Federal Railroad Administration
Office of Railroad Safety
Accident and Analysis Branch

Accident Investigation Report
HQ-2013-28

Metro North Commuter Railroad Company (MNCW)
Bronx, NY
December 1, 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-2013-28

TRAIN SUMMARY

1. Name of Railroad Operating Train #1	1a. Alphabetic Code	1b. Railroad Accident/Incident No.
Metro North Commuter Railroad Company	MNCW	2013120106

GENERAL INFORMATION

1. Name of Railroad or Other Entity Responsible for Track Maintenance	1a. Alphabetic Code	1b. Railroad Accident/Incident No.
Metro North Commuter Railroad Company	MNCW	2013120106

2. U.S. DOT Grade Crossing Identification Number	3. Date of Accident/Incident	4. Time of Accident/Incident
	12/1/2013	7:19 AM

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	Hudson Line

11. Nearest City/Town	12. Milepost *(to nearest tenth)*	13. State Abbr.	14. County
Bronx	11.3	NY	BRONX

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

19. Track Name/Number	20. FRA Track Class	21. Annual Track Density *(gross tons in millions)*	22. Time Table Direction
No. 2	Freight Trains-40, Passenger Trains-60	15.77	South

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OPERATING TRAIN #1

1. Type of Equipment Consist:	2. Was Equipment Attended?	3. Train Number/Symbol
Commuter Train-Pushing	Yes	8808

4. Speed (recorded speed, if available)	Code	5. Trailing Tons (gross exluding power units)	6a. Remotely Controlled Locomotive?	Code
R - Recorded E - Estimated 82 MPH	R		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	0

6. Type of Territory

Signalization:

Signaled

Method of Operation/Authority for Movement:

Signal Indication

Supplemental/Adjunct Codes:

Q, A, B

7. Principal Car/Unit	a. Initial and Number	b. Position in Train	c. Loaded (yes/no)
(1) First Involved *(derailed, struck, etc.)*	MNCW6222	1	yes
(2) Causing *(if mechanical, cause reported)*	0	0	

8. If railroad employee(s) tested for drug/alcohol use, enter the number that were positive in the appropriate box.	Alcohol	Drugs
	0	0

9. Was this consist transporting passengers? Yes

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
(1) Total in Train	0	0	0	1	0
(2) Total Derailed	0	0	0	1	0

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 Equipment Consist	0	7	0	0	0
(2) Total Derailed	0	7	0	0	0

12. Equipment Damage This Consist	13. Track, Signal, Way & Structure Damage
5000000	876090

14. Primary Cause Code

H604 - Train outside yard limits, in block signal or interlocking territory, excessive speed

15. Contributing Cause Code

H199 - Employee physical condition, other (Provide detailed description in narrative)

Number of Crew Members

16. Engineers/Operators	17. Firemen	18. Conductors	19. Brakemen
1	0	3	0

Length of Time on Duty

20. Engineer/Operator	21. Conductor
Hrs: 1 Mins: 26	Hrs: 1 Mins: 26

Casualties to:	22. Railroad Employees	23. Train Passengers	24. Others
Fatal	0	4	0
Nonfatal	9	73	0

25. EOT Device?	26. Was EOT Device Properly Armed?	27. Caboose Occupied by Crew?
N/A	N/A	N/A

28. Latitude	29. Longitude
40.879597000	-73.922829000

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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

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

10. Signaled Crossing Warning

11. Roadway Conditions

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	Yes
28. Locomotive Headlight Illuminated?	**29. Locomotive Audible Warning Sounded?**
Yes	N/A

<u>10. Signaled Crossing Warning</u>

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

<u>Explanation Code</u>

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 December 1, 2013, at 7:19 a.m., EST, a southbound Metro-North Railroad (MNCW) passenger train, number 8808, derailed in Bronx, New York, on Main Track Number 2. The derailment resulted in four fatalities, multiple personal injuries, a fuel spill, equipment and track damage of $5,876,090, and disruption to MNCW's Hudson Division service for 2 days. Train 8808 originated in Poughkeepsie, New York, with a destination of Grand Central Terminal in New York City. Train 8808 consisted of one control car, seven passenger cars, and one diesel electric locomotive at the rear in a push/pull configuration. The entire train derailed and came to rest on the west side of the tracks. The derailment occurred on MNCW's Hudson Division, near Spuyten Duyvil Station, Bronx, New York, in a 6-degree, 30-minute, left-hand curve where the maximum authorized track speed was limited to 30 mph. The locomotive event recorder data indicated that the train was traveling at 82 mph when it derailed. As a result of the derailment, 82 people were transported to local hospitals with injuries and four passengers died as a result of their injuries. The total number of passengers on board the train was unknown but MNCW reports the average ridership for this train to be around 110.

