

National Transportation Safety Board

Office of Railroad, Pipeline and Hazardous Materials

Washington, DC 20594



RRD24FR009

SIGNAL AND TRAIN CONTROL

Group Chair's Factual Report

July 8, 2024

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A. ACCIDENT

Location: Easton, PA
Date: March 2, 2024
Time: 07:11a.m. Local Time

Train 1: NS Train 24XH101 (eastbound intermodal stationary train)
Train 2: NS Train 268H429 (eastbound intermodal striking train)
Train 3: NS Train 19GH501 (westbound mixed freight train)

B. SIGNAL AND TRAIN CONTROL GROUP

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C. SUMMARY

For a summary of the accident, refer to the Accident Summary in the docket for this investigation.

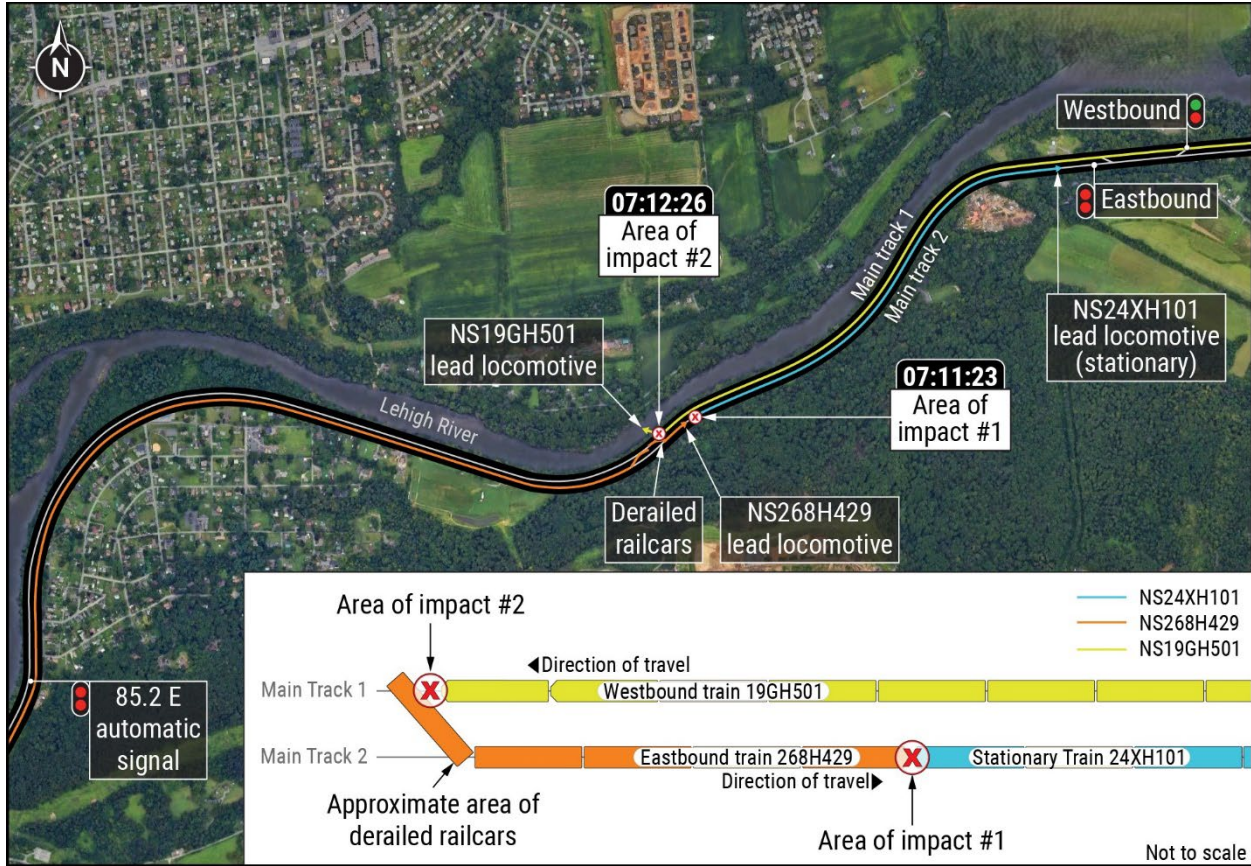


Figure 1 - Diagram showing an aerial view of the accident location supplemented with an accident sketch.

