Federal Railroad Administration
Office of Safety
Headquarters Assigned
Accident Investigation Report
Q-2005-50

Burlington Northern Santa Fe (BNSF)
Gypsum, Colorado
June 25, 2005

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

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION

FRA FACTUAL RAILROAD ACCIDENT REPORT

FRA File # HQ-2005-50

1.Name of Railroad Operating Train #1: Union Pacific RR Co. [UP]	1a. Alphabetic Code: UP	1b. Railroad Accident/Incident No.: 0605DV019
2.Name of Railroad Operating Train #2: N/A	2a. Alphabetic Code: N/A	2b. Railroad Accident/Incident: N/A
3.Name of Railroad Responsible for Track Maintenance: Union Pacific RR Co. [UP]	3a. Alphabetic Code: UP	3b. Railroad Accident/Incident No.: 0605DV019
4. U.S. DOT_AAR Grade Crossing Identification Number:	5. Date of Accident/Incident: Month 06 / Day 25 / Year 2005	6. Time of Accident/Incident: 02:00: ☐ AM ☑ PM

7. Type of Accident/Indicent (single entry in code box): 1. Derailment; 2. Head on collision; 3. Rear end collision; 4. Side collision; 5. Raking collision; 6. Broken Train collision; 7. Hwy-rail crossing; 8. RR grade crossing; 9. Obstruction; 10. Explosion-detonation; 11. Fire/violent rupture; 12. Other impacts; 13. Other (describe in narrative): 01

8. Cars Carrying HAZMAT	9. HAZMAT Cars Damaged/Derailed	10. Cars Releasing HAZMAT	11. People Evacuated	12. Division
0	0	0	0	Denver

13. Nearest City/Town	14. Milepost (to nearest tenth)	15. State Abbr	15. State Code	16. County
Glenwood Spring	347.4	N/A	CO	GARFIELD

17. Temperature (F) (specify if minus)	18. Visibility (single entry) 1. Dawn 2. Day 3.Dusk 4.Dark	Code	19. Weather (single entry) 1. Clear 2. Cloudy 3. Rain 4. Fog 5.Sleet 6.Snow	Code	20. Type of Track 1. Main 2. Yard 3. Siding 4. Industry	Code
79 F		2		2		3

21. Track Name/Number	22. FRA Track Class (1-9, X)	Code	23. Annual Track Density (gross tons in millions)	24. Time Table Direction 1. North 3. East	Code
Allen Siding		2	0		3

OPERATING TRAIN #1

25. Type of Equipment Consist (single entry) 1. Freight train 2. Passenger train 3. Commuter train 4. Work train 5. Single car 6. Cut of cars 7. Yard/switching 8. Light loco(s). 9. Maint./inspect.car	A. Spec. MoW Equip. Code	26. Was Equipment Attended? 1. Yes 2. No	Code	27. Train Number/Symbol
	1	1		CWEP AH23

28. Speed (recorded speed, if available) R - Recorded E - Estimated			Code	30. Method(s) of Operation (enter code(s) that apply)			30a. Remotely Controlled Locomotive?
	23	MPH	R	a. ATCS; b. Auto train control; c. Auto train stop; d. Cab; e. Traffic; f. Interlocking; g. Automatic block; h. Current of traffic; i. Time table/train orders; j.Track warrant control; k. Direct traffic control; l.Yard limits; m.Special instructions; n. Other than main track; o. Positive train control; p. Other (Specify in narrative)			0 = Not a remotely controlled; 1 = Remote control portable; 2 = Remote control tower; 3 = Remote control transmitter - more than one remote control transmitter: 0

29. Trailing Tons (gross tonnage, excluding power units): 14705

Code(s): e | n | N/A | N/A | N/A

31. Principal Car/Unit	a. Initial and Number	b. Position in Train	c. Loaded (yes/no)
(1) First involved (derailed, struck, etc)	N/A	38	yes
(2) Causing (if mechanical cause reported)	0	0	N/A

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

Alcohol	Drugs
0	0

33. Was this consist transporting passengers? (Y/N): N

34. Locomotive Units	a. Head End	Mid Train b. Manual	Mid Train c. Remote	Rear End d. Manual	Rear End c. Remote
(1) Total in Train	2	0	3	0	1
(2) Total Derailed	0	0	0	0	0

