Palestine, Ohio
Date: February 3, 2023
Time: 8:54 p.m.
Train: 32NB101

B. SYSTEM SAFETY AND HUMAN PERFORMANCE GROUP

Group Chair — Dr. Anne Garcia
NTSB
Washington, DC

Group Chair — Dr. Stephen Jenner
NTSB
Washington, DC

C. SUMMARY

On February 3, 2023, about 8:54 pm, local time, eastbound Norfolk Southern Railway, general merchandise freight train 32N, derailed on main track 1 of the NS Fort Wayne Line of the Keystone Division in East Palestine, Ohio. As a result of the derailment, 38 rail cars derailed and a fire ensued which damaged an additional 12 cars. There were no reported fatalities or injuries. A 1-mile evacuation zone surrounding the derailment was implemented by first responders due to the release of hazardous OPERATIONS RRD23MR005 GROUP CHAIR'S FACTUAL REPORT PG 4 of 29 materials. The evacuation affected approximately up to two thousand residents. The weather at the time of the accident was nighttime, 10°F and clear with no precipitation.

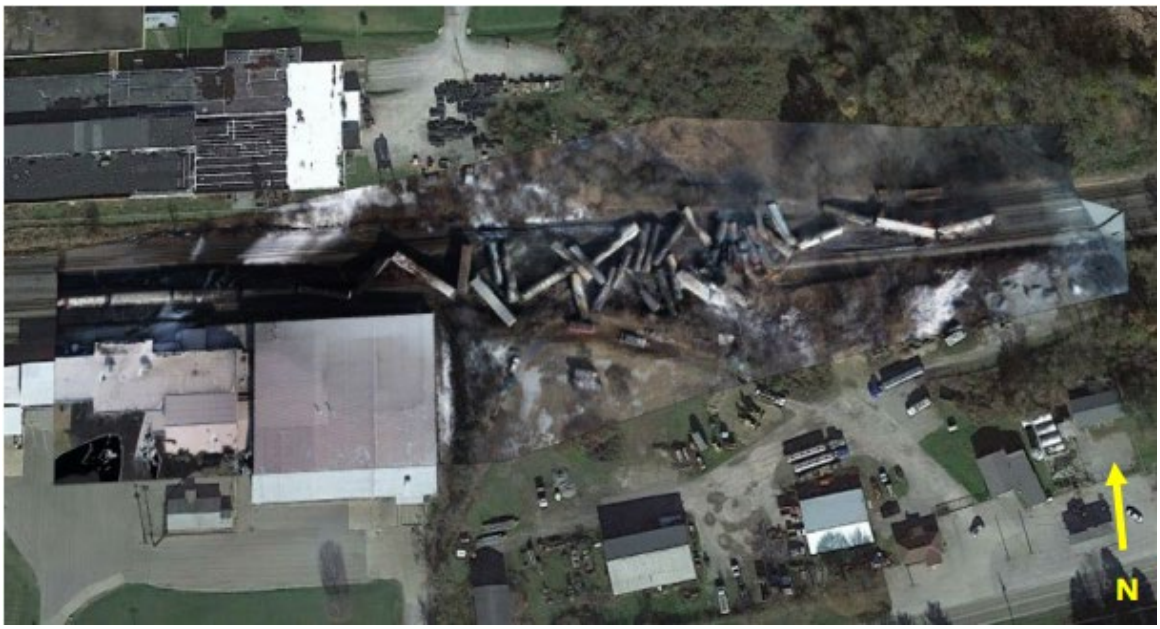

Figure 1: Overhead view of the Norfolk Southern Railway's train derailment with hazardous materials release in E. Palestine, OH. This is a orthomosaic image overlayed atop Google Earth, as developed by NTSB's UAS Aerial Imagery Specialist/RPIC, Eric Gregson and presented in the Unmanned Aircraft System Aerial Imagery Specialist's Field Notes.

D. DETAILS OF THE INVESTIGATION

1.0 INVESTIGATION SYNOPSIS

The derailment of NS train 32N began at rail car GPLX 75465. The System Safety/ Human Performance Factual Report describes the timeline of NS train 32N and the rail car inspection processes related to the Norfolk Southern accident in East Palestine, Ohio on February 3, 2023. This Factual Report provides a summary of key processes and challenges involved with inspecting and responding to potential wheel bearing issues on rail cars, both pre-departure and enroute.

