

Federal Railroad Administration Office of Safety Headquarters Assigned Accident Investigation Report HQ-2005-101

Burlington Northern Santa Fe (BNSF) Ft. Madison, Iowa November 10, 2005

Note that 49 U.S.C. §20903 provides that no part of an accident or incident report made by the Secretary of Transportation/Federal Railroad Administration under 49 U.S.C. §20902 may be used in a civil action for damages resulting from a matter mentioned in the report.

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BNSF Rwy Co. [BN		BNSF						<u>N/A</u>												
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7. Type of Accident/I	Indicent	1. Derailı	nent		4. Side collision				. Hwy-rail	crossin	g 10	ion-deton	n-detonation 13. Other							
(single entry in cod	de box)	2. Head of	on coll	ision	ion 5. Raking collision				8. RR grade crossing 11. Fire/vic					ent rupture (describe in narrative)						
		3. Rear er	nd col	lision	sion 6. Broken Train collision				9. Obstruction 12. Ot				mpacts		nurra			0	4	
8. Cars Carrying 9. HAZMAT Cars					10. Cars Releasin				g 11. People					12. Division			l			
HAZMAT 4 Damaged/Derailed				ea	1 0 HAZMAT				0	acuated	0 Ch			Chicago						
13. Nearest City/Tow		14. Milepost					State 11 G 1			6. County										
	Fort	Madison			(to nearest te				1		Abbr Code			-	LEE					
17. Temperature (F)		18 Visib	ility	(sin	single entry) Code 10 X			Vooth	or (cing)	o ontru)				20 Tun	a of Track				lodo	
(specify if minus))	1.1	Dawn	3.D	3.Dusk			. Clear 3. Rain			5.Sleet Code			20. Type of Trac.			Siding		Joue	
49	49 F 2. Day				4.Dark 2 2				udy 4. Fo	og	6.Snow 1			2. Ya	ard 4. Industry				1	
21. Track Name/Num	iber				22. FRA Track				Code 23. Annual			ick Dens	ity	24. Time Table Direc			ction	C	ode	
Main No					Class (1-9, X				2	(g m	gross tons villions)	s in	55	5 1. Nort			th 3. East		3	
							OPER		ING TRA	 1N #1	,									
25 Type of Equipme	nt 1	Freight tr	nin	4 W	ork train 7	Yard/sw	itching	Δ	Spec Mo	W Equi	n Code	- 126. W	/as Equir	ment (ode	27 '	Train Nu	nher/S	Symbol	
Consist (single entry) 2. Passenger train 5. Single car 8. Light loco(s).									. opee. 110	III Equ	p. coue	A	ttended?	ended?				27. Train Number/Symbol		
	r			1. Yes	2. No 1 SFTMFTM310															
28. Speed (recorded speed, if available) Code 30. Method(s) of Operation (enter code(s) that apply) 30a. Remotely Controlled Locom												omotiv	ve?							
R - Recorded a. ATCS g. Auto									block raffic	r	0 = Not a 4 changed of the state									
E - Estimated 25 MPH R b. Auto train control h. Curre									rain orders	o. Pos	itive trair	n control		2 = Remote control portable						