35. Cars	Loade a. Freight	Loade b. Pass.	Empty c. Freight	Empty d. Pass.	e. Caboose
(1) Total in Equipment Consist	104	0	0	0	0
(2) Total Derailed	18	0	0	0	0

36. Equipment Damage This Consist	37. Track, Signal, Way, & Structure Damage	38. Primary Cause Code	39. Contributing Cause Code
785680	166323	M405	N/A

Number of Crew Members				Length of Time on Duty	
40. Engineer/ Operators	41. Firemen	42. Conductors	43. Brakemen	44. Engineer/Operator	45. Conductor
N/A	0	1	0	Hrs 5 Mi 15	Hrs 5 Mi 15

Casualties to:	46. Railroad Employees	47. Train Passengers	48. Other
Fatal	0	0	0
Nonfatal	N/A	0	0

49. EOT Device? 1. Yes 2. No	50. Was EOT Device Properly Armed? 1. Yes 2. No
1	1

51. Caboose Occupied by Crew? 1. Yes 2. No: 2

OPERATING TRAIN #2

52. Type of Equipment Consist (single entry) 1. Freight train 2. Passenger train 3. Commuter train 4. Work train 5. Single car 6. Cut of cars 7. Yard/switching 8. Light loco(s). 9. Maint./inspect.car	A. Spec. MoW Equip. Code	53. Was Equipment Attended? 1. Yes 2. No	Code	54. Train Number/Symbol
	N/A	N/A		N/A

55. Speed (recorded speed, if available) R - Recorded E - Estimated			Code	57. Method(s) of Operation (enter code(s) that apply)			57a. Remotely Controlled Locomotive?
	0	MPH	N/A	a. ATCS; b. Auto train control; g. Automatic block; h. Current of traffic; m.Special instructions; n. Other than main track			0 = Not a remotely controlled; 1 = Remote control portable

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56. Trailing Tons (gross tonnage, excluding power units): 0

c. Auto train stop; d. Cab; e. Traffic; f. Interlocking; i. Time table/train orders; j. Track warrant control; k. Direct traffic control; l. Yard limits; o. Positive train control; p. Other (Specify in narrative)
Code(s): N/A | N/A | N/A | N/A | N/A

2 = Remote control tower
3 = Remote control transmitter - more than one remote control transmitter: N/A

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

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

Alcohol	Drugs
N/A	N/A

60. Was this consist transporting passengers? (Y/N): N/A

61. Locomotive Units	a. Head End	Mid Train b. Manual	Mid Train c. Remote	Rear End d. Manual	Rear End c. Remote
(1) Total in Train	0	0	0	0	0
(2) Total Derailed	0	0	0	0	0

62. Cars	Loade a. Freight	Loade b. Pass.	Empty c. Freight	Empty d. Pass.	e. Caboose
(1) Total in Equipment Consist	0	0	0	0	0
(2) Total Derailed	0	0	0	0	0

63. Equipment Damage This Consist: 0

64. Track, Signal, Way, & Structure Damage: 0

65. Primary Cause Code: N/A

66. Contributing Cause Code: N/A

Number of Crew Members

67. Engineer/ Operators	68. Firemen	69. Conductors	70. Brakemen
0	0	0	0

Length of Time on Duty

71. Engineer/Operator: Hrs 0 Mi 0

72. Conductor: Hrs 0 Mi 0

Casualties to:	73. Railroad Employees	74. Train Passengers	75. Other
Fatal	0	0	0
Nonfatal	0	0	0

76. EOT Device? 1. Yes 2. No: N/A

77. Was EOT Device Properly Armed? 1. Yes 2. No: N/A

78. Caboose Occupied by Crew? 1. Yes 2. No: N/A

Highway User Involved

79. Type: A. Auto; B. Truck; C. Truck-Trailer.; D. Pick-Up Truck; E. Van; F. Bus; G. School Bus; H. Motorcycle; J. Other Motor Vehicle; K. Pedestrian; M. Other (spec. in narrative)
Code: N/A

80. Vehicle Speed (est. MPH at impact): 0

81. Direction geographical) 1.North 2.South 3.East 4.West
Code: N/A

82. Position: 1.Stalled on Crossing 2.Stopped on Crossing 3.Moving Over Crossing 4. Trapped
Code: N/A

86a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? 1. Highway User 2. Rail Equipment 3. Both 4. Neither
Code: N/A