The National Transportation Safety Board (NTSB) investigated the accident as DCA14MR-002.

The weather at the time of the accident was clear with no precipitation. The temperature was 39 degrees F.

Damage of equipment and track was estimated by MNCW to be $5,876,090.

The Federal Railroad Administration's (FRA) investigation determined the probable cause to be excessive speed.

A contributing cause was determined to be the Engineer suffering from severe Obstructive Sleep Apnea (OSA).

FRA obtained fatigue-related information, including a 10-day work history for MNCW's Locomotive Engineer. The Fatigue Analysis Software (FAST) sleep settings were adjusted according to the information on the Fatigue Analysis Questionnaire received from the Engineer. The FAST overall effectiveness was determined to be 92.60 and his sleep setting was excellent.
Fatigue, according to the testing conducted with the FRA model, was determined not to be a factor in this accident according to the Engineer's sleep habits.

After the accident, the Engineer had a sleep evaluation conducted that identified excessive daytime sleepiness. He then underwent a sleep study that resulted in a diagnosis of OSA.

The NTSB shared this information with FRA. It is unclear if the Engineer or his counsel offered the testing results to the NTSB. The results of the testing determined the Engineer suffered from severe OSA and the NTSB's report determined the Engineer was asleep at the time of the accident.

The OSA medical condition suffered by the Engineer negates FRA's FAST analysis.

NARRATIVE

Circumstances Prior to the Accident

Metro-North Railroad (MNCW) Train 8808 was manned by a train crew of four qualified MNCW employees, which included a locomotive engineer, a conductor, and two assistant conductors. The Engineer and Conductor reported for duty at 5:04 a.m., EST, and an Assistant Conductor reported for duty at 5:30 a.m., at the Poughkeepsie Engine House, Poughkeepsie, New York, which was their home terminal. One Assistant Conductor joined the crew at Croton Harmon Station at 6:25 a.m., Croton-on-Hudson, New York. All the crew members had received more than the statutory off-duty rest period prior to reporting for duty. Also on the train were several off-duty MNCW employees commuting to work.

Their assigned train, 8808, was a push/pull, consisting of one diesel electric locomotive, seven passenger cars, and Control Car 6222 in the lead. The locomotive was providing the power for movement in a push mode at the rear of the train. The train originated in Poughkeepsie and was scheduled to travel to its final destination of Grand Central Terminal (GCT), New York, New York. The train departed Poughkeepsie on time and made nine station stops en route. The equipment had received all required inspections and tests prior to starting its daily operating cycle.

As the southbound Train 8808 approached the accident area, the Locomotive Engineer was seated at the controls on the southwest side of Car 6222. An Assistant Conductor was seated in the first car and the Conductor and an Assistant Conductor were seated in the sixth car of the seven-car train.

In the area of the accident, the Hudson Line consists of three main line tracks. The tracks are geographically oriented north to south and referenced by timetable direction as north to south. The tracks are numbered west to east 4-2-1. The milepost numbering increases in the northward direction. On Main Track Number 2, a curve begins at milepost (MP) 11.38 and ends at MP 11.16. The length of the curve is 1,198 feet. On the Hudson Division, maximum authorized speed (MAS) for passenger trains is 90 mph with 24 permanent speed restrictions identified in the timetable. Timetable speed for the three main tracks in the vicinity of Spuyten Duyvil is 70 mph with a 30 mph speed restriction between MP 11.5 and MP 9.9. The derailment occurred at MP 11.3. The railroad at this location is centralized traffic control (CTC) with interlocking track side signal indications and cab signals. Trains operations at the accident location are capable of operating in both directions on all tracks.

Train 8808 made nine station stops prior to the derailment. The last station stop was at Tarrytown Station, Tarrytown, New York, and the crew reported the trip as uneventful. Train 8808, according to the event recorder data, departed the station at 7:02 a.m., operating south on Main Track Number 2. The event recorder data also shows the Engineer manipulated the controls several times after leaving Tarrytown. At 7:05:34 a.m., the Engineer shut off the throttle after reaching 70 mph MAS. Train 8808 then coasted for 4 minutes and 35 seconds and slowed to 47 mph in 70 mph territory before the throttle was moved to position 8 at 7:10:19 a.m. The Engineer then manipulated the controls several times to comply with speed restrictions and sounded the horn. He then placed the throttle in position 8 at 7:14:37 a.m. This was the last recorded action prior to the derailment. The train approached the curve north of Spuyten Duyvil Station in the southward direction at a recorded speed of 82 mph with the throttle in position 8. That is when the entire consist derailed in the middle of a 6.5- degree, 30 mph curve. MNCW established the tracks as Class 2 with a maximum allowable operating speed for passenger trains of 30 mph with a timetable speed of 30 mph between MP 11.5 to MP 9.9 as designated in the current MNCW Timetable Number 1 effective April 7, 2013. There were no posted speed restrictions in effect at the time of the accident.