29. Trailing Tons (gross tonnage, d. Cab j.Tra								varrant control p. Other (Specify in narrativ						3 = Remote control						
excluding power units) e. Traffic								k. Direct traffic control				Code(s)				transmitter - more than one				
N/A f. Interlocking 1. Yard limits $e N/A N/A N/A$ remote control transmitter 0																				
31. Principal Car/Unit	t	a. Initial	and N	umber	b. Positio	on in Train	n c. l	Load	ed _(yes/no)	32. I	f railroad	employ	ee(s) teste	ed for drug	/alcoho	ol use	,			
(1) First involved			1				yes enter the			number	that were	positive in	n		Alcohol	D	rugs			
(derailed, struck, e	etc)								5		the appro	opriate b	ox.				0		0	
(2) Causing (if mec		0				N/A 33. Was this cor				transport	ing passen	1/IN)			N					
34. Locomotive Units a. Head				Mid 7	Mid Train Rear End				35 Car	s			Lo	aded		Emp	oty			
		End	b. Ma	anual	c. Remote	d. Manua	l c. Rei	mote		-		a	. Freight	b. Pass.	c. Fre	ight	d. Pass.	e. Ca	aboose	
(1) Total in Train	1	2		0	0	0	0		(1) Total	in Equ	ipment C	Consist	0	0	0)	0		0	
(2) Total Deraile	d	2		0	0	0	0		(2) Total	Derail	ed		0	0)	0		0	
36. Equipment Dama	ige	-		27 T.	vals Signal X	Var	Ů		29 During	owy Cox			Ű	20 Cont	, i haatina	° Cou			<u> </u>	
This Consist	37. 112 &	Structure Da)	Code H221						Code H401										
Number of Crew Members									Length of Time on Duty											
40. Engineer/	neer/ 41. Firemen			42. Conductors 43. Brakemen					44. Engineer/Operator					45. Conductor						
Operators 1	rators 1 0			1		1		Hrs 2			Mi	50		Н	Irs	2	Mi	50		
Casualties to:	46. Railı	Railroad Employees 47			. Train Passengers		48. Other		49. EOT	Device	evice?			50. Was	EOT Device Properly			Arme	ed?	
Fatal		0						1. Yes 2. No				2	1. Yes 2. No N/A					N/A		
0				0 0			51. Caboose Occupied by Crew?						<u> </u>							
Nonfatal N/A				0 0				1. Yes 2. No									1	N/A		
OPERATING TRAIN #2																				
52. Type of Equipment 1. Freight train 4. Work train 7. Yard/switching A. Spec. MoW Equip. Code 53. Was Equipment Code 54. Train Number/Symbol																				
Consist (single en	<i>try</i>) 2.	Passenger	train	5. Sir	igle car 8.	Light loc	o(s).					A	ttended?							
	3.	Commuter	r train	6. Cu	t of cars 9.	Maint./in	spect.ca	r			1		1. Yes	2. No 1			ZWSPK	CK91	υ	
D. Speed (recorded speed, if available) Code 57. Method(s) of Operation								ente	enter code(s) that apply)						57a. Remotely Controlled Locomotive?					
K - Recorded	ATCS	g , 1	g. Autom	atic l	tic block m.Special instructions of traffic n. Other than main track					U = Not a remotely controlled 1 = Remote control portable										
E Loumated				b	. Auto train o	control r	i. Curren	n of t	i di i i c					1 - Keni		aon p	Situdio			