Rail Equipment Involved

83. Equipment: 1.Train(units pulling); 2.Train(units pushing); 3.Train (standing); 4.Car(s) (moving); 5.Car(s) (standing); 6.Light Loco(s) (moving); 7.Light(s) (standing); 8.Other (specify in narrative)
Code: N/A

84. Position of Car Unit in Train: 0

85. Circumstance: 1. Rail Equipment Struck Highway User; 2. Rail Equipment Struck by Highway User
Code: N/A

86b. Was there a hazardous materials release by 1. Highway User 2. Rail Equipment 3. Both 4. Neither
Code: N/A

86c. State here the name and quantity of the hazardous materials released, if any.
N/A

87. Type of Crossing Warning: 1.Gates; 2.Cantilever FLS; 3.Standard FLS; 4.Wig Wags; 5.Hwy. traffic signals; 6.Audible; 7.Crossbucks; 8.Stop signs; 9.Watchman; 10.Flagged by crew; 11.Other (spec. in narr.); 12.None

Code(s)							
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

88. Signaled Crossing Warning (See instructions for codes) Code:

89. Whistle Ban 1. Yes 2. No 3. Unknown
Code: N/A

90. Location of Warning 1. Both Sides 2. Side of Vehicle Approach 3. Opposite Side of Vehicle Approach
Code: N/A

91. Crossing Warning Interconnected with Highway Signals 1. Yes 2. No 3. Unknown
Code: N/A

92. Crossing Illuminated by Street Lights or Special Lights 1. Yes 2. No 3. Unknown
Code: N/A

93. Driver's Age: 0

94. Driver's Gender 1. Male 2. Female
Code: N/A

95. Driver Drove Behind or in Front of Train and Struck or was Struck by Second Train 1. Yes 2. No 3. Unknown
Code: N/A

96. Driver 1. Drove around or thru the Gate 2. Stopped and then Proceeded 3. Did not Stop 4. Stopped on Crossing 5. Other (specify in narrative)
Code: N/A

97. Driver Passed Standing Highway Vehicle 1. Yes 2. No 3. Unknown
Code: N/A

98. View of Track Obscured by (primary obstruction) 1. Permanent Structure 2. Standing Railroad Equipment 3. Passing Train 4. Topography 5. Vegetation 6. Highway Vehicle 7. Other (specify in narrative) 8. Not obstructed
Code: N/A