D. DETAILS OF THE INVESTIGATION

1.0 Description of NS Lehigh Line

The Norfolk Southern Railway (NS) Lehigh Line of the Keystone Division extended from milepost (MP) LE 36.0, Control Point (CP) Port Reading Junction in Manville, NJ, to milepost LH 130.60, CP M&H Junction in Weatherly, PA, in a west-east timetable direction. The Lehigh Line consisted of single and double main track territory with passing sidings. Milepost numbering increased in a timetable west direction. Maximum authorized timetable speed on the Lehigh Line was 50 mph. In the vicinity of the derailment, the maximum authorized speed on main tracks 1 and 2 was 40 mph.

In the vicinity of the derailment area, NS authorized train movements with a Traffic Control System (TCS). Train movements were coordinated by a train dispatcher located at the NS Network Operations Center (NOC) in Atlanta, Georgia. Train movements on the Lehigh Line Subdivision were governed by operating rules, special instructions, timetable instructions, and the signal indications of the TCS. The

subdivision was supplemented with an overlaid Positive Train Control (PTC) system, between MP LE 36 and MP LB 88.20.

Wayside defect detectors that included hot bearing defect detectors and dragging equipment detectors were present on the subdivision.

2.0 Description of Signal and Train Control Systems

The signal system used coded track circuits for train occupancy detection. Wayside signals were color light signals with upper and lower signal heads capable of displaying green, yellow, and red aspects for train movement in either direction. The signal heads used 10-volt, incandescent lamps to display signal aspects.

The wayside signal equipment at CP 87 (milepost 87.09) consisted of color light signals, two power-operated switch machines (GRS model 5H), and a Vital Harmon Logic Controller (VHLC) designed to control wayside signals, switches, and track circuits. The track circuits within the CP were direct current (DC) track circuits.

The wayside signal equipment at Automatic Signals MP 85.6 consisted of color light signals and an ElectrologIXS Electro-code 5 system.

The wayside signal equipment at CP Redington (MP 82.7) consisted of color light signals, four power-operated switch machines (GRS model 5H), and an ElectrologIXS VLC designed to control wayside signals, switches, and track circuits. The track circuits within the CP were DC track circuits.

The subdivision was equipped with a PTC system, which consisted of Interoperable Electronic Train Management System (I-ETMS).

3.0 Post Accident Field Examination

The post-accident investigation found all wayside signal equipment and appurtenances at CP 87, automatic signals at MP 85, and CP Redington on main tracks 1 and 2 locked and secured with no indications of tampering or vandalism.

Wayside signals were aligned to their corresponding track and no physical obstructions were noted. Signal lamp voltages for all wayside signals were measured and recorded. Wayside signal aspects and indications were observed and verified for the involved train movements. All associated wayside signal insulated joints and track connections were inspected. Track circuits were verified for all tracks involved in the accident. Ground tests were performed with no exceptions.

Dispatcher Unified Train Control System (UTCS) data logs and video playback displaying train movements and track circuit indications were obtained and reviewed.

Railroad signal maintenance, inspection and test records were obtained for the most recent completed monthly, quarterly, yearly, relay, insulation resistance, and locking test records for wayside signal locations between CP 87 and CP Redington (including all associated switches and automatic signals).

One year of signal malfunction reports for CP 87, automatic signals at MP 85, and CP Redington were obtained and reviewed.

Wayside defect detector data logs that capture the involved train movements prior to the accident were obtained and reviewed.

4.0 Signal System and PTC Data Logs

Following the derailment, Dispatch UTCS, TCS, and PTC wayside data logs for CP 87 - CP Redington were downloaded for the investigation. Data logs from the NS Dispatcher Unified Train Control System (UTCS) were examined to develop a timeline of signal events and summarized in Table 1.

