Railroad Accident Investigation Reports

REPORT NO. 80—2
BURLINGTON NORTHERN, INC.
ALMA WISCONSIN
AUGUST 28,1978

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION
Office of Safety

Location and Method of Operation

The accident occurred on that part of the BN Chicago Division's 4th Subdivision, extending from North La Crosse, Wisconsin to St. Croix Tower, Minnesota, a distance of 109.3 miles. In the accident area, the railroad is double track over which train movement with the current of traffic is governed by signal indications of an automatic block signal system. Between East Winona and Winona Junction, 24.5 and 27 miles west of North La Crosse, there is a 2.5 mile segment of single track. Train movements over this track are governed by signal indications of a traffic control system. Alma, Wisconsin is 50.1 miles west of North La Crosse.

Although geographical directions in the accident area are north and south, east and west timetable directions will be used in this report unless otherwise designated.

The derailment occurred on the westbound track, approximately 2.5 miles east of Alma. The collision occurred on the eastbound track, 2.4 miles east of Alma.

Track

Approaching the point of accident on the eastbound track there is, in succession, a tangent of 1,448 feet, a 400-foot spiral, a compound curve to the left from $0^{\circ}30'$ to $1^{\circ}02'$ for 2,231 feet, a spiral of 407 feet and a tangent of 98 feet to the point of collision and for 770 feet beyond. In the compound curve to the left, the greatest degree of curvature occurs in the last 484 feet.

On the westbound track there is, in succession, a long tangent, a $0^{\circ}56'$ curve to the left for 1,585 feet, a tangent of 3,040 feet, a $0^{\circ}30'$ curve to the right of 4,040 feet, and a 770-foot tangent to the point of collision and for 98 feet beyond.

The gradient in the accident area is level.

At the accident site, the double track line runs geographically north and south along the Wisconsin side of the Mississippi River. On the east, an embankment rises to Wisconsin State Highway No. 35, about 20 feet above the level of, and parallel to, the railroad. On the west side, an embankment slopes steeply 15-20 feet below the level of the eastbound track. Dairyland Power Company's Alma generating plant is located between the tracks and the river, 2.2 miles south of Alma.

Paralleling the tracks westward toward the river, there is, in succession, an overhead electric power transmission line located about 30 feet from the eastbound track, and a 30 to 40-foot wide ditch and rock fill that lies level with the tracks.

Hot Bearing Detectors

On the 4th Subdivision, hot bearing detectors are located 60.2 miles east of North La Crosse at Prairie du Chien, Wisconsin and on the single track segment between East Winona and Winona Junction. Because of a track maintenance program in progress between East Winona and Winona Junction, the detector at that location was not in service on the day of the accident.

Authorized Speed

The maximum authorized speed for freight trains in the accident area is 60 m.p.h.

Signals

Intermediate block signal No. 348.9, governing movements on the eastbound main track, is located 97 feet west of the point of collision. The applicable aspect, corresponding indication and name is:

Signal	Aspect	Indication	Name
348.9	Green	Proceed	Clear

Circumstances Prior to the Accident

Extra CS 873 East

Extra CS 873 East departed Northtown Yard, Minneapolis, Minnesota, 34.3 miles west of St. Croix Tower at 10:02 p.m. on the day before the accident. The eastbound train consisted of two diesel-electric locomotive units, 56 cars and a caboose. Prior to departure, an initial terminal test of the train brakes was performed by carmen.

At Dayton's Bluff Yard, St. Paul, Minnesota, 16.2 miles west of St. Croix Tower, 37 cars were added to the head end of the train. Yard carmen performed an intermediate test of the train brakes. The train departed Dayton's Bluff at 1:27 a.m. on the day of the accident, and passed St. Croix Tower at 2:10 a.m. After a stop at Hager, Wisconsin, where the head car in the train was set out, Extra CS 873 East continued with 69 loads and 23 empties. As the train passed Alma and approached the accident area, the engineer was seated at the controls of the leading locomotive unit and the fireman and front trainman were seated at their respective stations on the opposite side of the control compartment. The conductor and the rear trainman were in the caboose.

