National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: April 25, 2007

In reply refer to: R-07-7 and -8

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The National Transportation Safety Board is an independent Federal agency charged by Congress with investigating transportation accidents, determining their probable cause, and making recommendations to prevent similar accidents from occurring. We are providing the following information to urge your organization to take action on the safety recommendations in this letter. The Safety Board is vitally interested in these recommendations because they are designed to prevent accidents and save lives.

These recommendations address the need for positive train control on your rail system and the need for alerters to be installed on all your lead locomotives. The recommendations are derived from the Safety Board's investigation of the July 10, 2005, collision of two CN freight trains in Anding, Mississippi,[1] and are consistent with the evidence we found and the analysis we performed. As a result of this investigation, the Safety Board has issued eight safety recommendations, one of which is addressed specifically to the CN, and one of which is addressed to all Class I railroads, including the CN. Information supporting these recommendations is discussed below. The Safety Board would appreciate a response from you within 90 days addressing the actions you have taken or intend to take to implement our recommendations.

On Sunday, July 10, 2005, about 4:15 a.m., central daylight time, two CN freight trains collided head on in Anding, Mississippi. The collision occurred on the CN Yazoo Subdivision, where the trains were being operated under a centralized traffic control signal system on single track. Signal data indicated that the northbound train, IC 1013 North, continued past a *stop* (red) signal at North Anding and collided with the southbound train, IC 1023 South, about 1/4 mile beyond the signal. The collision resulted in the derailment of 6 locomotives and 17 cars. About 15,000 gallons of diesel fuel were released from the locomotives and resulted in a fire that burned for about 15 hours. Two crewmembers were on each train; all four were killed. As a precaution, about 100 Anding residents were evacuated; they did not report any injuries. Property

[1] For additional information, see National Transportation Safety Board, *Collision of Two CN Freight Trains, Anding, Mississippi, July 10, 2005,* Railroad Accident Report NTSB RAR-07/01 (Washington, DC: NTSB, 2007).

damages exceeded $9.5 million; clearing and environmental cleanup costs totaled about $616,800.

The National Transportation Safety Board determined that the probable cause of the July 10, 2005, collision in Anding, Mississippi, was the failure by the crew of the northbound train (IC 1013 North) to comply with wayside signals requiring them to stop at North Anding. The crew's attention to the signals was most likely reduced by fatigue; however, due to the lack of a locomotive cab voice recorder or the availability of other supporting evidence, other factors cannot be ruled out. Contributing to the accident was the absence of a positive train control (PTC) system that would have stopped the northbound train before it exceeded its authorized limits. Also contributing to the accident was the lack of an alerter on the lead locomotive that may have prompted the crew to be more attentive to their operation of the train.

Northbound Train Crew's Actions

The Safety Board examined the work/rest cycles of the northbound train crew based on CN records and interviews with family members. Both the engineer and the conductor had worked about 11 1/2 hours per night and had been only sleeping about 5 1/2 hours per night for at least the 3 days immediately before the accident. A regularly deficient amount of sleep can impair human performance and alertness. These short sleep periods likely led to the northbound train crew developing a cumulative sleep loss, or sleep debt. Sleep debt occurs when an individual does not obtain sufficient restorative sleep over time.[2] According to one prominent sleep researcher, the tendency of an individual to fall asleep increases progressively in direct proportion to the increase in the sleep debt.[3]

Despite indications[4] that the northbound train crew's alertness was likely diminished by fatigue, investigators could not rule out the possibility that other factors might also have played a role in this accident. The Safety Board has determined in previous accidents that crewmembers were inattentive to the wayside signals due to human factors other than fatigue, including distraction. In its investigation of a commuter train and passenger train collision near Silver Spring, Maryland,[5] the Board noted that a conversation between the engineer and conductor likely occurred in the cab control car, which "creates a potential for distraction and interference with the engineer's retention of information, in this case the signal information." The Board determined that the probable cause of the accident was the apparent failure of the engineer and train crew to operate their train according to signal indications due to multiple distractions. Similarly, an engineer and conductor operating a freight train in Placentia, California,[6] failed to observe a wayside signal and collided with a commuter train. Considering

[2] W.C. Dement, *The Sleepwatchers*, 2nd ed. (Menlo Park, CA: Nychthemeron Press, 1996).

[3] Dement, 1996.

[4] For further information, see NTSB RAR-07/01.

[5] National Transportation Safety Board, *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*, Railroad Accident Report NTSB/RAR-97/02 (Washington, DC: NTSB, 1997).