The final train crew of NS train 32N, on February 3, 2023 consisted of an Engineer with about 27 years of experience at NS, a Conductor with less than one year of experience as a Conductor (promoted to Conductor in July, 2022) and a Conductor Trainee with less than six months of experience. The Conductor Trainee stated during his interview that if a conductor has less than 1 year and has a Conductor Trainee, then the trainee is to stay on the train while the senior crew member(s) inspect the train. NS stated, during Technical Review comments, that the Conductor Trainee's statements are not supported by NS policy NS Operations Bulletin OB-4, concerning Conductor Trainees that was in effect on the day of the E. Palestine accident states, "Conductor Trainees, while working on the railroad right of way must remain on the same side of the track and equipment and within 5 car

lengths (250 feet) of their assigned Conductor or other designated crew member with one year of service or more."

Following the E. Palestine train derailment with hazmat release, on February 13, 2023, Norfolk Southern reissued OB-4, adding the highlighted text:

> "Conductor Trainees (CT), while working on the railroad right of way must remain on the same side of the track and equipment and within 5 car lengths (250 feet) of their assigned Conductor or other designated crew member with one year of service or more (unless allowed to train with a Conductor with less than one year's experience following the local supervisor's consultation with the Division Training Coordinator).
>
> EXCEPTION: When riding equipment, conductor trainees are permitted to be positioned on the opposite side of a railcar or locomotive on the same end as the Conductor or other designated crew member."

2.0 ACCIDENT TIMELINE AND SYSTEM SAFETY

This Timeline of rail car GPLX 75465 on NS train 32N was developed from information included in the train crew interviews, the Operations Factual Report, the Mechanical Factual Report, and the RE Specialists Report. Prior to rail car GPLX 75465 being added to the consist of Norfolk Southern train 32N, it was on Union Pacific train MHOAS 29, which originated in Houston, TX and traveled to Gateway Yard, IL. There, the rail car was interchanged to Alton Southern Railway and moved from Gateway Yard, IL to TRRA Yard in Madison, IL before being received by Norfolk Southern.

2.1 Timeline of NS rail car GPLX 75465 on NS train 32N

February 1, 2023

Madison, IL, TRRA Yard
8:30 p.m.

- Class 1 air brake test (232.205) certified completed by TRRA
- Train crew (Engineer and Conductor) on duty
- TRRA employees completed a 232.205 Class 1 air brake test
- Train crew conducted pre-departure/mechanical inspection of Train 32N

10:14 p.m.

- Train 32N departed TRRA Yard
- 3 locomotives on the headend
- Total: 163 rail cars (127 loaded, 36 empty)
- Weight: 16,889 tons
- Length: 10,713 feet
- Rail car GPLX 75465 was at line 26 in consist

February 2, 2023

Decatur, IL, NS Yard
6:10 a.m.

- Train 32N arrived Decatur, IL NS Yard
- Removed from train: 55 cars
- Added to train: 40 cars which were previously inspected. Also, a Class 1 airbrake test and a pre-departure mechanical test were performed at Decatur NS yard
- Total 150 rail cars
- The third locomotive at head end was moved to the middle of the train, making it a Distributed Power unit

1:10 p.m.

- New train crew (Engineer and Conductor) on duty

4:15 p.m.

- Train 32N departed Decatur, IL NS Yard
  2 locomotives remain on the headend
  The Distributed Power Unit was at line 112
- Weight:17,977 tons
- Length: 9,309 feet
- When interviewed, Engineer expressed concern with weight placement: 32% of weight on headend, 20% of weight in the middle, 40% of weight on the rearend.

Bement, IL (nearby)
About 6:17 p.m.

- Train stops due to Engineer noting the air pressure started to drop
- Dispatcher notified and mechanical personnel replaced the EOT.

Williamsport, IN
10:48 p.m.

- Train induced emergency brake application
- Broken knuckle at line 93 (car GPLX 75465 was 68 cars away).
- Mechanical personnel replaced the knuckle
- New train crew (relief crew of Engineer and Conductor) on duty (the Decatur crew was limited due to hours of service requirements)

February 3, 2023

Peru, IN
6:15 a.m.

