Federal Railroad Administration
Office of Safety
Headquarters Assigned
Accident Investigation Report
HQ-2012-33

Paducah & Louisville Railway Company (PAL)
Louisville, KY
October 29, 2012

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-2012-33

1.Name of Railroad Operating Train #1: Paducah & Louisville Rwy Co. [PAL]	1a. Alphabetic Code: PAL	1b. Railroad Accident/Incident No.: 2012OCT1D
2.Name of Railroad Operating Train #2: N/A	2a. Alphabetic Code: N/A	2b. Railroad Accident/Incident No.: N/A
3.Name of Railroad Operating Train #3: N/A	3a. Alphabetic Code: N/A	3b. Railroad Accident/Incident No.: N/A
4.Name of Railroad Responsible for Track Maintenance: Paducah & Louisville Rwy Co. [PAL]	4a. Alphabetic Code: PAL	4b. Railroad Accident/Incident No.: 2012OCT1D
5. U.S. DOT_AAR Grade Crossing Identification Number:	6. Date of Accident/Incident: Month 10 | Day 29 | Year 2012	7. Time of Accident/Incident: 04:59:00 ☑ AM ☐ PM

8. 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)* — Code: 01

9. Cars Carrying HAZMAT	10. HAZMAT Cars Damaged/Derailed	11. Cars Releasing HAZMAT	12. People Evacuated	13. Division
33	10	2	999	Louisville District

14. Nearest City/Town	15. Milepost *(to nearest tenth)*	16. State Abbr	16. State Code	17. County
Louisville	20.2	KY	21	JEFFERSON

18. Temperature (F) *(specify if minus)*	19. Visibility *(single entry)* 1. Dawn 2. Day 3.Dusk 4.Dark — Code	20. Weather (single entry) 1. Clear 2. Cloudy 3. Rain 4. Fog 5.Sleet 6.Snow — Code	21. Type of Track 1. Main 2. Yard 3. Siding 4. Industry — Code
36 F	4	1	1

22. Track Name/Number	23. FRA Track Class (1-9, X) — Code	24. Annual Track Density *(gross tons in millions)*	25. Time Table Direction 1. North 2. South 3. East 4. West — Code
Main	3	8.3	1

OPERATING TRAIN #1

26. 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	27. Was Equipment Attended? 1. Yes 2. No — Code	28. Train Number/Symbol
1	1	CPL1-28

29. Speed *(recorded speed, if available)* R - Recorded E - Estimated — Code	31. Method(s) of Operation *(enter code(s) that apply)*	31a. Remotely Controlled Locomotive?
25 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
30. Trailing Tons *(gross tonnage, excluding power units)*: 3810	Code(s): g | j | N/A | N/A | N/A	0

32. Principal Car/Unit	a. Initial and Number	b. Position in Train	c. Loaded *(yes/no)*
(1) First involved *(derailed, struck, etc)*	SHPX221320	26	yes
(2) Causing *(if mechanical cause reported)*	0	0	N/A

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

Alcohol	Drugs
0	0

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

35. 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	6	0	0	0	0
(2) Total Derailed	0	0	0	0	0

36. Cars	Loaded a. Freight	Loaded b. Pass.	Empty c. Freight	Empty d. Pass.	e. Caboose
(1) Total in Equipment Consist	48	0	9	0	0
(2) Total Derailed	12	0	1	0	0

37. Equipment Damage This Consist	38. Track, Signal, Way, & Structure Damage	39. Primary Cause Code	40. Contributing Cause Code
$650,000.00	$85,777.00	T207	N/A

Number of Crew Members

41. Engineer/ Operators	42. Firemen	43. Conductors	44. Brakemen
1	0	1	0

Length of Time on Duty

45. Engineer/Operator	46. Conductor
Hrs 9 Mi 59	Hrs 9 Mi 59

Casualties to:	47. Railroad Employees	48. Train Passengers	49. Other
Fatal	0	0	0
Nonfatal	0	0	0

50. EOT Device? 1. Yes 2. No	51. Was EOT Device Properly Armed? 1. Yes 2. No
1	1

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

OPERATING TRAIN #2

53. 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	54. Was Equipment Attended? 1. Yes 2. No — Code	55. Train Number/Symbol
N/A	N/A	N/A

56. Speed *(recorded speed, if available)* R - Recorded E - Estimated — Code	58. Method(s) of Operation *(enter code(s) that apply)*	58a. 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

