

MISSOURI PACIFIC RAILROAD COMPANY

NEELYVILLE, MISSOURI

JUNE 16, 1977

Synopsis

One hazardous material tank car exploded and a second was punctured and leaked its entire contents following a side collision of two Missouri Pacific Railroad freight trains on June 16, 1977, at 1:17 a.m., at Neelyville, Missouri. Two crew members were injured and about 160 area residents were evacuated as a result of the accident.

Cause

The engineer of Extra 3126 North, one of the two trains involved in the collision, did not operate his train in accordance with the signal indications displayed. A primary contributing factor was the Extra 3126 North front brakeman's failure to take any positive action to stop the train when the engineer did not do so.

Location and Method of Operation

The accident occurred on that part of the railroad extending southward from Poplar Bluff, Missouri, to North Little Rock, Arkansas, a distance of 178.1 miles. Trains operate in the accident area by timetable, train orders and signal indications of a traffic control system in either direction over a single main track. A siding that is 8,457 feet long parallels the main track to the east. The trains collided at the north siding switch, 4,153 feet north of the Neelyville, Missouri, station sign.

From the south in the immediate accident area the grade is practically level, and the track alignment is as follows: a tangent for 23,649 feet; a $0^{\circ}14'$ curve to the left for 814 feet; a tangent for 3,039 feet to the point of collision and 1,914 feet beyond.

The maximum authorized speed in the accident area is 60 m.p.h. However, a train order restricted the speed of the two involved freight trains to a maximum of 50 m.p.h.

Signals

Signals 1814 and 1798L govern northbound movements on the main track at Neelyville. They are, respectively, 9,073 and 146 feet south of the collision point at the north siding switch. Signals 1779 and 1797 govern southbound movements proceeding on the main track and entering the siding. They are, respectively, 8,269 and 101 feet north of the north siding switch at Neelyville. The signals are constant lighted and, when power is off, approach lighted.

The applicable aspects, corresponding indications and names are:

<u>Signal</u>	<u>Aspect</u>	<u>Indication</u>	<u>Name</u>
1814	Green Over Red	Proceed	Clear
	Yellow Over Red	Proceed, immediately reducing to 40 MPH or slower if necessary, prepared to stop before reaching next signal.	Approach
1798L	Red Over Red	Stop	Stop
	Yellow	Proceed, immediately reducing to 40 MPH or slower if necessary, prepared to stop before reaching next signal.	Approach
1779	Yellow	Proceed, immediately reducing to 40 MPH or slower if necessary, prepared to stop before reaching next signal.	Approach
1797	Red Over Lunar	Proceed at Low Speed: * * * (3) Where this signal governs movement onto non-signalized track -- until entire train is through turnout.	Low

Employees in the train dispatcher's office at North Little Rock, Arkansas, control signals 1814, 1798L, 1797 and both Neelyville siding switches from the traffic control machine. The circuits are so arranged that with the north siding switch lined for the movement of a southbound train from the main track into the siding, and with the south siding switch lined for the movement of a northbound train on the main track, the signals display the following aspects: for a southbound train, signal 1779 displays a Yellow (Approach) aspect, and 1797, a Red Over Lunar (Low) aspect. For a northbound train signal 1814 displays a Yellow Over Red (Approach) aspect, and 1798L, a Red Over Red (Stop) aspect.

Sight Distance

The view of signal 1814 from a northbound train is unobstructed for more than 15,000 feet approaching the south siding switch. Track curvature, vegetation and a pole line

on the west side of the main track restrict the view of signal 1798L. Signal 1798L is first visible when the locomotive of a northbound train is 5,100 feet south of the signal and remains in sight until the locomotive is 3,050 feet south of the signal. At this point, cars of a southbound train on the north end of the siding obstruct the view of 1798L. The view remains obstructed until the northbound train is 1,500 feet south of signal 1798L. There the signal once again is visible and remains so until the northbound train passes the signal.

Uniform Code of Operating Rules

LOW SPEED -- A speed that will permit stopping short of train, engine, obstruction, or switch not properly lined and looking out for broken rail, but not exceeding 20 miles per hour.

107. Co-operation Between Crew Members. -- * * *
(6) * * *

When the conductor or engineer fails to take action to stop the train, and an emergency requires, other members of crew must take immediate action to stop the train.