Extra 6530 West

Extra 6530 West departed Galesburg, Illinois at 5:00 p.m. on the day prior to the accident. Carmen inspected the train, and the required brake test was performed. The train consisted of three diesel-electric locomotive units, 109 cars and a caboose. At 9:48 p.m., the train departed Savanna, Illinois, 97.5 miles west of Galesburg.

Extra 6530 West arrived at North La Crosse at 1:40 a.m. on the day of the accident. During a crew change, a yard assignment added 29 cars to the rear of the train. After the outbound crew performed an intermediate terminal train brake test, the train departed at 2:48 a.m.

According to the engineer operating the train from North La Crosse, the speed indicator on the leading locomotive unit was inoperative. Speed was estimated by observing the time elapsed between mile posts. Between North La Crosse and East Winona, Extra 6530 West maintained a speed of approximately 40 m.p.h.

Approaching East Winona, speed was reduced to comply with signal indications and a slow order. The slow order was in effect to protect a track sledding program in progress on the single track territory. Extra 6530 West passed East Winona at 3:46 a.m., and proceeded over the single track territory at 10 m.p.h. Upon reentering double track territory at Winona Junction on a clear signal, Extra 6530 West passed two trains standing on the eastbound main track. The conductor on Extra 8010 East, the first eastbound train, observed, from his position on the caboose, the south side of Extra 6530 West. He took

no exception to the passing train. A lantern signal to that effect was given to crew members of the westbound train on the caboose. The conductor of Extra 7000 East, the following eastbound train, also observed the south side of Extra 6530. No mechanical defects or indications of a hot bearing were noted. Results of this inspection were communicated to Extra 6530 West by radio.

The engineer calculated that the speed of his train eight miles west of Alma was 42 m.p.h. This speed was maintained with little or no change. Both the front trainman and the rear trainmen observed the south side of the train as it proceeded through the $0^{\circ}56'$ curve to the left, about four miles east of Alma. This observation did not detect any signs of mechanical defect.

As Extra 6530 West approached the accident area, the engineer was at the controls of the leading locomotive unit and the front trainman was seated at the fireman's position. The conductor and the rear trainmen were in the caboose.

Both train crews were operating in compliance with Hours of Service regulations.

The Accident

Extra CS 873 East

As Extra CS 873 East was proceeding through a curve 1.6 miles east of Alma, the front end crew observed the reflection of the headlight of an approaching westbound train on the rails. The fireman and the front trainman left their seats and stood near the center of the cab to observe the passing train. The train was identified as Extra 6530 West. When nearing the end of the curve, after passing about 15-20 cars of the westbound train, the crew heard a radio transmission from the engineer of Extra 6530 West. The engineer notified the crew of the eastbound train that the brakes of his train had applied in emergency. The engineer of Extra CS 873 East immediately initiated an automatic brake application. At the same time, the train entered tangent track which extended visibility along the side of the westbound track. A car was observed to be protruding from the east side of the westbound train, fouling the east main track. Sparks were seen from under the car. The engineer continued the brake application to the emergency position, while the fireman and the front trainmen jumped to the right side of the cab behind the engineer's seat. The leading locomotive unit of Extra CS 873 East collided with the derailed car a short while after the brakes were applied in emergency.

Extra 6530 West

Upon entering a curve to the right, west of the accident point, the locomotive of Extra 6530 West passed the eastbound train's locomotive consist. Shortly thereafter, the brakes of Extra 6530 West applied in emergency. The engineer immediately transmitted a radio warning to Extra CS 873 East and placed the automatic brake control valve in emergency. While the train was stopping, the engineer and the front trainmen observed that an emergency application had also occurred on the eastbound train. Several minutes after both trains came to a stop, a radio transmission was heard to the effect that the locomotive units of Extra CS 873 were in a ditch and that the crew members were safe.