The Accident

Train Number 8088 was routed southward on Track Number 2 through control point (CP) 12 to CP 11. The train received a Proceed Cab Aspect on the 2S Signal and a Normal Cab as it approached, proceeded through, and exited the Interlocking at CP 12. As Train 8808 approached the left hand curve north of Spuyten Duyvil Station, the event recorder data shows the train reached the MAS of 70 mph at 7:15:41 a.m., and the Engineer took no action to prevent an over speed condition at MP 12.85 and continued to accelerate. At 7:16.45 a.m., at MP 11.50, the MAS fell to 30 mph and Train 8808 entered this section at 79 mph with the Engineer taking no action to reduce his speed. The train speed continued to increase to 82 mph within the 30 mph restriction at MP 11.32 at 7:16:53 a.m. The event recorder stopped recording at 7:16:56. The overturn derailment occurred at MP 11.3 (GPS 40.879597 latitude, -73.922829 longitude) where the leading west wheel of Control Car 6222 climbed the west rail (high-lateral-wheel forces) while simultaneously a high cant deficiency induced in the cars resulted in complete wheel unloading of the wheels on the east side rail or low rail allowing the cars to turn over. As the train continued forward, the trailing Cars 2 through Car 7 derailed in this same area and in the same manner. The first 5 cars fell and slid on their west sides and saw tooth buckling occurred at each end of the fourth car and it flipped over leaning to the left. Cars 1 and 5 uprighted themselves. Cars 6 and 7, as well as the locomotive, traveled through the debris field at a 45-degree angle and were slowed by plowing into the ballast. The train traveled approximately 880 feet before coming to rest. When the train came to rest, the first car, Control Car 6222, was upright; the second car, Number 6228 and third car, Number 6345, were on their west side; the fourth car, Number 6440 (flipped), leaning 45-degree angle to the south; the fifth car, Number 6188 and the sixth car, Number 6147 were upright (deep in ballast); and the seventh car, Number 6156, and Locomotive Number 225 were leaning at a 45-degree angle west.

Just prior to the derailment, the Engineer, who was seated at the controls in the west side of the Control Car, stated he felt "dazed and hypnotized" looking ahead at the track and that shaking of the car shook him out of this state. When the train derailed, he was thrown about the control compartment. When the train stopped, he attempted to initiate an emergency broadcast, “Emergency – Emergency – Emergency,” to which he did not receive a response from the Rail Traffic Controller (RTC). He then saw his controller keys were missing and the radio was not working. He went into the passenger compartment of the cab car, helped one of the Assistant Conductors, and used her portable radio to make an emergency broadcast. He also called the RTC. The Engineer said he stayed with his Assistant Conductor and tried to assist other passengers in the car until first responders arrived. He then called his union representative.

The Conductor was seated in the sixth car of the train, which was closed to revenue service at the time of the derailment. He stated he heard metal clanging about 2 seconds before the car derailed. He said he was thrown about the car and was stunned. When he was able, he immediately called the RTC District “C” and reported the derailment. He and an Assistant Conductor assisted passengers until the first responders arrived. The Conductor said that he thought that the Assistant Conductor and six off-duty employees were the only people in the sixth car.

The second Assistant Conductor boarded the train at the Croton-Harmon Station as part of his regular assignment and was seated in the sixth car at the time of the derailment. He said he did not have any contact with the Engineer before the accident, he felt the train brakes acted normally, and he did not feel anything unusual immediately before the derailment. When the derailment occurred, he was thrown about the car but was able to assist passengers until the first responders arrived. The crew described the evacuation as orderly and first responders arrived within minutes.

The Federal Railroad Administration’s (FRA) post-accident investigation included an in depth review of all aspects of the train operation including equipment, signal, operating practices, human factors, and track. Inspection of the equipment included review of records of tests and maintenance performed prior to the accident. Inspection of the signal system included review of records of tests and maintenance performed prior to the accident. Review of the train operation for compliance with the railroads applicable rules and timetable instructions was performed. The crew’s status with regard to physical exams, training and hours of service was established. Measurements of the post-accident track geometry were made and previous automated track geometry records in the vicinity of the derailment were reviewed. MNCW Track Inspection Reports, Periodic CWR Joint Bar Inspection Reports, and Rail Inspection Records were reviewed.

