Federal Railroad Administration
Office of Railroad Safety
Accident and Analysis Branch

Accident Investigation Report
HQ-2013-29

Wisconsin Central Ltd. (WC)
Two Harbors, MN
December 5, 2013

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.

U.S. Department of Transportation
Federal Railroad Administration

FRA FACTUAL RAILROAD ACCIDENT REPORT

FRA File #HQ-2013-29

TRAIN SUMMARY

1. Name of Railroad Operating Train #1	1a. Alphabetic Code	1b. Railroad Accident/Incident No.
Wisconsin Central Ltd. (also Railway)	WC	798870
2. Name of Railroad Operating Train #2	**2a. Alphabetic Code**	**2b. Railroad Accident/Incident No.**
Wisconsin Central Ltd. (also Railway)	WC	798870

GENERAL INFORMATION

1. Name of Railroad or Other Entity Responsible for Track Maintenance	1a. Alphabetic Code	1b. Railroad Accident/Incident No.
Wisconsin Central Ltd. (also Railway)	WC	798870
2. U.S. DOT Grade Crossing Identification Number	**3. Date of Accident/Incident**	**4. Time of Accident/Incident**
	12/5/2013	1:15 PM

5. Type of Accident/Incident
Derailment

6. Cars Carrying HAZMAT	7. HAZMAT Cars Damaged/Derailed	8. Cars Releasing HAZMAT	9. People Evacuated	10. Subdivision
0	0	0	0	Iron Range

11. Nearest City/Town	12. Milepost *(to nearest tenth)*	13. State Abbr.	14. County
Two Harbors	0.7	MN	LAKE

15. Temperature (F)	16. Visibility	17. Weather	18. Type of Track
-12 ˚F	Day	Clear	Main

19. Track Name/Number	20. FRA Track Class	21. Annual Track Density *(gross tons in millions)*	22. Time Table Direction
Track No. 23	Freight Trains-25, Passenger Trains-30	23	South

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OPERATING TRAIN #1

1. Type of Equipment Consist:	2. Was Equipment Attended?	3. Train Number/Symbol
Freight Train	Yes	U 78982 04

4. Speed (recorded speed, if available) R - Recorded E - Estimated	Code	5. Trailing Tons (gross exluding power units)	6a. Remotely Controlled Locomotive? 0 = Not a remotely controlled operation 1 = Remote control portable transmitter 2 = Remote control tower operation 3 = Remote control portable transmitter - more than one remote control transmitter	Code
47 MPH	R	10813		0

6. Type of Territory

Signalization:

Not Signaled

Method of Operation/Authority for Movement:

Direct Train Control

Supplemental/Adjunct Codes:

Z, N/A

7. Principal Car/Unit	a. Initial and Number	b. Position in Train	c. Loaded (yes/no)	8. If railroad employee(s) tested for drug/alcohol use, enter the number that were positive in the appropriate box.	Alcohol	Drugs
(1) First Involved *(derailed, struck, etc.)*	DMIR 70801	6	yes		0	0
(2) Causing *(if mechanical, cause reported)*	DMIR 70801	6	yes	9. Was this consist transporting passengers?		No

10. Locomotive Units (Exclude EMU, DMU, and Cab Car Locomotives.)	a. Head End	Mid Train b. Manual	Mid Train c. Remote	Rear End d. Manual	Rear End e. Remote	11. Cars (Include EMU, DMU, and Cab Car Locomotives.)	Loaded a. Freight	Loaded b. Pass.	Empty c. Freight	Empty d. Pass.	e. Caboose
(1) Total in Train	5	0	0	0	0	(1) Total in Equipment Consist	107	0	0	0	0
(2) Total Derailed	0	0	0	0	0	(2) Total Derailed	76	0	0	0	0

12. Equipment Damage This Consist	13. Track, Signal, Way & Structure Damage
4912618	1057623

14. Primary Cause Code

M199 - Other extreme environmental conditions (Provide detailed description in narrative)

15. Contributing Cause Code

M199 - Other extreme environmental conditions (Provide detailed description in narrative)

Number of Crew Members				Length of Time on Duty	
16. Engineers/Operators	17. Firemen	18. Conductors	19. Brakemen	20. Engineer/Operator	21. Conductor
2	0	2	0	Hrs: 7 Mins: 15	Hrs: 7 Mins: 15

Casualties to:	22. Railroad Employees	23. Train Passengers	24. Others	25. EOT Device?	26. Was EOT Device Properly Armed?
				Yes	Yes
Fatal	0	0	0	27. Caboose Occupied by Crew?	
Nonfatal	3	0	0		No

