



# National Transportation Safety Board

Washington, D.C. 20594

## Safety Recommendation

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**Date:** July 29, 1999

**In reply refer to:** R-99-12 through -14

Honorable Jolene M. Molitoris  
Administrator  
Federal Railroad Administration  
400 Seventh Street, S.W.  
Washington, D.C. 20590

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On March 25, 1998, about 4:48 a.m. eastern standard time, southbound Norfolk Southern Corporation (Norfolk Southern) train 255L5, which was en route to Fort Wayne, Indiana, struck eastbound Consolidated Rail Corporation (Conrail) train TV 220, which was en route to Columbus, Ohio.<sup>1</sup> The collision occurred where the Norfolk Southern Huntington District and the Conrail Chicago main lines cross at grade at the east end of the town of Butler, Indiana. Both locomotives and five cars from the Norfolk Southern train derailed, and three cars from the Conrail train, two with multiple stacked platforms, derailed. The Norfolk Southern conductor was killed; the engineer and student engineer sustained minor injuries. The two Conrail crewmembers were not injured.

No hazardous materials were released, but both Norfolk Southern locomotive fuel tanks ruptured and released approximately 7,000 gallons of fuel oil. Norfolk Southern estimated total damages of \$264,000 (\$187,000 to equipment, \$18,000 to track and signals, and \$59,000 to cargo). Conrail estimated total damages of \$352,200 (\$314,000 to equipment, \$33,500 to track and signals, and \$4,700 to cargo).

The National Transportation Safety Board determined that the probable cause of this accident was the failure of the engineer and conductor of train 255L5 to comply with operating rules (specifically, their failure to observe and confirm signal aspects and their failure to continuously and directly supervise the student engineer) and the failure of Norfolk Southern Corporation to ensure employees' compliance with operating rules. Contributing to the accident was Norfolk Southern Corporation's failure to ensure that its locomotive engineer training program provided effective, timely training; oversight; and feedback to ensure that students were adequately prepared for operational situations. Also contributing to the probability of this accident occurring was the failure of Norfolk Southern Corporation's signal maintenance program to respond to a reported signal deficiency.

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<sup>1</sup> For additional information, read Railroad Accident Report—*Collision of Norfolk Southern Corporation Train 255L5 With Consolidated Rail Corporation Train TV 220 in Butler, Indiana, on March 25, 1998* (NTSB/RAR-99/02).

The investigation found that Norfolk Southern's oversight of student engineers during the on-the-job portion of training is inadequate. The student engineer had not been evaluated on his performance by a qualified engineer or road foreman since completing the classroom portion of locomotive engineer training. During the accident trip, the student engineer was not supervised by a coach-trained engineer and was unaware that because of this, he should not have operated the train. In addition, the investigation found that the classroom portion of Norfolk Southern's engineer training program was not adequate to prepare student engineers to cope with all known or anticipated operational requirements systemwide, such as operating trains with the long hood forward. Safety Board interviews with the student revealed that the student engineer had not been trained in long-hood-forward operation, a configuration that significantly limits an engineer's view; in fact, the first time he had ever operated a locomotive in this configuration was the day before the accident.

The Safety Board also found that cab discipline, crew coordination, and communication were inadequate in the events leading up to the accident. The student engineer was not adequately supervised or instructed; further, the crewmembers' actions neither promoted compliance with the operating rules nor provided a positive model for the student engineer to emulate. For instance, contrary to operating rule 34, the engineer and conductor did not call clear signals. In addition, based on the statements of the engineer and the student engineer, all crewmember communication ceased well before the train approached the interlocking at Butler. In fact, for at least 30 minutes before the accident, the student engineer operated the train independently of the engineer and conductor. Moreover, he could not utilize their experience to help determine his location until just before the train was placed into emergency braking because he had not been provided strategies for dealing with crewmembers who disregard carrier rules and procedures. Norfolk Southern stated that student engineers could contact the dispatcher or road foreman to report problems such as the ones that occurred during the accident trip. However, an employee, particularly a trainee eager to gain operational experience, may be reluctant to challenge or report fellow crewmembers. The Safety Board concluded that Norfolk Southern lacks adequate safeguards to prevent student engineers from being placed in untenable situations in which rules and procedures are disregarded.

Effective crew coordination and communication are imperative, especially when a crewmember is receiving on-the-job training. One method of improving crew coordination and communication is through training. The Safety Board has long been a proponent of crew resource management (CRM) training in the aviation community and bridge resource management (BRM) training in the marine community. The goals of CRM and BRM are similar in that they promote safe operations by emphasizing the efficient use of all resources to achieve and maintain better coordination of activities. CRM and BRM training addresses critical areas, including:

- crewmember proficiency,
- situational awareness,
- effective communication and teamwork, and
- strategies for appropriately challenging and questioning authority.

The principles of CRM and BRM could be used to develop train crew resource management (TCRM) training for the railroad industry. The Safety Board has investigated several railroad accidents<sup>2</sup> that occurred because of inadequate communication, lack of discipline, and crewmembers' failure to function collectively as a team. In 1996, the Safety Board became aware of training developed by and for railroad employees of the former Southern Pacific Railroad (now Union Pacific) and modeled after the training provided to crewmembers at American Airlines. Union Pacific continues to provide this training to its employees and, since late 1998, has required all newly hired employees to receive it. Contact with several other Class I railroads revealed that they are not providing TCRM training. The Safety Board is not aware that the Federal Railroad Administration has demonstrated an interest in exploring and developing TCRM principles and training for the industry. The Safety Board concluded that this and other accidents investigated by the Safety Board demonstrate that railroad safety would be enhanced if crewmembers received TCRM training.

