

Federal Railroad Administration Office of Railroad Safety Accident and Analysis Branch

Accident Investigation Report HQ-2015-1047

BNSF Railway Company (BNSF) Heimdal, ND May 6, 2015

Note that 49 U.S.C. §20903 provides that no part of an accident or incident report, including this one, 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.

SYNOPSIS

On May 6, 2015, at 7:30 a.m. (CDT), an eastbound BNSF Railway (BNSF) loaded petroleum crude oil unit train, U-TIOCXP0-44T, derailed six loaded oil tank cars (consist positions 84 through 89), near the town of Heimdal, North Dakota, while operating at a recorded speed of 24 mph. The town of Heimdal is located at Milepost (MP) 149.5 on the single main track of BNSF's KO Subdivision, Twin Cities Division, and is located approximately 75 miles east of Minot, North Dakota. The initial derailment occurred at MP 153.9 followed by an ensuing general pile-up of cars at MP 149. The derailment occurred toward the rear of the train and five of the derailed cars ended up on their sides and one car (consist position 89) derailed but remained upright.

The derailment resulted in five of the six derailed cars catching fire which then resulted in an evacuation of the local population of Heimdal. Approximately 30 residents were evacuated at 7:30 a.m. due to heavy smoke, which created respiratory health concerns. The tank cars were allowed to burn themselves out prior to the local emergency responders entering the accident area and extinguishing associated fires. The derailment caused 98,090 gallons of petroleum crude oil to be released from the five loaded tank cars. The crew from Train U-TIOCXP0-44T was not injured and no civilian injuries were reported. The on-scene commander (Harvey Fire Chief) lifted the evacuation at 9:00 p.m. on May 6, 2015.

The railroad damages reported were: \$476,670 for equipment damages and \$2,000,000 for track, signal, way, and structure damages, for a total of \$2,476,670 in reported damages. The BNSF's KO Subdivision is not an Amtrak route and this accident/incident was not PTC-preventable.

At the time of the accident, it was daylight and cloudy with a south east wind of about 13 mph. The temperature was 40° F.

The Federal Railroad Administration's (FRA) investigation determined the probable cause of the accident was due to a broken rim on wheel L2 of railcar TFRX 1224-FRA Accident/Incident code E61C.

0	U.S. Department of Transportation
	Federal Railroad Administration

FRA FACTUAL RAILROAD ACCIDENT REPORT FRA File #HQ-2015-1047

TRAIN SUMMARY												
1. Name of Railroad Ope		1a. Alphabetic Code			1b. Railroad Accident/Incident No.							
BNSF Railway Company	BNSF			TC-0515-101								
GENERAL INFORMATION												
1. Name of Railroad or Oth	ick Mainte	1	1a. Alphabetic Code			1b. Railroad Accident/Incident No.						
BNSF Railway Compan			BNSF			TC-0515-101						
2. U.S. DOT Grade Crossin		3	3. Date of Accident/Incide			nt 4. Time of Accident/Incident						
			5/6/2015			7:30 AM						
5. Type of Accident/Incident												
Derailment												
6. Cars Carrying	Cars Carrying 7. HAZMAT Cars 8. Cars Releasing				-	9. People	•		10. Subdivision			
HAZMAT 107	Damaged/Derailed	6	HAZ	ZMAT	5	Evacuated	30		КО			
11. Nearest City/Town	12. Milepost (to nearest tenth) 13				State Abbr.	14. County	unty					
Heimdal	153.900				D	WELLS	.S					
15. Temperature (F)	16. Visibility	17. Weather					18. Type of Track					
40 °F	Dawn	Cloudy					Main					
19. Track Name/Number	20. FRA Track Class					21. Annual Track Density			22. Time Table Direction			
Single Main Track	Freight Trains-60, Passenger Tra				ns-80	(gross to 59.53	ons in	millions)	East			