[6] National Transportation Safety Board, *Collision of Burlington Northern Santa Fe Freight Train With Metrolink Passenger Train, Placentia, California, April 23, 2002*, Railroad Accident Report NTSB/RAR-03/04 (Washington, DC: NTSB, 2003).

the crewmembers' statements to investigators, the Board found that the engineer and conductor were focusing attention on their conversation rather than on the signals governing the operation of their train.

Unfortunately, the northbound train crew was killed, and the inability to obtain autopsies or toxicological specimens limited the evaluation of medical factors in the Anding accident. Crewmember statements are not available to help reveal what transpired in the locomotive cab during the minutes preceding the collision. The Safety Board concludes that the northbound train crew's attention to the wayside signals was most likely reduced by fatigue; however, without a locomotive cab voice recorder or the availability of other supporting evidence, it cannot be determined whether distraction or some other factor also contributed to the crew's failure to comply with the signals.

Positive Train Control

For more than 30 years, the Safety Board has investigated train collisions that could have been prevented through the deployment of a PTC system. Over the years, the Board has issued a series of relevant recommendations and PTC has remained on the Board's Most Wanted Transportation Safety Improvements list since 1990. The most recent safety recommendation relating to PTC, Safety Recommendation R-01-6, was issued to the Federal Railroad Administration (FRA) as a result of the Board's investigation of a fatal train collision in Bryan, Ohio.[7] Since its adoption by the Board, Safety Recommendation R-01-6 has been reiterated in two other reports about railroad accidents that took place in Placentia, California,[8] in 2002 and Chicago, Illinois,[9] in 2003:

> R-01-6
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> Facilitate actions necessary for the development and implementation of positive train control systems that include collision avoidance, and require implementation of positive train control systems on main line tracks, establishing priority requirements for high-risk corridors such as those where commuter and intercity passenger railroads operate.

Based on a March 27, 2002, letter in which the FRA outlined steps that it had taken toward "achieving the proper atmosphere in the rail industry to allow for the development and implementation of PTC," the Board classified Safety Recommendation R-01-06 "Open—Acceptable Response."

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[7] National Transportation Safety Board, *Collision Involving Three Consolidated Rail Corporation Freight Trains Operating in Fog on a Double Main Track Near Bryan, Ohio, January 17, 1999*, Railroad Accident Report NTSB/RAR-01/01 (Washington, DC: NTSB, 2001).

[8] National Transportation Safety Board, *Collision of Burlington Northern Santa Fe Freight Train With Metrolink Passenger Train, Placentia, California, April 23, 2002*, Railroad Accident Report NTSB/RAR-03/04 (Washington, DC: NTSB, 2003).

[9] National Transportation Safety Board, *Derailment of Northeast Illinois Regional Commuter Railroad Train 519 in Chicago, Illinois, October 12, 2003*, Railroad Accident Report NTSB/RAR-05/03 (Washington, DC: NTSB, 2005).

In answer to an April 17, 2003, letter from the Safety Board asking for an update on actions regarding this safety recommendation, the FRA responded, in a May 5, 2003, letter, that it was "moving forward across a broad front to create the conditions under which PTC systems can be more widely deployed on the national rail system." In the letter, the FRA detailed some of the steps the agency was taking in the following areas:

- Providing a radionavigation infrastructure and ensuring adequate spectrum;
- Facilitating PTC through regulatory change;
- Supporting the demonstration and deployment of candidate technologies; and
- Analyzing costs and benefits.

The FRA stated that the agency was "doing everything within its power to prepare the way for PTC and encourage its rapid deployment." In the meantime, the vast majority of railroad operations occur in territory without any automatic means of preventing train collisions.

The Safety Board hosted a seminar on PTC at the NTSB Training Center in March 2005, and the Board is aware of some promising initiatives in the railroad industry to test and implement PTC installations. Effective June 6, 2005, the FRA issued a performance standard for processor-based signal and train control systems. The Board is encouraged that on January 8, 2007, the FRA applied these performance standards and approved the BNSF Railway Company's (BNSF's) Product Safety Plan for its Electronic Train Management System (ETMS). The ETMS is capable of automatically controlling train speed and movements. Although the Board remains concerned that it is taking so long for the FRA and the railroad industry to implement such systems, progress is being made as more freight railroads[10] have pilot projects underway to develop PTC technology.

Had a PTC system been in place at Anding, it would have intervened by slowing and stopping the northbound train when the crew did not respond to the signal indications. The Safety Board concludes that had a PTC system with collision avoidance capabilities been in place on the CN Yazoo Subdivision at the time of the accident, the collision would not have occurred. The need for PTC persists, the technology is available, and performance standards have been established. Therefore, the Safety Board believes that the CN should develop and implement a PTC system that includes collision avoidance capabilities on main line tracks, establishing priority requirements for high-risk corridors such as those where passenger trains operate.