Damage

Extra CS 873 East

The locomotive units of Extra 873 East derailed to the right, or south, and stopped in line at an 45° angle to the track. The front of the locomotive was 420 feet east of the point of impact, and 65 feet south of the east main track. The first through the 15th and the 20th through the 44th cars were derailed.

The first through 13th cars stopped behind the locomotive south of the eastbound track within a distance of 180 feet. The 20th through 44th cars were scattered on each side of the east and the west main tracks within a distance of 200 to 600 feet west of the point of collision. The 14th and 15th cars stopped upright in line with the eastbound track. The 16th through 19th cars did not derail and were undamaged. Separations occurred between the trailing locomotive and the first car, and between the 1st through the 14th cars. Separations also occurred between the 19th and the 44th cars.

The locomotive units were heavily damaged. Twenty-nine of the 40 derailed cars were destroyed, 10 were heavily damaged and one was slightly damaged.

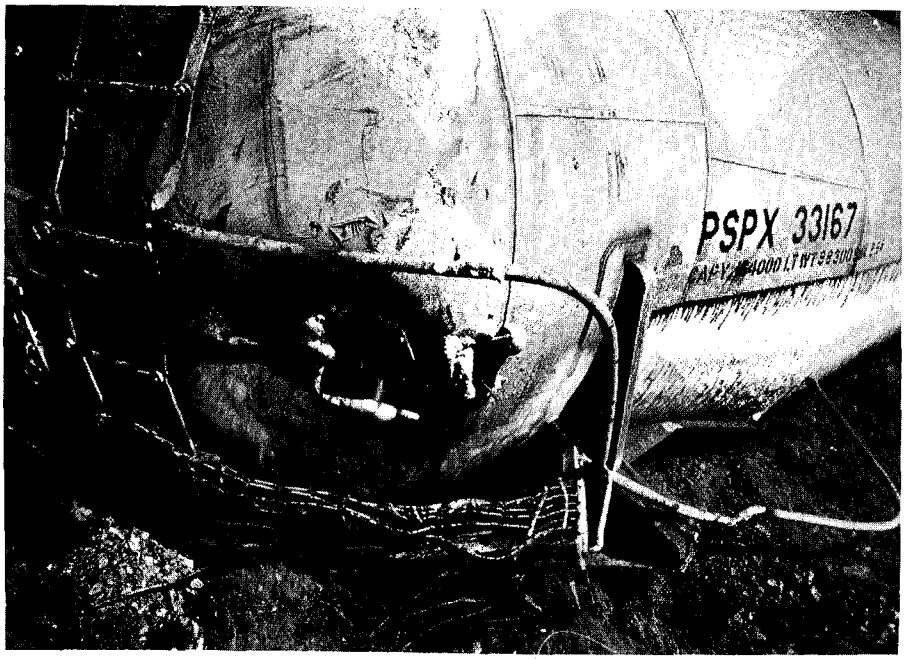
Extra 6530 West

The locomotive units of Extra 6530 West and the head end 54 cars cleared the accident site intact. The locomotive units stopped an estimated 3,800-3,900 feet west of the point of collision. The 54th car stopped 56 car lengths west of the rear of the eastbound train. The 55th through 72nd cars derailed.

The body of the 55th car, BN 231736, stopped upright on the structure of the west main track with the west end of the car 50 feet east of the point of collision. The remaining derailed cars stopped at various angles to the track structures of the east and west main tracks, 190 to 600 feet east of the point of collision. Separations occurred between the 54th and 72nd cars.

The trucks of BN 231736 were found on the east main track about 200 feet east of the point of collision, adjacent to the west end of BN 244569, the 56th car of Extra 6530 West. BN 231736 was destroyed as a result of the collision. Of the 17 other derailed cars, eight were destroyed and nine were heavily damaged.

The 70th car of Extra 6530 West, PSPX 33167, was a tank car containing anhydrous ammonia. The tank was separated from both trucks in the derailment, and from the cars at either end. The tank came to rest on and parallel to the shoulder on the field side of the westbound track, tilted to the north at about 15°. The head of the tank on the west or "B" end was embedded in the roof of a covered hopper car, the 68th car. A gash in the tank head on the west end allowed the release of a considerable portion of the contents.