An additional concern identified during the accident investigation involved the functioning of signal 111, the signal that was missed by the Norfolk Southern crewmembers. Signal 111 was observed going dark at random intervals during the postaccident investigation; consequently, the Electro Code 4 unit containing the lighting module was removed and bench tested. Bench tests identified failed internal aluminum electrolytic capacitors that caused the signal to go dark for 10 to 24 seconds. The investigation revealed that the Norfolk Southern signal maintainer, after investigating the February and March 1998 reports of dark signal occurrences, reported to the Norfolk Southern dispatching center that intermediate signal 111 was working properly. The signal maintainer also informed the dispatching center that the signal would be monitored again. During interviews, the signal maintainer explained that monitoring consisted of acquiring downloads from the signal data recorder and examining the logs. However, no followup downloads were performed after either dark signal report. Adequate followup was crucial in the case of signal 111 because routine troubleshooting by a signal maintainer would not have identified the failed capacitors; they are on an electronic unit that a signal maintainer would not normally access. The Safety Board concluded that the Norfolk Southern Lake Division dispatching center lacked an effective procedure for identifying reported signal malfunctions of undetermined causes for further monitoring. The Safety Board further concluded that had Norfolk Southern's maintenance program responded to and corrected the twice-reported signal deficiencies at signal 111, the signal would not have continued to go dark intermittently.

Electro Code 4 units, such as the one at signal 111, determine which aspects to display from the codes received from the tracks. These units supply energy to illuminate the signal lamps directly and cause all lamps to go dark if internal self-tests and microprocessor operations detect a loss or perceived loss of control over the lamp output. The voltage to the lamps ceases until the failure condition is corrected.

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<sup>2</sup> Railroad Accident/Incident Summary Report—*Knox, Indiana, September 17, 1991* (NTSB/RAR-92/02/SUM); Railroad Accident/Incident Summary Report—*Derailment of Amtrak Train 87, Silver Meteor, in Palatka, Florida, on December 17, 1991* (NTSB/RAR-93/02/SUM); and Railroad Accident Report—*Collision and Derailment of Maryland Rail Commuter MARC Train 286 and National Railroad Passenger Corporation Amtrak Train 29, near Silver Spring, Maryland, on February 16, 1996* (NTSB/RAR-97/02).

Field inspections of other Harmon Electro-Code 4 units in the Lake Division found evidence of capacitor failures on the 212A modules manufactured from 1987 to 1988. On May 15, 1998, Harmon Industries issued a product improvement announcement detailing the failure of the capacitor and explaining how to exchange the 212A module for a replacement. By the time Harmon issued this announcement, the faulty unit at signal 111 had been replaced. The company also offered components and modification instructions to railroads preferring to and capable of making their own modifications.

Harmon Industries provided field technicians to aid Norfolk Southern in a systemwide program to identify and replace all modules manufactured from 1987 to 1988. During Safety Board depositions held in October 1998, Norfolk Southern Signal Department officials stated this program was complete for all Norfolk Southern divisions.

However, the Harmon components still have the potential to cause signal problems on other railroads. Harmon Industries estimates that of the Electro Code 4 units manufactured from 1987 to 1988, approximately 25,000 are currently installed on the nation's railroads. The Safety Board concluded that although the product improvement announcement issued by Harmon Industries addresses the capacitor problem, replacement of the capacitors is not just an improvement but needs to be made a requirement for the safe operation of Electro Code 4 units.

Therefore, the National Transportation Safety Board recommends that the Federal Railroad Administration:

Review Norfolk Southern's 49 *Code of Federal Regulations* 240 submission, *Certification of Locomotive Engineers*, specifically "Section 5: Training, Testing, and Evaluating Persons Not Previously Certified," to determine whether the company's training program is adequate for training new engineers and require that any deficiencies found be corrected. (R-99-12)

In cooperation with Class I railroads, the American Short Line and Regional Railroad Association, the Brotherhood of Locomotive Engineers, and the United Transportation Union, develop and require, for all crewmembers, crew resource management training that addresses, at a minimum:

- crewmember proficiency,
- situational awareness,
- effective communication and teamwork, and
- strategies for appropriately challenging and questioning authority. (R-99-13)

Direct Harmon Industries and the railroad carriers to identify and replace all faulty Electro Code 4 capacitors. Ensure, through followup inspections, that corrective actions have been taken. (R-99-14)

The Safety Board also issued recommendations to Norfolk Southern Corporation, the Class I railroads and Amtrak, the American Short Line and Regional Railroad Association, the Brotherhood of Locomotive Engineers, the United Transportation Union, Harmon Industries, and the DeKalb County Emergency Management Agency. Please refer to Safety Recommendations R-99-12 through -14 in your reply.

Chairman HALL, Vice Chairman FRANCIS, and Members GOGLIA and BLACK concurred in these recommendations. Member HAMMERSCHMIDT concurred, in part, with these recommendations. (For further information, see Member HAMMERSCHMIDT's concurring and dissenting opinion in the published report referenced on page 1 of this letter.)

By: Jim Hall  
Chairman