327. Where Stop Must be Made. -- A train or engine must stop before any part of the train or engine passes a Stop, or Stop, Then Proceed at Low Speed indication. * * *

400. Movement by Signal Indication. -- Within defined limits on designated tracks, so specified on the timetable, or by special instructions, the movement of trains and engines will be governed by block signals whose indications will supersede the superiority of trains for both opposing and following movements on the same track, but do not supersede train orders. * * *

The movement of trains and engines will be supervised by the train dispatcher, who will issue instructions to the control operator, when required.

Circumstances Prior to the Accident

Extra 3211 South

The crew of Extra 3211 South went on duty at Poplar Bluff, Missouri, at 12:30 a.m., on June 16, 1977. At 12:44 a.m., Extra 3211 South, consisting of 2 locomotive units, 34 loads and 76 empties left Poplar Bluff. Signal 1779 at Neelyville displayed a Yellow (Approach) aspect, and the crew reduced the speed of the train to 25 m.p.h. Signal 1797 displayed a Red Over Lunar (Low) aspect, and the crew further reduced the speed of the train to 20 m.p.h. When Extra 3211 South entered the siding at the north siding switch, the engineer and front

brakeman were in the lead locomotive unit. This unit was positioned with the front, or short, end southernmost, placing the engineer on the right, or west, side of the locomotive. The flagman was riding in the second locomotive unit, and the conductor was in the caboose.

Extra 3126 North

The crew of Extra 3126 North went on duty at North Little Rock, Arkansas, at 7:30 p.m., on June 15, 1977. The engineer received the three-unit locomotive consist, 3126, 3027, 3087, in that order, at the North Little Rock diesel service track. He was instructed to operate the units to the yard and there to couple them to the rest of the train, which already had been tested and inspected. Before leaving the service track, the engineer made an air brake test on the consist and discovered a defective automatic brake valve on lead unit 3126. This unit then was placed in the middle of the locomotive consist, with unit 3087 operating as the lead unit. In this order, the brakes functioned as intended.

At 9:00 p.m., Extra 3126 North, consisting of 3 locomotives, 103 loads and 13 empties, left North Little Rock. At McRae, Arkansas, 36 miles north of North Little Rock, the crew made a carrier-required walking inspection of the train. During this inspection the train was delayed 15 minutes while the conductor tried unsuccessfully to repair a loose generator belt on the caboose. Also during the inspection the flagman found an air leak about 35 cars ahead of the caboose. He could not completely repair the leak, but the train air brakes were used several times en route to Neelyville, and no problems were encountered.

As Extra 3126 North approached Neelyville, the engineer and front brakeman were riding in unit 3087, the lead locomotive unit. This unit was positioned with the front, or short, end northernmost, with the engineer on the right, or east, side of the locomotive. The conductor and flagman were in the caboose.

The Accident

Extra 3211 South

The engineer of Extra 3211 South first saw the headlight of oncoming Extra 3126 North when the lead unit of Extra 3211 South was 1,500 feet into the siding. Neither he nor his front brakeman could state after the accident whether the crew of the northbound train ever sounded its horn or bell or applied the train air brakes. Extra 3126 North struck the 87th car behind the locomotives of Extra 3211 South.

The force of the impact derailed the 93rd through 98th cars; the train separated between the 92nd and 93rd cars, causing an emergency train air brake application. The 89th through 92nd cars jackknifed in derauling and sideswiped Extra 3126 North. A jackknife derailment of Extra 3126 North caused another derailment, the 74th through 82nd cars of Extra 3211 South.

Extra 3126 North

In his post-accident statement, the engineer of Extra 3126 North stated that as his train approached Neelyville, signal 1814 at the south siding switch displayed a Yellow Over Red (Approach) aspect. When the train was about 2,000 feet south of the south siding switch at Neelyville, he added, the signal changed from Yellow Over Red (Approach) to Green Over Red (Clear), so the engineer maintained a speed of 50 m.p.h. past this signal.

According to the front brakeman, however, signal 1814 displayed a Yellow Over Red (Approach) aspect as Extra 3126 North neared and passed the signal. He said he called this signal indication to the engineer and thought his call was acknowledged. But no action was taken to reduce the train speed.

The locomotives of Extra 3126 North met and passed the locomotives of Extra 3211 South 4,626 feet south of the collision point. After the opposing locomotives passed each other, the engineer and front brakeman of Extra 3126 North did not immediately note the aspect displayed by signal 1798L. After the accident, the front brakeman stated that when he first saw signal 1798L, shortly after passing the other locomotives of Extra 3211 South, it displayed an aspect indicating Approach although Extra 3211 South had not yet cleared the main track. He immediately arose from his seat, called to the engineer and, without taking any action to stop the train, jumped from the locomotive to the ground. Train speed at this time was 50 m.p.h.