28. Latitude	29. Longitude
47.018416200	-91.689910000

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FRA FACTUAL RAILROAD ACCIDENT REPORT

FRA File #HQ-2013-29

OPERATING TRAIN #2

1. Type of Equipment Consist:	2. Was Equipment Attended?	3. Train Number/Symbol
Cut of Cars	No	Yard Track Number 22

4. Speed (recorded speed, if available) R - Recorded E - Estimated	Code	5. Trailing Tons (gross exluding power units)	6a. Remotely Controlled Locomotive? 0 = Not a remotely controlled operation 1 = Remote control portable transmitter 2 = Remote control tower operation 3 = Remote control portable transmitter - more than one remote control transmitter	Code
0 MPH	E			0

6. Type of Territory

Signalization:

Not Signaled

Method of Operation/Authority for Movement:

Supplemental/Adjunct Codes:

7. Principal Car/Unit	a. Initial and Number	b. Position in Train	c. Loaded (yes/no)	8. If railroad employee(s) tested for drug/alcohol use, enter the number that were positive in the appropriate box.	Alcohol	Drugs
(1) First Involved *(derailed, struck, etc.)*	DMIR 70530	48	yes		0	0
(2) Causing *(if mechanical, cause reported)*	DMIR 70530	48	yes	9. Was this consist transporting passengers?		No

10. Locomotive Units (Exclude EMU, DMU, and Cab Car Locomotives.)	a. Head End	Mid Train b. Manual	Mid Train c. Remote	Rear End d. Manual	Rear End e. Remote	11. Cars (Include EMU, DMU, and Cab Car Locomotives.)	Loaded a. Freight	Loaded b. Pass.	Empty c. Freight	Empty d. Pass.	e. Caboose
(1) Total in Train	0	0	0	0	0	(1) Total in Equipment Consist	85	0	0	0	0
(2) Total Derailed	0	0	0	0	0	(2) Total Derailed	18	0	0	0	0

12. Equipment Damage This Consist	13. Track, Signal, Way & Structure Damage
1103891	0

14. Primary Cause Code

M199 - Other extreme environmental conditions (Provide detailed description in narrative)

15. Contributing Cause Code

M199 - Other extreme environmental conditions (Provide detailed description in narrative)

Number of Crew Members				Length of Time on Duty	
16. Engineers/Operators	17. Firemen	18. Conductors	19. Brakemen	20. Engineer/Operator	21. Conductor
0	0	0	0	Hrs: 0 Mins: 0	Hrs: 0 Mins: 0

Casualties to:	22. Railroad Employees	23. Train Passengers	24. Others
Fatal	0	0	0
Nonfatal	0	0	0

25. EOT Device?	26. Was EOT Device Properly Armed?	N/A
No		N/A

27. Caboose Occupied by Crew? N/A

28. Latitude	29. Longitude
47.021458000	-91.679707000

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CROSSING INFORMATION

Highway User Involved		Rail Equipment Involved
1. Type		5. Equipment
2. Vehicle Speed *(est. mph at impact)*	3. Direction *(geographical)*	6. Position of Car Unit in Train
4. Position of Involved Highway User		7. Circumstance
8a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? N/A		8b. Was there a hazardous materials release by N/A

8c. State here the name and quantity of the hazardous material released, if any.

9. Type of Crossing Warning	10. Signaled Crossing Warning	11. Roadway Conditions
1. Gates 4. Wig wags 7. Crossbucks 10. Flagged by crew 2. Cantilever FLS 5. Hwy. traffic signals 8. Stop signs 11. Other *(spec. in narr.)* 3. Standard FLS 6. Audible 9. Watchman 12. None N/A		N/A

12. Location of Warning	13. Crossing Warning Interconnected with Highway Signals	14. Crossing Illuminated by Street Lights or Special Lights
N/A	N/A	N/A

15. Highway User's Age	16. Highway User's Gender	17. Highway User Went Behind or in Front of Train and Struck or was Struck by Second Train	18. Highway User

19. Driver Passed Standing Highway Vehicle	20. View of Track Obscured by *(primary obstruction)*

Casualties to:	Killed	Injured	21. Driver was	22. Was Driver in the Vehicle?
23. Highway-Rail Crossing Users	0	0	24. Highway Vehicle Property Damage *(est. dollar damage)*	25. Total Number of Vehicle Occupants *(including driver)*