U.S. Department of Transp Federal Railroad Administr	ortation ation	FRA FACTUAL RAILROAD ACCIDENT REPORT									RA File #HQ-2015-1047				
				(OPE	RATING 1	[RA]	IN #1							
1. Type of Equipment		2. Was Equipment Attended					3. Tra	in Num	ber/Symbol						
Freight Train		Yes					U-TIOCXP0-44T								
4. Speed (recorded spe if available)	eed,	Code 5 e	. Trailing xluding po	Tons (gros wer units)	s (6a. Remotely Controlled Locomotive? Code 0 = Not a remotely controlled operation 1 1 = Remote control portable transmitter Image: Control portable transmitter									
R - Recorded E - Estimated 24	1 MPH	R	14995			$\begin{vmatrix} 2 &= \text{Remote control portable transmitter} \\ 3 &= \text{Remote control portable transmitter} - \text{more than one remote control transmitter} \end{vmatrix} 0$									
6. Type of Territory		II													
Signalization: Signaled															
Method of Operation	n/Author	ity for Mo	ovement:												
Supplemental/Adjur	nct Codes	:													
7. Principal Car/Unit	a. Initi	al and Nu	mber b. Po	osition in T	rain	c. Loaded (yes/	no)	8. If railr	oad employ	yee(s) tes	sted for	Alcohol		Drugs	
(1) First Involved (derailed, struck, etc.)	TR	FX 1224		84		yes ap			r that were riate box	positive	in the	0		0	
(2) Causing (if mechanical, cause reported)	TR	FX 1224		84		yes	9. Was this consist transportin				ing passens	gers?	·	No	
10. Locomotive Units	a. Head	Mid	Train	Re	ar En	d 11. Cars	EMIT		Loa	ded	Em	Empty			
DMU, and Cab Car Locomotives.)	End	b. Manual	c. Remote	d. Manual	e. Rem	DMU, an Ote Car Loco	eMU, nd Cab motiv	Cab a otives.) Frei		b. Pass.	c. Freight	d. Pass.	С	e. Caboose	
(1) Total in Train	3	0	0	0	0	0 (1) Total in Equipmen Consist			109	0	0	0		0	
(2) Total Derailed	0	0	0	0	0	(2) Total Derailed			6	0	0	0		0	
12. Equipment Damage This Consist 13. Track, Signal, Way & Structure Damage 476670 2000000															
14. Primary Cause Co	de														
E61C - Broken rim															
15. Contributing Cau	se Code														
Number of Crew Members										Length c	of Time on	Duty			
16. Engineers/Operato	6. Engineers/Operators 17. Firemen 18. Conducto			nductors	1	19. Brakemen	20. Enginee		Operator		21. Conductor				
1		0		1		0	Hrs: 4		Mins	[:] 40	Hrs:	4	Mins:	40	
Casualties to:	22. Ra Emple	ilroad oyees	ad 23. Train Passengers			24. Others	5. EOT Device? 26.				. Was EOT Device Properly Arm				
Fatal		0		0	-+	0				Yes				Yes	
Nonfetal		0		0		0	27. C	27. Caboose Occupied by Crew?							
INONIATAI		0	20 1	U		0								No	
47.793096000	-99.6	42249000)												

SKETCHES

FRA File #HQ-2015-1047

HQ-2015-1047



NARRATIVE

CIRCUMSTANCES PRIOR TO THE ACCIDENT:

The crew of eastbound Train U-TIOCXP0-44T went on-duty at 2:50 a.m. on May 6, 2015, at BNSF's General Office Building (GOB), in Minot, North Dakota. The two-person crew consisted of an Engineer and a Conductor. This was the home terminal for the Conductor and the away-from-home terminal for the Engineer. Both employees had received more than the statutory off-duty period prior to reporting for duty. After collecting the necessary paperwork, the crew was transported via crew van from the GOB in downtown Minot out to Gavin Yard to board their train in the north inspection track at Gavin Yard. Their assigned freight train consisted of three head-end locomotives and 109 loaded cars (107 tank cars loaded with Petroleum Crude Oil, UN 1267, Cl. 3, PG I (petroleum crude oil) and two sand cars (buffers)). It was 6,648 feet in length, and consisted of 14,995 trailing tons. The crew was assigned to operate the train from Minot to Dilworth, Minnesota, a distance of approximately 203 rail miles. The train had received a FRA Extended Haul Air Brake Inspection at Tioga, North Dakota, on May 5, 2015.