Until immediately before the collision, the engineer stated, he never noted the aspect displayed by signal 1798L. When he did see it, it displayed a Red (Stop) aspect, and he had only seconds to place the train brakes into emergency and fall to the floor before impact. He did not have time to reduce the throttle from its eighth position.

The force of the collision derailed all three locomotive units and the first 11 cars behind the locomotives at or near the point of collision. When the train air brakes applied in emergency, the 18th and 19th cars behind the locomotives jackknifed off the track.

The coupler of the 25th car overrode the coupler of the 26th car, puncturing the 26th car and causing its cargo, vinyl chloride, to explode and burn. Heavy smoke and toxic fumes resulting from the explosion and fire prompted the local Civil Defense Director to order the evacuation of 162 residents at 4:00 a.m. The evacuation order was rescinded at 9:00 a.m., that same morning, at which time the people were permitted to return to their homes. The explosion, together with the emergency brake application, caused another derailment, this of the 27th through 52nd cars.

Damages and Casualties

Extra 3211 South

The locomotives and first 73 cars of Extra 3211 South did not derail, nor were they damaged. A jackknife derailment and the sideswipe collision derailed the 74th through 82nd cars. The explosion and fire destroyed two cars and heavily damaged three others; these five were the 83rd through 87th cars. The 87th car did not derail. The collision damaged the 88th car but did not derail it. The 89th through 92nd cars derailed but remained upright. The 93rd through 98th cars derailed and overturned in various positions near the point of collision. And at the rear of the train, the caboose and 99th through 109th cars neither derailed nor were damaged.

Extra 3126 North

In the derailment, the lead locomotive of Extra 3126 North, unit 3087, was turned at a right angle to the west of the track and propelled about 21 feet in that direction into a field, coming to rest on its right side. The second and third locomotive units, 3126 and 3027, also derailed to the west of the main track, traveling northward beyond unit 3087, before coming to rest on their left sides with the leading end of unit 3126 391 feet north of the collision point.

The first 11 cars behind the locomotives derailed, overturned and stopped at or near the collision point. Among these 11 cars was a car of hydrochloric acid which was punctured; the contents were lost. The 12th through 17th cars did not derail. The 18th through 21st cars jackknifed, derailing to the east into the side of Extra 3211 South. The 22nd through 25th cars did not derail, but the force of the impact caused the type "E" coupler of the 26th car to override the type "F" coupler of the 25th car, puncturing the 25th car. The contents of the 25th car, vinyl chloride, exploded and burned, destroying the 26th car. The explosion and emergency brake application resulted in the derail-

ment of the 27th through 52nd cars. Twenty-four of these cars sustained heavy damage; two sustained minor damage. All 26 cars stopped in various positions across the main track and siding, causing further derailment of Extra 3211 South. The rear 64 cars of Extra 3126 North did not derail, nor were they damaged.

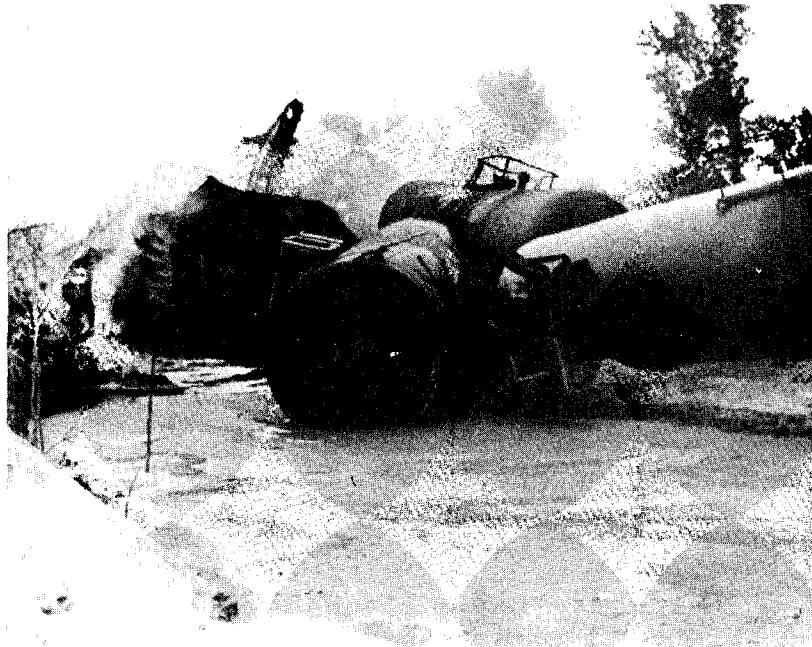
Cost

Missouri Pacific officials enumerated the cost of damages to equipment, track and signals as follows:

Cars	\$ 780,050.00
Locomotive Units	246,150.00
Track	57,000.00
Signals	60,000.00
TOTAL	<u>\$1,143,200.00</u>

Casualties

No crew member of Extra 3211 South was injured in the collision and subsequent derailment. The engineer and front brakeman of Extra 3126 North sustained cuts, sprains and bruises when the lead locomotive unit derailed and overturned. The flagman and conductor were uninjured.



General View Looking Northeast

The tank car in the foreground is leaking Hydrochloric acid.

Post-Accident Examinations

Locomotives & Cars/Extra 3126 North

Units 3087 and 3027 are Electro-Motive Division SD40 road-switcher type locomotives, equipped with 26L air brake equipment. Unit 3087 has a gross weight of 391,520 pounds; unit 3027 has a gross weight of 387,900 pounds. Unit 3126 is an Electro-Motive Division SD40-2 road-switcher type locomotive equipped with 26L air brake equipment. Its gross weight is 390,600 pounds.

Post-accident investigators checked the brake application on locomotive unit 3087: the automatic brake valve was in the full service application position; the independent brake valve was about in the 50% application zone; the throttle was in the No. 1 position; and the reverser lever was in the forward position. The fireman's emergency brake valve was in the normal, or closed, position. Because the locomotives were so badly damaged, post-accident air brake tests were impossible. Since none of the three units was equipped with a speed recorder tape, train speed at the time of the collision could not be verified.

Investigators tested and inspected the air brakes on the remaining undamaged cars of Extra 3126 North and found them to be in effective operating condition.

Signal System

No tests were made on signal 1798L because the signals and all signal equipment at north siding switch at Neelyville were destroyed by the derailment.

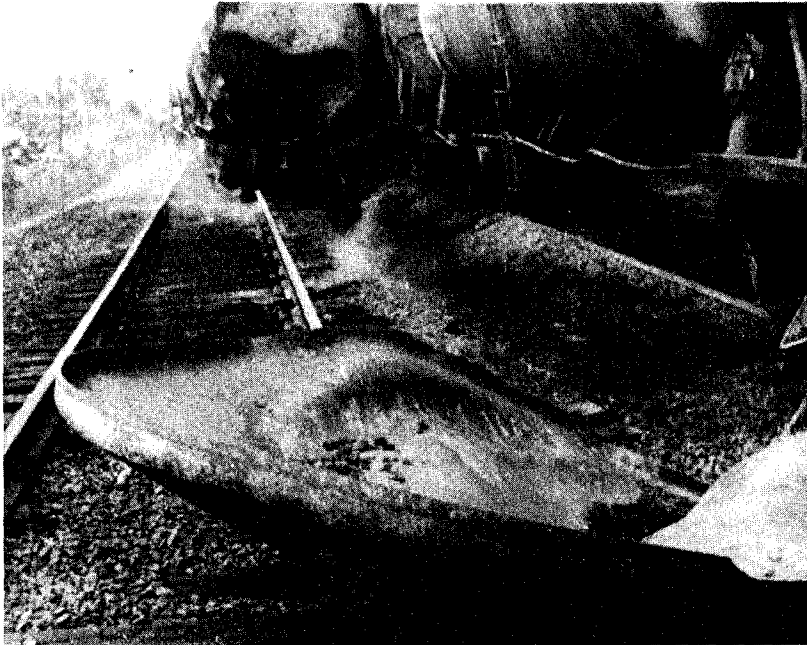
On June 16, 1977, investigators tested signal 1814 at the south siding switch at Neelyville as described below. When lighted, the Yellow aspect of signal 1814 was clearly visible with nothing to obstruct the view of this signal from an approaching northbound train. For signal 1814 to display a Green Over Red (Clear) signal aspect, the D relay would have to be in the energized position. This D relay was tested and found to function properly. No defects were noted during a walking inspection of the pole line from the south siding switch at Neelyville to the collision point. All signal circuits were free of grounds. In summary, investigators discovered nothing to indicate that the signal system malfunctioned.