- Train 32N arrived NS Peru, IN yard

6:30 a.m.
- New train crew (Engineer and Conductor) on duty

8:09 a.m.
- Train 32N departed Peru, IN
- No change to the train consist

Toledo, OH, NS Yard
1:00 p.m.
- Train 32N arrived Toledo, OH NS yard

1:15 p.m.
- New train crew (Engineer, Conductor and Conductor Trainee) on duty.
- Conductor has less than one year of experience.
- Engineer "walked through the lead locomotive consist to check everything"
- Engineer performed a train check with the DP, using full-service application

2:15 p.m.
- Train 32N departed Toledo, OH NS Yard
- No change to the train's consist

Cleveland (outside of it)
5:29 p.m. (approximately)
- Engineer stops train 32N and performs additional train check with the DP using a full-service application
- Train 32N departs

Alliance, OH (nearby)
Time unknown
- Train 32N starts catching up to another train, 10Q. Engineer operates in and out of auto mode with Trip Optimizer, due to hilly terrain.

Sebring, OH
7:47 p.m.
- Train 32N entered Sebring hot box detector/dragging equipment detector at MP PC 79.8
- Bearing recorded at 38 degrees above ambient temperature

Salem, OH
8:13 p.m.

- Train 32N entered Salem hot box detector/dragging equipment detector at MP PC 69.01
- Bearing recorded at 103 degrees above ambient temperature
- No defects reported to train crew
- The hot box detector sent an alert to the NS ATC desk, of rail car GPLX 75465's L1 axle having a "K" value of 5.8 and a bearing temperature of 103 degrees above ambient temperature.

East Palestine, OH

8:46:44 p.m.

- Train 32N rail car with burning bearing (GPLX 754654, 101st axle) passed a house with a ring doorbell.

8:52:48 p.m.

- Train 32N's lead locomotive passed over the East Palestine hot box detector/dragging equipment detector at MP PC 49.81
- Bearing recorded at 253 degrees above ambient temperature
- Train speed was 43 mph (maximum authorized speed was 50 mph)
- MP 49.2, train struck the crossing at North Pleasant Drive and cars derailed and began piling up

8:53 p.m.

- Radio transmission audible alert from East Palestine hot box detector/ dragging equipment detector to train 32N crew of critical alarm was broadcast three times to train crew, "Critical alarm, critical alarm, critical alarm. Norfolk Southern milepost 49.8, track 1 hotbox axle 101 south rail"
- MP 49.5 the derailment started, when the journal came off and hit the ground
- MP PC 49.2, cars derailed and began piling up near crossing at North Pleasant Drive
- Engineer put train into dynamic braking to stop the train.

8:53:45 p.m.

- Conductor turns light on

8:54:25 p.m.

- Locomotive's emergency indication red interior light comes on.
- Conductor Trainee transmits, "Emergency, emergency, emergency" at MP PC 48.63
- Train induced emergency braking is initiated independently near MP PC 49.5

8:55:01

- Train 32N came to rest at MP PC 48.41
- (Locomotive traveled 1,368 feet before stopping) Check w RE Factual

8:56 p.m.

- NS Cleveland East Dispatcher radio transmission to train 32N, asks if the crew was having an issue.
- Train 32N crew responds they have a critical alarm and are in emergency
- Cleveland East dispatcher contacts the crew of train 547, approaching on other track, notifies them that, "32N eastbound next to you on 1 track head end at 48.4 is in emergency, come down restricted, slow it down as quick as you can."
- The 547 train crew confirms Cleveland East dispatcher's instructions.

9:11 p.m.

- Engineer of 32N radios NS Road Foreman's Desk, provides consist and discusses the method of train handling that occurred just prior to and during the derailment. NS Road Foreman's Desk advises Train 32N they were contacted by the Wayside Desk and were told the police reported a derailment.

- Conductor exits locomotive cab and walks toward the derailment to check on the train. Conductor Trainee does not exit locomotive cab, as Conductor has less than one year of experience, as he stated during his interview, "I wasn't able to walk out with him because of your experience

9:17 p.m.

– (NS moved this down to 9:27 p.m.
- Radio transmission; Conductor Trainee advises Conductor of smoke back there, and to cut away from the train
- Conductor responds that he observes fire and heads back to the lead locomotive

9:19 p.m.

- Train 32N radios the Cleveland East dispatcher, requesting to cut the locomotive away from their train.
- Dispatcher approves movement.
- Engineer works with Cleveland East Dispatcher and Conductor to cut the locomotives away from train 32N, as they have hazmat in the rail cars and a fire had started.

9:27 p.m.

- Train 32N radios to Cleveland East dispatcher, they cut away light power and moved about 300 feet East of their train.
- Radio transmission from train 547 to Cleveland East Dispatcher; 32N has derailed onto their track (Main 2) and is on fire.
- Conductor reported reading the hazmat book and discovered they should be one mile away, so they moved further, to one mile.

- Dispatcher contacts ATC desk operator, advises that train 32N had received a critical alarm, and had derailed.