The crew had no work assigned to their train en route from Minot to Dilworth.

As the eastbound train approached the accident area, the locomotive engineer was seated at the controls on the south side of the leading locomotive. The conductor was seated on the north side in the conductor's chair of the leading locomotive.

BNSF's KO Subdivision in this accident area is single main track territory. The method of operation in the area of the accident is by signal indications of a traffic control system (TCS) controlled by a BNSF train dispatcher located in Fort Worth, Texas. Per BNSF's Twin Cities Division Timetable No. 5, dated August 22, 2012, in the area of the accident the maximum authorized timetable speed is 60 mph. The U-TIOCXP0-44T exceeded 100 tons per operative brake, and therefore, was restricted to 45 mph as required by current BNSF System Special Instructions.

The track through the accident area consists of continuous welded rail on treated wood ties secured with double shoulder tie plates and six inch cut spikes. The north and the south rails in both curves are 136-pound-RE profile rail section made by Nippon Steel in April of 1994 and installed at this location in 1995. The rails in the tangent track are 136-pound-RE profile rail section made by Rocky Mountain Steel in February 2010.

The rail lays on double-shoulder tie plates that are 7 3/4 inches wide and 14 inches long, secured by four 6 inch long cut track spikes to fasten the rail to the plate (2 rail holding and two anchor spikes one in each quadrant of the plate). The tie plates rest on treated 7 inch-by-9 inch wooden ties that are 8 feet, 6 inches long, with an average spacing of 19 1/2 inches between tie centers.

The track ballast is crushed granite. The tie cribs appear to be full with an average of 12 inches of shoulder ballast. The track is sitting on an average of 8 to 10 feet of fill above the ditch line.

Beginning at MP 155, the track grade is descending an average of 0.35 percent to MP 150.95. Between MP 150.95 and MP 150.9, the track grade ascends an average of 0.2 percent. Between MP 150.9 and MP 150.3, the track grade descends an average of 0.35 percent. Between MP 150.3 and MP 150.0, the track grade is level. From MP 150.0 to MP 149.4, the track grade ascends an average 0.30 percent. Between MP 149.4 to MP 148.95, the track grade descends an average of 0.43 percent. There is a 1 degree, 2-inch right hand curve between MP 154.2 and MP 153.9. There is a left hand curve between MP 151.2 and MP 151.0.

The geographic direction for the loaded petroleum crude oil train was east. The railroad timetable direction for the loaded petroleum crude oil train was east. Timetable directions are used throughout this report.

THE ACCIDENT:

Per post-accident interview statements from the crew of Train U-TIOCXP0-44T, the train had departed off of the Gavin Yard North Inspection Track and after meeting two westward trains at the Simcoe siding (Milepost (MP) 211.9) they proceeded in an eastward direction on proceed (green) signal indications. A 25 mph Form A speed restriction was in affect from MP 148.6 to MP 144. As the train proceeded through the area of the designated speed restriction at MP 149, a sudden undesired emergency application of the train's air braking system was experienced while the train was traveling at a speed of 24 mph (as recorded by the event recorder). After stopping their train, the crew was able to determine that there was a fire, and six cars had derailed. The cars which derailed were consist positions 84 through 89. As a result of the derailment, five of the derailed cars ended up on their sides, breached

and releasing product which then caught fire. The sixth car derailed in an upright position and was not compromised and did not release any product. All of the tank cars which derailed were the un-jacketed type CPC 1232s. The crew immediately initiated an emergency call to BNSF's dispatcher in Fort Worth, Texas. The derailment caused a total of 98,090 gallons of petroleum crude oil to be released from five of the six derailed tank cars.