Engineer and Front Brakeman Extra 3126 North

The engineer of Extra 3126 North had 35 years of service, 13 of them as an engineer, at the time of the accident. The front brakeman had five years of service. Both employees last were examined on the operating rules in March 1976.

Hazardous Materials

The vinyl chloride was being transported in a DOT 105A-300W specification tank car from the Great American Chemical Company in Freeport, Texas, to the Great American Chemical Company in Fitchburg, Massachusetts, when it was punctured by an adjacent car, resulting in spillage, fire and toxic fumes. The car was equipped with "F" type couplers and no head shields. Another tank car, also DOT specification 105A-300W, contained Hydrochloric Muratic Acid. The shipper was Morton Chemical Company in Weeks, Louisiana; the consignee, U. S. Steel Corporation in Gary, Indiana. It was punctured in the derailment and leaked its contents. The car had no head shields.



Looking North
Towards
GATX 47545

Analysis

Extra 3211 South left Poplar Bluff, Missouri, at 12:44 a.m., 14 minutes after the crew was called for duty. The crew reported no problems en route to Neelyville, where the proper signal indications approaching and at the north siding switch were received. The train entered the siding in accordance with signal indications. When struck by Extra 3126 North, Extra 3211 South was being operated in accordance with carrier operating rules.

At North Little Rock, Extra 3126 North was called for 7:30 p.m., however, the automatic brake valve on unit 3126 was defective. Unit 3087 was placed in the lead position, and after the air brakes were tested, the train departed at 9:00 p.m.

According to the crew members of Extra 3126 North, minor problems did not affect normal operation of the train. The air brakes worked effectively, and the radios on the locomotive and caboose were operable. In fact, crew members stated there was a radio conversation between the head-end and rear-end of the train just 10 or 15 minutes prior to the accident, as the train passed the hot box detector near Corning, Arkansas, 11.7 miles south of Neelyville. The dispatcher's time sheet showed Extra 3126 North passing Corning at 1:05 a.m., 12 minutes before the collision. The distance and time involved indicate the train was traveling at an approximate speed of 58.5 m.p.h., although crew members estimated the speed to be 50 m.p.h. approaching Neelyville.

There are discrepancies between the statements of the engineer and front brakeman of Extra 3126 North. The engineer stated that signal 1814 was Yellow when first sighted and that it turned Green as the train approached to within 2,000 feet of it. He added that he did not see signal 1798L at the north siding switch at Neelyville until the train was within 1,000 feet of it and that at that time it displayed a Red aspect. The front brakeman, however, stated that signal 1814 displayed a Yellow aspect and that it stayed Yellow until the train passed the signal. When he saw signal 1798L at the north siding switch, the front brakeman said, it displayed a Yellow aspect.

Another discrepancy concerned the engineer's location before the accident. He stated he stood up in the middle of the cab of the locomotive, as he passed Extra 3211 South in the siding. The front brakemen from both trains, however, stated the engineer was seated in his seat as Extra 3126 North passed Extra 3211 South.

The locomotives of the two trains passed each other approximately 4,480 feet south of signal 1798L. Signal 1798L probably could not have been seen from this point because the engineer and front brakeman of Extra 3126 North would have had to look beyond, almost directly at, the headlight of the southbound train. After passing the headlight of the southbound train, they would have had about 1,430 feet, traveled at a speed of 50 m.p.h., or about 19.5 seconds, to see the signal before the view was restricted. The engineer would not again see signal 1798L until the train was within 1,500 feet of it.

The conflicting statements made by the engineer and front brakeman of Extra 3126 North suggest that they were not alert to conditions affecting the movement of their train. The front brakeman could give no reason for jumping from the train without operating the emergency brake valve, and the engineer, who should have seen signal 1798L displaying a Red aspect, had only enough time to move the brake handle and drop to the floor. Post-accident investigators found the automatic brake handle in the full service position.

Findings

1. The engineer of Extra 3126 North took no action to slow his train in compliance with the indication of signal 1814 which was displaying a Yellow aspect, indicating Approach. He was therefore unable to stop his train in compliance with the Red aspect of signal 1798L, indicating Stop.

2. The front brakeman took no action to require the engineer to slow the train as it passed northbound signal 1814 at the south siding switch at Neelyville. He jumped from the train without taking action to stop the train as it approached signal 1798L at the north siding switch at Neelyville.

3. Extra 3211 South was being operated in accordance with all applicable carrier operating rules.