101. Casulties to Highway-Rail Crossing Users

Killed	Injured
0	0

99. Driver Was 1. Killed 2.Injured 3. Uninjured
Code: N/A

100. Was Driver in the Vehicle? 1. Yes 2. No
Code: N/A

102. Highway Vehicle Property Damage (est. dollar damage): 0

103. Total Number of Highway-Rail Crossing Users (include driver): 0

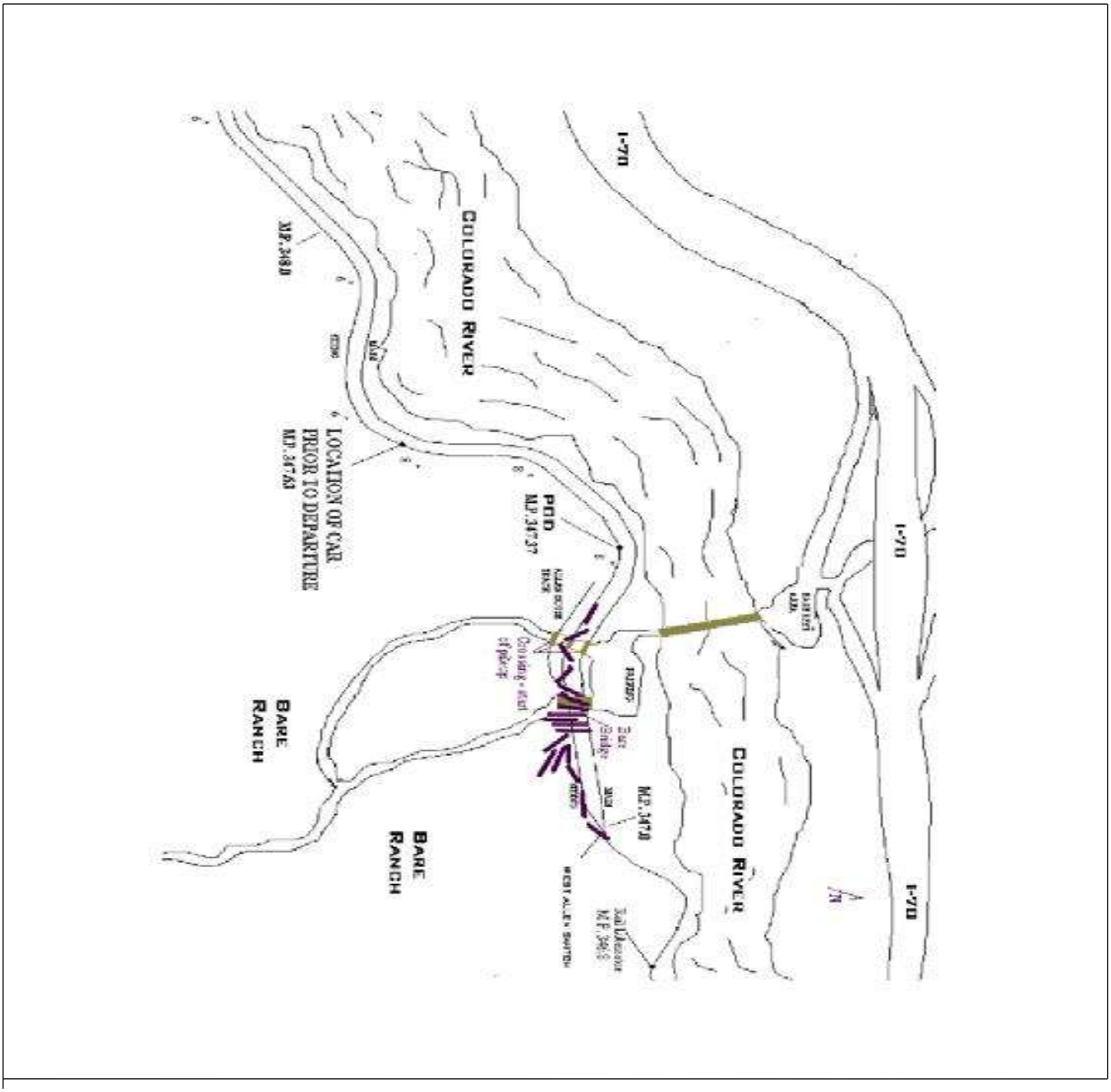
104. Locomotive Auxiliary Lights? 1. Yes 2. No
Code: N/A

105. Locomotive Auxiliary Lights Operational? 1. Yes 2. No
Code: N/A

106. Locomotive Headlight Illuminated? 1. Yes 2. No
Code: N/A

107. Locomotive Audible Warning Sounded? 1. Yes 2. No
Code: N/A

108. DRAW A SKETCH OF ACCIDENT AREA INCLUDING ALL TRACKS, SIGNALS, SWITCHES, STRUCTURES, OBJECTS, ETC., INVOLVED.
HQ-50-05
Sketch.jpg



109. SYNOPSIS OF THE ACCIDENT

A loaded Union Pacific Railroad Company (UP) coal train derailed while traveling eastward on the UP Glenwood Springs Subdivision about 16 miles east of Glenwood Springs, Colorado, in Garfield County. The accident occurred on the Allen Siding track at UP Milepost (MP) 347.4, on June 25, 2005, at 2:00 p.m.

Train Symbol CWEPAH-23 came to a stop following a tug, another stronger tug, and an immediate undesired emergency brake application. Upon inspection, it was discovered that the 36th head car had derailed. The 37th through the 53rd head cars were also derailed. Most cars were stacked together in accordion style within a space less than 250 feet wide. Most of the cars rested on their sides, spilling their content. No coal was dumped into the Colorado River, which is located just north of the main line. Although the point of derailment (POD) was on the Allen Siding, the main line was also damaged. There were no injuries reported by the two-person crew, no hazardous materials involved and no evacuations were required. The estimated monetary damage cost is $785,680 to equipment and $166,323 to track. A bridge on the Allen Siding was also destroyed.

The train was being operated under Centralized Traffic Control (CTC), at a speed of 23 mph at the time, when the train experienced an undesired emergency brake application, as recorded by the event recorder of controlling Locomotive No. UP 6509. The maximum operating speed for a loaded coal train on the Allen Siding is 25 mph, as designated by the current UP Timetable No. 2.

At the time of derailment, it was daylight, cloudy and the temperature was 79 °F.

The cause of the accident was due to interaction of lateral/vertical forces (harmonic rock off).