26. Locomotive Auxiliary Lights?	27. Locomotive Auxiliary Lights Operational?
N/A	N/A
28. Locomotive Headlight Illuminated?	29. Locomotive Audible Warning Sounded?
N/A	N/A

10. Signaled Crossing Warning

1 - Provided minimum 20-second warning
2 - Alleged warning time greater than 60 seconds
3 - Alleged warning time less than 20 seconds
4 - Alleged no warning
5 - Confirmed warning time greater than 60 seconds
6 - Confirmed warning time less than 20 seconds
7 - Confirmed no warning
N/A - N/A

Explanation Code

A - Insulated rail vehicle
B - Storm/lightning damage
C - Vandalism
D - No power/batteries dead
E - Devices down for repair
F - Devices out of service
G - Warning time greater than 60 seconds attributed to accident-involved train stopping short of the crossing, but within track circuit limits, while warning devices remain continuously active with no other in-motion train present
H - Warning time greater than 60 seconds attributed to track circuit failure (e.g., insulated rail joint or rail bonding failure, track or ballast fouled)
J - Warning time greater than 60 seconds attributed to other train/equipment within track circuit limits
K - Warning time less than 20 seconds attributed to signals timing out before train's arrival at the crossing/ island circuit
L - Warning time less than 20 seconds attributed to train operating counter to track circuit design direction
M - Warning time less than 20 seconds attributed to train speed in excess of track circuit's design speed
N - Warning time less than 20 seconds attributed to signal system's failure to detect train approach
O - Warning time less than 20 seconds attributed to violation of special train operating instructions
P - No warning attributed to signal systems failure to detect the train
R - Other cause(s). Explain in Narrative Description

SYNOPSIS

On December 5, 2013, at 1:15 p.m., CST, Canadian National Railway (CN) Taconite Train U-78982-04 derailed the leading 76 cars of its train on the Iron Range Subdivision at Milepost 0.7, CN (U789), while operating southward and entering a yard track from the main track (other than main track authority); with 107 loads, 0 empties, 10,813 tons, and 5 locomotives, at Two Harbors, Minnesota. As a result of the derailment, an additional 18 loaded taconite cars on an adjacent yard track were struck and subsequently derailed. Seventy four of the 76 derailed cars on U789, and 17 of the 18 standing cut of cars on yard track were destroyed. The timetable direction and actual direction is south. Timetable direction will be used throughout this report.

The weather at the time of the accident was stated to be of an 'extreme' nature. The temperature was -13 degrees F and a snow storm had recently deposited about 3 feet of snow throughout the area. As a result of the accident, three crew members received non-life threatening injuries. There was no hazardous material released; no fire or explosion. Damages were reported to be $6,016,509 to equipment, and $1,057,623 in track, signal, and structures.

The probable cause of the accident was a lack of operative braking due to ice and snow buildup on the wheels due to extreme weather conditions.

NARRATIVE

Circumstances Prior to the Accident

The train crew of Train U-78982-04 (U789) included a Locomotive Engineer and a Conductor. They reported for duty at 11:59 p.m., on Wednesday, December 4, 2013, at Canadian National Railway's (CN) Two Harbors Yard. This was the home terminal for both crew members. The Engineer had been off duty for 18 hours and 44 minutes, and the Conductor had 125 hours and 29 minutes before reporting for the assignment.

Train U789 originally consisted of three locomotives: DMIR 407, BLE 909, and CN 6021, and 107 empty ore cars, 2,547 tons, and was 2,568 feet long. The train crew was provided an air slip upon the completion of the Class I brake test, which was performed using yard air by a carman. The train crew then coupled the engines to the train and connected the train line brake system and the Orinoco brake system (straight air). After completing the train air brake continuity test, the Engineer charged the Orinoco braking system. The Conductor confirmed that the brake pistons applied as a result. The Engineer stated that the end-of-train device (EOT) reflected the Orinoco brake system was charged. The practice of testing the Orinoco braking system does not include the carman at this location, nor is it part of the initial terminal air brake test, and is primarily completed by the train crews prior to departure.

The Orinoco braking system is a braking system which, when applied, acts as a retaining system that is unique to this type of operating environment – heavy loaded ore trains and significant grades, and allows the Engineer to recharge the automatic brake system. As determined in CN rules, this particular brake test when completed by the train crew is meant to determine the need for the number of individual ore car retainers that may need to be set prior to operating the train down the descending grades.