[10] Alaska Railroad, Union Pacific Railroad, BNSF, Norfolk Southern Railway, and CSX Transportation. The CN has no pilot project underway.

Locomotive Alerters

In its investigation of the collision of two Conrail trains in 1988,[11] the Safety Board found that the accident was caused by the sleep-deprived condition of the crew and their consequent failure to comply with a signal. After examining the role of alerters in that accident, the Board concluded that had the locomotive of the striking train "been equipped with a state-of-the-art alertness device, the train would have been stopped and the collision would have been avoided."

The leading locomotive of the northbound train involved in the Anding collision was not equipped with an alerter to help the crew maintain vigilance, nor was such a device required by any regulation or railroad policy. Based on signal sight-distance observations, the crew would have had about 4 minutes from the time the *approach* signal first became visible until the time the locomotive passed the North Anding *stop* signal, which would have been a sufficient amount of time to stop the train. Signal system data indicated that the northbound train continued traveling at an average speed of 45 mph past these signals and up to the point of collision.

The Safety Board has closely examined the role of alerters. In the collision of two Norfolk Southern Railway freight trains at Sugar Valley, Georgia,[12] on August 9, 1990, the crew of one of the trains failed to stop at a signal. The Board concluded that the engineer of that train was probably experiencing a micro-sleep or was distracted. Based on testing, it was determined that as the train approached the stop signal, the alerter would have begun an alarm cycle. The Board concluded that the engineer "could have cancelled the alerter system while he was asleep by a simple reflex action that he performed without conscious thought." As a result of the investigation, the Board made the following recommendation to the FRA:

> R-91-26
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> In conjunction with the study of fatigue of train crewmembers, explore the parameters of an optimum alerter system for locomotives.

The FRA responded to this recommendation on June 28, 1993, advising that it had "awarded two contracts to develop proposals to modify the existing alerter systems so that they cannot be reset by reflex action." In a followup letter dated August 12, 1997, the FRA told the Safety Board that while a proposal for a prototype had been developed, the contractor had advised the FRA that "they could not see a market for the device large enough to justify its further development." The FRA advised the Safety Board that it believed that the lack of a market was due to the FRA's own "announced determination" to support positive train separation technology. As a result, the Safety Board classified Safety Recommendation R-91-26 "Closed—Unacceptable Action" on November 4, 1997.

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[11] National Transportation Safety Board, *Head-end Collision of Consolidated Rail Corporation Freight Trains UBT-506 and TV-61 Near Thompsontown, Pennsylvania, January 14, 1988*, Railroad Accident Report NTSB/RAR-89/02 (Washington, DC: NTSB, 1989).

[12] National Transportation Safety Board, *Collision and Derailment of Norfolk Southern Train 188 with Norfolk Southern Train G-38 at Sugar Valley, Georgia, August 9, 1990*, Railroad Accident Report NTSB/RAR-91/02 (Washington, DC: NTSB, 1991).

The most recent Safety Board recommendations relating to locomotive alerters were made as a result of an investigation into a sideswipe collision between two Union Pacific Railroad (UP) freight trains in Delia, Kansas,[13] on July 2, 1997. In that accident, a train entered a siding but did not stop at the other end, and it collided with a passing train on the main track. The Board concluded that "had the striking locomotive been equipped with an alerter, it may have helped the engineer stay awake while his train traveled through the siding." As a result of its investigation, the Board made the following recommendation to the FRA:

> R-99-53
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> Revise the Federal regulations to require that all locomotives operating on lines that do not have a positive train separation system be equipped with a cognitive alerter[14] system that cannot be reset by reflex action.

In an April 28, 2000, letter, the FRA advised the Safety Board that it had issued regulations requiring that "each passenger train not equipped with a positive train separation system be equipped with a working dead man or alerter." Although this was an important safety improvement, the FRA's regulations neglected to address the critical components of Safety Recommendation R-99-53. The FRA's regulations applied only to passenger trains, and they did not require the installation of cognitive alerters. On September 25, 2000, the Board responded that it was disappointed that the FRA's new safety standards applied only to passenger locomotives and not to freight locomotives. Safety Recommendation R-99-53 was classified "Closed—Reconsidered" on August 6, 2002, after the Board concluded that the type of cognitive alerter envisioned at the time the recommendation was issued did not exist.