The point of derailment was determined to have occurred at MP 153.9 (GPS 47 degree 49-foot, 27.04-inch latitude and -99 degree, 43-foot, 53.37-inch longitude) with the ensuing general pile-up occurring at MP 149.

Per post-accident statements of the conductor during an interview, following the derailment the crew cut the leading locomotives off of the train and pulled to the east approximately 1-mile. An unspecified time later a first responder approached the crew and told the crew he felt it was safe to go back and pull the cars which were ahead of the derailed cars in the clear to the east. The conductor was given a ride to a crossing approximately 25 cars from the derailed cars. He stated he walked back and closed the angle cock on the 80th railcar, after which, the head 80 cars and

3 locomotives were pulled east to Bremen siding (MP 136.8) and secured. Per BNSF personnel, the rear 21 cars were then pulled west with locomotives from a train which was following the derailed train and taken to a siding west of Heimdal and secured.

The crew was transported to Carrington Health Center in Carrington, North Dakota, for FRA post-accident toxicology testing.

Hazardous Materials-

Below is a list of the six petroleum crude oil rail cars which were derailed and the amount of product released from each car:

Car Number	Released Volume (GAL)					
TRFX 1224	28,610					
TRFX 1176	2,730					
TRFX 1374	30,060					
TRFX 1056	20,980					
TRFX 1170	15,710					
TRFX 1044	0					
	Car Number TRFX 1224 TRFX 1176 TRFX 1374 TRFX 1056 TRFX 1170 TRFX 1044					

There were no fatalities or injuries resulting from a direct exposure to the release of the petroleum crude oil.

Emergency Response-

The Harvey and Fessenden Volunteer Fire Departments both responded to the accident on

May 6, 2015. The Harvey firefighters received the call from dispatch around 7:35 a.m. to act as mutual aid to the Fessenden firefighters. The Harvey and Fessenden Departments formed a unified command structure and assessed the situation. The Harvey Fire Department determined that the material was crude oil and consulted the Emergency Response Guide (ERG) for information on potential hazards. The decision was made to take a defensive stance because of the aggressive nature of the fire. The Harvey Fire Chief ordered an evacuation of nearby residents issuing a reverse 911 order. Firefighters also went door-to-door to evacuate the community. The Harvey fire department reported that the fire raged for approximately three hours until a BNSF contractor, Wenck, arrived with chemical foam to fight the fire. Between

9-9:30 p.m., the major fire was extinguished and residual pool fires were extinguished. Air monitoring was conducted by another contractor, the Center for Toxicology and Environmental Health (CTEH), and they determined the site was clear.

The on-scene commander (Harvey Fire Chief) lifted the voluntary evacuation at approximately 9:00 p.m. on May 6, 2015.

POST-ACCIDENT INVESTIGATION:

On May 6, 2015, the Federal Railroad Administration (FRA) began an investigation of this accident. FRA's Region 8 management assigned a Railroad Safety Specialist (Chief Inspector) as Investigator/Inspector-in-Charge (IIC) of this investigation. They also sent the Regional Administrator, two Deputy Regional Administrator's, three

this investigation. They also sent the Regional Administrator, two Deputy Regional Administrator's, three Operating Practices Inspectors, two Hazardous Material Inspectors, two Motive Power & Equipment Inspectors, two Track Inspectors, and a Track Integrity Specialist to assist the IIC. FRA worked in conjunction with the go-team from the National Transportation Safety Board (NTSB) and three inspectors from the Pipeline and Hazardous Materials Safety Administration (PHMSA). The following analysis and conclusions, as well as any possible contributing factors and the probable cause in this report, represent the findings of FRA's investigation.

ANALYSIS AND CONCLUSIONS:

Analysis- FRA Post Accident Toxicological Testing:

The accident/incident met the criteria for FRA Post-Accident Toxicology Testing as required under Title 49 Code of Federal Regulations (CFR) Part 219, Subpart C.

Conclusion:

Carrington Health Center in Carrington collected specimens from the crew for FRA Post-Accident Toxicological Testing. Test results were negative for both crew members.

