Federal Railroad Administration
Office of Railroad Safety
Accident and Analysis Branch

Accident Investigation Report
HQ-2014-1042

Canadian National - North America (CN)
Joilet, IL
December 13, 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 #R4-2014-1042

TRAIN SUMMARY

1. Name of Railroad Operating Train #1	1a. Alphabetic Code	1b. Railroad Accident/Incident No.
Canadian National - North America	CN	835171
2. Name of Railroad Operating Train #2	**2a. Alphabetic Code**	**2b. Railroad Accident/Incident No.**
Canadian National - North America	CN	835171

GENERAL INFORMATION

1. Name of Railroad or Other Entity Responsible for Track Maintenance	1a. Alphabetic Code	1b. Railroad Accident/Incident No.
Canadian National - North America	CN	835171
2. U.S. DOT Grade Crossing Identification Number	**3. Date of Accident/Incident**	**4. Time of Accident/Incident**
	12/13/2014	9:37 AM

5. Type of Accident/Incident
Rear End Collision

6. Cars Carrying HAZMAT	7. HAZMAT Cars Damaged/Derailed	8. Cars Releasing HAZMAT	9. People Evacuated	10. Subdivision
122	3	0	0	Leighton

11. Nearest City/Town	12. Milepost *(to nearest tenth)*	13. State Abbr.	14. County
Joilet	0.15	IL	WILL

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

19. Track Name/Number	20. FRA Track Class	21. Annual Track Density *(gross tons in millions)*	22. Time Table Direction
Main Track No. 2	Freight Trains-40, Passenger Trains-60	60	South

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OPERATING TRAIN #1

1. Type of Equipment Consist:	2. Was Equipment Attended?	3. Train Number/Symbol
Freight Train	Yes	A404-81-11

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
17 MPH	R	10987		0

6. Type of Territory

Signalization:

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.)*	CN 8877	1	no		0	0
(2) Causing *(if mechanical, cause reported)*	n/a	0	no	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	75	0	36	0	0
(2) Total Derailed	0	0	0	0	0	(2) Total Derailed	0	0	0	0	0

12. Equipment Damage This Consist	13. Track, Signal, Way & Structure Damage
150000	0

14. Primary Cause Code

H222 - Automatic block or interlocking signal displaying other than a stop indication - failure to comply.*

15. Contributing Cause Code

H605 - Failure to comply with restricted speed in connection with the restrictive indication of a block or interlocking signal.

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: 7 Mins: 7	Hrs: 7 Mins: 7

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	2	0	0		N/A

28. Latitude	29. Longitude
41.542030000	-88.060250000

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OPERATING TRAIN #2

1. Type of Equipment Consist:	2. Was Equipment Attended?	3. Train Number/Symbol
Freight Train	Yes	U738-51-07

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	R	13858		0

6. Type of Territory

Signalization:

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.)*	CN 8958	100	no		0	0
(2) Causing *(if mechanical, cause reported)*	N/A	0	no	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	1	0	(1) Total in Equipment Consist	100	0	0	0	0
(2) Total Derailed	0	0	0	1	0	(2) Total Derailed	4	0	0	0	0

12. Equipment Damage This Consist	13. Track, Signal, Way & Structure Damage
433503	13619

14. Primary Cause Code

H222 - Automatic block or interlocking signal displaying other than a stop indication - failure to comply.*

15. Contributing Cause Code

H605 - Failure to comply with restricted speed in connection with the restrictive indication of a block or interlocking signal.

Number of Crew Members

16. Engineers/Operators	17. Firemen	18. Conductors	19. Brakemen
1	0	1	0

Length of Time on Duty

20. Engineer/Operator	21. Conductor
Hrs: 6 Mins: 50	Hrs: 6 Mins: 50

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?	27. Caboose Occupied by Crew?
Yes	Yes	No

28. Latitude	29. Longitude
41.542030000	-88.060250000

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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?		8b. Was there a hazardous materials release by
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		

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

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?