As a result of its investigation of the Delia accident, the Safety Board also recommended that the UP

> R-99-59
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> Install a cognitive alerter system that cannot be reset by reflex action on all locomotives that operate on lines that do not have a positive train separation system.

In a response dated October 31, 2000, the UP advised the Safety Board that the alerters it was installing on some existing locomotives and on new locomotives were "cognitive . . . [and] considered to be state-of-the-art in the industry." The UP letter added that although "the level of cognition is not optimal. . . . there are no more sophisticated alerters available in the market today." Based on the UP's response, the Board classified Safety Recommendation R-99-59 "Closed—Acceptable Alternate Action" on April 24, 2001. During its investigation[15] of a

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[13] National Transportation Safety Board, *Collision Between Union Pacific Freight Trains MKSNP-01 and ZSEME-29 near Delia, Kansas, July 2, 1997,* Railroad Accident Report NTSB/RAR-99/04 (Washington, DC: NTSB, 1999).

[14] Currently, all alerters are reset by reflex action or manipulation of the train controls. In 1999, a cognitive alerter was considered to be an alerter that would have required more than a simple reflex action from the crew.

[15] National Transportation Safety Board, *Side Collision of Burlington Northern Santa Fe Railway Train and Union Pacific Railroad Train Near Kelso, Washington, November 15, 2003,* Railroad Accident Brief NTSB/RAB-05/03 (Washington, DC: NTSB, 2005).

collision 3 years later between a UP freight train and a BNSF freight train on November 15, 2003, near Kelso, Washington, the Board was advised by the UP that about 67.6 percent of UP locomotives were alerter equipped.

Alerters installed on new locomotives today require about the same level of cognition as those that existed when the Safety Board closed Safety Recommendations R-99-53 and -59. Typically, alerter alarms occur more frequently as train speed increases.[16] Unlike the Sugar Valley accident in which the train had slowed and entered a siding before overrunning a signal, the northbound train in the Anding collision remained on the main track at higher speeds. Had an alerter been installed, there was a 4-minute time period after passing the *approach* signal during which the alerter would have activated four to five times. It seems unlikely that the engineer could have reset the alerter multiple times by reflex action without any increase in his awareness. Therefore, an alerter likely would have detected the lack of activity on the part of the engineer and sounded an alarm that could have alerted one or both crewmembers. Had the crew been incapacitated or not responded to the alarm, the alerter would have automatically applied the brakes and brought the train to a stop. The Safety Board concludes that had an alerter been installed on the lead locomotive of the northbound train, it may have prevented the collision in Anding.

Although the Safety Board considers a safety redundant PTC system to be the preferred method for preventing collisions, it recognizes that fully implementing PTC on the U.S. rail network will take time. The Board notes that in the interim alerters can prevent some train collisions. The FRA's requirement that alerters be installed on passenger trains was a good first step; however, it fell short of extending a readily available means of increasing safety to all trains. Passenger trains and freight trains share the same tracks, and the crews on both train types work similar schedules. Freight trains carry hazardous materials that can have a devastating effect on communities should they be released as a result of an accident. Although most freight trains are operated by two crewmembers and many (but not all) passenger trains are operated by a single engineer, the Anding accident and many other freight train accidents investigated by the Board indicate that a second crewmember is no assurance against incapacitation or fatigue-induced inattentiveness. Considering this, expectations of crew alertness for freight and passenger train operations should not be different. Therefore, the Safety Board believes that all Class I railroads should ensure that alerters are installed on all their lead locomotives used to operate trains on tracks not equipped with a PTC system.

Therefore, the National Transportation Safety Board makes the following recommendations to the CN:

> Develop and implement a positive train control system that includes collision avoidance capabilities on main line tracks, establishing priority requirements for high-risk corridors such as those where passenger trains operate. (R-07-7)
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> Ensure that alerters are installed on all your lead locomotives used to operate trains on tracks not equipped with a positive train control system. (R-07-8)

[16] Unless the engineer is manipulating the controls, in which case the alerter resets.

The Safety Board also issued safety recommendations to the Federal Railroad Administration, the Pipeline and Hazardous Materials Safety Administration, the Occupational Safety and Health Administration, and all Class I railroads. Specifically, Safety Recommendation R-07-8 also was issued to all Class I railroads. In your response to the recommendations in this letter, please refer to Safety Recommendations R-07-7 and -8. If you need additional information, you may call (202) 314-6177.

Chairman ROSENKER, Vice Chairman SUMWALT, and Members HERSMAN, HIGGINS, and CHEALANDER concurred in these recommendations.

[*Original Signed*]

By: Mark V. Rosenker
Chairman