Analysis- Crew Fatigue:

FRA obtained fatigue related information, including a 10-day work history, for both crew members.

Conclusion:

Upon analysis of that information with FRA's Fatigue Analysis Scheduling Tool (FAST) program, FRA concluded that fatigue was probable for both crew members and that the employees may have been working at a diminished level of safety (effectiveness) due to mental and/or physical attributes associated with fatigue. However, FRA determined that fatigue was not a contributing or causal factor to this accident/incident and that any actions or lack of actions by the employees would not have prevented this accident/incident.

Analysis- Locomotive Event Recorder:

Downloads of the Locomotive Event Recorder from the leading locomotive of train U-TIOCXP0-44T were obtained and analyzed by FRA.

Conclusion:

FRA's analysis of the locomotive event recorder downloads concurred with BNSF's analysis. The speed of the U-TIOCXP0-44T when an undesired emergency application of the train's air braking system was initiated and the ensuing derailment occurred was 24 mph. FRA's analysis noted no exceptions to proper train handling on the part of the train crew.

Analysis- Locomotive Camera:

FRA reviewed the locomotive camera download off of the leading locomotive of the U-TIOCXP0-44T.

Conclusion:

FRA verified that there was nothing unusual about the condition of the track, or any unusual conditions prior to the derailment.

Analysis- FRA Track Inspection:

FRA investigators conducted a thorough walking inspection of the KO Subdivision track from MP 155.3 through MP 150.9.

Conclusion:

On May 6th, FRA's inspection determined that the Point-Of-Derailment was at MP 153.87 (rounded up to 153.9 for this report) on the Single Main Track. Other than derailment damage, no track defects were noted.

On May 7, 2015 a combined track inspection of the track segment between MP 155.7 and MP 149.0 was conducted by FRA and BNSF. At this time the track segment was also examined by the NTSB. Marks on the south railhead that appeared to come from a damaged wheel were evident every 9 feet, 5 inches. The marks began at MP 154.4 and became more pronounced on the inside curve rail (south rail) at MP 154. A south wheel dropped into the gage at MP 153.9 and left marks on the cross tie surface. The wheel marks were four feet from the gage face of the north rail. The marks continued within the gage until the wheel struck the west end of the public grade crossing at MP 153.6; at that point, the north wheel also went into the gage of the track and the south wheel also stayed in the gage of the track. These two marks continued until the wheels struck the curved closure rail near the frog at the west

of the track. These two marks continued until the wheels struck the curved closure rail near the frog at the west switch of Heimdal. At that point the north wheel damaged the closure rail and stayed within the gage, but the south wheel climbed the south rail ending up on the field side. The wheel marks stayed tracking in that configuration until the general pileup occurred at MP 149.

Analysis- FRA Hazardous Materials Inspection:

FRA's Hazardous Materials Inspector conducted a thorough investigation of the paper work and handling of the cars from both the shipper and the railroad.

Conclusion:

BNSF Train U-TIOCXP0-44T was a unit "key train" with a total of 107 tank cars containing petroleum crude oil which is designated by the U.S. Department of Transportation (DOT) as hazardous for commercial transportation purposes. Commercial transport of petroleum crude oil is subject to the regulatory requirements of the Hazardous Materials Regulations (HMR) in

Title 49 CFR. The train was transporting a shipment of Bakkan crude oil from Tioga to Philadelphia Energy Solutions in Philadelphia, PA.

The investigation determined the train consist (list) matched the physical placement of the cars in the train and no exceptions were taken. This was verified by reviewing the automatic equipment identification scan taken of the train at BNSF's Gavin Yard (Minot) and the original consist. Six hazardous materials tank cars were derailed in the accident. These tank cars were in consist positions 84 through 89 in the train. None of the remaining 101 tank cars containing petroleum crude oil were derailed or breached in the accident. All five of the derailed tank cars were general service specification DOT-111S100W1 constructed to the AAR CPC-1232 standard that contained petroleum crude oil from the Bakken region of North Dakota. Upon FRA's investigation and review of the DOT F5800.1 forms submitted by BNSF, FRA determined that the five compromised tank cars released a total of 98,090 gallons of petroleum crude oil. Tank car TRFX 1044, which had derailed in an upright position, was not breached and did not release any product.