At 1:45 a.m., Train U789 departed Two Harbors Yard to go to the Minntac mine for loading. The middle locomotive was tagged as having an inoperative dynamic braking feature prior to departure. The Engineer stated that during this portion of the trip, he had an opportunity to utilize both the train brake system and the Orinoco braking system. The Engineer reported that there were no exceptions taken to the train brake handling and the trip was proceeding normally.

Upon completion of loading, the train was operating with the three aforementioned locomotives, 107 loads, zero empties, 10,813 tons, and a length of 2,568 feet. During the return trip to Two Harbors Yard, the Engineer operated the train through undulating territory and felt the train was responding properly to the various applications of train air brake, dynamic brake and Orinoco braking.

Prior to cresting the hill and beginning the descent (some portions at 2.9 percent) into Two Harbors Yard, the Engineer began to condition the train brakes by using the Orinoco braking system. At approximately Milepost (MP) 8.48 operating at 32 mph with a 1.3-percent descending grade, and with 24 psi of Orinoco straight air applied into the system, and with dynamic braking at 255 amperes (amps), the Engineer made a train air brake system reduction of 8 psi for a distance of approximately ½-mile to MP 8.03.

The train speed continued to increase and the Engineer began to take corrective actions by further applying the train air brake system, increasing the Orinoco air brake, and increasing the amperage of the dynamic braking system. At MP 5.82, at a speed of 41.7 mph, in a maximum 35 mph speed segment of track, and on a now descending grade of 1.38 percent, the Engineer felt the train was no longer under control and initiated an emergency application of the train air brake system. At the time of the emergency application, the train air brake system pressure was recorded at 61 psi, with the Orinoco braking system at 36 psi and the dynamic braking effort at 255 amps. At this time, the Conductor of Train U789 contacted CN's Rail Traffic Coordinator (RTC) and notified him that they had a runaway train as they were unable to stop.

The lead locomotive of Train U789 did come to a stop at 11:21 a.m., at MP 3.13, at the beginning of the 2.9-percent descending grade, and a distance of 3 miles remaining until the beginning of Two Harbors Yard.

After stopping, the Conductor contacted the RTC and notified him that they had stopped and provided them with their location. After a discussion between the train crew, the RTC and the Two Harbors Yardmaster, and considering the crew's limited hours of service time remaining, and there being no vehicular access, it was decided that a relief yard crew, YTH10805 (YTH108), would be dispatched with two additional locomotives to MP 3.13. The original train crew of Train U789 expired on their hours of service at 11:59 a.m., and remained on the train. The relief crew, YTH108 was dispatched from Two Harbor Yard with two locomotives to couple to the head-end of U789. The relieving Engineer and Conductor had reported for their assignment at Two Harbors at 6:00 a.m. The Engineer had been off duty for 11 hours and 50 minutes and the Conductor was off duty for 19 hours and 1-minute prior to reporting for duty.

The relief crew proceeded to the train's location and coupled the two additional locomotives, DMIR 405 and CN 5337, to the locomotive consist of Train U789 and the relief-Conductor connected the train line, and Orinoco brake system. The relief-Engineer attached the M-U cable between the locomotives. The air was cut in at approximately 12:42 p.m. The event recorder information retrieved from DMIR 405, now in the lead, reflected that a train air brake test was conducted with a 14 psi brake pipe reduction while standing. This crew did not, however, conduct a locomotive brake test after the addition of DMIR 405 and CN 5337 to the original locomotive consist. The relief-Engineer stated that he did not hear any air leaks after the air connections were completed. The relief-Engineer also stated that he removed the 'Head-End-Device' (HED) from the original lead locomotive and installed the device on DMIR 405, to allow him to have communication with the train's end-of-train device.

The relief-Engineer noted that the Orinoco straight air was showing 32 psi on the rear end of the train (the download event recorder captured the actual Orinoco set at 35 psi). He also stated that the HED reflected there was 89 psi on the rear of the train line, before he made a set to check continuity through the train line. After he saw the rear pressure drop with the set, he released the train line brakes and began charging the system.

The Accident

At 12:56 p.m., in a 20 mph maximum authorized speed segment of track, and after completing the restoration of the train air brake system, the train air brake pipe pressure reflected 91 pounds, and an Orinoco straight air set of 13 pounds, the relief-Engineer initiated train movement by placing the throttle into run position 1. As Train U789 started to move down the hill, the relief-Engineer gradually and continuously, increased the Orinoco straight air brake pipe pressure to a final setting of 38 pounds, beginning at 2.4 mph. At 12:56 p.m., throttle position was reduced to 0 and remained in that position for the duration of the trip. At 12:57 p.m., and a speed of 2.4 mph, dynamic braking was initiated, locomotive brake cylinder pressure registered 5 psi, with no application of the train air brake system.