The National Transportation Safety Board (NTSB) conducted an independent investigation of this accident concurrently with FRA. These investigations were supported by parties or public entities as follows:

Metro-North Railroad
MTA Police
New York Police Department (NYPD)
New York Fire Department (NYFD)
Connecticut Department of Transportation (CDOT)
New York Public Transportation Safety Board (NYPTSB)
Bombardier Transportation
Volpe National Transportation Systems Center
Association of Commuter Rail Employees
Teamsters Local 808
Brotherhood of Locomotive Engineers and Trainmen
United Transportation Union

United Transportation Union

Analysis: FRA obtained fatigue-related information for the 10-day period preceding this accident/incident, including the 10-day work history (on-duty/off-duty cycles) for the employees involved. This analysis of fatigue-related information was based upon answers provided regarding activities and rest. FRA's FAST program was used for this analysis.

Conclusion: Upon analysis of fatigue-related information, FRA concluded that fatigue was not probable for the Engineer and Conductor of Train 8808.

Analysis: Post-accident sleep disorder medical tests of the Engineer were performed.

Conclusion: These tests concluded the Engineer suffered a sleep disorder, specifically severe Obstructive Sleep Apnea (OSA) according to the NTSB's final report. These findings negate FRA's FAST fatigue analysis findings.

Analysis: This accident met the criteria for Title 49 Code of Federal Regulations (CFR) Part 219 Subpart C, Post-Accident Toxicological Testing. In accordance with Federal regulations, following the accident, operating crewmembers from Train 8808 were required to undergo post-accident toxicological testing. MNCW's Director, Operating Practices Rules oversees the railroad's drug and alcohol program also tested two rail traffic controllers (RTC).

Conclusion: Drug or alcohol use was not a factor in this accident. Specimens were collected from the crewmembers of Train 8808 and the two RTCs. Their results were negative.

Analysis: Review of pertinent records of MNCW Passenger Train 8808 were conducted

Conclusion: Train 8808 was found to have received the proper Class 1 air brake test at 2:14 a.m on December 1, 2013. Interior and exterior calendar day inspections were performed by Qualified Mechanical Person, as required. Periodic inspection records for the entire consist were found to be compliant with Federal regulations.

Analysis: All the wheels, brake rigging, brake pads, and brake discs of the consist involved in the derailment were inspected.

Conclusion: Train 8808 showed no evidence of wheel flats, or flat marks on the wheel's tread, wheels on the equipment were full, had full flanges and normal wheel tread wear except for wheel R1 of Car 6222, which showed indications of direct contact with the third rail (arcing and mechanical damage). All brake rigging appeared normal and all brake pads and discs were within tolerances with the exception of the parking brake rigging on Car 6440 which was broken as a result of the derailment.

Analysis: Media reported the Engineer operating Train 8808 initially stated that the train air brakes failed to respond when initiated. The train was reconstructed, damaged parts of the brake system were repaired or parts were substituted with parts readily available from the Harmon storeroom. Locomotive 225's air compressor was used as an air supply and the brakes were tested using the locomotive's brake valve controller and a single car test device.

Conclusion: The brakes were tested on each car independently and on the consist as a train. The brakes applied and released as designed. Additionally, using the interior passenger emergency brake valve (B-3C), one emergency brake application was initiated from each car. All valves dumped the brake pipe, applying emergency brake to the train. No exceptions were taken.

Analysis: Investigators conducted random brake shoe force measurements of the consist at the Harmon shop in Croton-on-Hudson. The tests were completed using Knorr test equipment Number 806993. The test consisted of inserting a calibrated load cell fixture in the tread brake unit brake head. One location was selected at random from each car.

Conclusion: The brake system was able to produce adequate retarding force.

Analysis: Verify the reference input to Control Car 6222's event recorder. This input provides the event recorder with the car's brake cylinder pressure.

Conclusion: With the system in emergency, the reading was recorded at 46 psi, verifying the pressure reading on the gauge. No exceptions were taken.

Analysis: The task was to verify the functionally of 30-CDW module portion (brake control valve) and the 30-A-CDW brake valve portion from Control Car 6222.

Conclusion: The Investigators completed testing on the 30-CDW module portion (brake control valve) from Control Car 6222 in MNCW's air brake shop. The tests were completed according to Procedure T-3689-0 Rev 10. No exceptions were taken. Tests were completed using MNCW test rack 4, s/n 9200622, last calibrated on November 29, 2013. The 30-A-CDW brake valve portion from Control Car 6222 was tested according to procedure T-4296-S, Rev. 3. No exceptions were taken. Tests were completed using MNCW test rack 4, s/n 9200622, last calibrated on November 29, 2013.

Analysis: The control key switch was examined from Control Car 6222. The switch is activated by a specially designed key issued to engineers. When inserted into the mechanism, the key is pushed into a spring loaded lock mechanism and turned clockwise to one of three positions. The key can only be removed in the key out (KO) position.

Conclusion: Investigators verified the key system functioned as designed.

Analysis: Investigators examined the radio system installed on Control Car 6222. The system consists of the push button control portion, located in the engineer's cab, the main unit, located in the equipment locker behind the engineer's cab, and the antenna.