Table 1: Dispatcher UTCS Data Logs

Time ¹	Location	Event
Train #1: NS 24X-01 Eastbound (Stationary train at CP Redington)		
6:16:22	CP 87 MT2	Dispatcher Clears East Home Signal MT2 at CP 87
6:38:16	CP 87 MT2	Track Circuit 1TK Occupied at CP 87
6:38:28	CP 87 MT2	2WAK Track East of CP 87 Occupied
6:39:54	CP 87 MT2	1TK Unoccupied at CP 87
6:40:59	85 Signal - CP Redington	4EAK Circuit East of 85 Signal Occupied
6:43:02	85 - CP Redington	2WAK Circuit Unoccupied - Track Circuit West of 85 Signal
Train #2: NS 268 Eastbound (Striking Train)		
6:57:15	CP 87	Dispatcher Clears East Home Signal MT2 at CP 87
7:00:10	CP 87	Track Circuit 1TK Occupied at CP 87 MT 2
7:00:25	CP 87 - 85 Signal	2WAK Track East of CP 87 Occupied
7:04:29	CP 87	1TK Track Circuit Unoccupied at CP 87 MT2
7:10:01	CP 87 - 85 Signal	2WAK Track Circuit Unoccupied
7:11:00	CP Redington	Time of collision - Both Eastbound Trains were between 85 Signal and CP Redington.

¹ All clock times in this report are Eastern Standard Time (EST). Clock times for the PTC data logs (wayside and onboard locomotive logs) were recorded in Coordinated Universal Time (UTC). The PTC clock times were synchronized with the NS microprocessor times by adjusting the UTC times and subtracting 5-hours to synchronize to local EST time.

Train #3: NS 19G-01 Westbound (Traveling on Main Track 1)		
6:16:01	CP Redington M1	Dispatcher Clears West Home Signal MT1
7:04:22	East of CP Redington MT1	2WAK Track Circuit MT1 Occupied
7:09:39	CP Redington	2TK Track Circuit Occupied
7:10:08	West of CP Redington MT1	2EAK Track Circuit Occupied

The wayside data logs from CP 87, automatic signals MP 85, and CP Redington were examined to develop a timeline of signal events and summarized in Table 2, Table 3, and Table 4.

Table 2: CP 87 Wayside VHLC Data Log

Time	Event
	Train #1: NS 24X-01 (Stationary Train)
06:16:20	2E Home Signal lined - 2EADG = True
06:16:20	2EHGK = True 1LK = True
06:38:14	Track Circuit Occupied - 1TK = True/2EHGK = False
06:38:27	Track Circuit East of CP 87 Occupied - 2WAK=True
	Train #2: NS 268 (Striking Train)
06:57:14	2E Home Signal Approach - 2EHGK = True/1LK True
07:00:09	Track Circuit Occupied - 1TK = True

Table 3: Automatic Signal 85 MT2 Wayside Data Log

Time	Event
06:38:29	Automatic Signal MT2 displaying a Yellow over Red - RUYEL=True
06:40:57	Automatic Signal MT2 displayed a Red over Red - RUYEL=False/RURED=True - Train #2: NS 24X-01 (Striking Train)
07:00:24	Automatic Signal MT2 displayed a Red over Red - RURED=True
07:15:27	Automatic Signal MT2 displayed Red over Red - RURED=True

Table 4: CP Redington Wayside ElectrologIXS VLC Data Log

Time	Event
	Train #2: NS 24X-01 (Striking Train) on Main Track 2
17:34:36	Main Track 2 East Home Signal at Stop and not cleared. Remained at Stop since 5:34:36 p.m., on March 1, 2024
	Train #3: NS 19G Westbound on Main Track 1
06:15:58	2WADG = True 2WARG = False
07:09:39	2W Home Signal Slotted - 2WADG= False 2WARG= True
07:09:39	2TK Track Circuit Occupied - 2TK = True

PTC data logs from CP 87 - CP Redington were examined to develop a timeline of signal events and summarized in Table 5, Table 6, and Table 7.

