NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, D.C. 20594

February 17, 2016

Locomotive Event Recorder

Specialist's Factual Report
By Cassandra Johnson

1. EVENT SUMMARY

Location:	Heimdal, North Dakota
Date:	May 6, 2015
Company:	BNSF Railway
Locomotive ID:	BNSF Railway 9100[1] (lead locomotive)
NTSB Number:	DCA15FR009

On Wednesday May 6, 2015, about 7:30 a.m. central daylight time (CDT), a BNSF Railway crude oil unit train traveling at 24 mph derailed due to a broken wheel. The train consisted of 109 cars (107 loaded tank cars and 2 buffer cars on the head end), and three locomotives at the front of the train. Six tank cars derailed. As a result, five of the derailed tank cars were breached and caught on fire. The derailment was about a mile east of Heimdal, North Dakota near the 45th Avenue crossing in Wells County, ND.

2. LOCOMOTIVE EVENT RECORDER GROUP

A locomotive event recorder group was not convened.

3. DETAILS OF RECORDER INVESTIGATION

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received an event recorder file from BNSF 9100.

3.1. Locomotive Event Recorder Recording Description

Using the wheel size of 42.09 as embedded in the event recorder data, BNSF 9100's locomotive event recorder data were extracted using the Wabtec Railway Electronics Event Recorder Data Analysis Software. The Wabtec Railway Electronics Event Recorder Data Analysis Software outputted the locomotive event recorder parameters including distance and speed. The exported data have a sampling rate of one second; therefore, the data has an accuracy of +/- 1 second. Only the data relevant to this event are provided in this report.

3.2. Parameters

Table A-1 in appendix A lists the parameters verified and provided in this report for BNSF 9100. Additionally, table A-2 in appendix A contains the unit and discrete state abbreviations for the parameters.

[1] For the rest of this report, BNSF Railway locomotive number 9100 will be referred to as BNSF 9100.

Ex3126-0001-VAN

3.2.1. Distance Traveled

The default output for the distance traveled is the distance decreasing in time. Therefore, the distance traveled began with a very large value and continually decreased.

3.3. Time Correlation

The recorded time from BNSF 9100's event recorder data is independently time stamped and, consequently, the times do not necessarily reflect the actual time of day. During the on-scene portion of the investigation, investigators extracted and processed BNSF 9100's event recorder data using the Wabtec Railway Electronics Event Recorder Data Analysis Software program. When they performed the download, investigators correlated the event recorder time to real time. Using the on-scene extracted data as the time baseline, no time offset was needed to be applied to BNSF 9100's event recorder data. Therefore, for the rest of the report, all times are referenced as CDT.

3.4. Plots and Corresponding Tabular Data

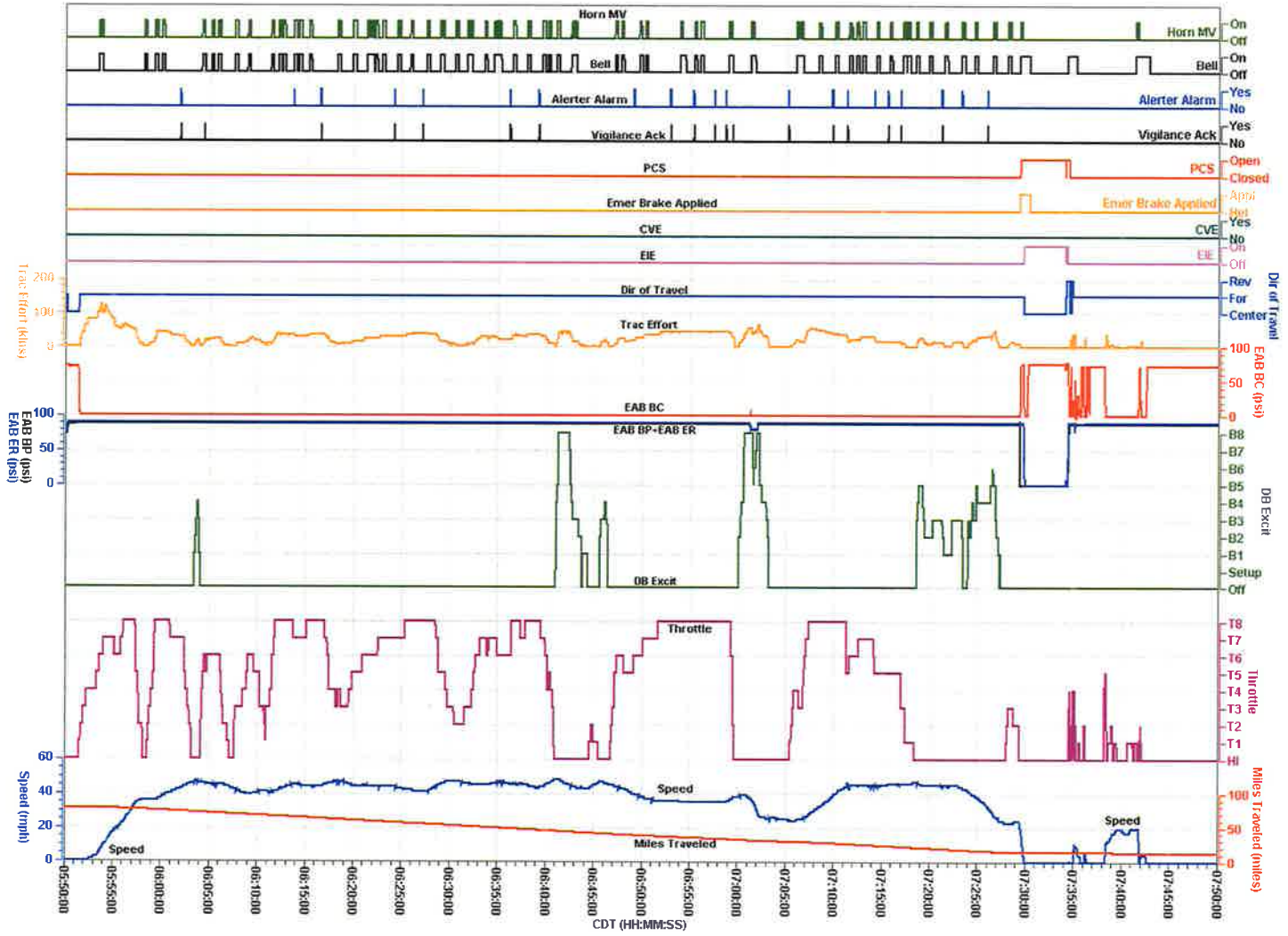
Figures 1 and 2 contain locomotive event recorder data from BNSF 9100 recorded during the May 6, 2015 event. Table A-1 in appendix A provides an index of which parameters are plotted in each figure.