DEPARTMEN FEDERAL RAI	T OF TRA	ANSPOR DMINIS	TATI TRAT	ION FION	FRA F.	ACTUA	L RAILF	ROAD AC	CIE	DENT I	REPO	ORT	F	RA File #	<u>HQ-200</u>	<u>5-101</u>	
56. Trailing Tons (gross tonnage, excluding power units) 1392					Auto trai Cab Traffic Interlockin	n stop i. j. k g l.	rain orders of the second s	in orders o. Positive train control control p. Other (Specify in narrative) control control code(s)					2 = Remote control tower 3 = Remote control transmitter - more than one remote control transmitter				
58, Principal Car/Unit a. Initial and Nu					b. Posit	n c. Loa	ted(ves/no)	ed(vac/na) 50 If railroad amployad(a) tastad for drug/alaphal									
(1) First involved			707		1		(yes/no)	enter the number that were positive in Alcohol							Drugs		
(derailed, struck, etc)						1		yes	the appropriate box. 0						0	0	
(2) Causing (<i>if mechanical</i> cause reported) 0						0		N/A	60	. Was this	s consi	st transporti	ing passen	N			
61. Locomotive Ur	nits	a. Head End b. Mar			Train c. Remote	Re d. Manua	ear End ll c. Remote	62. Cars	62. Cars Loaded a. Freight b. Pass. c.						pty d. Pass.	e. Caboose	
(1) Total in Train		2		0	0	0	0	(1) Total in	n Equipment Consist 23 0 0 0						0		
(2) Total Dera	2) Total Derailed 0		0	0 0		0	(2) Total Derailed				8	0	0	0	0		
53. Equipment Damage This Consist 469477 6				64. Tr	ack, Signal, Structure D	Way, amage	0	65. Primar Code	65. Primary Cause 66. Contributing Cause Code H221 Code						use	H401	
		Numt	er of C	Crew Me	mbers							Length of	Time on D	uty			
67. Engineer/ Operators 1	68. Fi	remen 0		69. Co	nductors 1	70. Bi	rakemen 0	71. Engineer/Operator Hrs 7 Mi 05					72. Con	72. Conductor Hrs 7 M			
Casualties to:	73. Rail	road Emp	loyees	74. Tra	in Passenge	rs 75. Ot	her	76. EOT Device?					77. Was	Armed?			
Fatal		0			0		0	1. Yes 2. No 1					1.	1			
Nonfatal		1			0		0		78. Caboose Occupied by Crew? 1. Yes 2. No							N/A	
		High	way U	ser Inv	olved				Rail Equipment Involved								
79. Type C. Truc	k-Trailer.	F Bus		I Other	Motor Vel	icle	Code	83. Equip	oving)	Code							
A. Auto D. Pick B. Truck E. Van	-Up Truck	K. Pede M. Othe	strian	narrative)	1.Train(units pulling) 4.Car(s) (moving) 7.Light(s) (standing) N/A 2.Train(units pushing) 5.Car(s) (standing) 8.Other (specify in parent)									N/A			
80. Vehicle Speed	d	geograph	ical)	Code	84. Positio	84. Position of Car Unit in Train											
(est. MPH a	outh 3.East	N/A						N/A									
82. Position					Code	85. Circun	istanc	e ent Struc	k High	way Hear				Code			
4. Trapped	r Crossing	N/A	2. Rail Ed	quipm	ent Struc	k by H	ighway Use	er			N/A						
86a. Was the high		Code	86b. Was t	here a	hazardo	us mat	erials releas	se by			Code						
in the impac	t transportin	ng hazardo	ous ma	terials?	4		I N/A	1. High	wav I	Jser 2.	Rail E	auipment	3. Both	 Neither 	r	N/A	
1. Highway User 2. Rail Equipment 3. Both 4. Neither N/A 1. Highway User 2. Rail Equipment 5. Doin 4. Neither 86c State here the name and quantity of the bazardous materials released if any														10/11			
	name and q	[uunity of	the h	Lurdous	indicitais i	indused, ii	N/A										
87. Type of 1.0	Gates	4.W	ig Wag	gs	7.Cross	bucks 1	0.Flagged by	crew	88. S	ignaled C	Crossin	g Warning	Code	89. Whis	tle Ban	Code	
Warning 3.9	Cantilever F Standard FI	ffic sign	als 8.Stop 9.Wate	signs 1 hman 1	1.Other (spec 2.None	c. in narr.)	(5	ee instru	ctions j	tions for codes)			1. Yes 2. No				
Code(s)	N/A	N/A N/A N/A N/A N/A							known	N/A							
90. Location of Wa 1. Both Sides	arning			1	Code	91. Cross with	ing Warning Highway Si	interconnected Code sinals				Crossing Illu Lights or S		Code			
2. Side of Vehicle Approach							1. Yes		I		1. Yes 2. No						
3. Opposite Side of Vehicle Approach					N/A	3		N/A 3. Unknown							N/A		
93. Driver's 94	Code	95. Dr	iver Drove	Behind or	ain Code 96. Driver								Code				
Age 0	1. Male 2. Femal	e 1	N/A	an 1.	d Struck or Yes 2	was Struch 2. No	I'rain	2. Stopped and then Proceeded 5. Other (specify in narrative) N/A 3. Did not Stop							g N/A		
97. Driver Passed Standing Code 98. View of Track Obscured by (primary obstruction)												Code					
Highway Vehicle 1. Permanent Structure 3. Passing Train 5. Vegetation 7. Other (specify in narrative) 1. Yes 2. No 3. Unknown N/A 2. Standing Railroad Equipment 4. Topography 6. Highway Vehicle 8. Not obstructed														N/A			
101. Casulties to Highway-Rail					Jaine J	99. Drive	r Was	6r-1 0.	Code 100. V			100. Was E	Driver in th	Code			
Crossing Users Killed					injured	1 2.Injured 3.	Uninjured N/A 1. Property Damage 103 Tot					es Number of	N/A				
			0		0	(<i>est</i> .	dollar dama	ge)	inage	0		(includ	le driver)	ingnway-	0	ing USCIS	
104. Locomotive Auxiliary Lights? Code 105. Locomotive Auxiliary Lights Operational?													Code				
1. Yes 106. Locomotive F	Headlight III	2. N uminated	10 ?				Codo	1. res 2. NO 107 Locomotive Audible Warning Sounded?							N/A		
1. Yes	lo				N/A	1.	1. Yes 2. No							N/A			