110. NARRATIVE

The following information was obtained from an investigation that was conducted by the Federal Railroad Administration.

Circumstances Prior to the Accident

The two-person crew of UP Train Symbol CWEPAH-23 consisted of a locomotive engineer and a conductor. They went on duty at 8:45 a.m., MDT, in Grand Junction, Colorado, on June 25, 2005. Each crew member received more than the statutory off-duty period with the engineer receiving 15 hours and 10 minutes and the conductor receiving 31 hours of rest prior to reporting for duty at Grand Junction.

The scheduled route of the loaded coal train was from Grand Junction to Denver, Colorado, then to points east for unloading. The unloaded train was then scheduled to return to Grand Junction. The consist, upon leaving Grand Junction, was equipped with 2 leading locomotives, 3 DPUs in the middle, and 1 rear DPU, with 104 loaded coal cars. The last Class 1A (1,000-mile) brake test was performed at Salina, Kansas. Testing of the end-of-train device was conducted at Grand Junction, prior to departure. This test was conducted successfully by UP mechanical personnel.

Both crew members were present in the control compartment of the lead locomotive when the derailment occurred. The engineer was positioned on the south side of the locomotive at the controls and the conductor was positioned in the conductor's seat on the north side of the locomotive. Interviews performed by Federal Railroad Administration (FRA) revealed that the trip was uneventful prior to the derailment.

This portion of the Glenwood Subdivision siding track traverses through the Glenwood Canyon of the Colorado River. The track is located on the south side of the river and on the north side of the canyon walls. The point of derailment (POD) was at UP Milepost 347.4, which is in the body of an 8-degree 00-minute left-hand curve. This curve stretches for about 300 feet. This curve is the last of a series of sharp curves leading up to the East Allen switch. Just west of this curve is another 8-degree 00-minute left-hand curve which follows a 6-degree 00-minute left-hand curve and a 6-degree 00-minute right-hand curve. The grade at the POD is ascending at +0.23 percent. The approach to the POD, just to the west of UP Milepost 347.85 is flat. East of UP Milepost 347.0 the grade is also flat.

Track conditions in the area of the derailment were good. The siding has second hand 133 and 136 pound jointed rail on the high side and 133 and 136 pound continuous-welded rail (CWR) on the low side. This rail is slightly curve worn. Curve grease is evident on the rail. The closest rail lubricator is located to the east at UP Milepost 346.8. Ties appear to be in good condition. No installation date was available. The ballast in the area was good, with a 2-foot shoulder on both sides. The rail was secured to the ties using two inside spikes and one outside spike. One anchor spike located on the outside of the rail, assisted with holding the tie plate securely to the tie. The rail is also box anchored to the tie using Channeloc rail anchors on every other tie. This is a very remote area, with rail being the only access. The railroad timetable direction of the train was east. The geographic direction was north-east. Timetable directions are used throughout this report.

The Accident

Train Symbol CWEPAH-23 was traveling eastward in a transition from the Allen Siding to the main track at a recorded speed of 23 mph when the train experienced an undesirable emergency brake application. The speed was recorded by the event recorder of controlling Locomotive No. UP 6509. The maximum operating speed for a loaded coal train on the Allen Siding is 25 mph, as designated by the current UP Timetable No. 2.

The forward end of the train passed through the turnout at East Allen. Both the engineer and the conductor stated they did not see or feel anything out of the

346.85, the engineer throttled down from Position eight to seven and then to six at approximately UP Milepost 346.8. Soon after at about UP Milepost 346.75, as the front of the train was beginning to negotiate a 4-degree 30-minute curve the crew felt a tug, followed by a stronger tug, followed by an undesired emergency brake application, bringing the train to a stop.

After coming to a stop, the engineer contacted the dispatcher to report the situation while the conductor walked the train to inspect it. Upon inspection, he found the 36th head car derailed. The 37th through the 53rd head cars were also derailed. Most cars were stacked together in accordion style within a space less than 250 feet wide. Most of the cars rested on their sides, spilling their load. No coal was dumped into the Colorado River, which is located just north of the main line. Although the POD was on the Allen Siding, the main track was also damaged. Soon after contacting the dispatcher, emergency response officials from the cities of Glenwood Springs and Eagle, Colorado, and the railroad began to arrive at the site.