Figure 1 covers 2 hours of data from 05:50:00 CDT to 07:50:00 CDT. Figure 2 has an expanded scale covering 6 minutes of data from 07:25:00 CDT to 07:31:00 CDT.

In brief, the locomotive event recorder data from BNSF 9100 indicated at 07:29:26 CDT, while at a speed of 24 miles per hour (mph), the emergency brake applied transitioned from "Released" to "Applied", the electronic air brake – brake pressure (EAB BP) changed from 88 pounds per square inch (psi) to 0 psi, and the throttle position changed from throttle position 2 (T2) to High Idle (HI). One second later the pneumatic control switch (PCS) transitioned from "Closed" to "Open" and the speed reduced slightly to 23 mph. At 07:29:48 CDT, 21 seconds later, the engineer induced emergency (EIE) discrete transitioned from "Off" to "On" and the speed had reduced to 7 mph. Seven seconds later at 07:29:55 CDT, the speed decreased to 0 mph.

The tabular data from 05:50:00 CDT to 07:50:00 CDT for all the parameters listed in table A-1 are provided in electronic comma separated value (.csv) format as attachment 1 to this factual report.

Figure 1: BNSF 9100's locomotive event recorder parameters (2 hours).



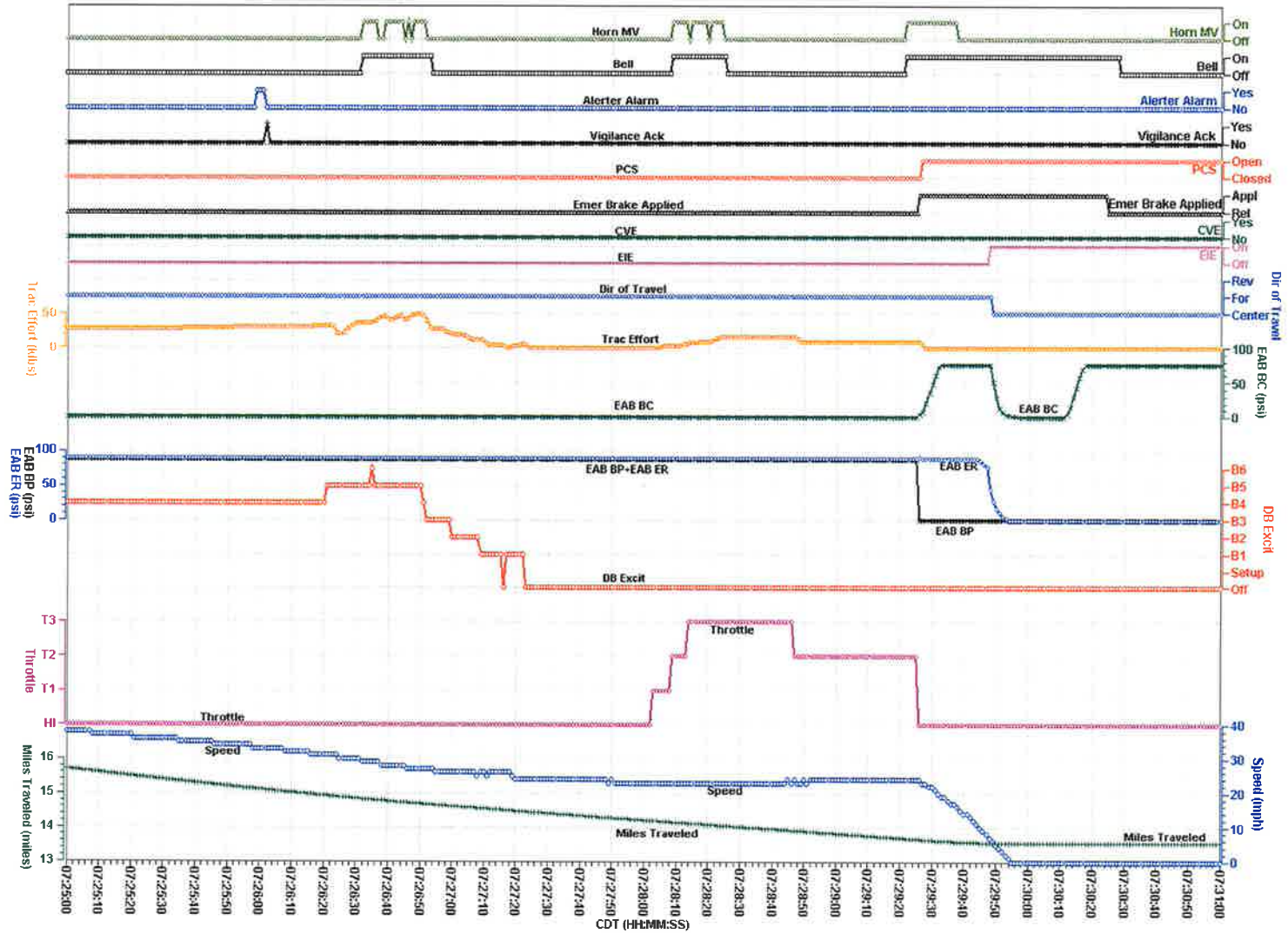
Revised: 5 February 2016

BNSF 9100 (2 hours)

National Transportation Safety Board

Ex3126-0003-VAN

Figure 2: BNSF 9100's locomotive event recorder parameters (6 minutes).



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BNSF 9100 (6 minutes)

National Transportation Safety Board

Ex3126-0004-VAN

APPENDIX A

This appendix describes the locomotive event recorder parameters provided and verified in this report for BNSF 9100. Table A-1 lists the parameters, plot or table label, units, and which figure(s) the data is plotted in. Table A-2 contains the unit and discrete state abbreviations for the parameters.