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION

FRA FACTUAL RAILROAD ACCIDENT REPORT

FRA File # HQ-2012-33

57. Trailing Tons *(gross tonnage, excluding power units)* N/A

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

59. 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

60. 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

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

62. 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

63. Cars	Loaded a. Freight	Loaded 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

64. Equipment Damage This Consist $0.00

65. Track, Signal, Way, & Structure Damage $0.00

66. Primary Cause Code N/A

67. Contributing Cause Code N/A

Number of Crew Members

68. Engineer/ Operators	69. Firemen	70. Conductors	71. Brakemen
0	0	0	0

Length of Time on Duty

72. Engineer/Operator Hrs 0 Mi 0

73. Conductor Hrs 0 Mi 0

Casualties to:	74. Railroad Employees	75. Train Passengers	76. Other
Fatal	0	0	0
Nonfatal	0	0	0

77. EOT Device? 1. Yes 2. No N/A

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

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

OPERATING TRAIN #3

80. 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 N/A

81. Was Equipment Attended? 1. Yes 2. No Code N/A

82. Train Number/Symbol N/A

83. Speed *(recorded speed, if available)* Code R - Recorded E - Estimated N/A MPH N/A

84. Trailing Tons *(gross tonnage, excluding power units)* N/A

85. Method(s) of Operation *(enter code(s) that apply)*

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

85a. Remotely Controlled Locomotive?
0 = Not a remotely controlled
1 = Remote control portable
2 = Remote control tower
3 = Remote control transmitter - more than one remote control transmitter N/A

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

87. 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

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

89. 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	N/A	N/A	N/A	N/A	N/A
(2) Total Derailed	N/A	N/A	N/A	N/A	N/A

90. Cars	Loaded a. Freight	Loaded b. Pass.	Empty c. Freight	Empty d. Pass.	e. Caboose
(1) Total in Equipment Consist	N/A	N/A	N/A	N/A	N/A
(2) Total Derailed	N/A	N/A	N/A	N/A	N/A

91. Equipment Damage This Consist N/A

92. Track, Signal, Way, & Structure Damage N/A

93. Primary Cause Code N/A

94. Contributing Cause Code N/A

Number of Crew Members

95. Engineer/ Operators	96. Firemen	97. Conductors	98. Brakemen
N/A	N/A	N/A	N/A

Length of Time on Duty

99. Engineer/Operator Hrs N/A Mi N/A

100. Conductor Hrs N/A Mi N/A

Casualties to:	101. Railroad Employees	102. Train	103. Other
Fatal	N/A	N/A	N/A
Nonfatal	N/A	N/A	N/A

104. EOT 1. Yes 2. No N/A

105. Was EOT Device Properly 1. Yes 2. No N/A

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

Highway User Involved

107. 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

108. Vehicle Speed *(est. MPH at impact)* N/A

109. *geographical)* 1.North 2.South 3.East 4.West Code N/A

Rail Equipment Involved

111. 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

112. Position of Car Unit in N/A

DEPARTMENT OF TRANSPORTATION
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FRA FACTUAL RAILROAD ACCIDENT REPORT

FRA File # HQ-2012-33

110. Position 1.Stalled on Crossing 2.Stopped on Crossing 3.Moving Over Crossing 4. Trapped	Code N/A	113. Circumstance 1. Rail Equipment Struck Highway User 2. Rail Equipment Struck by Highway User	Code N/A
114a. 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	114b. Was there a hazardous materials release 1. Highway User 2. Rail Equipment 3. Both 4. Neither	Code N/A
114c. State here the name and quantity of the hazardous materials released, if any. N/A			

115. Type 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	116. Signaled Crossing *(See instructions for codes)*	Code	117. Whistle Ban 1. Yes 2. No 3. Unknown	Code
Code(s) N/A N/A N/A N/A N/A N/A N/A		N/A		N/A

118. Location of Warning 1. Both Sides 2. Side of Vehicle Approach 3. Opposite Side of Vehicle Approach	Code N/A	119. Crossing Warning with Highway Signals 1. Yes 2. No 3. Unknown	Code N/A	120. Crossing Illuminated by Street Lights or Special Lights 1. Yes 2. No 3. Unknown	Code N/A