108. DRAW A SKETCH OF ACCIDENT AREA INCLUDING ALL TRACKS, SIGNALS, SWITCHES, STRUCTURES, OBJECTS, ETC., INVOLVED. HQ-101 Sketch.jpg 109. SYNOPSIS OF THE ACCIDENT

An eastbound BNSF consist of light locomotives collided with a westbound BNSF intermodal train on November 10, 2005, at 10:05 a.m. The collision occurred in Ft. Madison, Iowa, at BNSF milepost (MP) 234.1, on the BNSF Chillicothe Subdivision.

The engineer of the eastbound consist sustained a serious head injury. The conductor of the eastbound consist sustained minor facial burns, suspected to be from battery acid. The engineer of the westbound train sustained a minor back injury. As a result of the collision, both of the eastbound locomotives were derailed, and two cars (eight platforms) of the westbound train were derailed. The westbound lead locomotive released 930 gallons of diesel fuel as a result of the collision; there were no other hazardous materials released. The estimated cost of damage to equipment and track is \$707,677.00 At the time of the collision, it was daylight and clear with a temperature of 49 °Fahrenheit, and a southeasterly wind of 7 mph.

The accident was caused by the failure of the engineer of the eastbound consist of locomotives to comply with a STOP signal indication. The engineer states that he had a proceed signal indication. However, investigation concluded that the signal displayed a STOP indication. Therefore, it is most likely that the engineer lost situational awareness, and that by the time he regained cognizance of his position, was unable to stop his train before impact.

110. NARRATIVE

The following information was obtained from an investigation that was performed by the FRA.

Circumstances Prior to the Accident

Eastbound Train Symbol S-FTMFTM3-10 (striking train)

The crew of Train Symbol S-FTMFTM3-10 consisted of a conductor, a brakeman, and a locomotive engineer. The crew went on duty at 7:15 a.m., CST, November 10, 2005, at the BNSF Ft. Madison Yard in Ft. Madison, lowa. This was the home terminal for all crew members and all received more than the statutory off-duty period, prior to reporting for duty.

The crew was called as an extra train to take two locomotives and move a small cut of empty auto rack cars from the yard in Ft. Madison to Media Storage Track, approximately 30 miles west. This was a move commonly referred to as the "shuttle." The crew took the cars to the storage track and returned, engines light, to Ft. Madison. At West Ft. Madison, the light locomotive consist entered the CTC controlled siding from main Track No. 1, eastbound, on a diverging clear signal. The consist continued eastward, passing the Bridge Signal at MP 235.0, which was displaying an approach signal indication. The crew called the signal, and all were aware that they were on an approach signal when they stopped moments later at the west end of the Ft. Madison Depot. They performed a job briefing just prior to stopping. They stopped to let the brakeman off with the end-of-train device (EOTD), and he stored it on the EOTD rack at the end of the depot. The brakeman then walked into the yard toward Yard Track No. 212 to get the switches lined for movement into that track. Approximately 15 minutes earlier, the yardmaster had directed them to come to East Ft. Madison and back their locomotives into that track. The engineer, having stopped at the depot to let the brakeman off, initiated movement eastbound toward East Ft. Madison and the site of the accident. The conductor was seated on the left side of the lead locomotive, and the engineer was seated on the right side of the lead locomotive. The

The railroad area conditions in the direction in which the eastbound train was then headed are as follows: no significant grade, straight track for approximately 1,100 feet, a slight curve to the left for about 300 feet, then a 3.5 degree curve to the right. The Twentieth Street public grade crossing lies just after the beginning of the right-hand curve. Yard tracks are off to the left. Main Tracks No. 1 and No. 2 are to the right, in that order. A

row of about nine tall power poles, spaced approximately 150 feet apart, is located between the siding and main Track No. 1.