Conclusion: The circuits were isolated from the car's battery supply and a portable power supply was used to power the system while still installed in the car. Investigators verified the proper operations of the radio. No exceptions were taken.

Analysis: The speed sensor installed on axle number 2 from Control Car 6222 was examined. The sensor is installed in a threaded slot that allows a fine adjustment to achieve a maximum of 0.016-inch clearance between the sensor's pick-up and a tachometer ring.

Conclusion: Investigators measured the clearance at 0.017-inches. The slight 0.001 gap difference did not influence the sensor's input.

Analysis: The Aspect Display Unit (ADU), which includes the speedometer, from Control Car 6222 was removed for visual and functional inspection. Upon opening the ADU (S/N 1298007), the mechanical group noticed that inductors L1 and L2 were dislodged from the printed circuit board as a result of the derailment. The L1 and L2 inductors were reinstalled on the printed circuit board and the ADU was given a functional self-test using Cab Car 6314 as a substitute for Control Car 6222.

Conclusion: No exceptions were taken with the ADU's functionality.

Analysis: Investigators tested the P-2-A brake application valve removed from Control Car 6222 at MNCW's air brake shop.

Conclusion: The tests were completed according to procedure T-2499-0 Rev 7. No exceptions were taken. Tests were completed using MNCW test rack 3, s/n 9200621, last calibrated on November 29, 2013.

Analysis: Investigators tested the D-1 foot valve (dead-man pedal) removed from Control Car 6222.

Conclusion: The valve was supplied with compressed air at 110 psi. No leaks were observed when in the closed position (pedal depressed). With the pedal in the release position, air flowed as designed through the pneumatic whistle.

Analysis: Review of Control Car 6222's compliance with the requirements of 49 CFR § 238.237(a), Duty to equip with an alerter device.

Conclusion: The control car was ordered on November 8, 2000, and placed in service on September 5, 2002. The control car was not required to be equipped with an alerter device according to Federal regulation.

Analysis: Train 8808 was governed and authorized by interlocking signals, as well as cab signals controlled from a centralized dispatching center located in GCT New York City. The derailment occurred at MP 11.3 on the Hudson Line, control at this location is CTC with interlocking track side signal indications and cab signals. Train operations, at the derailment location, are operating on three main tracks, capable of operating in both directions on all tracks. The authorized timetable speed for trains was 30 mph at the accident location.

Operating Rules governing employees were reviewed, specifically MNCW Operating Rules, MN-400 last updated with general order Number 104, effective April 14, 2013. Also governing train movements was MNCW Timetable Number 1 effective February 27, 2011, which was updated by General Order Number 104, effective April 14, 2013. Bulletin Orders in effect 1-S-101 through 1-129. As well as Daily Train Operations Bulletin Order Number December 1, 2013. The train crew involved was governed by wayside interlocking signal indications and Cab Signals, MNCW operating rules, specifically Rule Numbers 11-A (11-A(1)) and 11-B (11-B(1)). Train 8808 with Control Car 6222 received a "Proceed Cab" (the visible trackside signal outside the cab) at the last Control Point (CP 12) prior to the accident. The cab signal indication was a "normal" indication in the control compartment.

Operations Bulletins that were in effect were also reviewed. On July 25, 2013, MNCW issued Bulletin Order 1-113 for the Hudson Line that went into effect at 00:02 hours on Friday, July 26, 2013. Paragraph (b) identified the MAS changes for passenger trains with the following: MP 11.5—MP 33.0 - 70 mph (previously it had been 75 mph).

The bulletin also detailed that from CP 10 (MP 9.9)—MP 11.5, the MAS was restricted to 30 mph (a permanent speed restriction for the curve).

On November 8, 2013, MNCW issued Bulletin Order 1-126, effective 00:02 hours Sunday, November 10, 2013. Paragraph (a) advised that Timetable MAS that Bulletin Orders HUD 1-113 and others were cancelled in their entirety. Under paragraph (b), the bulletin identified the following changes (among others—the permanent speed restriction for the curve at MP 11.5 was not changed) for passenger trains: MP 11.5–MP 18.7 –70 mph MAS.

Conclusion: The Engineer of Train 8808 failed to operate the train in compliance with MNCW operating rules and in violation of 49 CFR Part § 240.305(a)(2) which states (a) "It shall be unlawful to: . . . (2) Operate a locomotive or train at a speed which exceeds the maximum authorized limit by at least 10 miles per hour."

Analysis: The Engineer of Train 8808 was a certified engineer in possession of a valid certification with an expiration date of May 2, 2014. He was hired by MNCW on October 5, 1989, as a station master and became a fully qualified locomotive engineer on April 1, 2004 (9 years and 8 months experience). This was his regular assignment beginning on November 18, 2013, after having worked nights continuously for several years. His last operational rules class occurred on October 11, 2013.