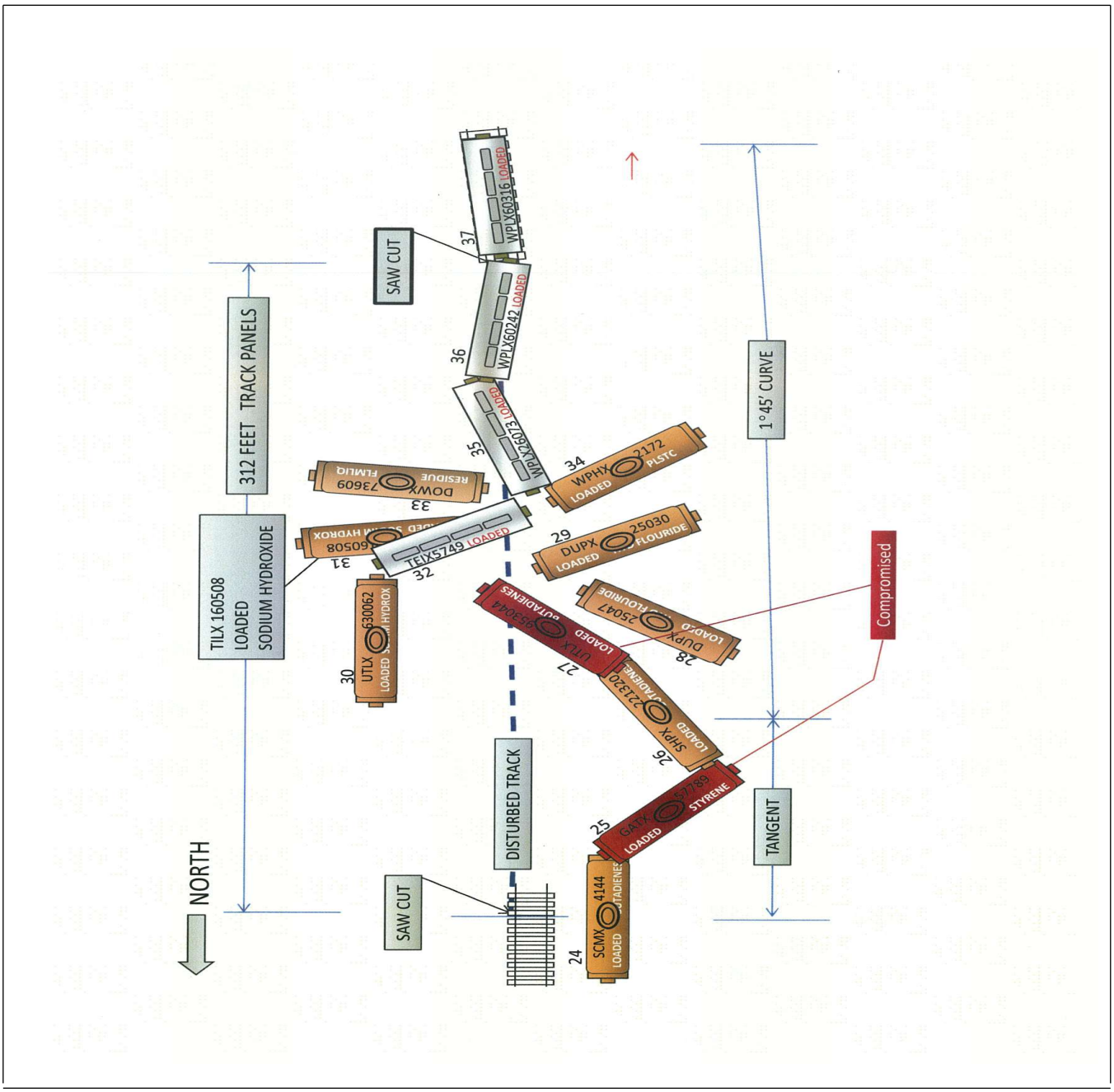
121. Age N/A	122. Driver's Gender 1. Male 2. Female	Code N/A	123. Driver Drove Behind or in Front of and Struck or was Struck by Second Train 1. Yes 2. No 3. Unknown	Code N/A	124. Driver 1. Drove around or thru the Gate 2. Stopped and then Proceeded 3. Did not Stop 4. Stopped on Crossing 5. Other *(specify in narrative)*	Code N/A

125. Driver Passed Highway Vehicle 1. Yes 2. No 3. Unknown	Code N/A	126. 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