Table A-1. Verified and provided locomotive event recorder parameters for BNSF 9100.

Parameter Name	Plot/Table Label	Unit	Figures
1. Alerter Alarm	Alerter Alarm		1,2
2. Bell	Bell		1,2
3. Conductor Valve Emergency	CVE		1,2
4. Direction of Travel	Dir of Travel		1,2
5. Dynamic Brake Excitation	DB Excit		1,2
6. Electronic Air Brake – Brake Cylinder Pressure	EAB BC	psi	1,2
7. Electronic Air Brake – Brake Pipe Pressure	EAB BP	psi	1,2
8. Electronic Air Brake – Equalizing Reservoir Pressure	EAB ER	psi	1,2
9. Emergency Brake Applied	Emer Brake Applied		1,2
10. Engineer Induced Emergency	EIE		1,2
11. Feet Traveled	Feet Traveled	ft	-
12. Horn Magnet Valve	Horn MV		1,2
13. Miles Traveled	Miles Traveled	miles	1,2
14. Pneumatic Control Switch	PCS		1,2
15. Speed	Speed	mph	1,2
16. Throttle Position	Throttle		1,2
17. Tractive Effort	Trac Effort	klbs	1,2
18. Vigilance Acknowledgement	Vigilance Ack		1,2

NOTE: Parameters with a blank unit description in table A-1 are discretes. 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.

NOTE: Parameters with a - in the figures column in table A-1 means the parameters are not plotted but are provided in the tabular data.

Table A-2. Unit and discrete state abbreviations.

Abbreviation	Description
Appl	Applied
B1	Brake Position 1
B2	Brake Position 2
B3	Brake Position 3
B4	Brake Position 4
B5	Brake Position 5
B6	Brake Position 6
B7	Brake Position 7
B8	Brake Position 8

Abbreviation	Description
For	Forward
ft	feet
HI	High Idle
klbs	kilo pounds
mph	miles per hour
psi	pounds per square inch
Rel	Released
Rev	Reverse
T1	Throttle Position 1
T2	Throttle Position 2
T3	Throttle Position 3
T4	Throttle Position 4
T5	Throttle Position 5
T6	Throttle Position 6
T7	Throttle Position 7
T8	Throttle Position 8