Conclusion: The Engineer of Train 8808 was fully qualified to work the territory where the incident occurred. FRA reviewed this individual's training history and noted no exceptions.

Analysis: A simulated reenactment of the Engineer's view approaching the 30 mph restriction at MP 11.5 from the cab of Train 8808 was performed using train equipment that was similar in design to the equipment involved and at the approximate time of the accident with similar weather conditions.

Conclusion: FRA took no exceptions to the Engineer's ability to view the approaching restriction and apply the trains braking system in sufficient time to comply with the required speed.

Analysis: The Conductor of Train 8808 was a certified Conductor in possession of a valid certification with an expiration date of March 30, 2015. His last operational rules class occurred on September 10, 2013. He has 16 years of experience as a Conductor and was working his regular assignment. He stated that at the time of the derailment he and an Assistant Conductor were seated in the sixth car of the train which was a deadhead (closed to revenue service). He stated he heard metal clanging about 2 seconds before the car kicked over and derailed. He said he was thrown about the car and was stunned. When he was able, he immediately called the RTC and reported the derailment. He and the Assistant Conductor assisted passengers until the first responders arrived. The Assistant Conductor stated that he did not notice a brake application immediately before the accident.

Conclusion: The Conductor was fully qualified to work the territory on which the accident occurred. FRA reviewed this individuals training history and noted no exceptions. FRA took no exceptions to the Conductor's performance prior to or during the accident.

Analysis: On December 2, 2013, representatives from the NTSB, the Federal Railroad Administration, and MNCW began inspecting and testing the signal system at CP 11 and CP 12. Ground readings were taken on all busses and all track circuits in the interlocking were .06 ohm shunted. Lamp voltages at the 2S signal were taken for each bulb as they were illuminated and buss voltages were measured. Switch obstruction, switch circuit controller, and switch indication tests were performed on all switches. Switch correspondence tests were performed on all crossovers. Traffic locking, verification of track circuits, inspection of insulated joints, testing of fouling circuits, loss of shunt protection, and cab axle testing were done on Tracks 1 and 2 between CP 11 and CP 12. The signal cable that was located under where Train 8808 came to rest, when inspected, did not show any evidence of being damaged. Periodic inspection records for both interlocking, and the train track, and SCADA event recorder were reviewed.

Conclusion: The investigation determined that the signal system displayed the proper wayside and onboard signal up to the time of the derailment and did not contribute to nor play a role in this accident.

Analysis: FRA also inspected the cab car onboard equipment to verify that it had been tested within 24 hours and was operating, and sealed, in the "cut in" position, which it was found to be. The Cab Car Form FRA F6180-49a shows the car in the shop at Harmon, New York, October 27, 2013 (35 days), and the car history report shows periodic test last performed at Harmon shop on October 25, 2013 (37 days). Onboard equipment was last tested on December 1, 2013, at 2:00 a.m., in Poughkeepsie. Both tests were in compliance with Federal regulations.

Conclusion: The investigation determined that the onboard automatic train control equipment had properly received its periodic and daily testing and was cut in and functional up to the time of the derailment and did not contribute to nor play a role in this accident.

Analysis: Train 8088 was routed southward on Track Number 2 through CP 12 to CP 11. This route, with no trains ahead, would receive a Proceed Cab Aspect on the 2S Signal and, a Normal Cab as it approached, proceeded through, and exited the Interlocking at CP 12. A reconstructive test was performed of this train's movement to confirm wayside and cab aspects the train should have received. In addition, the switch indication circuits for each switch in this route were opened to confirm that 2S signal at CP 12 went to stop as each circuit was opened.

Conclusion: All tests found the signal system working as designed and intended in compliance with required specifications.

Analysis: A representative from the National Transportation Safety Board and representatives from the Federal Railroad Administration, along with MNCW, reviewed the derailment site and determined that the point of derailment (POD) to be located on Track Number 2, west rail, at MP 11.3 . At this location, the west rail is continuous welded rail (CWR), having a stamp of 119-pound, Steelton, manufactured October 1983. The track is comprised of concrete ties with 24 inch spacing. Indications on top of the rail head showed a singular rail flange mark that was documented. Investigators observed a continuous mark beginning at the gage corner of the west rail that traveled in a southerly direction and diagonally across the top of the rail head surface from the gage side to the field side of the rail head. There were no other visible markings south of the location noted as POD. To the west and south of the west rail, the field side of the concrete ties showed damage from the car wheels traversing over the top of the ties and causing considerable damage. Also, to the west side of Main Track Number 2, MNCW maintains a third rail system that was damaged from the derailment. To the west of Track Number 2 is Track Number 4, which also received a considerable amount of damage to the crossties, ballast, and running rail after Train 8808 came to rest.

