



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: July 29, 1999

In reply refer to: R-99-15 through -24

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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.¹ 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.

¹ 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 Safety Board believes that this accident could have been avoided had the conductor and engineer complied with Norfolk Southern rules and instructions to include: observing and confirming all signal aspects; actively supervising the student engineer, particularly one who was unfamiliar with the territory; and not reading or engaging in other distracting activities.

According to Norfolk Southern operating rule 601, engineers are responsible for train handling and care of the equipment and, by extension, for a student's operation of the train. According to operating rule 581, conductors are in charge of all train crewmembers and are responsible for enforcing rules and instructions. The investigation found that during the accident trip, 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. In light of this, the Safety Board concluded that the engineer, as the individual responsible for train handling and care, and the conductor, as the individual responsible for ensuring that rules and instructions are followed, disregarded their responsibilities during the accident trip.

Another compliance issue that was pivotal to this accident concerns operating rule 34. According to testimony by both the engineer and the student engineer, the conductor stated it was crew practice not to call clear signals, an instruction that company officials stated is in violation of the rule 34 requirement to call all signals. Had the conductor and engineer called the clear signal at MP 108.4 in compliance with Norfolk Southern operating rule 34, their attention would have been engaged before the accident. Calling the signal, in turn, would have set the stage for the train either to prepare to stop in response to an approach signal in accordance with rule 285 or to stop in response to a dark signal in accordance with rule 27, which requires that a dark signal be treated as the most restrictive indication possible. The Safety Board concluded that because of the engineer's and conductor's lack of vigilance and decision not to call clear signals, the crew of Norfolk Southern train 255L5 failed to react to either an approach or a possible dark signal at MP 111.

The Norfolk Southern Lake Division had a sufficient record for conducting tests and observations for operating rule compliance, including rule 34 compliance, and reported a low failure rate during testing. But such data may be misleading because a supervisor must be on board the train and witness noncompliance for a failure to result. That the train crew could routinely ignore this operating rule, despite the Lake Division's conscientious testing and observation program and even after the conductor had received a letter of reprimand within a year of the accident for violating that operating rule, strongly argues that an operating rule alone will not guarantee that signals are called.

Unlike Norfolk Southern, which does not maintain a record of in-cab communication of signals, two other railroads, the Burlington Northern Santa Fe Railway Company (BNSF) and the Union Pacific Railroad (UP), require that signal aspects, time, and speed be noted on a form. The BNSF requires that these forms be submitted at the end of each trip as directed by the applicable division superintendent. The UP requires that conductors maintain the forms for five trips and keep them in their possession while on duty.

The railroad industry already has requirements for recording crewmember actions or events during a trip, such as those for drug and alcohol testing under 49 CFR 219 and the use of event recorders under 49 CFR 229.135. These measures provide an after-the-fact record, reinforcing desired behavior by ensuring crewmember accountability. In addition, tasking crewmembers to keep a record of signals observed would enhance train crew coordination by ensuring that crewmembers communicate during a trip. The Safety Board concluded that having procedures to actively engage crewmembers in observing and confirming all signal aspects, such as recording the aspects, would make it more likely that train crews call signals in compliance with the operating rules.

The investigation also 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.

The Safety Board evaluated the effectiveness of the on-the-job portion of Norfolk Southern's locomotive engineer training program principally in the context of the relationship between the student engineer and the engineer. During the accident trip and during the preceding trip from Peru to Detroit, the student engineer did not follow company policy by failing to ascertain whether the engineer was coach trained. That a student engineer was ultimately paired with an engineer who was not coach trained clearly illustrates that despite the company's assertion to the contrary, Norfolk Southern procedures designed to prevent such situations have not worked.

The Safety Board determined that the training requirements form noting the restrictions on student engineers and signed by the student engineer on March 3, 1998, while developed and deemed appropriate for student engineers assigned to the Lake Division, was not being used systemwide. The System Road Foreman of Engines stated that the form was unique to the Lake Division and that other divisions used similar forms or dispensed similar information orally. The Safety Board concluded that allowing local variations in training requirements promotes operational inconsistencies and hinders uniform compliance with the student engineer training program.

Because Norfolk Southern provided information on the student engineer program to coach-trained engineers only and, in the Lake Division at the time of the accident, relied on student engineers to inform engineers of operating restrictions, it is unlikely that the engineer would have known that the student should not operate the train. According to the Division Road Foreman of Engines, a Superintendent's Notice was issued after the accident informing all Lake Division personnel of operating restrictions on student engineers. The Safety Board concluded that unless all Norfolk Southern operating personnel are informed of restrictions on the operation of trains by student engineers, a situation in which a student engineer operates a train without proper supervision could occur again.