Casualties to:	Killed	Injured	127. Driver 1. Killed 2.Injured 3. Uninjured	Code N/A	128. Was Driver in the Vehicle? 1. Yes 2. No	Code N/A
129. Highway-Rail Crossing Users	N/A	N/A	130. Highway Vehicle Property Damage *(est. dollar damage)*	N/A	131. Total Number of Highway-Rail Crossing Users *(include driver)*	N/A

132. Locomotive Auxiliary Lights? 1. Yes 2. No	Code N/A	133. Locomotive Auxiliary Lights Operational? 1. Yes 2. No	Code N/A
134. Locomotive Headlight Illuminated? 1. Yes 2. No	Code N/A	135. Locomotive Audible Warning Sounded? 1. Yes 2. No	Code N/A

136. DRAW A SKETCH OF ACCIDENT AREA INCLUDING ALL TRACKS, SIGNALS, SWITCHES, STRUCTURES, OBJECTS, ETC., INVOLVED.



137. SYNOPSIS OF THE ACCIDENT

On October 29, 2012, Paducah & Louisville Railroad (PAL) freight Train CPL1-28 derailed 13 cars in their train near Louisville, KY. The derailment occurred at 4:59 AM Central Daylight Time (CDT) as the train was traveling north with six (6) locomotives and 57 mixed freight cars (48 loads, 9 empties, 3,810 trailing tons, 3,265 feet in length). It was operating on the main line, having entered into the southwestern edge of the City of Louisville, KY, when the train experienced an undesired emergency air brake application. The conductor walked the train and found the 23rd car separated from the train with the knuckle broken off of the leading end and coupler body twisted off of the trailing end. The 24th through 36th cars were derailed at milepost 20.2. Ten (10) of the derailed cars contained hazardous materials which included nine (9) loads and one (1) empty. At the time of the derailment the train was traveling 25.1 mph.

As a result of the derailment, two (2) tank cars were breached and released hazardous product. The Pleasure Ridge Park Fire Department evacuated 12 homes in Abbott's Beach subdivision and 20 homes on Katherine Station Road, initially covering a one-half (1/2) mile radius. The precautionary evacuation remained in place for the residents of Abbott's Beach. The residents of Katherine Station Road were allowed to return home that same night. During the next eight (8) days, various shelter in place and evacuations from one-half (1/2) mile to five (five) miles would be implemented by Louisville Jefferson County Emergency Management Authority as precautions due to activities at the site.

At the time of the derailment, the weather was dark with a temperature of 36 degrees Fahrenheit. There was no precipitation and wind speed of 8.1 mph.

The probable cause of the accident was a broken rail.

138. NARRATIVE

CIRCUMSTANCES PRIOR TO THE ACCIDENT

The crew of northbound Paducah & Louisville Railroad (PAL) Train CPL1-28 included a locomotive engineer and a conductor. They first went on duty at Paducah, Kentucky October 28, 2012, at 7:00 PM (CDT). This was the home terminal for all crew members and all received more than the statutory off-duty period prior to reporting for duty. The crew had the assistance of railroad carmen to perform the Class 1 Initial Terminal brake test and pre-departure inspection on the train which was completed at 9:00 AM (CDT). PAL Train CPL1-28 departed Paducah, Kentucky (MP 225) at 9:10 PM (CDT) on October 28, 2012. The train consist in the possession of the crew lists a total of 77 rail cars, which included 64 loads and 13 empties. The departing train was 4,640 feet in length and weighed 7,907 tons. Six (6) online and active locomotives, shown on consist, supplied the power for train, and these six (6) locomotives are counted in the total load count, thus, the total PAL count of 77 rail cars in train. Actual total number of rail cars listed on consist, minus the six (6) locomotives, is 71 rail cars, including 58 loads and 13 empties. Included in the 71 actual rail cars of Train CPL1-28 were 27 loaded cars containing hazardous materials and six (6) empties.

PAL Train CPL1-28 arrived at Cecilia, Kentucky (MP 47.0) at 3:30 AM (CDT) on October 29, 2012. At Cecilia, the head 14 rail cars in the train were set out, which included 10 loads and 4 empties. Prior to CPL1-28 departing Cecilia, the conductor updated the consist to reflect the new current position in the train of each hazardous material rail car. At 4:00 AM (CDT), CPL1-28 departed Cecilia, Kentucky with six (6) locomotives and 57 cars after having performed a Class III train air brake continuity test. The 57 mixed freight cars were: 48 loads and 9 empties. As the train approached the accident site, the engineer was seated at the controls of the lead locomotive (PAL 2114) and the conductor was seated on the opposite side of the cab compartment.