The investigation determined the POD to be at UP Milepost 347.37 (347.4). Evidence at the scene indicated that the lead trucks of the first derailed car, UP No.48771, derailed in the body of an 8-degree curve. The train continued on for about 1,000 feet when the derailed car struck a private crossing. At that point the trailing trucks derailed. The train traveled another 200 feet when the derailed car came into contact with a house track switch. The switch diverted the car to the north, turning it sideways. At this point, other cars began to derail tearing out the track on the siding and the main as well as the house track turnout and a bridge that carried the siding over a private road. In addition to the 700 feet of siding track destroyed, about 156 feet of the main line track, located just north of the siding was destroyed. There were no other vehicles or persons involved. The train crew did not report any injuries. There were no hazardous materials involved, or evacuations required. Monetary damage estimates include $785,680 to equipment and $166,323 to track.

The UP's emergency wreck clearing crews along with an emergency wreck clearing contractor, were called to help with removal of the cars, grade work, and laying of the new track through the derailment site. The contracting company used was Hulcher, based out of Cheyenne, Wyoming.

Analysis and Conclusions

Analysis

The weather on the day of the accident was cloudy and calm. The temperature was 79 °F. The weather during the week prior to the derailment was average, with little or no rain and temperatures in the 80's.

After crew interviews and viewing of the event recorder, the UP operational manager concluded there was no fault in the way the train was handled. The crew members of Train Symbol CWEPAH-23 were tested for alcohol and drug usage, in accordance with FRA post-accident criteria. Results of the tests were negative.

A UP mechanical manager investigated the derailment and examined the wreckage. After close examination, he found that the initial car that was derailed was coal Car No. UP 48771. Upon further examination of this car, he found no mechanical problems that might have been a casual or contributing factor to the derailment. It should be noted, however, these coal cars are loaded to the extreme. Average weight is 241,000 pounds, with a maximum weight of 246,000 pounds. Many of the cars are loaded heavy on one end. In most cases the head end is full leaving the back almost empty.

Results of a track inspection on the curve where the first car derailed revealed that the track was in good condition, with no FRA defects. The spirals on both sides are relatively smooth, climbing to an elevation of 4 inches in the body. The largest measurement under load (amount of space between the base of the rail and the tie-plate) was 3/8 inches. Gage measurements around the curve measured from 56 1/2 inches to 57 1/8 inches. The rail which was jointed on the high side of the curve with CWR on the low side, was slightly curve worn and had evidence that grease was being used.

With the knowledge that the cause of the derailment could not be blamed on any of the three factors mentioned above, the railroad hired a team of railroad scientists to analyze the area around the derailment in an attempt to find a cause. The railroad scientists performed and documented track measurements, car measurements, and data related to how the train was operated. They also noted the geography of the track, speed of the train, and the many tight curves and grade. They took all this data and put it into a computer to run simulations to find a cause.

Conclusions

The railroad was in compliance with their own and all applicable Federal standards. Computer simulations performed by railroad scientists concluded that the derailment was a result of many factors. Train Symbol CWEPAH-23 had just pulled out of the siding after meeting another train. The train had been stopped for about 28 minutes. The location of the initial derailed car, as it sat in the siding while stopped, was about 1,400 feet west of the POD, (UP Milepost 347.63). While the train was pulling out of the siding, the car came out of a 6-degree left-hand curve and traveled through an 8-degree right-hand curve, a small tangent, and was negotiating another 8-degree right-hand curve when the lead wheel of the leading truck climbed the high rail and went on the ground. The event recorder indicated that the train was traveling at about 18 MPH at throttle Position eight, at this point.

Probable Cause and Contributing Factors

The FRA determined that the probable cause of the accident was M405 - Interaction of lateral/vertical forces (includes harmonic rock off).

The geography of the track the tremendous pull and push from the locomotives the weight of the cars the jointed rail on the high side that was curve worn and the speed of the train at that point, made the vertical and lateral forces placed upon the rail optimal for the wheel to climb the high rail.

The UP has plans to change the rail on both sides of the siding with newer second hand CWR. This would help alleviate the harmonic rock as there would be no joints. This would also eliminate the curve worn track which effects the lateral forces of the wheel on the rail.

The majority of cars loaded at the coal mines in western Colorado are loaded unbalanced. According to UP employees, this has been occurring for a long time. Referencing the photo attachment of this report, it is obvious that the cars are loaded heavy on one end and light on the other. An unbalanced car could have wheel lift on the light end when encountering an anomaly in the track structure.