Timetable direction of the light locomotive consist was east. The geographic direction was southeast. Timetable directions are used throughout this report.

An air test was performed prior to leaving Ft. Madison Yard and again when the engineer swapped ends of the consist at Media, in preparation for eastward movement back to Ft. Madison

Westbound Train Symbol Z-WSPKCK9-10

The crew of Train Symbol Z-WSPKCK9-10 consisted of a locomotive engineer and a conductor. They went on duty at 3 a.m., CST, on

November 10, 2005, at the BNSF Yard in Chillicothe, Illinois. This was the away-from-home terminal for both crewmen. Both crewmen received more than the statutory off-duty period prior to reporting for duty. Their assigned freight train consisted of 2 locomotives and 10 articulated, intermodal railcars (23 platforms). The consist read as 23 loads, 0 empties, with 1,392 tons, and 2,136 feet long. The train was scheduled to stop in Ft. Madison for a crew change. Ft. Madison is the home terminal for both crewmen. Both crewmen were qualified as locomotive engineers. The crewman called to work as the conductor took over the duties of engineer around BNSF MP 130.0. The trip from Chillicothe had been uneventful. The train was heading westbound on main Track No. 1, past an approach signal at MP 234.0. They had slowed to 25 mph, the maximum authorized timetable speed, for the turnout switch at MP 234.1, where the siding and main track meet. The train was in the 3.5 degree curve as it approached the accident area. The engineer was on the right side of the lead locomotive in the engineer's seat. The conductor was on the left side of the lead locomotive. An air test was performed at Willow Springs, Illinois, by TTX, a contract company for BNSF.

The Accident

Eastbound Train Symbol S-FTMFTM3-10 (striking train)

The next signal that would govern movement of the eastbound light locomotive consist was about 1,600 feet away from where they stopped to let the brakeman off the train. It is a pot signal (signal extending approximately 2 feet above the ground) at the east end of the siding and was obscured from view by several wooden power poles that run parallel to the track. Due to these obstructions, the engineer was only able to view the signal at a point approximately 700 feet away from the signal. The conductor could see the signal slightly sooner because of his vantage point from the left side of the locomotive. The engineer initiated movement eastward from the west end of the depot, placing the train's throttle in positions 1, 2, 3, and 4, successively. He then went from position 4 to position 8, with no hesitation in between. The eastbound locomotive consist reached a recorded speed of 25 mph before the engineer backed the throttle from position 8 to the idle position and made an emergency air brake application. The brakes were applied 216 feet from the point of impact with the westbound train traveling on main Track No. 1. The westbound train was also traveling at a speed of 25 mph when the eastbound train struck it approximately 10 feet back from the front of the lead locomotive. Both of the eastbound locomotives and two cars (eight platforms) of the westbound train were derailed.

When the eastbound train had pulled away from the depot, the conductor felt that they had started somewhat quicker than would be normal in that situation. He reminded the engineer that they were on an approach signal. The conductor then stood up from his seat. He turned to get his coat on and retrieve his radio and switch keys from his grip, in preparation of getting off the locomotive at East Ft. Madison and boarding the second locomotive to provide point protection as they shoved back into the yard. The conductor entrusted movement of the train exclusively to the engineer, never looking to see the pot signal indication. The next thing the conductor recalled was hearing the engineer place the train's air brakes in emergency application. At that point, he turned around and saw the approaching westbound train and tried to exit the locomotive, but got his clothing (overalls) caught on the front door of the locomotive. He was still on the front of the lead locomotive when the impact occurred, throwing him forward and off the locomotive. The engineer was on the front of the lead locomotive as well, trying to get off. He was also thrown forward and off the locomotive at the time of impact. The engineer maintained that the pot signal was displaying an approach indication and that he told the conductor so. The conductor did not recall the engineer saying anything. The engineer said that he was concentrating on looking for cars approaching the 20th Street grade crossing at East Ft. Madison. His visibility of the westbound train was inhibited due to restricted visibility by the power poles and the curvature of the track.