Just prior to the accident, the engineer stated he had released the dynamic brake for about two and a half minutes (no air brake applied), running on a Clear Signal Indication, and had started to apply power. The locomotive controls were in number three throttle at 25 mph when the crew felt a slight tug and the train went into an emergency air brake application. The engineer reported they were moving at a smooth steady speed. The crew reported the trip as uneventful until the accident.

The track alignment traveling toward the derailment site is described as follows. Beginning at Milepost 20.9 in the northward direction of travel and in succession, are 1,000 feet of tangent track, a 4-degree left hand curve about 400 feet, 1,400 feet of tangent track, then a 1-degree 45 minute right hand curve 600 feet leading to the point of derailment (POD). Following the POD, the curve continues for another 100 feet leading to 3,300 feet of tangent track. Beginning at MP 20.9, in the direction of travel and in succession, the grade is 0.11-percent ascending for about 900 feet, 0-percent for about 1200 feet, 0.26 percent descending for about 1100 feet to the POD, and 0-percent through the last tangent.

THE ACCIDENT

Approaching MP 20.2 of the PAL Louisville District at approximately 4:59.58 AM, CDT, PAL Train CPL1-28 was operating northward at a recorded speed of 25.1 mph and on a clear signal indication. The engineer was seated at the controls of the lead locomotive and the conductor was seated on the opposite side of the cab compartment when the train experienced an emergency application of the train air brakes. The event recorder download from the controlling locomotive, PAL 2114, shows Train CPL1-28 travelling at approximately 25.1 miles per hours at the time of the emergency air brake application. The maximum track speed for this portion of the "J" main is 35 mph. At the time of derailment the temperature was 36 F degrees, windchill: 30.1 F degrees, dew point 28.6 F degrees, humidity 74%, Pressure 30.09, visibility 10 miles, wind direction north west, wind speed 8.1 mph, no precipitation, clear conditions and dark.

The conductor made his way south to investigate the cause of the emergency brake application. He first found the train to be separated between the 22nd and 23rd cars by 10 to 12 car lengths. He closed the angle cock on the rear of the 22nd car to regain air pressure. Moving southward he found the 23rd car, SCMX 4129, a tank car containing a load of Butadiene, to be standing alone on the track with the north end knuckle broken off and the south end coupler body twisted off. About 370 feet behind the 23rd car, he discovered a complete wheel set on the rails as it had been left behind when the 24th car, SCMX 4144 tank car containing Butadiene, had rolled westward off the tracks and into the trees taking its trucks with it that were hanging by the brake rods. There is no evidence that product escaped from SCMX 4144. The conductor began to smell odors and headed back to the locomotives. A fire department first responder heading southbound on U.S. 31W (Dixie Highway) observed the situation, turned around to find the locomotives and to begin offering help. Ten (10) of the derailed rail cars contained hazardous materials, which included nine (9) loads and one (1) empty residue. No injuries were reported from the train crew.

The 25th car, GATX 57789, a tank car containing Styrene Monomer, was ruptured with a large hole on the right side of the upper B-end of the tank. This car came to rest upright and leaning slightly to its left side.

The 26th car, SHPX 221320, a tank car containing Butadiene was punctured by the west rail on the inner side of the A-end, right side car body bolster. The A-end right side truck side frame also was severely cut as the rail continued on to the car body bolster frame. A rail end was found imbedding into SHPX 221320 which was found resting nearly upside down and leaning slightly.

The 27th car, UTLX 953044 tank car containing Butadiene, sustained a large puncture hole in the A-end. UTLX 953044 derailed and came to rest on left side with the B-end elevated above the road bed. Damage to this car included a rip in the jacket near the B-end, bottom left side of the rail car. A large puncture hole is located on the A-end. A significant amount of product escaped from this tank car, contaminating the soil.

The 28th car, DUPX 25047 a tank car containing a load of Hydrogen Fluoride, Anhydrous derailed and came to rest on it's right side with dome at the ground and laying parallel to UTLX 953044. Although there is considerable exterior damage to DUPX 25047, there is no evidence that product escaped.