-ATC desk analyst searched for alerts pertaining to train 32N. He found one alert from the Salem HBD (103 degree axle temperature of railcar GPLX 075465 L1 axle. Did not receive any information, alerts or alarms from the East Palestine hot box detector regarding train 32N, even though that HBD had alerted the 32N train crew of a critical bearing alarm. This was because the train had not cleared the detector due to the derailment.

- When interviewed, the ATC analyst was asked if he would have taken any action if he had seen the alert from the Salem hot box detector. He stated according to SOP's he would have just monitored it for future alerts from other HBD's.

9:30 p.m.

- Cleveland East dispatcher instructs train 547 to tie down their train and to tie down the rear of train 32N.

2.2 Post-derailment inspection of NS train 32N's cars:

Post-derailment inspection was conducted, as stated in the Mechanical Factual Report:

Car GPLX 75465

- Damage description provided in the Mechanical Group's Factual Report

Cars 1-22

- Did not derail
- 6 of the 22 cars had FRA defects, not contributory to the accident

Cars 23 – 60

-Derailed

Cars 61 – 72

Did not derail but were damaged

Cars 73-149

- Did not derail
- Were moved to Canton Yard
- 20 of the 77 cars had FRA defects, not contributory to the accident

The FRA list of defects included low couplers, brake pipe leaking on one car, cross key retainer missing, brakes shoes missing, cut level bent)

- Car 113 had one major defect; the cross-key retainer was missing

Lead locomotive and DPU

- Were inspected with no critical defects found.

3.0 RAIL CAR INSPECTION PROCESSES

3.1 Federal Regulations for Rail Car Inspections

Prior to a train's departure, an air brake test and a pre-departure inspection must be performed. This section describes the pre-departure inspection, which is performed by either a Qualified Mechanical Inspector (Carman), per Title 49, Code of Federal Regulations (CFR) Part 215, or a train crew, per Part 215 Appendix D[1].

Title 49, Code of Federal Regulations (CFR) Part 215

If a Carman is not available to perform rail car inspections, Part 215.13(C) allows the railroad to have the train crew perform a shorter mechanical pre-departure inspection under Part 215-Appendix D. The pre-departure inspection of freight car components is provided in Part 215.101 – 215.129 and consists of the following elements:

Suspension System 215.103 – 215.119
§ 215.103 Defective wheel.
§ 215.105 Defective axle.
§ 215.107 Defective plain bearing box: General
§215.109 Defective plain bearing box: Journal lubrication system.
§215.111 Defective plain bearing.
§215.113 Defective plain bearing wedge.
§215.115 Defective roller bearing.
§215.117 Defective roller bearing adapter.
§ 215.119 Defective freight car truck.

Car Bodies 215.121
§ 215.121 Defective car body.

Draft System 215.123 – 215.129
§ 215.123 Defective couplers.
§ 215.125 Defective uncoupling device.
§ 215.127 Defective draft arrangement.
§ 215.129 Defective cushioning device.

Subpart C Restricted Equipment 215.201 – 215.203
§ 215.201 Scope
§ 215.203 Restricted cars.

Subpart D Stenciling 215.301 – 215.305
§ 215.301General.
§ 215.303 Stenciling of restricted cars.

[1] The Operations Group Factual Report provides additional information on required air brake testing.

§ 215.305Stenciling of maintenance-of-way equipment.

Appendix D to Part 215, Pre-departure Inspection Procedure

Appendix D to Part 215 addresses the inspection of freight cars when a person, designated as a car inspector under Part 215.11, is not on duty. In this case, freight cars need to be inspected for imminently hazardous conditions that may cause an accident while the rail car is enroute to its destination. The person designated by the railroad to perform these pre-departure inspections must demonstrate their knowledge and ability to the railroad, to inspect rail freight cars for compliance and must be able to make determinations needed to remove defective cars for repair as required by Part 215.9

These hazardous conditions are considered to be discoverable by a train crew member while they perform their customary inspection and are listed here:

1. Car body:
    (a) Leaning or listing to side.
    (b) Sagging downward.
    (c) Positioned improperly on truck.
    (d) Object dragging below.
    (e) Object extending from side.
    (f) Door insecurely attached.
    (g) Broken or missing safety appliance.
    (h) Lading leaking from a placarded hazardous material car.
2. Insecure coupling.
3. Overheated wheel or journal.
4. Broken or extensively cracked wheel.
5. Brake that fails to release.
6. Any other apparent safety hazard likely to cause an accident or casualty before the train arrives at its destination.