28. Locomotive Headlight Illuminated?	29. Locomotive Audible Warning Sounded?

10. Signaled Crossing Warning

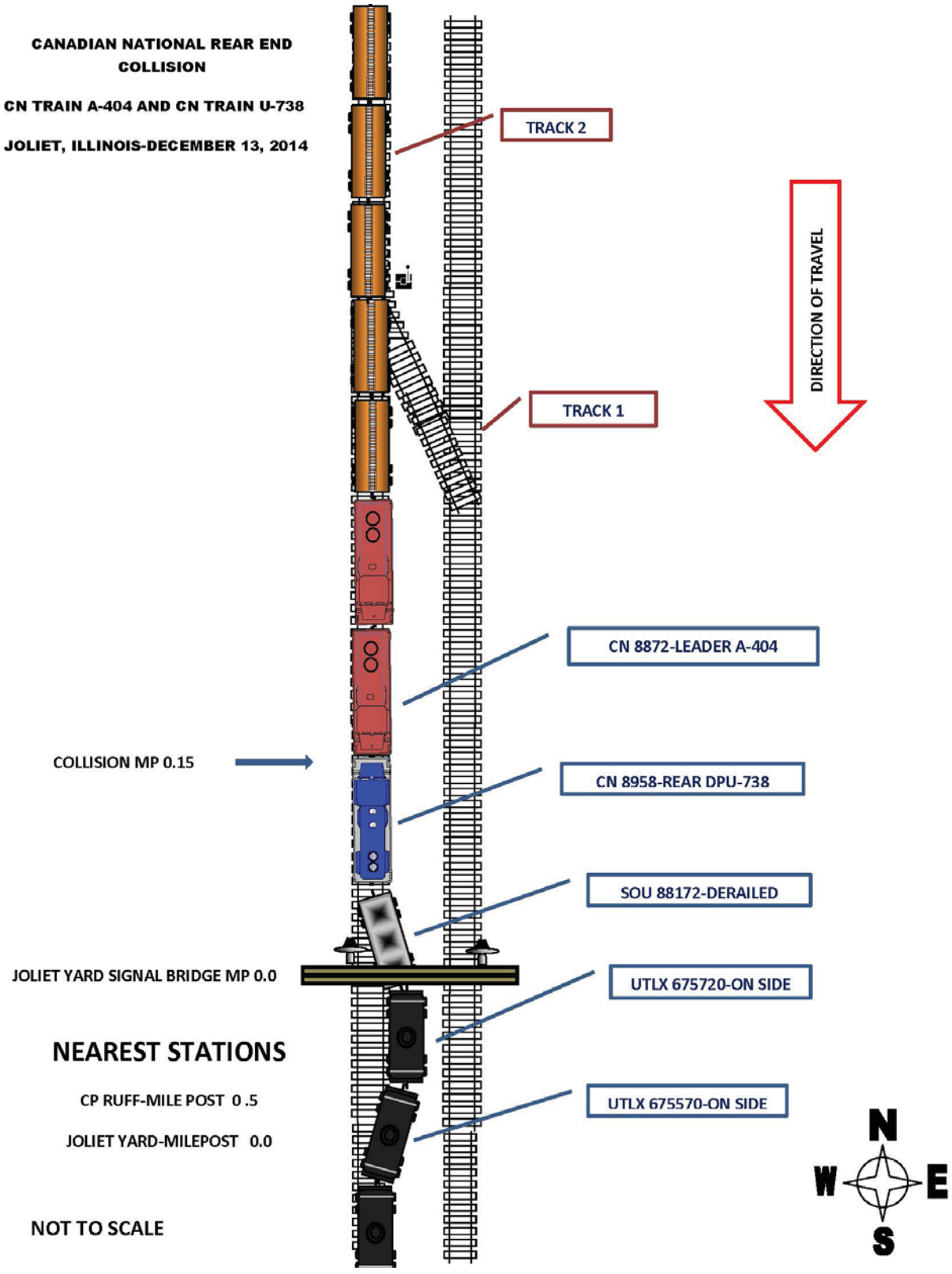
1 - Provided minimum 20-second warning
2 - Alleged warning time greater than 60 seconds
3 - Alleged warning time less than 20 seconds
4 - Alleged no warning
5 - Confirmed warning time greater than 60 seconds
6 - Confirmed warning time less than 20 seconds
7 - Confirmed no warning
N/A - N/A

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

SKETCHES

HQ-2014-21 Sketch



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SYNOPSIS

At 9:37 a.m. CST, on December 13, 2014, Canadian National Railway (CN) A404-81-11, (A404), southbound train, loaded with 111 cars of mixed freight, passed a restricting signal at Milepost 0.5 Control Point (CP) Ruff and impacted the rear Distributive Power Unit (DPU) locomotive of CN U738-51-07 (U738) at Milepost 0.15.

