Federal Railroad Administration
Office of Railroad Safety
Accident and Analysis Branch

Accident Investigation Report
HQ-2014-1

Wisconsin Central Ltd. (WC)
Fairbanks, MN
February 24, 2014

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-2014-1

TRAIN SUMMARY

1. Name of Railroad Operating Train #1	1a. Alphabetic Code	1b. Railroad Accident/Incident No.
Wisconsin Central Ltd. (also Railway)	WC	805789

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	805789
2. U.S. DOT Grade Crossing Identification Number	3. Date of Accident/Incident	4. Time of Accident/Incident
	2/24/2014	6:00 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	North

11. Nearest City/Town	12. Milepost *(to nearest tenth)*	13. State Abbr.	14. County
Fairbanks	32.7	MN	ST LOUIS

15. Temperature (F)	16. Visibility	17. Weather	18. Type of Track
5 °F	Dusk	Clear	Main

19. Track Name/Number	20. FRA Track Class	21. Annual Track Density *(gross tons in millions)*	22. Time Table Direction
Iron Range Main	Freight Trains-40, Passenger Trains-60	23.32	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 78981-24

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
30 MPH	R	11138		0

6. Type of Territory

Signalization:

Signaled

Method of Operation/Authority for Movement:

Direct Train Control

Supplemental/Adjunct Codes:

N

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 403	1	yes		0	0
(2) Causing *(if mechanical, cause reported)*	DMIR 403	1	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	2	0	0	0	0	(1) Total in Equipment Consist	116	0	0	0	0
(2) Total Derailed	2	0	0	0	0	(2) Total Derailed	50	0	0	0	0

12. Equipment Damage This Consist	13. Track, Signal, Way & Structure Damage
3526458	250000

14. Primary Cause Code

H220 - Fixed signal (other than automatic block or interlocking signal), failure to comply.

15. Contributing Cause Code

T319 - Switch point gapped (between switch point and stock rail)

Number of Crew Members				Length of Time on Duty	
16. Engineers/Operators	17. Firemen	18. Conductors	19. Brakemen	20. Engineer/Operator	21. Conductor
1	0	1	0	Hrs: 4 Mins: 47	Hrs: 4 Mins: 47

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	1	0	0		N/A

28. Latitude	29. Longitude
47.380959000	-91.931235000

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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			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

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SYNOPSIS

On February 24, 2014, at 6:17 p.m., CST, Wisconsin Central Ltd. (WC) Train Number U78981-24, operating southbound on single main track, on WC's Iron Range Subdivision, derailed two locomotives and 50 loaded taconite hopper cars at Milepost 32.7. The derailment occurred near Fairbanks, Minnesota, on the north siding switch (NSS) of the Fairbanks Siding.

Wisconsin Central Ltd. is a subsidiary of the Canadian National Railway (CN) and will be referred to as CN throughout this report.

One member of the two-person train crew sustained non-life-threatening injuries and was treated at a nearby hospital and released. Total estimated damages were $3,776,458 with $3,526,458 in locomotive and rail car damage and $250,000 for track and signal.

At the time of the accident, it was clear with moderate northwest winds. The temperature was 5 degrees F with approximately 30 inches of fresh snow on the ground.

The probable cause of the derailment was failure of the train crew to stop short of a fixed signal displaying a stop indication for a spring switch that was gapped open due to snow and ice build-up between the switch point and stock rail.

NARRATIVE

At the time of the incident, the crew of U78981-24 included a locomotive engineer and a conductor. The crew was called at 11:30 a.m., to re-crew the unit ore train. They reported for duty at 1:30 p.m., February 24, 2014, at Canadian National Railway's (CN) Proctor Yard in Proctor, Minnesota. This was the home terminal for both crew members, and both received more than the statutory off-duty period prior to reporting for duty. Both crew members had 30 or more hours off duty prior to this assignment.

