

# National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



RRD23FR013

## **LOCOMOTIVE EVENT RECORDER**

Specialist's Factual Report

November 9, 2023

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## **A. ACCIDENT**

Location: Elliston, Virginia  
Date: July 6, 2023  
Time: 7:42 p.m. eastern daylight time (EDT)  
Locomotive: Norfolk Southern 1019

## **B. LOCOMOTIVE EVENT RECORDER SPECIALIST**

Specialist                      Cassandra Johnson  
   Mechanical Engineer  
   National Transportation Safety Board (NTSB)

## **C. DETAILS OF THE INVESTIGATION**

A locomotive event recorder group was not convened. The NTSB Vehicle Recorder Division received electronically an event recorder file from the lead locomotive 1019 of the train 814V04.<sup>1</sup>

### **1.1 Recording Description**

The locomotive event recorder data were extracted using the Central Railway Data Playback 2020 (referred to as CDP 2020). The data file included the wheel size of 41.6 inches for NS 1019. The software outputted the locomotive event recorder parameters including distance and speed. The exported data have a sampling rate of one hertz (one data sample per second); therefore, the data have a precision of 1 second. Only data relevant to this event are provided in this report.

### **1.2 Parameters**

Table 1 lists the parameters verified and provided in this report for NS 1019. Additionally, table 2 contains the unit and discrete state abbreviations for the parameters.

#### **1.2.1 Distance Traveled**

The output for the distance traveled is the distance decreasing in time.

#### **1.2.2 Speed**

The resolution of speed is 1 mile per hour (mph). Thus, any movement less than 1 mph will not be shown.

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<sup>1</sup> In this report, Norfolk Southern lead locomotive 1019 is referenced as NS 1019.

### **1.2.3 EIE (Tenth Sec), Horn (Tenth Sec), and PCS (Tenth Sec)**

As stated in section 1.1, the event recorder data were exported with a sampling rate of one sample per second. However, the engineer initiated emergency tenth second (EIE (Tenth Sec)), horn tenth sec (Horn (Tenth Sec)), and pneumatic control switch tenth second (PCS (Tenth Sec)) parameters were exported in text to indicate tenths of a second by using a combination of dashes and ones. For example, the data -1--1111-- indicates the parameter was active in the following tenths of a second: 0.1, 0.4, 0.5, 0.6, and 0.7. Additionally, data recorded as 1111111111 indicates the parameter is active for the entire second.

### **1.3 Recorded Timing**

The data was recorded in coordinated universal time (UTC). Within the CDP 2020 program, the timing was adjusted to local time, EDT, by subtracting 4 hours. Therefore, the times used in this report are expressed as EDT.

## **D. FIGURES AND TABULAR DATA**

Figures 1 and 2 contain locomotive event recorder data from NS 1019 recorded during the event on July 7, 2023. All the parameters listed in table 1 are plotted except feet traveled, EIE (Tenth Sec), Horn (Tenth Sec), and PCS (Tenth Sec). Figure 1 covers the data from 14:20:00 EDT to 20:20:00 EDT and figure 2 focuses on the final movement from 19:10:00 EDT to 19:50:00 EDT.

The event recorder data from NS 1019 indicated between 14:28:08 EDT to 17:32:37 EDT, NS 1019 traveled about 71.8 miles. At 14:28:08 EDT, the positive train control lead milepost (PTC Lead MP) with its designated letter (PTC Lead MP Letter) was N362.8687, and at 17:32:36 EDT it was V274.3164.<sup>2</sup>

At 19:16:39 EDT, based on feet traveled, NS 1019 started moving. At this time, the throttle was set at dynamic brake (DB), and the PTC Lead MP and its associated letter was V274.3156.

By 19:44:12 EDT, NS 1019 traveled about 12.1 miles when the brake pipe pressure (Brake Pipe PR) decreased from 88 pounds per square inch (psi) to 25 psi. At this time, the speed was 14 mph and the PTC Lead MP and its associated letter was V262.1027.