3.2 Pre-Departure Inspections

Carmen duties

According to the CFR Part 215.13, at each location where a freight rail car is placed in a train, the freight car shall be inspected before the train departs. The inspection can be made before or after the car is placed into a train.

A freight carman's primary duty is to ensure the safe operation of railcars per federal regulations and industry standards. There are at least 90 points of inspection in a railcar. The carman must thoroughly inspect, maintain and repair rail car parts, such as gaskets, air hoses, load restraining equipment and tie-down devices. Their duties usually entail inspecting vehicles for any damage, fixing or replacing components, attaching different parts. They may need to replace ladders, steps and hand holds on rail cars to prevent injury to employees.

Car inspectors also conduct visual inspections for leaky bearings or damaged components. If they see grease around the bearing seals, they'll get their gauge and slightly pry it to see if it's loose. A loose bearing seal could allow water and foreign particles into the bearing while allowing lubricants to escape. The bearing could eventually fail and result in the car and train derailing.

During an interview with the NTSB, officials from the Transportation Communications Union (TCU) indicated that it takes about three years to become a journeyman carman.

Time provided to inspect a train car

During their interview with the NTSB, the TCU discussed the reduction in the amount of time carmen have available to inspect cars. They stated that about 20 years ago carmen were provided sufficient time (several minutes) to inspect cars. Years later (and before new train scheduling strategies were implemented in Norfolk Southern and some other Class 1 railroads) that time was reduced, on average, to 3:00 - 3:45 minutes per car. TCU told the NTSB that that amount of time was sufficient to conduct a car inspection (and perhaps less time is required if the inspector were moving quickly). TCU indicated that in the last few years (following the implementation of new train scheduling strategies), Norfolk Southern reduced the average amount of time for car inspections to about one minute per car, which TCU believed was not enough time to conduct a thorough car inspection. Norfolk Southern told the NTSB that they do not have a policy limiting time for car inspections. Norfolk Southern's CEO told the NTSB, "I expect our folks to take the time to safely and thoroughly inspect our cars." Vice President of Safety and Environmental for Norfolk Southern also told the NTSB, with respect to inspections, that, "the expectation is that you [inspect the car] safely."

The NTSB noted factors that could increase the required amount of time to conduct a car inspection, including the type of railcar (for instance, box cars have less ground clearance than some other railcars, making it more difficult to inspect components beneath the train), poor lighting, adverse weather conditions, and the need to create a bad order tag for a defective car.[2]

The TCU also discussed a local Norfolk Southern senior general foreman threatening discipline if inspectors at their facility if they did not decrease their current inspection times. The foreman told carmen and other employees that his bosses were instructing him to do this.

Availability of facilities and carmen to perform inspections

During an interview with the NTSB, a BLET official noted that, based on his understanding, locomotives went from a required inspection of 92-days to 6- months.

[2] A bad order tag or note is applied to a defective piece of equipment. Generally, equipment tagged as bad order must not be used until repaired, inspected, and approved for use.

Federal regulations detail the requirements for inspections.[3] The BLET official stated, "A lot of latitude was given to the railroads so they could cut costs." He also stated that NS combined territories to make large inspection / car department inspection territories, while some yards closed. He further indicated that under federal regulations, if there is no yard and no mechanical personnel, a train does not need to be inspected at that facility. The train would travel to the next mechanized point to where a car would have to be inspected. Norfolk Southern told the NTSB that they conduct inspections with duly certified inspectors, crewmen, conductors, engineers, and other personnel, consistent with FRA regulations.

The TCU also noted that at Norfolk Southern there has been a reduction in the number of carmen, and that there are facilities (such as a train yard) on the railroad system where carmen had been stationed to inspect cars, but according to the TCU those facilities have been shut down. Norfolk Southern has reopened hump yards in the last year.[4] Consequently, according to the TCU, trains may travel longer distances without the rail cars being inspected as often as previous performed.

The TCU further noted that there are locations on the railroad system where conductors - who do not have the training or experience of carmen - are tasked with performing car inspections when cars have been added to a train, a task previously performed by carmen. Carmen and conductors interviewed by the NTSB all stated that the conductors do not have the training, experience, or equipment to conduct a comprehensive car inspection, as outlined in 49 CFR Part 215.13. They are not tasked with performing the same type of detailed mechanical inspection as carmen. Rather, they conduct visual inspections that largely focus on the train's coupling, wheels, brakes, and pistons, as outlined in 49 CFR Part 215 Appendix D.