At 12:57 p.m., and a speed of 3.8 mph, locomotive brake cylinder pressure was released to 0 psi, dynamic braking was increased to 229 amps with no train air brake application. At MP 2.88 at 12:59 p.m., and a speed of 10.9 mph, the initial train air brake application was made; dynamic braking effort had increased to 612 amps and the Orinoco straight air set remained at 38 psi. At MP 2.43 at 1 p.m., train speed had increased to 22.5 mph within a 20 mph maximum authorized speed segment, train air brake pressure had been reduced to below 61 psi, Orinoco straight air system remained at 38 psi, and the dynamic braking effort recorded remained at 612 amps.

When lead locomotive DMIR 405 was located at MP 2.08 at 1:01 p.m., and the entire train on a descending grade between 2.65 percent and 2.9 percent, and a recorded speed of 28.7 mph, Train U789's train brake system was placed into an emergency application by the relief-Engineer. Train brake pipe pressure at the time of the emergency application was recorded to be 51 psi with 38 psi still applied to the Orinoco straight air brake system, and the dynamic braking effort 306 amps.

At MP 1.37 at 1:02 p.m., train speed had increased to 39.5 mph and the locomotive independent brake cylinder pressure was applied and increased to 70 pounds. At this time, the relief-Engineer notified the Two Harbors Yardmaster and informed him of their runaway train. About this time the relief crew exited the locomotive cab of DMIR 405 and jumped from the train. The original train crew, remained on-board the train in the third locomotive, the DMIR 407, until its final stopping point.

Train U789, with the controlling locomotive cab now unoccupied, continued to gain speed as it traversed a 6-degree right-hand curve with switches lined for yard Track Number 23. At MP 0.70 at a speed of 47 mph, the lead car, DMIR 70801, disengaged from the broken coupler of trailing locomotive CN 6021 derailed and initiated the general derailment. An additional 18 cars of an 85-car cut of loaded taconite cars on adjacent yard Track Number 22 were impacted and also derailed.

All five locomotives remained on the track and came to a stop approximately 1,000 feet beyond.

Both the relief-Engineer and Conductor, after exiting DMIR 405, sustained non-life threatening injuries and were transported to a local medical facility for treatment. The original Engineer and Conductor remained on the train. The original Engineer did not report any injuries. The original Conductor reported minor non- life threatening injuries and was seen and treated at a local medical facility.

Analysis and Conclusions

Analysis – Toxicology Testing: The relief crew's Engineer and Conductor were Post Accident Toxicological Tested under Title 49 Code of Federal Regulations Part 219, Subpart C. Test results were negative for both the relief-Engineer and relief-Conductor.

Conclusion: Drug use of the relief crew was not a factor.

Analysis – Fatigue: The Federal Railroad Administration (FRA) obtained information for the 10-day period preceding the derailment. The information included a 10-day work/rest history for the relief-Engineer and relief-Conductor on duty at the time of the derailment.

Conclusion: FRA concluded that fatigue was not a factor for the relief crew, and not a contributing factor in this incident.

Analysis – Locomotive Engineer Operating Performance: The lead locomotive, DMIR 405, was equipped with an event recorder as required. The relevant data was downloaded and reviewed by CN officials and FRA inspectors.

Conclusion: The relief-Engineer did not conduct the required locomotive air brake test when adding locomotives, as prescribed by CN's ABTH Rules 5th Edition - Rule Number 114 and was in noncompliance for this railroad rule. Additionally, as required by CN's ABTH Rules 5th Edition – Rule Number 328(3), Mountain and Heavy Grade, states; "If the speed of the movement exceeds the maximum authorized speed by 5 mph, the movement must be brought to an immediate stop (including an emergency stop if necessary). Movement must not proceed until it is determined that adequate braking performance is restored. By timetable, the segment of track where the emergency application was initiated was a maximum authorized speed of 20 mph. In addition to ABTH Rule 328(3), CN Timetable Number 4 – Two Harbors Hill Restrictions (MP 3.5 to 0.5) - requires that trains descending the grade must immediately be brought to a stop (if necessary, using an emergency application from both the head end and rear end) and secured, under any of the following circumstances:

• If there is any doubt about the ability to safely control train speed
• Train speeds reach 25 mph
• Rear brake pipe pressure falls below 50 psi
• There is an indication an undesired release may be occurring

Based on DMIR 405's event recorder download data, the relief-Engineer did not take additional braking measures until the speed of the train had reached 28.7 mph. Additional download data reflects that no attempt was made to initiate an emergency application from the rear end of the train as prescribed by rule and is in noncompliance for this railroad instruction.