View of punctured tank of car PSPX 33167

Approximately 1,250 feet of westbound track and 1,150 feet of eastbound track was destroyed or heavily damaged. The mast and base of intermediate signal 348.9 was destroyed. In addition, four poles supporting an overhead electric power transmission line were destroyed, cutting off power to the town of Alma and the surrounding area.

The estimated cost of damage was $1,121,800 to equipment, $112,400 to track and $2,000 to signals. Total cost was $1,236,200.

Hazardous Material Aspects

After Extra 6530 West had stopped because of the emergency brake application, the conductor and the rear trainman proceeded toward the head end of the train to determine the cause. Upon encountering a progressively stronger odor of ammonia, they retreated back toward the caboose. The conductor reported, by radio, the presence of a car of anhydrous ammonia in his train. He also reported that he had encountered strong ammonia fumes, indicating a release of the anhydrous ammonia. The conductor and the rear brakeman then climbed the embankment to the highway where they stopped a truck to carry them through the affected area. The conductor and the rear trainman were subsequently treated for inhalation of ammonia.

At approximately 5:15 a.m., the conductor arrived at Alma and notified the county sheriff and the local fire department of the accident and release of anhydrous ammonia. The sheriff accompanied the conductor to the location of the leaking tank car, and proceeded to evacuate occupants of dwellings close to the highway.

The Alma fire department apparatus reached the accident site at 5:30 a.m., and pumped water on the escaping ammonia for several hours. On the day of and following the accident, vaporization of the liquid in the tank occurred at a slow rate. Prevailing light winds dispersed the ammonia fumes, and evacuees were permitted to return to their homes.

Post Accident Investigation and Analysis

Extra CS 873 East

In the collision, the left front and side walkway of the front locomotive unit of Extra CS 873 East absorbed most of the impact. The front and side of the control compartment on the fireman's side, including the forward exit door, were torn out. The seats were demolished. Steps and handholds at the left

front corner and the hand rail along the left walkway were destroyed. Damage to the left front of the locomotive hood indicated that contact with the derailed car initially occurred about 11 inches inside the north rail of the eastbound main track.

View of damage to Locomotive Unit CS 873

The speed recorder in this unit was not equipped with a recording tape.

Similar damage was sustained by the control compartment on the fireman's side, the left front corner, and the left walkway of the trailing locomotive unit of Extra CS 873 East, unit 6446. Access doors to compressor compartments on each side of the unit were torn away.

The recording tape removed from the trailing locomotive unit, No. 6446, indicated a speed of 50 m.p.h. at the time of the collision. This speed recorder was subsequently calibrated to indicate a speed of 52-53 m.p.h.

Extra 6530 West

The speed recorder on the leading locomotive unit of Extra 6530 West did not register because of an improperly positioned stylus. Recording tape removed from the trailing locomotive unit indicated a speed of 42-43 m.p.h. at the time of the accident. Calibration of the equipment disclosed that the actual speed was 38 m.p.h.

The derailed car, BN 231736, was a 50 foot 6 inch, all steel, double door box car built by the Great Northern Railway in July 1957. The car was equipped with 5 1/2" x 10" plain bearings, Model National C-1 trucks and type "E" couplers. In the train consist the "B" end was the leading end.

The following stenciled information was taken from the car body at the scene:

Light weight	59,000 pounds
Capacity	110,000 pounds
Load limit	118,000 pounds
Extreme width	10 feet 8 inches
Height to eaves	14 feet 2 inches
Height to extreme width	13 feet 6 inches
Capacity - cubic feet	4,958
Inspected (FRA-Everett, Washington)	1/77 BN SH BN

The carrier's record of movement for this car indicated that the car was received in interchange from the Atchison, Topeka and Santa Fe (ATSF) at Kansas City, Missouri on August 20, 1978. The car was placed for loading at the Calcium Carbonate Company in West Quincy, Missouri on August 23, 1978, and loaded with 2,250 50-pound bags of ground limestone. This load weighed 113,063 pounds. Forty-five wooden pallets at 60 pounds each added 2,700 pounds. The car was forwarded on BN at Quincy, Illinois on August 24, 1978.