4.0 RAIL CAR ENROUTE INSPECTIONS

4.1 NS ATC Analyst Desk

ATC duties

Norfolk Southern described ATC analysts as being responsible for assisting a team of 24/7 Operations Center (OC) resources to provide accurate real time troubleshooting, tickets and artifacts, coordination and escalation of any Positive Train Control (PTC), Energy Management, Communications and Signals (C&S) and Wayside Detection related incidents to determine root cause and safely mitigate and minimize train delays. Their principal duties include reviewing and addressing triggers and escalations of system or component issues that cause train delays or result in reportable incidents.

[3] See, e.g., 49 C.F.R. §§ 229.23(a)-(b)(1).

[4] https://www.trains.com/trn/news-reviews/news-wire/norfolk-southern-resumes-hump-operations-at-two-yards-under-new-operating-plan/.

Hot Box Detector (HBD) data for each train is transmitted to ATC analysts at the NS Wayside Help Desk in Atlanta for analysis, and the formulas underlying the system generate alerts when certain conditions are met. The ATC analyst will contact a train crew when action is required, e.g., to stop and inspect their train. They also communicate with dispatchers for emerging safety issues who, in turn, may also communicate directly with the train crew. No data (including alerts or critical alarms) are sent to the ATC analyst until the entire train passes the HBD. Because the entire train 32N did not clear the HBD at East Palestine, the ATC analyst did not receive any alerts or data from the HBD at that location until several hours after the derailment.

Advanced Train Control analyst's background

The Advanced Train Control (ATC) analyst who was on duty the night of the East Palestine accident received his degree in electrical engineering and was hired by Norfolk Southern as a manager trainee in 2003. He then worked various positions including general foreman on the mechanical side. After several years, he moved to the Wayside Help Desk operations in 2017 and started working as an ATC analyst. On February 3, 2023, his 12-hour shift began at 6:30 p.m.

ATC actions on the day of the accident

On the night of the accident, the ATC analyst received a radio call just before 9:00 p.m. from the crew of train 32N. The crew told him they had had an emergency brake application and had received an audible radio message about a critical alarm pertaining to the 101st axle broadcast in the cab of the locomotive. The crew had received the alarm immediately after the car with the axle defect passed the HBD. The notification stated, "critical alarm, critical alarm, critical alarm Norfolk Southern MP 49.8, track 1 hot box axle 101 south rail." This alarm required the train crew to stop and inspect the train. However, the train derailed shortly after the notification, and before it came to a full stop.

After receiving the call, the analyst looked at his system dashboard to check if the detector data from East Palestine was available. Because the train did not fully clear the detector, the East Palestine data was not available. He accessed available data to assess what may have happened at East Palestine, including defect detector data from the HBDs the train had most recently passed (i.e., Sebring, Salem, and East Palestine). Using the data from the Salem detector, the analyst informed the train crew to check the bearing on axle 101 of Car 23. After this call, the analyst did not hear back from the train crew the rest of the night. The analyst was later informed by a dispatcher that a derailment had occurred. Table 1 contains data from the prior HBD locations.

Table 1: HBD Data for NS Train 32N

Location of HBD	Milepost	Time passed HBD	L1 Axle Bearing Above Ambient Temperature (degrees F)	R1 Axle Bearing Above Ambient Temperature (degrees F)
Sebring	79.8	(TBD)	38	20
Salem	69.01	8:13 p.m.	103	20
East Palestine	49.81	8:52 p.m.	253	20

HBD alerts for train 32N

No alert was triggered at Sebring because the temperature was 38-degrees above ambient, which does not trigger any bearing-related alerts. The only alert that was sent to the ATC analyst was from the Salem detector. At Salem, the alert (code 953 - Bearing temperature spike) did not reach the threshold of an on-train alarm. (A 953 alert is triggered when a bearing has a Kt value greater than 4, and the temperature of the bearing is greater than 90 degrees F above ambient temperature).[5] The ATC analyst, who was evaluating three other alerts from trains on the Norfolk Southern system, did not immediately evaluate that alert. (Prioritizing three alerts to determine which ones are most important can take a few minutes). Had he analyzed the alert, he would have, per procedure, moved the alert to a watch window portion of this computer screen to monitor and evaluate any additional alerts related to that train. Per NS SOPs, he would not have taken any immediate action pending more information from subsequent detectors.