Analysis- Emergency Response:

FRA conducted an analysis of BNSF's emergency response efforts as well as those of the local emergency responders.

Conclusion:

The Harvey and Fessenden Volunteer Fire Departments both responded to the accident on May 6, 2015. The Harvey firefighters received the call from dispatch around 7:35 a.m. to act as mutual aid to the Fessenden firefighters. The Harvey and Fessenden Departments formed a unified command structure and assessed the situation. The Harvey Fire Department determined that the material was crude oil and consulted the Emergency Response Guide (ERG) for information on potential hazards. The decision was made to take a defensive stance because of the aggressive nature of the fire. The Harvey Fire Chief ordered an evacuation of nearby residents issuing a reverse 911 order. Firefighters also went door-to-door to evacuate the community. The Harvey Fire Department reported that the fire raged for approximately 3 hours until a BNSF contractor, Wenck, arrived with chemical foam to fight the fire. Between 9-9:30 p.m., the major fire was extinguished and residual pool fires were extinguished. Air monitoring was conducted by another contractor, the Center for Toxicology and Environmental Health (CTEH), and they determined the site was clear.

The Harvey Fire Chief served as the incident commander and lifted the recommended voluntary evacuation at approximately 9 p.m. on May 6, 2015, and the residents returned to their homes.

FRA concluded that the emergency response was both immediate and thorough.

Analysis- FRA Mechanical Investigation

All derailed cars from U-TIOCXP0-44T were examined for mechanical defects and possible causal factors.

Conclusion:

On May 8, 2015, the mechanical group conducted inspections on the running gear of the six derailed cars. The running gear parts were staged adjacent to the incident site by railroad contractors for review by the investigative teams.

The running gear parts were inspected for defects and regulatory compliance with no defects noted. However, the "B" end truck of Car TRFX 1224 had received the most damage from the derailment. The left number 2 wheel (L2) was broken and tagged with NTSB tag number 1 as evidence.

Wheel set number 1 and the slack adjuster from the TRFX 1224 was also tagged with NTSB tag number 2 and is

Wheel set number 1 and the slack adjuster from the TRFX 1224 was also tagged with NTSB tag number 2 and is being held by BNSF. No exceptions were observed with the condition of the brake rigging or brake pads. All appeared to have indications of normal contact patterns consistent with properly braking equipment. The truck assemblies and wheels were examined and no abnormal conditions were observed.

On May 9, 2015, the mechanical group conducted an FRA Class I Air Brake Test and Pre-Departure Inspection on the remaining 103 cars from the U-TIOCXP0-44T that did not derail. The train was reassembled in its original configuration from the time of the incident. The following is a summary of the defects observed:

- 42 cars had head shields that were not properly secured.
- 10 cars had safety appliance defects.
- 2 cars had bottom outlet valve flange bolts that were loose.
- 1 car had a bottom outlet cap that was loose.
- 1 car had a broken/inoperable draft gear.
- 1 car had a broken knuckle pin.
- 1 car had an AAR thin flange.

On May 10, 2015, the end-of-train device, BNQ 47479, was inspected and tested by the mechanical group with no exceptions noted.

All trucks and axles from all the derailed cars were inspected and FRA determined the only exception was the broken rim on wheel L2 of railcar TFRX 1224.

Possible Contributing Factors:

FRA's investigators concluded defects in track, signal, hazardous materials, and operating practices (train handling, etc.) were not contributing factors in the cause of this accident/incident. All damages to track and signal structures resulted from the accident/incident.

Probable Cause:

FRA's investigation determined the probable cause of the accident was due to a broken rim on wheel L2 of railcar TFRX 1224-FRA Accident/Incident code E61C.