Train U738, southbound, consisting of 98 loaded tank cars of non-Bakken crude and 2 loaded buffer cars was stopped on the Leighton Subdivision, Main Track No. 2. The recorded speed of the collision was 17 mph. As a result of the collision, the rear DPU locomotive, one buffer car, and three tank cars were derailed. Two tank cars were on their sides, however, none of the tank cars were breached and no explosion occurred. These tank cars are DOT 111S -100W1 built in 2013.

The engineer of A404 initiated an emergency application of the brakes approximately 15 cars lengths prior to impact. The crew of A404 was transported to the local hospital, treated for minor injuries, and released.

The probable cause of the accident was A404's crew failure to comply with an automatic block or interlocking signal displaying other than a stop indication.

A contributing cause of the accident was A404's crew failure to comply with restricted speed in connection with the restrictive indication of a block or interlocking signal.

It is undetermined if PTC would have prevented this accident due to the fact that the striking train was required to be operating at restricting speed at the time of the collision.

NARRATIVE

Circumstances Prior to the Accident

Method of Operations

Train movements are governed and authorized by signal indication. A Traffic Control System (TCS) is in effect in this territory with the train dispatcher stationed at Homewood, Illinois. The train dispatcher sets routes at control points. Intermediate automatic block signals are located at intervals between control points.

Railroad operations in the accident area are conducted on two main tracks signaled for bidirectional movement. CN's Chicago Division Timetable No. 9, indicates the main tracks run north and south and CN designates the west track as Main Track No. 2, and the east track as Main Track No. 1. Maximum track speed in the accident area is 45 mph.

A404

The crew of A404 included a locomotive engineer and a conductor. They went on duty at 2:30 a.m., c.s.t, December 13, 2014, at Joliet, Illinois. This was the home terminal for both employees. The engineer received 30 hours and 13 minutes of off duty time prior to reporting for duty. The conductor received 23 hours and 49 minutes of off duty time prior to reporting for duty.

A404 consisted of two locomotives, 75 loads and 36 empties; it was 6,045 feet long; and weighed 10,987 tons. The train was scheduled to operate to CN's Joliet Yard in Joliet. The train received a Class 1 air brake test-initial terminal inspection in Stevens Point, Wisconsin, on December 11, 2014.

The railroad timetable direction of the train was south. The geographic direction was west. Timetable direction is used throughout this report.

U738

The crew of U738 included a locomotive engineer and a conductor. They went on duty at 9 a.m., c.s.t., December 13, 2014, at Joliet. This was the home terminal for both employees. The engineer received 13 hours and 30 minutes of off duty time prior to reporting for duty. The conductor received 36 hours and 15 minutes of off duty time prior to reporting for duty.

U738 consisted of two locomotives on the head-end and one DPU locomotive on the rear. U738 had 100 loads of which 98 were loaded tank cars of non-Bakken crude (Dilbit -UN1267, Class 3, Packing Group 2). U738 was 5,860 feet long and weighed 13,858 tons. The train was scheduled to operate to Memphis, Tennessee. The train received a Class 1 air brake test-initial terminal inspection in Stevens Point, on December 10, 2014.

U738 was parked at Joliet Yard at 7:30 a.m., and was awaiting an outbound crew to operate south at MP 0.2. The crew of U738 boarded their train at 9:15 a.m., and was preparing to take the train south. The train was stopped north of the signal on Main Track No. 2 at the time of the accident the crew was located in the cab of the locomotive.

The Accident

A404 passed an intermediate signal at CP West Bridge, MP 1.9, displaying an diverging approach indication at a speed of 28 mph. At 9:33 a.m., A404 continued southward passing an intermediate signal at CP Ruff, MP 1.0, displaying a restricted proceed indication at 9:35 a.m.

This signal indication requires the train to proceed at restricted speed, not to exceed 20 mph. After passing the restricted proceed signal, A404's speed was recorded at 27 mph. At 9:36 a.m., A404 observed U738 on Main Track No. 2 and initiated an emergency brake application approximately15 cars from the rear end of U738. The lead locomotive of A404 was impacted into the rear DPU locomotive of U738.

Analysis and Conclusions

Analysis - Post accident Toxicological Tests

The crew of A404 was taken for toxicological testing under Non-Federal authority.