Furthermore, the Safety Board is concerned that when the student engineer returned to the Lake Division, he received no feedback on his performance. The fact that the student received no

oral or written feedback during this phase of his training is additional evidence that the locomotive engineer training program at the time of this accident was inadequate. The Safety Board regards timely feedback as an essential element in any training program for achieving and maintaining desired behavior consistent with stated policy; inadequate or no feedback degrades the training experience. Performance feedback, whether by a qualified engineer or a road foreman, should occur throughout the training process. The Safety Board concluded that not providing feedback because the student engineer had not yet reached the point at which he was scheduled to be formally evaluated by a road foreman (that is, he had not worked in the Lake Division for 1 month) is inconsistent with the goals of effective training.

The Safety Board evaluated the effectiveness of the classroom portion of Norfolk Southern's locomotive engineer training program principally in the context of whether the training adequately prepared the student for operational situations encountered during the accident trip. The investigation revealed that the student engineer had not been trained to operate a locomotive in the long-hood-forward configuration; in fact, the first time he had ever operated a locomotive in this configuration was the day before the accident.

Norfolk Southern Training Center personnel indicated that locomotive engineer training includes the fundamental concepts of locomotive and train operations. Classroom and laboratory activities are combined with daily hands-on simulated train operations using one full-motion and two stationary locomotive simulators. All three simulators are configured with the "short nose forward"; consequently, the view from the simulator is significantly less restricted than the view the student engineer had during the accident trip. Training Center personnel said that while students in training at McDonough may have the opportunity to operate a locomotive in the long-hood-forward configuration on the school's training track, the division is responsible for training student engineers on operational variations and conditions unique to the division, including operating locomotives in the long-hood-forward configuration.

The Safety Board disagrees with this approach to engineer training. An adequate training program should address all known or anticipated operational requirements systemwide. The idea that training should address operational requirements systemwide is particularly relevant considering the local variations in student engineer training requirements that were discussed earlier in this letter. By delegating selected aspects of operational training to the divisions, the locomotive engineer training program does not equally prepare student engineers for situations encountered on the job. The Safety Board concluded that 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.

The Safety Board considers aggressive oversight to be essential to any program, but particularly to a training program, because such oversight promotes compliance with company policy. The lack of oversight in this accident is particularly relevant considering the training improvements that Norfolk Southern stated it implemented after a strikingly similar accident near Knox, Indiana, in 1991.² As was the case in this accident, the Knox investigation found

² Railroad Accident/Incident Summary Report—*Knox, Indiana, September 17, 1991* (NTSB/RAR-92/02/SUM).

deficiencies in crew coordination, communication, and cab discipline, prompting the Safety Board to make the following recommendation to Norfolk Southern:

R-92-09

Review and revise your programs for traincrew supervision, locomotive cab discipline, and training of student engineers in light of the circumstances of this accident, and make necessary improvements.

In December 1992, the Safety Board classified this recommendation “Closed—Acceptable Action,” based on the company’s response that it had revised its training to emphasize the understanding of and compliance with operating rules and to emphasize the engineer’s responsibility for safe and effective train handling. However, the circumstances of the Butler accident led the Safety Board to determine that Norfolk Southern’s locomotive engineer training program is inadequate; therefore, the company must explore additional ways to improve engineer training, both in the classroom and the field.

When a crewmember is receiving on-the-job training, effective crew coordination and communication are imperative. 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 knowingly 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.

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 accidents³ 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 UP) and modeled after the training provided to crewmembers at American Airlines. The UP 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 safety concern identified during the investigation was the adequacy of Norfolk Southern's signal malfunction reporting procedures, especially with respect to signal 111. Signal 111, which was missed by the Norfolk Southern crewmembers, 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 the signal maintainer does 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.

The majority of Class I railroad dispatching centers have full-time signal personnel working in their dispatching centers to handle all signal and grade crossing malfunction reports. The dispatchers forward such reports to these representatives, who record and track the status of the malfunctions and notify the necessary signal maintenance personnel to investigate and repair them. Having personnel technically knowledgeable in signal systems aids in prioritizing the

³ 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).

investigation and repair of malfunctions that require immediate attention. Designated personnel, not tasked with dispatching trains, can also better and more thoroughly identify and track locations that have repeated malfunction reports and ensure that all available tools are used to repair the malfunctions and maintain the proper level of safety.

Another safety concern identified during the accident investigation involved the identification and emergency response management of hazardous materials. Because a white powder that had been spilled by the Norfolk Southern train as a result of the collision was potentially hazardous, the DeKalb County Hazardous Materials Response Plan was initially activated for a level 3 response, resulting in two schools being closed.

When the two surviving Norfolk Southern crewmembers were unable to furnish the Butler fire department with a train consist listing the materials transported on the Norfolk Southern train, emergency responders donned self-contained breathing apparatus to collect information from one of the broken bags of white powder. The fire chief then attempted to contact the manufacturer. Because the accident occurred during nonbusiness hours, a cleaning person answered the telephone and provided the name of the only chemical manufactured by the company, nepheline syenite. (The cleaning person's information was later confirmed by company personnel during business hours.) The fire chief contacted CHEMTREC (Chemical Transportation Emergency Center), which confirmed that nepheline syenite is not a hazardous material. After about an hour, when the white powder had been identified as a nonhazardous material, the incident was downgraded to a level 2 response because of the diesel fuel on the ground.