At 19:44:13 EDT, the head of train emergency status (HOT Emerg) changed from off to emergency (Emerg), the electronic air brake emergency status (EAB Emerg) changed from no to emergency, and the brake pipe pressure decreased to 0

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<sup>2</sup> At 17:32:37 EDT, there was not a recorded PTC Lead MP value.

psi. At this time, NS 1019 had traveled 21 ft, the speed increased slightly to 15 mph, and the PTC Lead MP and its associated letter was V262.0986.

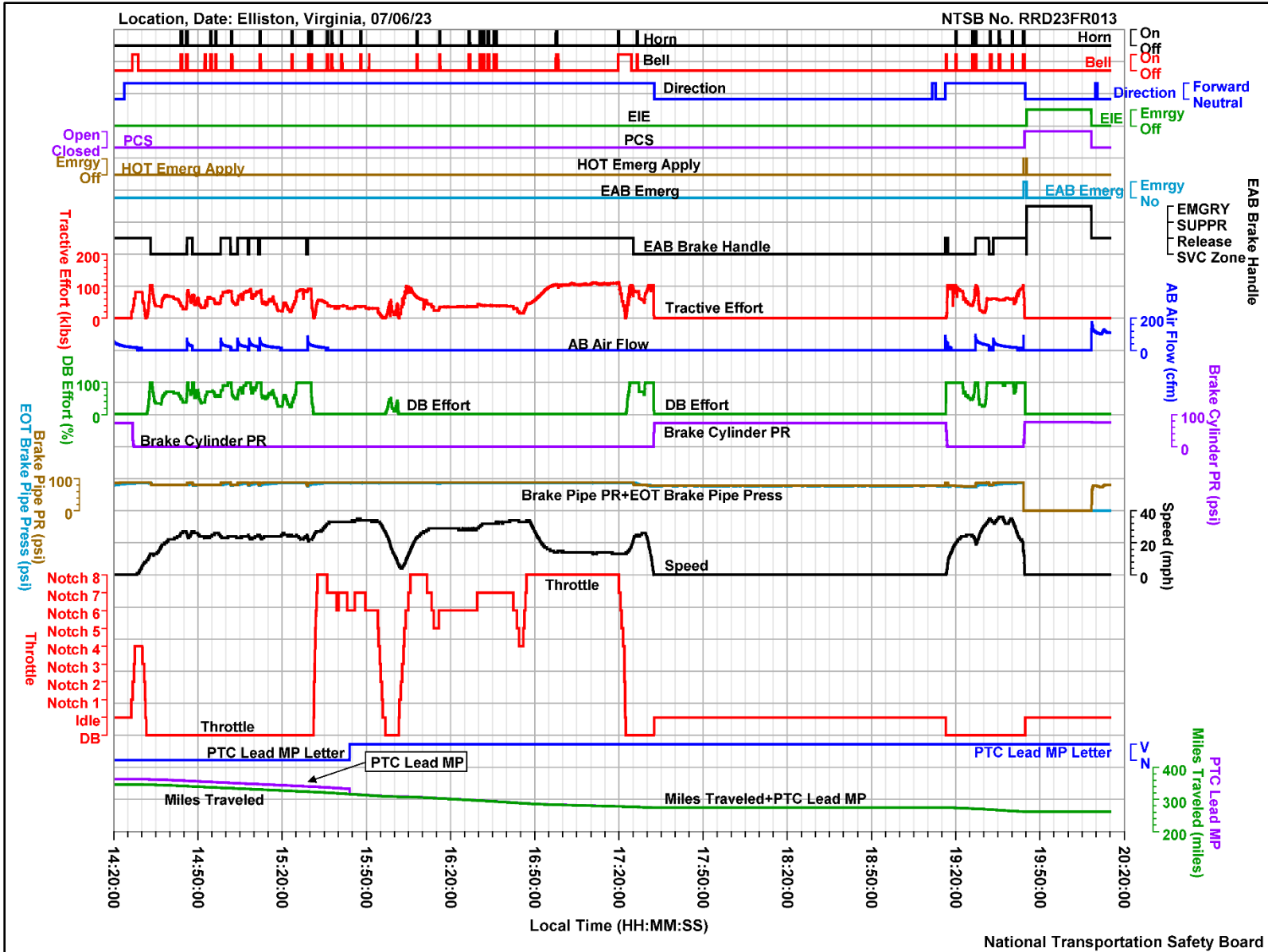
At 19:44:34 EDT, the speed reduced to 1 mph, and the pneumatic control switch (PCS) changed from closed to open. At this time, NS 1019 had traveled 318 ft and the PTC Lead MP and its associated letter was V262.0386.