At East Palestine, had train 32N completely passed the HBD and information sent to the ATC analyst, he would have called the train crew to stop and inspect the subject bearing per NS protocol. Had the train completely passed the HBD in East Palestine, the analyst would have received other alerts, including the 953 and 870 alerts, which would have resulted in the ATC analyst instructing the crew to stop and inspect the train.

Alert Details

Norfolk Southern data indicates that an ATC analyst receives a total of approximately 200 alerts during a shift. When an alert comes into the Wayside Help Desk, an ATC analyst determines which ones are actionable and which require no immediate or any response. They can retrieve additional data to help make that determination.

Most alerts do not require action by the ATC analyst. NS data shows that the majority of 953 alerts (67%) in 2022 were limited to a single occurrence. Moreover, inspection findings show the majority of 953 alerts (55%) were braking related as opposed to bearing related (5%).

[5] K values: Statistical indicators that define the relative variation of one measurement to the population. In this instance, it is the relative value for each bearing on the train side or equipment. Kt compares the bearings temperature against values on the same side of the train.

ATC analysts look for three instances of K-value for the bearing being greater than four over the course of the train's journey to detect a bearing temperature trend. To identify a trend, analysts can look at data for the specific bearing from previous detectors, regardless of whether the data generated an alert.

There are various types of alerts and associated codes an ATC analyst can receive related to bearings and wheel temperature. The following are examples of bearing alerts:

850 and 851 - Bearing temperature deviation alert
853 - Trending bearing alert
870 and 871 – Differential alerts
953 - Bearing temperature spike

Alarms

- HBD readings that exceed certain absolute bearing temperature "audible alarm" thresholds automatically transmit an audible announcement to the train crew, alerting the crew to the presence of a temperature reading that requires inspection.
- Bearing temperature readings greater than 170 degrees, but below 200 degrees, above ambient temperature trigger a non-critical alarm, which requires the train crew to reduce the speed to 8 to 10 mph until the rear of the train clears the detector – to ensure that the best data possible is available for safety analysis – at which point the train must be stopped for inspection.
    - 8mph is the minimum speed that ensures the data is transmitted from the detector and 10mph is the maximum speed the train should be operating at once the alarm is triggered.[6]
- Bearing temperature readings greater than 200 degrees above ambient temperature trigger a critical alarm, which requires the train crew to stop the train immediately and inspect the equipment that caused the alarm.

Wheels

- A Hot Wheel Detector (HWD) that detects wheel temperatures between 400- and 600-degrees F above ambient temperature requires the train crew to set and release the train brakes.

[6] Exception: The analyst may relieve a crew from inspecting their train for defect alarms when information is available confirming it is safe to proceed. Trains relieved of inspection may proceed, in accordance with existing authority, at a speed not to exceed 30 MPH to the next detector or to the location where the car is to be set out, if applicable.

- A wheel temperature above 600 degrees F above ambient temperature requires the train to stop and inspect the train.

Resources previously available to ATC analysts

The NTSB interviewed an NS ATC helpdesk manager. In addition to overseeing the performance of ATC analysts, the manager is currently tasked with upgrading the program with new functionality, streamlining the process, writing SOPs at the desk, and making the desk more efficient. He is on call if any ATC analyst has issues or needs assistance. He also provides vacation relief for ATC analysts.

The ATC manager told investigators that a few years ago NS had two researchers who worked the day shift that would research various alerts. The manager had considered them as assets for ATC analysts during their shifts, including providing assistance with incoming alerts. For instance, they aided in researching data related to a train that derailed that day. (Researching a derailment is a requirement of an ATC analyst which can take two to three hours to complete a report). However, those two researcher positions no longer exist, so analysts and managers handle many of the tasks previously performed by the researchers during their shifts.

The ATC manager believed that the ATC position has become more demanding through the years, in part due to the addition of new alerts. Adding new detectors and machine vision technology has also increased the number of alerts they receive. He foresees the workload increasing as new technology is introduced to the system. The ATC manager told the NTSB that he has "consistently requested more manpower" who would be handling additional alerts. He further stated, "I do see a point where we'll need two people, not as an extra resource just to cover the desk and alerts."

The CEO of NS told the NTSB that they have hired 1500 employees at NS since he became CEO (which was about one year at the time of his interview with the NTSB). He stated that he asked his team to evaluate if there were enough resources in the ATC operations. The CEO indicated they are planning to add more resources on that desk. On May 30, 2023, Norfolk Southern informed the NTSB of the following: Norfolk Southern hired an additional full-time ATC analyst for the Wayside Help Desk in mid-May 2023, and is also in the process of hiring three additional full-time ATC analysts for the Wayside Help Desk. Beginning in mid-May, 2023, cross-trained employees from other desks have provided additional support to the Wayside Help Desk team. Norfolk Southern has also added more new positions in the Communications and Signals department, and those employees will provide additional support, including research support, to the Wayside Help Desk.