Analysis – Mechanical: The mechanical condition of the equipment involved and document review of this derailment provided the following information:

Train U789, at the time of the derailment, consisted of five locomotives, 107 loads, and 0 empties, operating with 10,813 tons for a length of 2,568 feet. An initial terminal air brake test had been completed, and an air brake slip provided to the train crew on December 4, 2013, prior to departure.

The lead locomotive, DMIR 405, is an EMD SD40-3 built in 1972 and has a 26L air brake system. The last periodic inspection was recorded on FRA 6180-49A as having been performed at Proctor, Minnesota, on September 5, 2013.

The second locomotive, CN 5337, is an EMD SD40-2 built in 1980 and has a 26LUM air brake system. The last periodic inspection was recorded on FRA 6180-49A as having been performed at Proctor on October 25, 2013.

The third locomotive, CN 407, is an EMD SD40-3 built in 1972 and has a 26L air brake. The last periodic inspection was recorded on FRA 6180-49A as having been performed on November 11, 2013.

The fourth locomotive, BLE 909, is an EMD SD40-3 built in 1973 and has a 26L air brake system. The last periodic inspection was recorded on FRA 6180-49A as having been performed on November 12, 2013.

The fifth locomotive, CN 6021, is an EMD SD40-3 built in 1995 and has a 26LUM air brake system. The last periodic inspection was recorded on FRA 6180-49A as having been completed on October 4, 2013.

The inspection of Train U789's derailment site on December 5, 2013, and December 6, 2013, found that the first 76 cars immediately trailing the locomotive consist derailed, completely destroying 74 of the 76 cars involved. In addition to the 76 derailed cars of Train U789, 18 cars of a standing 85-car cut of loaded taconite cars was struck by Train U789 derailed on adjacent Track Number 22. Seventeen of those 18 cars were destroyed.

An inspection was completed on Train U789's 31 remaining rear cars. Three defective conditions were noted, however, none are considered to be a contributing factor of the derailment. However, inspection did reveal ice and snow buildup on the treads of the wheels of the cars that did not derail; this coupled with the short distance from point at which the relief crew assumed control of the train, may prevented the brakes from applying with full retarding force and contributed to the loss of control of the train.

The five locomotives involved in this incident were mechanically inspected. Fourteen defective conditions were noted. Two of the identified defects were attributed to the derailment, and the remaining 12 defects identified are not considered to be a contributing factor. A records review of the five locomotives resulted in no defects found.

Conclusion: No components of the cars or locomotives inspected were contributed to this derailment.

Analysis – The inspection of the track, structures, and document review provided the following information: The lead track leading into Two Harbors Yard is FRA Class 2, and is comprised of a combination of continuous welded rail and jointed rail, and it encompasses three Number 9 switches. A review of CN required track inspection records reflect that recent inspections, both by hi-rail and walking, had been completed on the Main Track leading into Two Harbors Yard, as well as Yard Tracks Numbers 22 and 23, and included mainline and yard turnouts, and crossovers. Records show that mainline hi-rail inspections were conducted on the Iron Range Subdivision, from MP 0.70 to MP 13.27, on December 1, 2013, and December 4, 2013. The same records also reflect the turnouts located at MP 0.70 and Two Harbors Junction. (0.71) received walking inspections on December 1, 2013. Additional records indicate that both Yard Tracks Numbers 22 and 23 received walking inspections on November 26, 2013.

At the point of derailment, the vertical alignment is a 6-degree right-hand curve as viewed for the direction of travel south. At MP 1.0 the descending grade, traveling north to south is 2.6-degree leading into a .50 descending grade at the point of derailment at MP 0.70.

Conclusions: No track structure was found to have contributed to the cause of this derailment.

Overall Conclusions: During the investigation, it was found that there were minimal human factor deficiencies identified and no mechanical, track, or signal contributing factors to this accident. With the exception of two deficiencies noted above in this report, the train crew operated the locomotive and handled this train in compliance with all applicable Federal regulations and CN operating rules.

The probable cause of the accident was a lack of operative braking due to ice and snow buildup on the wheels due to extreme weather conditions.