At 19:44:35, NS 1019 came to a complete stop. At this time, there was not a recorded value for the PTC Lead MP.

The corresponding tabular data used to create figures 1 and 2, including feet traveled, EIE (Tenth Sec), Horn (Tenth Sec), and PCS (Tenth Sec), are provided in electronic comma-separated value (CSV) format as attachment 1 to this report.

Submitted by:

Cassandra Johnson  
Sr. Mechanical Engineer



**Figure 1.** NS 1019's locomotive event recorder parameters showing movement from 14:20:00 EDT to 20:20:00 EDT.

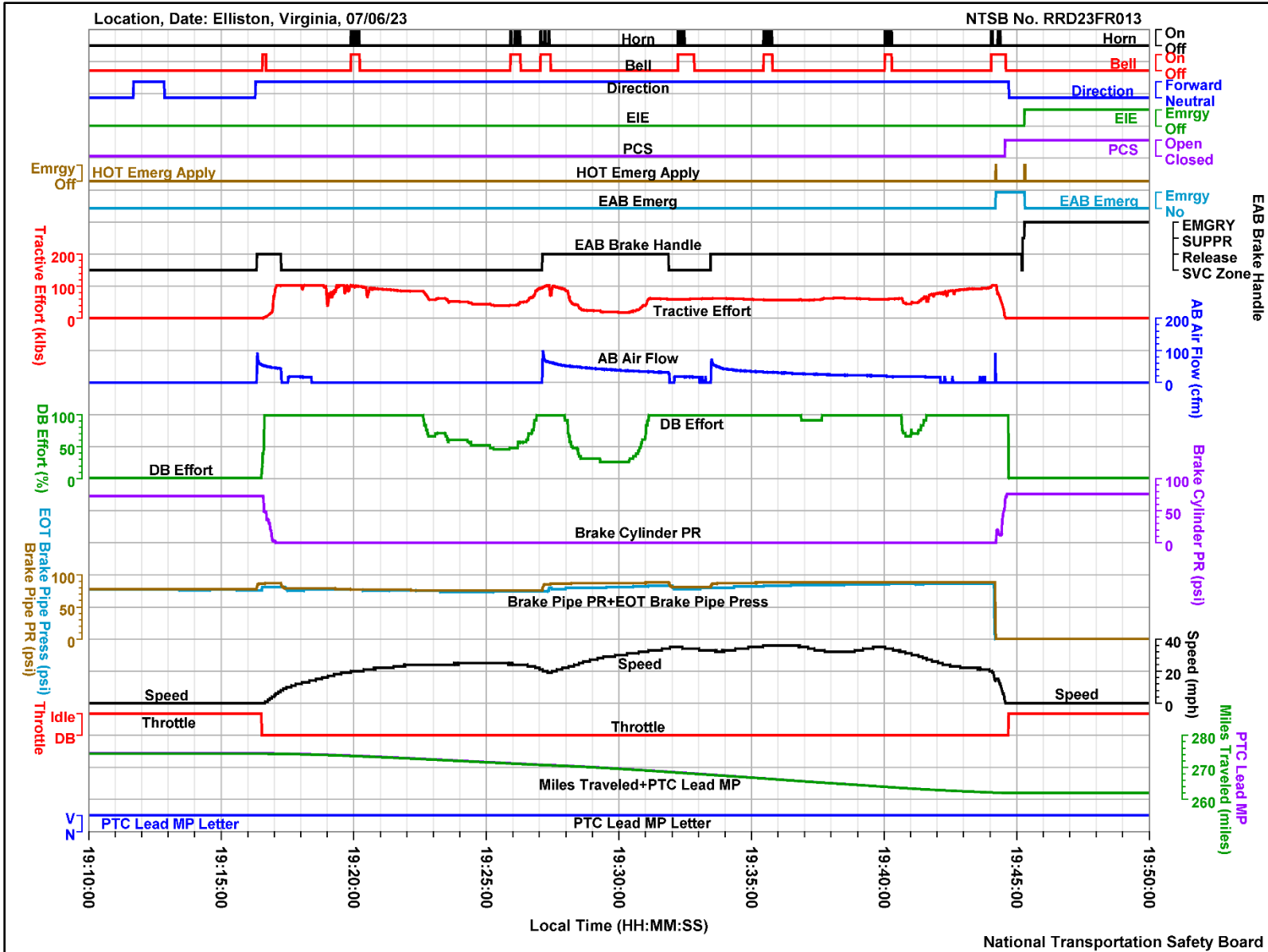


Figure 2. NS 1019's locomotive event recorder parameters focusing on the movement from 19:10:00 EDT to 19:50:00 EDT.

## APPENDIX A. VERIFIED AND PROVIDED PARAMETERS

This appendix describes the locomotive event recorder parameters provided and verified in this report for NS 1019. Table 1 lists the parameters, parameter descriptions, and units. Table 2 contains the unit and discrete state abbreviations for the parameters.

**Table 1.** Verified and provided locomotive event recorder parameters for NS 1019.

Parameter	Parameter Description	Unit
AB Air Flow	Automatic Brake Air Flow	cfm
Bell	Bell Activation	
Brake Cylinder PR	Brake Cylinder Pressure	psi
Brake Pipe PR	Brake Pipe Pressure	psi
DB Effort	Dynamic Brake Effort	%
Direction	Direction of Travel	