The Safety Board has long been concerned about the emergency response management of railroad accidents involving hazardous materials. The Board, in its 1991 safety study⁴ on transporting hazardous materials by rail, discussed how the lack of coordination between the railroads and communities on emergency response planning had presented major safety problems in nine accidents and incidents investigated between 1977 and 1987. The Safety Board subsequently issued the following recommendation to the Class I railroads:

R-91-15

Develop, implement, and keep current, in coordination with communities adjacent to your railroad yards and along your hazardous materials routes, written emergency response plans and procedures for handling releases of hazardous materials. The procedures should address, at a minimum, key railroad personnel and means of contact, procedures to identify the hazardous materials being transported, identification of resources for technical assistance that may be needed during the response effort, procedures for coordination of activities between railroad and emergency response personnel, and the conduct of disaster drills or other appropriate methods to test emergency response plans.

In December 1991, the Safety Board classified Safety Recommendation R-91-15 "Closed—Acceptable Action," based upon Norfolk Southern's initial response in July 1991 and subsequent November 1, 1991, letter that emergency response procedures had been developed

⁴ Safety Study—*Transport of Hazardous Materials by Rail* (NTSB/SS-91/01).

and were being implemented. The November 1, 1991, letter noted that Norfolk Southern directs its emergency response coordination efforts toward all of the communities along its service routes, not just those with rail yards, to include sharing hazardous material response plans with localities, providing training for the smaller cities and towns along its routes, and providing personnel to serve on local emergency planning committees.

However, according to the Norfolk Southern Lake Division Supervisor, DeKalb County was not on the list of communities trained recently by Norfolk Southern in emergency response coordination. In this accident, local officials did not attempt to contact the railroad for assistance beyond asking the surviving Norfolk Southern crewmembers what substance the Norfolk Southern train carried. The company's lack of coordination with the community resulted in emergency response personnel taking an hour to identify a potentially hazardous substance and in two schools being closed unnecessarily. The Safety Board concluded that better coordination by Norfolk Southern with DeKalb County may have prevented the delay in identifying the possibly hazardous material transported on the Norfolk Southern train.

In the Safety Board's opinion, such a situation is unacceptable, considering that more than 7 years have passed since Norfolk Southern stated it would coordinate emergency response plans with the communities along its service routes. The Safety Board is concerned that other communities may be exposed to similar risks from hazardous material releases and other rail emergencies because Norfolk Southern has not followed through on emergency response coordination.

Therefore, the National Transportation Safety Board recommends that Norfolk Southern Corporation:

Develop and implement methods to improve employee compliance with company rules and instructions. (R-99-15)

Develop and implement procedures that actively engage crewmembers in observing and confirming all signal aspects. (R-99-16)

Inform all operating personnel of their responsibilities regarding student engineers. (R-99-17)

Assign supervisors dedicated exclusively to student engineers who will, at a minimum:

- meet with student engineers at the start of the on-the-job training phase to ensure that student engineers are aware of the conditions under which they can operate a train and that they know what to do if these conditions are not met;
- track the student engineer's daily train assignments, daily crew assignments, and performance evaluations; and
- provide timely feedback and advice to student engineers on a continuing basis. (R-99-18)

Provide student engineers with formal training in all known or anticipated operational requirements systemwide, including operating trains with the long hood forward. (R-99-19)

Conduct a comprehensive assessment of the locomotive engineer training program and revise it, as necessary, to ensure that student engineers consistently operate with and are mentored by coach-trained engineers and that engineer training reflects actual operating conditions. (R-99-20)

Provide employees, especially trainees, with effective strategies for dealing with crewmembers who knowingly disregard the operating rules. (R-99-21)

In cooperation with the Federal Railroad Administration, the American Short Line and Regional Railroad Association, the Brotherhood of Locomotive Engineers, and the United Transportation Union, develop, for all train 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-99-22)

Designate dedicated personnel to record and track all signal malfunctions and repairs in order to identify recurring, unresolved failures. (R-99-23)

Conduct an audit to identify all communities through which you transport hazardous materials and, in coordination with those communities, develop, implement, and keep current written emergency response plans and procedures for handling hazardous material releases. The procedures should address, at a minimum, key railroad personnel and means of contact, procedures to identify the hazardous materials being transported, identification of resources for technical

assistance that may be needed during the response effort, procedures for the coordination of activities between railroad and emergency response personnel, and the conduct of disaster drills or other methods to test emergency response plans.
(R-99-24)

The Safety Board also issued recommendations to the Federal Railroad Administration, 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.

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you within 90 days regarding action taken or contemplated with respect to the recommendations in this letter. Please refer to Safety Recommendations R-99-15 through -24 in your reply. If you need additional information, you may call (202) 314-6435.

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