Conclusion:

Intoxication was not a factor.

Analysis - Signal System:

A404's crew reported that CP Ruff signal at MP 1.0 indicated a restricted proceed on Main Track No. 2. CN and FRA signal and train control inspectors reviewed the data event recorder for the CP Ruff signal and took no exception to its operation at the time of the incident. Review of data events recorder at CP Ruff and field testing of signal equipment support a restricting signal indication (flashing red over red aspect) was displayed for southward A404.

A FRA signal inspector's report reinforces the clarity of the signal indication during the reenactment. All wayside signals were working properly approaching the accident scene. No visibility problems were reported approaching the accident scene by the employees.

Post-accident Inspection/Testing of Signal System:

CP Ruff is located within a TCS on single main track controlled from CN’s Train Dispatching Management System Center (TMDS) located in Homewood. CP Ruff is a microprocessor based control point utilizing a GE Transportation, ElectroLogIXS Vital Logic Controller, with Safetran color light signals and Union Switch and Signal Model M-23B dual control electric power-operated switch machines.

The design of the carriers signal system, along with stopping distance of the train involved, and signal spacing for the train speeds involved was adequate. Review of CN’s Timetable No. 9, and CN’s signal aspects and indications properly defined the restricting signal indication displayed for A404.

Conclusion:

The signal system was operating as intended.

Analysis - Post Accident Train Air Brake and Locomotive Inspections:

CN and FRA personnel conducted an air brake inspection of all remaining cars of A404 prior to the train being removed from the collision site. Results indicate that all brakes were operative in the full service brake position.

Conclusion:

There were no problems with the locomotives. Inspections were current and car air brakes were operable. Equipment and braking systems were not a factor in the collision.

Analysis - Engineer Certificate and Training:

Locomotive certificate, hearing & vision testing, driver license checks, and other training were current and in compliance with 49 CFR part 240. The engineer of A404's current certificate was issued on November 10, 2012, with his latest monitored ride on October 10, 2014, indicating a satisfactory evaluation on the Monitoring and Skills Performance Report.

Conclusion:

Engineer training, monitoring rides, and certification were current and not a factor in the collision.

Analysis - Locomotive Engineer Operating Performance:

The event recorder data indicates CN Locomotive 8877 was operating at 27 mph when it was placed in full Dynamic Braking. At 9:37:14 a.m., the engineer initiated an emergency application of the air brakes. Additionally, the data clearly demonstrates that the locomotive engineer did not make any application of the air brakes previous to the emergency application. A404 was operated for several minutes between 25 and 30 mph with no air brake application prior to impact with the rear-end of U738.

Conclusion:

The engineer was not in compliance with several CN Operating Rules and Federal regulations. The engineer failed to comply with signal indications and restricted speed.

Analysis - Fatigue

Fatigue Analysis:
FRA uses an overall effectiveness rate of 77.5 percent as the baseline for fatigue analysis, which is equivalent to 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, including the locomotive engineer and conductor of A404.

Conclusion:

FRA concluded fatigue was probable for the locomotive engineer assigned to A404. FRA concluded fatigue was probable for the conductor assigned to A404.

Fatigue Conclusions:
1. Engineer of A404: Sleep setting - Excellent
Overall effectiveness = 75.24% Lapse Index = 3.8
Reaction Time = 131% Chronic Sleep Debt =8.64
Hours of Continuous Wakefulness = 9.13
Time of Day 09:37
BAC Equivalent = > 0.05
Conclusion: Fatigue was probable for this employee

2. Conductor of Train A404: Sleep setting - Good
Overall effectiveness = 74.77% Lapse Index = 4.0
Reaction Time = 133% Chronic Sleep Debt = 8.58
Hours of Continuous Wakefulness = 9.13
Time of Day 09:37
BAC Equivalent = > 0.05
Conclusion: Fatigue was probable for this employee

Analysis - Cell Phone Data

FRA obtained cell phone data related information for the engineer and conductor of A404,data was reviewed for one hour prior to the accident including one hour after the accident. Data showed that only one phone call was made from the conductor's cell phone 28 minutes after the collision took place.

Conclusion:

FRA concluded that cell phone use was not a factor in the collision.

Probable cause and contributing factors:

The probable cause of the accident was A404's crew failure to comply with an automatic block or interlocking signal displaying other than a stop indication.

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