Their assigned freight train consisted of 2 locomotives and 116 loaded hopper cars of taconite ore pellets. It was 2,921 feet long, and weighed 11,138 tons. The train started out empty as U78881-24 on the morning of February 24, 2014, and received a Class 1 terminal train air brake test at Two Harbors Yard at 6:30 a.m. The train traveled to Minntac mine, was loaded, and started its return trip to Two Harbors as U78981-24. The train stopped on the Biwabik Siding, approximately Milepost 58.6 (MP), to change crews at approximately 4:30 p.m. While at Biwabik, a northbound train passed on the main track. The relief crew for U78981-24 was briefed by the original crew, and then departed on signal indication at approximately 4:35 p.m. While passing Nugget, MP 47.8, the Conductor copied a track authority from Allen Junction to the north siding switch Highland.

Prior to passing Train U78981-24 at Biwabik, the northbound train went into the siding at Fairbanks to meet another southbound train. After the meet, the northbound train trailed through the spring switch on the north end of the siding. This switch is equipped with a switch point indicator with a distant signal for southbound traffic.

As the southbound U78981-24 approached the accident area, the Locomotive Engineer was seated at the controls on the west side and the Conductor was seated on the east side of the leading locomotive cab facing forward.

In this area of the railroad, traveling southbound, there is a right-hand, 3-degree curve approximately 500 feet long, followed by a stretch of tangent of approximately 2.7 miles to the point of the accident, and 1.7 miles beyond. Approaching the location of the derailment is a 0.5-mile section of 1.51-percent descending grade, followed by a 0.8-mile stretch of 0.47-percent ascending grade, followed again by 0.3 miles of 0.82-percent descending grade and is flat for 0.6 miles to the point of derailment (POD). This area is single main track and the accident occurred during a facing point move over the NSS Fairbanks.

The railroad timetable direction of the train was south. The geographic direction was southeast. Timetable directions are used throughout this report.

THE ACCIDENT

Approaching the accident area, the train was being operated in throttle position eight in excess of one-half hour, unable to reach the maximum authorized speed. As U78981-24 crested the hill near MP 35.5, at 14 mph, the Engineer reduced the throttle to position zero. No brakes were applied as the train descended the hill. It reached a maximum speed of 36 mph and began to decelerate prior to passing the distant signal located at MP 33.7, the location of the switch point indicator at the NSS Fairbanks. At the time the accident occurred, the recorded speed was 29.9 mph. The maximum authorized speed for freight trains was 40 mph with a permanent speed restriction of 35 mph between MP 33 and MP 30, as designated in the current CN Timetable Number 4.

When the lead locomotive passed over the north siding switch at MP 32.7, the Engineer felt the locomotive tilt to the right, alerting him that they had derailed, and he initiated an emergency brake application. The Engineer dialed 911 on the radio while still in motion, but did not receive a response. Once the train had come to a stop approximately 400 feet south of the switch, the Conductor called the rail traffic controller (RTC) by radio, and did not receive a response. The Conductor then called the Two Harbors Yardmaster and alerted him of the derailment.

The Conductor dismounted the locomotive on the east side and attempted to walk the train, but the snow was too deep. He went to the west side and noted that both locomotives had derailed along with numerous cars immediately behind the power. He walked back to the switch and saw two rail cars that were still on the track and on top of the turnout. He said the switch points appeared to be properly lined and the switch point indicator displayed a green aspect.

Two maintenance-of-way employees were the first on the scene and approached the crew to inquire about their wellbeing. A Trainmaster arrived at the scene and transported the crew to a hospital in Two Harbors. The Conductor was given a prescription medication for pain and released with no restrictions. The Engineer was given a CT scan and was released with no prescriptions or restrictions.

The accident occurred in a remote area and no fire or police department responders were dispatched. There was no release of hazardous materials and no evacuations ordered.

ANALYSIS AND CONCLUSIONS

Analysis – Toxicological testing: The accident met the criteria for Title 49 Code of Federal Regulations Part 219, Subpart C, Post Accident Toxicological Testing. The train crew members were tested under this authority. The test results for both crew members were negative.

The Federal Railroad Administration (FRA) reviewed the toxicology reports from CN and noted six exceptions in the process and paperwork of the toxicology testing performed by CN.

Conclusion: Impairment of the crew was not a causal factor in this accident.

Analysis – Fatigue: FRA used a fatigue analysis software program to create an analysis model for each crew member's overall effectiveness rate at the time of the accident. This model was produced through calculations made using the collected work/rest data from each of the crew members.