Table 5: CP 87 PTC, Device State Data Log

Time	Event
19:09:04	Switch normal - Since March 1, 2024
06:16:21	2E Home signal clear March 2, 2024 - For Train #2: NS 24X-01(Striking Train)
06:38:14	2E Home Signal Stop - Train NS 24X-01 Slots Signal
06:57:15	2E Home Signal Approach - Train NS 268
07:00:09	2E Home Signal Stop - Train NS 268 Slots Signal
07:10:52	2E Home Signal Approach

Table 6: Automatic Signal 85 Main Track 2 PTC, Device Status Log

Time	Event
05:46:17	Left Signal M2 Clear
06:00:37	Left Signal M2 Restricting
06:06:25	Left Signal M2 Approach
06:40:57	Left Signal M2 Restricting - Train #2: NS 24X-01(Striking Train) Slots Signal
	Status does not change with Train #2: NS 24X-0, Occupying Track West of CP Redington

Table 7: CP Redington PTC, Device Status Log

Time	Event
	Main Track 2
17:34:36	2E Home Signal MT2 at Stop Since 05:34:36 p.m., on March 1, 2024
	Main Track 1 - March 2, 2024
06:02:59	Number 3 Switch requested Invalid Status
06:03:03	Number 3 Switch Normal
06:15:58	2W Home Signal Clear
07:09:39	2W Home Signal Stop - Train #3: NS 19G Westbound Slots Signal

5.0 NS Signal System Maintenance, Inspection and Test Records

NS signal maintenance, inspection and test records between CP 87 and CP Redington (including all associated switches and automatic signals) were reviewed as part of the accident investigation. NS records indicated the signal system was maintained in accordance with Federal requirements and did not indicate any conditions or problems that could affect the operation of the signal system.

6.0 Signal System Malfunction Reports

One year of signal malfunction reports for CP 87, automatic signals at MP 85, and CP Redington were reviewed as part of the investigation. Table 8 summarizes the relevant signal reports between CP 87 and CP Redington.

Table 8: NS Signal Malfunction Reports

Date	Location	Problem Reported	Resolution Details
7/16/2023	CP REDINGTON	Track Occupied Indication West of CP	Storm/Weather Related Track flooded from heavy rains.
10/23/2023	CP REDINGTON	Lamp Out Indication	Replaced 2W CRG bulb, 9.6 vdc.
12/7/2023	CP REDINGTON	Track Occupied Indication East of CP	Broken rail at milepost LE 79.2, replaced and bonded.
1/19/2024	CP REDINGTON	Power switch failure Switch will not Reverse	Snow and/or ice affects switches. Cleaned out snow and adjustments made on #1 and #3 crossovers.
1/23/2024	CP REDINGTON	Power switch failure Switch will not Reverse	Adjustments made to lock rods and point detector rods on both switch machines.
2/29/2024	CP REDINGTON	Power switch failure Switch will not Reverse	Loose/worn wedges and braces causing issue with 1B switch. Adjustments and repairs made.
6/2/2023	SIGNAL 85	Cell Modem Down	Reset cell modem.
10/6/2023	SIGNAL 85	Cell Modem Down	Reset cell modem.
2/4/2024	SIGNAL 85	Erratic Signal	Back cover of red aspect discovered to somehow work its way open. Ladder guard and locks on signal heads all in place and secured.

7.0 Wayside Defect Detectors

Data downloads from the two previous wayside defect detectors traversed by both NS Train 24XH101 and NS Train 268H429 were obtained and examined. The defect detectors (which consisted of hot wheel bearing and dragging equipment detectors) were located at milepost 31.90 and milepost 68.80. The logs showed no recorded defects or alarms for both eastbound trains.

8.0 NS Locomotives Positive Train Control Equipment

The positive train control equipment from NS Train 24XH101, lead locomotive NS 4713, NS Train 268H429, lead locomotive NS 9906, and NS Train 19GH501, lead locomotive NS 8157, were examined as part of the investigation. The examination

included checking seals, fasteners, wiring, operation lights, locomotive mounted antennas, and PTC display with no exceptions noted.

A review of the PTC wayside data logs, the PTC back-office data logs, and the onboard PTC data logs from the three NS trains involved in the accident, indicated that they were aligned with one another. Additionally, the PTC logs indicated that they were consistent with the traffic control system data logs.

9.0 Damage Estimates

There were no damages to the wayside signals or associated equipment as a result of the accident.

Submitted by:

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