EAB Brake Handle	Electronic Air Brake - Brake Handle	
EAB Emerg	Electronic Air Brake Emergency status	
EIE	Engineer Initiated Emergency	
EIE (Tenth Sec)	Engineer Initiated Emergency (Tenth Second)	
EOT Brake Pipe Press	End of Train Brake Pipe Pressure	psi
Feet Traveled	Feet Traveled	ft
Horn	Horn Activation	
Horn (Tenth Sec)	Horn (Tenth Second)	
HOT Emerg Apply	Head of Train Emergency Apply status	
Miles Traveled	Miles Traveled	miles
PCS	Pneumatic Control Switch	
PCS (Tenth Sec)	Pneumatic Control Switch (Tenth Second)	
PTC Lead MP	Positive Train Control Milepost from the Lead Locomotive	
PTC Lead MP Letter	Letter Designation associated with the Positive Train Control Milepost data	
Speed	Speed	mph
Throttle	Throttle Position	
Tractive Effort	Tractive Effort	klbs

Note: Parameters with a blank unit description in table 1 are discrettes. A discrete is typically a 1-bit parameter that is either a 0 state or a 1 state where each state is uniquely defined for each parameter.

**Table 2.** Unit and discrete state abbreviations.

Unit and Discrete State Abbreviation	Description
%	percentage
cfm	cubic feet per minute
DB	Dynamic Brake



<b>Unit and Discrete State Abbreviation</b>	<b>Description</b>
Emrgy	Emergency
ft	feet
klbs	kilo pounds
mph	miles per hour
psi	pounds per square inch
SUPPR	Suppression
SVC Zone	Service Zone