Conclusion: The review of the derailment area determined that the POD to be located on Track Number 2, west rail, at MP 11.3. Investigators observed a continuous mark beginning at the gage corner of the west rail that traveled in a southerly direction and diagonally across the top of the rail head surface from the gage side to the field side of the rail head.

Analysis: MNCW employee timetable issued on July 25, 2013, Bulletin Order 1-113, for the Hudson Line, went into effect at 00:02 hours on Friday, July 26, 2013. Paragraph (B) of that bulletin identified the MAS changes for passenger trains with the following: MP 11.5 –MP 33.0, 70 mph (previously it had been 75 mph).

The bulletin also contained that from CP 10 (MP 9.9 – MP 11.5), the MAS was restricted to 30 mph (a permanent speed restriction for the curve). On November 08, 2013, MNCW issued Bulletin Order1-126, effective 00:02 hours Sunday November 10, 2013. Paragraph (a) advised that timetable MAS that Bulletin Orders HUD 1-113 and others were cancelled in their entirety. Under paragraph (B), the bulletin identified the following changes: The permanent speed restriction for the curve at MP 11.5 was not changed for passenger trains and MP 11.5—MP 18.7 was changed to 70 mph.

changed for passenger trains and MP 11.5—MP 18.7 was changed to 70 mph.

Conclusion: There had been a 30 mph speed restriction posted in MNCW's timetable for this section of track on July 25, 2013.

Analysis: MNCW's Hudson Line at the derailment location consists of three main line tracks. . The milepost numbering increases in the northward direction. The tracks are numbered east to west, Track Number 1, Track Number 2, and Track Number 4 (Track Number 4 is used primarily for westward movements).

There is two interlockings, CP 11 and CP 12 located respectively south and north of Spuyten Duyvil Station consisting of four switches, and CP 11 and 13 switches at CP 12 for diverging moves between the Main tracks.

MNCW has a program in place to inspect and maintain Main Track Number 2 on this section of the Hudson Line to comply with the Federal Railroad Administration's Track Safety Standards (TSS) for Class 2 track in the area of the derailment, from MP 11.5 to MP 9.9.

Conclusion: MNCW inspects and maintains the track according to FRA track safety standards for Class 2 track, with a maximum operating speed of 30 mph for passenger trains.

Analysis: MNCW performed maintenance work prior to the derailment in this curve. MNCW installed continuous welded rail (CWR) in the west rail in 2000, and recently replaced the rail on the low side (east rail) in August, 2013. Also, MNCW track workers improved drainage at several locations in the curve by installing wooden ties mixed with concrete ties, removing fouled ballast and applying clean ballast that began in July of 2013. Surfacing was also done throughout this curve and was followed by a track tamer and a ballast regulator on August 3, 2013. The 119-pound CWR in this curve is supported by concrete cross ties spaced two feel part. The rails are held in place to the concrete ties with elastic type fasteners (Pandrol Clips) which restrain the rail from moving longitudinal. The track was supported by granite ballast, an average of 8 to 12 inches deep. Investigators for this derailment looked for seat abrasion on both rails throughout the curve, but did not observe any conditions that would have affected the cant of the rails.

Conclusion: Regular track maintenance had been performed on this section of track including surfacing, ties, drainage, and continuous welded rail. The track, rail, surface, ties, and drainage were not a factor in this derailment.

Analysis: Post-accident geometry measurements were taken on December 1 and 2, 2013, at the site of the POD both on the tangent and curved section of Track Number 2. The stations were laid out at 15-feet and 6 inches apart. A 62-foot cord was used to collect the mid-ordinate measurements for 95 stations and all track geometry measurements were taken unloaded. Cross level and gage measurements were also taken at this time.
- Track inspectors field notes were collected.
- The maximum measurement allowed for gage in FRA Class 2 track with an authorized speed of 25 mph for freight and 30 mph for passenger, is 57 ¾ inches. Track notes determined that the wide gage prior to the POD was 57.28 inches or .52 inches under the maximum allowable limit.
- The maximum allowed deviation for alignment measured with a 62-foot cord in FRA Class 2 track is 3 inches for both tangent and curved track. Track notes determined that the greatest alignment deviation prior to disturbed track was ¼ of an inch or 2 ¾ inches under FRA's maximum allowable limits.
- The maximum allowable deviation from zero cross level at any point on tangent or reverse cross level elevation on curves may not be more than 2 inches for Class 2 track. Track notes taken determined there was no reverse cross level on the curve and that the maximum cross level was 0.15 of an inch or 1.85 inches under FRA's maximum allowable limit.

Conclusion: The track Geometry for this section of track where Train 8808 derailed was not a factor in this derailment.