Westbound Train Symbol Z-WSPKCK-9

The westbound train was already in the plant at East Ft. Madison on main Track No. 1 when the engineer saw the eastbound locomotive consist coming at him on the siding. He had only a couple of seconds to react when he realized that a collision was imminent. The engineer placed the train's air brakes in emergency application and jumped to the conductor's side of the lead locomotive. He then heard extremely loud noises and looked over toward where he had been sitting to see most of the engineer's side of the locomotive cab was gone,

including the engineer's seat. At that point, the conductor asked the engineer if he was all right and then realized that they were still moving. The lead locomotive had somehow become separated from the second locomotive during the collision and was rolling free down main Track No. 1. The conductor ran over to the controls of the locomotive and attempted to stop the train. He was unsuccessful. He then ran out on the front of the locomotive and applied the handbrake, stopping the locomotive approximately 2,100 feet west of the point of impact.

The knuckles of both locomotives had not been broken, indicating that they most likely separated at impact due to an upward force on the head-end of the second locomotive, sufficient to lift it high enough to allow the lead locomotive to separate from the second locomotive. The braking systems of the lead locomotive were apparently rendered inoperable due to excessive damage the systems sustained in the collision.

Analysis and Conclusions

Analysis

The daily locomotive inspection form on lead Locomotive No. BNSF 5211, of the eastbound locomotive consist, had not been signed since November 7, 2005. This was in violation of Title 49 Code of Federal Regulations (CFR) Part 229.21, which requires locomotives be inspected daily. This was not; however, a contributing cause of the accident.

Post-accident toxicological testing was performed on the crews of both trains, and the results were negative. The engineer of the striking train was taking prescription medication for diabetes only. He was not taking any medication that would have hampered his ability to safely operate a locomotive.

The FRA Signal Inspector conducted tests on the signal system for the plant at East Ft. Madison, including the pot signal, and concluded that although two anomalies were found in the system, they were not related to the pot signal. He concluded that the pot signal, as well as the rest of the signals at and surrounding East Ft. Madison, were operating as intended and that the pot signal indication for the eastbound train was Stop. An inspection of rules and efficiency testing data for all employees was conducted and found to be current and have no deficiencies, in compliance with Title 49 CFR Part 217.

Event recorder information was downloaded and examined for both trains involved. This analysis disclosed that the locomotive engineer of the westbound train was in compliance with all applicable railroad operating and train handling requirements. The engineer of the eastbound train was also in compliance prior to failing to stop for the STOP signal indication at East Ft. Madison. The data also confirmed that both trains were traveling at a speed of 25 mph at the time of the accident.

Visibility of the pot signal for the eastbound train approaching East Ft. Madison on the siding, was restricted due to the size of the signal, the curvature of the track on the approach to the signal, and the presence of power poles in the line-of-sight. GCOR rule 6.28 (Movement on Other Than Main Track) was in effect at this location. This rule requires the engineer to move at a speed which allows him to stop within half the range of vision of stop signals, track appliances, and men or equipment fouling the track.

The crew of the eastbound train had only been on duty for 2 hours and 50 minutes at the time of the accident. This was a much quicker turn than was expected, and the crew was almost finished working for the day. Conclusions

With the exception of the locomotive daily inspection card for Locomotive No. BNSF 5211, the railroad was in compliance with their own rules and all applicable Federal regulations. The engineer of the offending train was the only person who saw the pot signal indication at East Ft. Madison. There are no other witnesses to confirm or refute his testimony. He received a serious head injury during the accident, causing temporary amnesia. He was hospitalized for more than two weeks and endured an operation to restore restricted blood flow to his brain. The engineer said that, at first he had a hard time distinguishing his memories of the accident from dreams. However the engineer said he now remembers everything about the day in question except the collision itself, and states he had an approach indication.

It is believed that the engineer lost situational awareness and by the time he regained cognizance of his position, was unable to stop his train in compliance with a stop signal indication, resulting in the collision. This determination is based largely on the fact that the investigation concluded that the pot signal was displaying a STOP indication and functioning as intended.

Probable Cause and Contributing Factors

The FRA determined the probable cause is H221, Automatic block signal displaying a stop signal - failure to comply. The accident occurred because the engineer of the eastbound light engine consist failed to comply with a stop signal indication.

The contributing factor was H401, failure to stop train in clear.