Upon arrival at Galesburg, Illinois on August 25, 1978, BN 231736 was shopped for a plain bearing repack. The journals, equipped with stabilizers and seals, require repacking at 30-month intervals. The journals had previously been repacked in October 1975.

In addition to the journal repack which replaced all lubricating pads, truck springs at the "B-L" location were also replaced. A brake shoe at the R-2 location was replaced, a yellow-ball stencil was applied and an in-date-test of the AB brake control valve was performed. On August 27, 1978, the car was placed in the consist of Extra 6530 West.

Destruction of the car body and lading in the accident precluded any attempt to verify the car's contents. Information at the carrier's hearing disclosed that the shipper, in the first six months of 1978, had forwarded 425 box car loads of ground limestone under a weight agreement with no exceptions noted.

During the post-accident investigation, the west end of the truck of BN 231736 was identified by the car number stencilled on top of the truck side frame. It was discovered that the plain journal bearing on the leading wheel of the leading truck on the right side of the car had failed because of overheating. The journal stub, approximately eight inches in length, was found inside the box. The bearing was still hot when discovered several hours after the accident. An inspection of the journal box disclosed that the wedges, bearing and lubricator were destroyed, and that the top rear rim of the casting was burnt. The only identifying mark on the axle was the letter "T" stencilled on the collar. Inspection of other journal boxes on the truck disclosed that they were all equipped with saturated oil well lubricating pads, dated in June 1978.

The carrier's report on laboratory examinations and testing of the failed journal classified the failure as a typical burn-off resulting from a lack of lubrication.

Inspection of the truck disclosed no markings on the bottom of the side frame that indicated prolonged contact with, or dragging, on the track structure. The bolster center plate and side bearing cage at the front right side location showed evidence of a separation from the car body.

In the collision, the car was shoved back about 50 feet. The left, or south, side and the "A" end had been sheared away. There was no evidence of longitudinal or latitudinal impact damage to the "B" end coupler.

The punctured tank car, PSPX 33167, is a 114A340W type tank car not equipped with head shields. The car was built in February 1964, and is equipped with type E couplers. Stenciling on the tank indicates that the light weight is 98,300 pounds, the capacity is 164,000 pounds, and the water capacity is listed as 32,903 gallons. The safety valve and tank had last been tested on February 1, 1974. The accompanying waybill indicated that the tank contained 155,880 pounds of anhydrous ammonia, a nonflammable gas. The car was properly placarded and placed in the train consist.

During the derailment, a gash was opened in the tank head at the "B", or west, end. The gash measured 14 inches in length and two inches in width. From the size and depth of the dent, it appears that a coupler perforated the tank. There was also evidence of a coupler strike on the opposite side of the tank head.

Two empty tank cars last containing hazardous materials were among the derailed cars of Extra CS 873 East. Although both cars were destroyed, the tanks were not punctured and the cars presented no hazard.

Findings

1. Extra CS 873 East and Extra 6530 West approached the accident area operating in accordance with the carrier's rules and instructions.

2. When BN 231736 arrived at Galesburg, Illinois on August 25, 1978, the car was shopped for an overdue plain bearing repack. On August 26, 1978, the journals were repacked and the car was returned to service. The bearings were not replaced at the time of this repacking.

3. The derailment was caused by the overheating and failure of a journal on BN 731736, the 55th head car in the consist of the westbound train. The journal failure was classified by the carrier's report of laboratory examination as a typical burn-off resulting from a lack of lubrication.

4. The derailed car of the westbound train fouled the east main track and was struck by Extra CS 873 East.

Dated at Washington, D. C., this
24th Day of January 1980
by the Federal Railroad Administration

J. W. Walsh
Chairman
Railroad Safety Board

* U S GOVERNMENT PRINTING OFFICE : 1980 311-586/45