4.2 NS Dispatch Communications

The NS dispatcher provided the following information during their interview.

"32N, as they were going, I heard the detector call, critical alarm. I confirm with the 32N crew that it was them because I couldn't catch enough it. I had a lot of static. I couldn't catch enough of it to find out which rail, which train."

"My assistant chief on the Keystone, John Gray, came running up to me and yelled 32N is on fire. I said wait, what. Apparently, one of the cars had derailed into a building and was on fire. So that's when I found out 32N was derailed and on fire. Conductor for the 32N was walking towards the rear and reported smoke."

When asked if she had any communication with the ATC desk analyst regarding anything going on with NS train 32N, the dispatcher responded, "I did not have any interaction with anybody except the train crews."

The dispatcher does, however, receive emails from the ATC desk. "They will send out an email and they will try to contact the crew and tell them they've got a trending hot. If they're unable to [contact the crew] they call us on the phone."

"So normally, if they've got – if wayside is showing a trending hot, they will contact the crew directly after they send out… an email to everybody. They will also try to contact the crew directly on the radio."

The ATC desk, "will contact the crew ands send out the email and escalate if if they cannot contact the crew."

The interview with the dispatcher also provided the information that the dispatcher does not sit in their chair the entire time, that they use the restroom and go to coffee, et cetera, and that it was "a very fortunate thing that you were there."

Norfolk Southern offered the following explanation during the Technical Review, that "tracks can operate for brief periods without the assigned dispatcher, because of the assistance of dispatch technology Norfolk Southern uses. In addition, two supervisors for the dispatcher responsible for each territory are available to assist with any emergency tones that sound on the dispatcher's territory. Where the dispatcher will be away from their desk for more than a brief period, they are required to get permission from their supervisor under Norfolk Southern policy. The dispatcher's assigned tracks continue to be visible to the supervisors while the dispatcher is on a break."

5.0 NORFOLK SOUTHERN RISK REDUCTION PROGRAM

5.1 FRA Risk Reduction Program Regulation

The FRA issued its final rule, "Risk Reduction Program," 49 CFR Part 271, on February 18, 2020 (effective April 20, 2020) requiring Class I freight railroads, such as Norfolk Southern, to develop and implement a Risk Reduction Program (RRP) for improving operational safety[7]. The RRP uses a safety management systems approach to determine level of risk through the identification and analysis of hazards, and the development of plans for mitigating or eliminating these risks. RRP components include employee involvement, a risk-based hazard management program, safety performance evaluation, safety outreach, a technology implementation plan, RRP employee/contractor training, and an internal assessment.

The railroad is required to develop this written plan, obtain review and approval for it from the FRA, and implement the approved plan. The railroad is further required to conduct annual internal assessments of their RRP. The FRA conducts audits of a railroad's processes and procedures in their RRPs. The purpose of the RRP is to reliably improve the railroad's safety performance.

5.2 NS Risk Reduction/Safety Program prior to Train 32N Derailment

The FRA's RRP regulation 49 CFR 271 required the submission of Class I railroads RRP plans by August 16, 2021. Norfolk Southern submitted their RRP to the FRA by this deadline and received final approval of the plan within a year[8]. The FRA regulation provides three years for the Class I railroads to fully implement their approved RRPs.

Norfolk Southern's original RRP, responsive to 49 CFR 271, dated August 16, 2021, is in the Official Use Only portion of the docket for this investigation, along with their two updated RRPs that were revised February 3, 2022, and March 10, 2022. Norfolk Southern's document, Foundation of Safety, dated December 2021, describes their safety program that was in place prior to the implementation of their FRA approved RRP and is also provided in the Official Use Only portion of the docket.[9]

Submitted by:
Dr. Anne Garcia and Dr. Steve Jenner
System Safety and Human Performance Group Chairs

Reviewed by:
Bob Beaton, Ph.D., CPE
Chief, System Safety Division (RPH-40)

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[7] FRA Federal Register, Risk Reduction 2020.pdf
[8] Letter to NTSB investigators from John B. Graham, System Manager Safety, Norfolk Southern Corporation, dated April 10, 2023.
[9] Norfolk Southern has requested that the letter and documents referenced here receive FOIA confidential treatment and requested that these documents not be added to the public docket.