The 29th car, DUPX 25030, a tank car contained a load of Hydrogen Fluoride, Anhydrous, derailed and came to rest leaning significantly to the right with its dome in contact with side of covered hopper TEIX 5749. There is no evidence that product escaped from this rail car.

The 30th car, UTLX 630062, a tank car containing a load of Sodium Hydroxide Solution, derailed to the east side of the main line, coming to rest on its right side in the ditch that runs parallel to the track on the east side of the main line. There is no evidence that product escaped from this rail car.

The 31st car, TILX 160508, a tank car containing Sodium Hydroxide Solution derailed and came to rest upside down, with the B-end towards ditch, and the A-end embedded into the underside of covered hopper TEIX 5749. There is no evidence that product escaped from this rail car.

The 32nd car, TEIX 5749, a covered hopper containing plastic, derailed in an upright position with the main track. There was considerable loss of product though not hazardous.

The 33rd car, DOWX 73609, an empty tank car came to rest with the B-end in the ditch on the east side of the main line and the A-end against the right side of TEIX 5749.

The 34th car, WPHX 2172, a tank car containing plastic came to rest nearly upright back to the west side of the main line. There is no evidence that product escaped from this rail car.

The 35th car, WLPX 26073, a loaded covered hopper containing plastic came to rest upright with both ends derailed. There was loss of product though not hazardous.

The 36th car (last car derailed), WLPX 60242, a loaded covered hopper containing plastic came to rest upright. There was loss of product though not hazardous.

An evacuation was initiated by the first responders on the scene, and adjacent Dixie Highway (US21W/60) was closed. This first evacuation included a half mile radius as a precaution. The evacuation was completed by the Incident Commander in-charge from the Pleasure Ridge Park Fire Station which included 12 homes from Abbott's Beach, immediately north of the accident site between the mainline and the Ohio River. It also included 20 homes on Katherine Station Road, directly east of the accident site. Residents of Katherine Station Road were allowed to return to their homes that evening around 8:00 PM EDT. Other precautionary shelter-in-place and evacuations were implemented by the Louisville Jefferson County Emergency Management Authority during various activities related to clearing the derailment.

Agencies responding to the scene included Pleasure Ridge Park Fire Department, Louisville Jefferson County Emergency Management Authority, R. J. Corman derailment teams, Paducah and Louisville Railroad, CSXT Railroad, Louisville Gas & Electric, Kentucky Utilities, Kentucky Department of Transportation, Kentucky Emergency Management, CSXT Police, CSXT Hazmat, CSX Environmental, Pettit Environmental, CTEH, CTEB, MSD, AMEC, ASRC, DHS, LMHMT, NWS, 41st CST, 5H TECH, PRP, Louisville Metro Emergency Management S, Metro Hazmat, Louisville Metro Health Department, Federal Railroad Administration, U.S. Environmental Protection Agency, Dupont, and Summit. Numerous fire departments from surrounding counties supplied men and women for support. Louisville Metro Police continued to maintain a perimeter around the damaged cars until their removal, even after Dixie Highway was re-opened to two way traffic on November 5th, 2012.

POST ACCIDENT INVESTIGATION

Federal Post Accident Toxicology Testing- Analysis
Both crew members of PAL Train CPL1-28 were tested for alcohol and drug usage in accordance with FRA post accident testing requirements.

Conclusion
All tests were negative. Crew impairment was not a causal or contributing factor.

Operating Crew- Analysis
The two (2) crew members of PAL Train CPL1-28 were interviewed for proper train handling and operating procedures. FRA interviewed the crew to determine compliance with PAL Operating Rules, FRA regulations or any additional actions that may have impacted the train's operation. Crew actions and train handling that occurred before, during, and immediately after the accident were discussed. Crew work histories, rest cycles, experience, and training were also reviewed.

Conclusion
FRA took no exception to the practices and procedures of the train crew.

Fatigue- Analysis
The interviews of the crew members determined rest habits were normal and behaviors were conservative during off-duty hours.

(Fast Wizard) was used to develop various scenarios for analysis.
The CPL1-28 Engineer's effectiveness level at the time of the HGCS accident was 70.63 percent.
The CPL1-28 Conductor's effectiveness level at the time of the HGCS accident was 67.92 percent.

Conclusions: Fatigue was not a factor.