FRA uses an overall effectiveness rate of 77.5 percent as the baseline for fatigue analysis, which is equivalent to a blood alcohol content (BAC) of 0.05. At or above this baseline, we do not consider fatigue as probable for any employee. Software sleep settings vary according to information obtained from each employee. If an employee does not provide sleep information, FRA uses the default software settings.

FRA obtained fatigue-related information, including a 10-day work history, for two employees involved in this accident.

1. Locomotive Engineer assigned to Train U78981-24
Sleep setting: Excellent
Overall effectiveness: 93.84%
Lapse Index: 0.9
Reaction Time: 106%
Chronic Sleep Debt: 3.83
Hours of Continuous Wakefulness: 9.30
Time of Day (military): 18:17
BAC Equivalent: < 0.05
Conclusion: Fatigue was not probable for this employee.

2. Conductor assigned to Train U78981-24
Sleep setting: Excellent
Overall effectiveness: 99.04%
Lapse Index: 0.2
Reaction Time: 100%
Chronic Sleep Debt: 3.51
Hours of Continuous Wakefulness: 8.30
Time of Day (military): 18:17
BAC Equivalent: < 0.05

BAC Equivalent: < 0.05
Conclusion: Fatigue was not probable for this employee.

Conclusion: Fatigue of the crew members was not a causal factor in this derailment.

Analysis – Event Recorder: FRA analyzed the event recorder data provided by CN for Lead Locomotive DMIR 403. The event recorder data prior to the derailment suggested that train handling was in accordance with proper train handling procedures.

The maximum authorized speed for the subdivision was 40 mph. The maximum authorized speed at the location of the derailment was 35 mph. The lead locomotive was in idle throttle position travelling at 29.9 mph at MP 32.7 when the independent brake was applied. Four seconds later, at a speed of 28.9 mph, an emergency application of the train brakes occurred at MP 32.67.

Conclusion: Improper train handling was not a causal factor in this derailment.

Analysis – Mechanical: A proper Class 1 air brake test was performed at 6:30 a.m., on February, 24, 2014, by the mechanical department at Two Harbors. After receiving the air test, no additional cars were picked up or set out prior to the accident.

All flanges on the locomotives involved in the accident were in good condition. FRA reviewed the relevant records for the equipment involved in the incident and took no exceptions.

The locomotives involved in the incident were not equipped with cameras.

Conclusion: The mechanical condition of the equipment was not a causal factor in this derailment.

Analysis – Track Structure: Track measurements taken after the derailment showed the track geometry to be in compliance for the class of track. FRA's post-accident inspection of the track noted no FRA Part 213 deficiencies approaching the track damaged by the derailment.

The last track inspection prior to the accident was performed by a qualified CN track inspector on February 19, 2014, and no defects were noted within the area of the derailment. The last detailed switch inspection of the NSS Fairbanks was February 5, 2014, with one defect recorded. The inspector noted the point on the frog casting was cracked and required maintenance grinding. The defective condition noted on the frog casting was south of the POD and was not a contributing factor.

The NSS at Fairbanks was a number 11 right-hand spring switch constructed with wood crossties and 136-pound continuous welded rail (CWR) with Sampson undercut switch points and floating heel blocks. The track leading up to the derailment is constructed of wood crossties and 136-pound CWR.

The investigation revealed no sign of a blunt-force strike to the tip of the switch point. Wheel marks on the west stock rail trailed to the gage side and left scuff marks where the west wheels dropped off the other rail while the east wheels were still on the stock rail. The POD was just south of the number 3 switch rod. Wheel marks were left in the snow and ice between the west switch point and stock rail, over the heel block and continued south. These marks indicated that there was likely a significant gap between the west switch point and stock rail at the time the leading wheels traversed the point of switch and allowed the wheel flanges to go behind the west switch point.

There were few wheel marks between the west switch point and stock rail, indicating that after the leading wheels traversed the switch and derailed, the spring likely fully lined the west switch point to the stock rail and the remaining wheels traveled, as intended, through the straight side of the turnout and derailed south of the turnout.

The track south of the turnout was entirely destroyed as a result of the derailment; the turnout was mostly intact. The guard rail on the main track was severely damaged. The broken rail ends south of the frog displayed torsion-type fractures, indicating they were a result rather than a cause of the derailment.