Analysis: FRA operated their Automated Track Inspection Program (ATIP) geometry vehicle over the Hudson Line, including the derailment site, on June 4, 2013. FRA's geometry data generated an exception report for the territory of MP 19.0 to MP 10.0 and the following was noted: MP 12 posted speed as 30 mph. In the same report, FRA provided MNCW with a Curve Analysis Section. This section noted that on Main Track Number 2, a curve begins at MP 11.38 and ends at MP 11.16, and has a length of 1,198 feet. The measured degree of curvature was 6 degrees 28 minutes with 2.77 inches of super elevation. The posted speed was 30 mph, the curves maximum speed was 35 mph with 3 inches of elevation.

On November 21, 2013, MNCW operated a geometry vehicle south from CP 75 to Grand Central Station. MNCW Defect Report from that vehicle denoted the following: Defect Number 332 wide gage located at milepost 11.7+402 feet, to MP 11.7+388 feet for a total length of 14 feet with a maximum gage reading of 57.779 or 1.29 "from standard gage of 56 ½." (Note: MNCW's engineering personnel checked this particular item and learned that the wide gauge measurement was not valid due to the optical system registering a value from an undercut stock rail.)

Conclusion: The review of the post-accident track geometry measurements and the geometry records in the vicinity of the derailment site disclosed that the geometry was in compliance with FRA Track Safety Standards for Class 2 track. The track geometry was not a factor in this derailment.

Analysis: On April 29, 2013, Sperry Car Number 119A tested the Hudson Line and the area of derailment for any internal rail defects and no defects were found.

Conclusion: Sperry test records were reviewed for this section of track by all investigators. Rail defects were not a factor in this derailment.

Analysis: Under FRA regulations, frequency for the track inspections for this class of track is once a week. However, MNCW inspects all of its Main Line tracks twice a week by walking inspection. Track inspection records for this area, MP 12.0 to MP 5.0, were examined from the period June 2013, to November 2013. The records showed that the inspections were in compliance with Federal regulations. All records were signed and dated for the day in which they were inspected.

Conclusion: The inspection of MNCW Track Inspection Reports revealed that MNCW was in compliance with the Federal Track Safety Standards for frequency of inspections.

FRA dispatched a separate team to analyze damaged passenger cars and to make a correlation between the nature and extent of the passenger and crewmember injuries with the equipment damage involved. This team noted that the windows and gaskets were torn from their frames while the cars were sliding on their sides and allowed road-bed ballast to enter the car. Seat cushions became dislodged during the derailment and secondary impacts occurred with stationary interior parts and attachments such as luggage racks, walls and ceiling panels. There was a nominal loss of occupied volume within one passenger compartment of a car due to impact with and sliding on the ground in the direction of travel during the derailment.

Overall Conclusions

FRA's post-accident inspection of the equipment involved, including review of records of tests and maintenance performed prior to the accident revealed no contributing cause. Inspection of the signal system, including records of tests and maintenance performed prior to the accident, indicated the signal system was working as intended. The crew was current with regard to physical exams and training. Measurements of the post-accident track geometry and review of previous automated track geometry records in the vicinity of the derailment site disclosed that the track geometry was in compliance. Review of MNCW track inspection reports, periodic CWR joint bar inspection reports, and rail inspection records revealed that MNCW was in compliance with the frequency of inspections, reporting exceptions, and taking the required remedial action. Review of the train operation determined the train was not operated in compliance with the railroads applicable rules and timetable instruction. Human factors of the crew with regard to required rest periods and fatigue were analyzed by FRA with no exceptions taken. However, medical tests of the Engineer performed post-accident by the Engineer determined the Engineer suffered from a sleep disorder according to the NTSB's final report.

Probable Cause and Contributing Factors

FRA's investigation determined the probable cause to be excessive speed.

A contributing cause was determined to be that the Engineer suffered from severe Obstructive Sleep Apnea (OSA).

FRA obtained fatigue-related information, including a 10-day work history for MNCW's Locomotive Engineer. The Fatigue Analysis Software (FAST) sleep settings were adjusted according to the information on the Fatigue Analysis Questionnaire received from the Engineer. The FAST overall effectiveness was determined to be 92.60 and his sleep setting was excellent. Fatigue, according to the testing conducted with the FRA model, was determined not to be a factor in this accident according to the Engineer's sleep habits.

sleep habits.

After the accident, the Engineer had a sleep evaluation conducted that identified excessive daytime sleepiness. He then underwent a sleep study that resulted in a diagnosis of OSA.

The NTSB shared this information with FRA. It is unclear if the Engineer or his counsel offered the testing results to the NTSB. The results of the testing determined the Engineer suffered from severe OSA and the NTSB's report determined the Engineer was asleep at the time of the accident.

The OSA medical condition suffered by the Engineer negates FRA's FAST analysis.