Train Operations- Analysis
The locomotives were equipped with speed indicators and event recorders as required. The event recorder data was downloaded by PAL Road Foreman of Engines (RFE) at the accident site and reviewed by FRA and PAL in Louisville, KY. Sound and video recordings were also captured by the lead and rear locomotives of the consist. There were no exceptions to train handling.

Conclusion
The locomotive engineer was in compliance with all applicable railroad operating and train handling requirements.

Mechanical- Analysis
Inspections of the locomotives and cars were conducted at the scene of the accident and PAL Yard in Louisville Kentucky. No defects or exceptions were noted.

Conclusion
Inspections found no mechanical factors or defective conditions that could have contributed to or caused this accident.

Track- Analysis

An inspection was made of the undisturbed track at the accident site, no defective conditions were noted. Track notes were taken from the north and south approach to the derailment site, no defective conditions were noted. The rail throughout the accident site was 115LB RE manufactured by Tennessee in April of 1974. It's probable the rail was installed within the next couple years after manufacturing. The track section between mileposts 20 and 21 was timbered with 1,104 ties and surfaced in 2008. FRA found no evidence of recent track work or slow orders through the accident area.

FRA inspected the PAL's track inspection reports for one month prior to the derailment. No conditions were noted by the PAL Inspector in the area of the derailment, no exceptions were taken to the PAL's track inspection reports. A PAL Track Inspector inspected the track through the accident location two days prior to the derailment, no exception were noted on his report. During his interview he stated he recognized a flattened rail condition on the outer rail of the curve near the POD, but was not concerned. The track structure was last inspected by a Geometry Truck on March 22, 2012 no FRA exceptions were noted in the area of the accident during that inspection. A 1 ¼" inch difference in crosslevel was identified near the flattened rail condition and POD during the Geometry inspection.

Two years of rail inspection reports and associated remedial actions were reviewed for the accident area. Sperry Rail Services (SRS) conducted an internal search for rail defects in May 2012 through the accident area. One engine burn rail defect on the east rail at MP 20.3 was identified by Sperry during the May 2012 inspection. FRA Rail Integrity Specialist's reviewed the rail inspection records, along with Sperry screen shots for the curve at the derailment site. The FRA Staff Director of the Rail Integrity Division reviewed the screen shots and did not believe a citation for defective condition was warranted from the test car operator at the time of the inspection.

The prior two years of PAL service rail failures identified one failure of an epoxy insulated joint on the west rail near the northbound signal, south of the derailment site. No rail repair plugs were found in the rail recovered from the accident. All rail reconstructed was identified as 115 LB RE 1974 Tennessee. According to PAL, the

tonnage estimate for 2011 was 8.3 MGT. The estimate for prior years, back to 1998, averaged 7.8 MGT.

Rail Reconstruction

The damaged track at the site was saw cut, and eight 39 foot long track panels were installed for a total distance of 312 feet to replace the damaged track. The majority of the main track damaged rail was recovered for reconstruction and analysis.

The “Rail Re-construction” sketch identifies each piece of rail recovered in order of its original installation in track. The layout was determined by having a definite match or using probable evidence. Each piece of rail recovered was assigned a sequential number, in the order inventoried. The rail reconstruction team recovered the entire east rail matching it end to end; all rail except for 15 feet 8 inches was recovered from the west rail. After evaluation, it was determined there were three gaps adding up to the total missing rail. By using the consistent spacing of the rail identification markings, spaced every 80” on the web of rail, the Team determined a 34 ½ inch gap of missing rail existed between the 17th and 14th pieces. The flattened rail exhibited on rail #14 and #17 substantiates this gap.

Rail #14:
Severe rail end batter existed on the receiving end. Wheel flange climb marks, about 8” to 9” from the same end, were evident from the impact load of SHPX 221320 R1 wheel.
Rail #17:
Evidence of a transverse detail fracture existed in the gage corner. Evidence of head and web fatigue fractures existed in the gage side web. Rail end batter was evident on the trailing end.

Track Conclusion
The final position of the derailed cars was sudden and abrupt. This is typical in derailments caused from broken rails, especially when the rail failure occurs on the outer rail (high side) of a curve. Based on the compilation of evidence, it is probable that wheel R1 on the leading end of rail car SHPX 221320 was the first to derail. The loss of the wheel/rail relationship (POD) likely occurred at the 34 ½ inch length of missing rail.

Probable Cause
A broken rail is the probable cause of the accident, with a transverse detail fracture evident in the end of Rail #17.