During the investigation after the derailment, snow was covering most of the track structure up to the ball of the rail. The switch was equipped with a propane switch heater to help keep the switch point area clear of snow and ice. Although the switch was equipped with a switch heater, which was operational after the derailment, the investigation revealed the presence of ice and snow build-up between the switch points and stock rails.

CN United States Operating Rule (USOR) Number 706 states, in part, "During snow or ice storms or other conditions that may prevent a spring switch from functioning properly, avoid making a trailing movement through the switch until it has been lined by hand." The last train through this area prior to U78981-24 was a northbound train that went into the Fairbanks Siding to meet a southbound train and came out of the north siding switch to return to the main track. CN officials stated that the northbound train did not hand-line the switch. The investigation revealed that it was likely that conditions existed at the time of the accident that prevented the spring switch from functioning properly.

Conclusion: Post-accident investigation concluded that it was likely that snow and ice prevented the spring switch from closing completely after the northbound train trailed through the spring switch. This left the switch point gapped open, contributing to the cause of the derailment.

Analysis – Signal: The area of the derailment is non-signaled "dark territory" where the method of operation is USOR Track Authority and all movements are governed by the RTC in Homewood, Illinois.

There is a switch point indicator at the NSS Fairbanks with a signal at the switch and a distant signal with a "D" marker at a distance of 1-mile. Both signals display the same aspect simultaneously and are situated such that if in the right location, both signals can be viewed at the same time. When the switch is properly lined for main track to main track movement, both signals will display a green aspect. When the switch is lined for the siding, or is improperly lined, both signals display a dark aspect with no illumination. The signal aspects from this switch point indicator are not recorded. This is considered a non-conventional application which is not covered by FRA Part 236 regulations. It is considered a signal arrangement and therefore not considered to be part of a signal system.

CN USOR Numbers 845 through 849 prescribe the signal aspects to expect on distant signals marked with a "D" marker attached to the mast. A dark aspect with no illumination is not on this list of designated aspects. The distant signal with a "D" marker located at MP 33.7 was designed to provide only a green or a dark aspect.

The last signal test performed prior to the derailment was a monthly obstruction test completed on February 3, 2014, during which no defects were noted. Tests performed on the switch point indicator and spring switch buffer following the derailment showed the system to be working as intended. Review of CN signal trouble tickets revealed no recent reports of snow or ice obstructions at NSS Fairbanks.

Conclusions: The signal aspects designed to be displayed at the NSS Fairbanks were not congruent with CN USOR rules; however, the signal arrangement was working as intended and is not considered to be a causal factor of the derailment.
Analysis – Signal Aspect Observance: FRA conducted interviews with the Engineer and Conductor of the derailed train. Both employees stated they were familiar with the Iron Range Subdivision and felt comfortable traversing it. Neither employee remembers announcing the signal aspect for the switch point indicator for the NSS Fairbanks; only one recalled the existence of a distant signal at that location. One stated that it is uncommon for crews to communicate the aspect of switch point indicator signals within the lead locomotive, unless a supervisor is on-board.

USOR Number 104 discusses the duties of all crew members in the controlling locomotive and requires crew members to communicate the name of signals affecting their movement and announce any change in their aspect.

USOR Number 701 discusses switches equipped with a switch point indicator and states that when a red or dark aspect is displayed that employees must stop and inspect the switch. Signal testing showed the switch point indicator and the spring mechanism were operating as intended and would display a dark aspect when the switch point was gapped open. Post-accident investigation concluded that the switch point was likely gapped significantly at the time of the derailment and therefore, the signal likely displayed a dark aspect. There was no evidence in the event recorder data that the Engineer stopped or made a brake application immediately prior to the derailment. Both employees stated that the signal aspects could be either green or red, and not dark, even though the signal arrangement only allows for green or dark aspects at the location of the accident.

Conclusion: Train crew's noncompliance with observing and obeying fixed signals was the primary cause of the derailment.

Probable Cause and Contributing Factors

The probable cause of the derailment was failure of the train crew to stop short of a fixed signal displaying a stop indication for a spring switch that was gapped open due to snow and ice build-up between the switch point and stock rail.