National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: April 25, 2007

In reply refer to: R-07-1 through -3

Honorable Joseph H. Boardman
Administrator
Federal Railroad Administration
1120 Vermont Avenue, S.W.
Washington, D.C. 20590

On Sunday, July 10, 2005, about 4:15 a.m., central daylight time,[1] 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[2] 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 damages exceeded $9.5 million; clearing and environmental cleanup costs totaled about $616,800.[3]

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

[1] All times are central daylight time.

[2] *IC* were the initials of the Illinois Central Railroad, which was acquired by the CN in 1999.

[3] 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).

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.[4] 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.[5]

Despite indications[6] 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,[7] 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,[8] failed to observe a wayside signal and collided with a commuter train. Considering 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.

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

[5] Dement, 1996.

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

[7] 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).

[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).

Locomotive Alerters

In its investigation of the collision of two Conrail trains in 1988,[9] 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,[10] 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 Federal Railroad Administration (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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[9] 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).

[10] 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,[11] 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[12] 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[13] of a

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[11] 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).

[12] 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.

[13] 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 Railway Company 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.[14] 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 the FRA should require railroads to ensure that the lead locomotives used to operate trains on tracks not equipped with a PTC system are equipped with an alerter.

Availability of Train Consist Information

Federal regulations require that an accurate train consist documenting the location and type of hazardous materials in transport be kept and maintained on board the occupied locomotive of every freight train. The train consist is typically electronically generated at a train's origination point. When changes to the consist occur en route as a result of setouts and/or pickups (for example, the southbound train crew setting out and picking up cars at Greenwood), the conductor is required to correct the train consist by hand to ensure it reflects an accurate listing of the cars. Train consists are electronically updated in the CN Homewood Rail Traffic

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

Control Center only when a train passes by an Automatic Equipment Identification (AEI) reader. These readers identify cars on a train by the identification tags on the cars as they pass, and then they automatically relay information back to the central computer to update the master train consist. The southbound train passed two AEI readers en route from Memphis; however, both were located north of Greenwood, where the crew had set out and picked up cars. The next AEI reader that the southbound train would have passed, if not for the collision, was located beyond Anding. Consequently, the only accurate consist for the southbound train was the crew's hand-corrected copy on board the train.

As a result of the collision, derailment, and fire, all four crewmembers were killed, and all six locomotives and both on-board train consist documents were destroyed. When emergency response personnel arrived on the accident scene, about 4:41 a.m., it was dark; the fire was intense; and heavy black smoke prevented them from visually identifying all the hazardous materials tank cars in the wreckage. When the first CN official arrived, about 5:25 a.m., he told emergency responders that he believed two CN trains had collided, but he did not have any train consist documents or knowledge about the hazardous materials on either train.

About 5:45 a.m., the CN official obtained accurate consist information about the derailed cars on the northbound train via cell phone from the CN dispatcher and provided it to emergency responders, but cell phone service was disrupted before any information about the southbound train could be obtained. In the absence of a consist for the southbound train, continuing attempts were made to identify hazard placards and car stenciling at the accident site. Although the CN officials and emergency responders were able to visually identify the four hydrogen cyanide tank cars from their unique paint schemes and determine that they did not derail, they could not identify the derailed cars in the southbound train nor determine the potential hazardous materials threats.

A CN clerk from Jackson delivered copies of the consists for both trains about 6:45 a.m., about 2 1/2 hours after the collision occurred and about 2 hours after the fire chief had made his initial request upon arriving at the scene. Yet, the consist that the CN delivered for the southbound train did not accurately reflect the actual makeup of the southbound train at the time of the accident because it did not reflect the cars the crew had set out and picked up at Greenwood. CN representatives did not realize that the cars that had derailed from the southbound train did not match those listed on the consist until they attempted to create a map of the derailment. An accurate listing of the cars that had derailed from the southbound train and were involved in the fire was eventually developed by a site survey of the scene.

Diesel fuel was the cause of the fire in this accident. The limited release of hazardous materials from venting tank cars did not contribute to the severity of the accident. However, the lack of immediately available train consists prevented emergency responders from making a quick assessment of the potential for a hazardous materials release. Train consist documents are a vital source of information for emergency responders when they are trying to determine what hazardous materials might be involved in a derailment. It is essential that the information contained in these documents accurately reflect the current position of each railcar containing a hazardous material. Not having an accurate train consist makes it difficult for emergency responders to properly assess and manage an accident scene. Because the consist for the southbound train was never updated in the CN central computer system, the only up-to-date

consist was the on-board document that was destroyed in the accident. The Safety Board concludes that because the CN did not have the capability to provide an accurate consist for the southbound train after the on-board document was destroyed, emergency responders were unable to promptly identify all the hazardous materials cars involved in the accident and timely assess the threat from a hazardous materials release.

The Safety Board previously addressed the importance of timely and accurate train consists in its investigations of the Thermal, California,[15] and Miamisburg, Ohio,[16] accidents. The Board addressed the same safety issues in its investigation of a derailment that occurred in Akron, Ohio, on February 26, 1989.[17] In the Akron accident, as in the accident in Anding, the train consist provided to emergency responders was not accurate in that it did not reflect the setouts and pickups that the crew made between the time the train departed and the time it derailed, and as a result there was confusion about what hazardous materials were involved in the accident. Although the train crew from the Akron accident survived and was eventually able to update their consist information from memory, valuable time was lost and emergency responders were unable to properly assess and manage the accident scene. At the time of the accident, there were no Federal regulations requiring a train crew to maintain an up-to-date listing of the position of each hazardous materials car in the train. As a result, the Board recommended that the FRA

R-90-38

Revise 49 CFR 174.26(b) to require the traincrew to maintain, at all times, a document reflecting the current position of hazardous materials cars in the train.

The FRA responded that it agreed with Safety Recommendation R-90-38; as a result, with the FRA's cooperation, the Research and Special Programs Administration[18] published a final rule on January 8, 1997. The new rule revised 49 *Code of Federal Regulations* 174.26 to mandate that a train crew carry an on-board document reflecting the current position of each railcar transporting a hazardous material in a train. The new rule also required that the train crew update the consist when cars are added or removed from a train en route. Based on the FRA's response, Safety Recommendation R-90-38 was classified "Closed—Acceptable Action."

The accident at Anding demonstrates that accurate train consists may not be available if the on-board documents are destroyed in an accident. Also, the death or injury of crewmembers may prevent or hinder emergency response personnel from accessing accurate consist

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[15] National Transportation Safety Board, *Derailment of Southern Pacific Transportation Company Train No. 01-BSMFF-05, Carrying Radioactive Material, at Thermal, California, January 7, 1982,* Railroad Accident Report NTSB/RAR-83/01 (Washington, DC: NTSB, 1983).

[16] National Transportation Safety Board, *Hazardous Materials Release Following the Derailment of Baltimore and Ohio Railroad Company Train No. SLFR, Miamisburg, Ohio, July 8, 1986,* Hazardous Materials Accident Report NTSB/HZM-87/01 (Washington, DC: NTSB, 1987).

[17] National Transportation Safety Board, *Derailment of a CSX Transportation Freight Train and Fire Involving Butane, Akron, Ohio, February 26, 1989,* Hazardous Materials Accident Report NTSB/HZM-90/02 (Washington, DC: NTSB, 1990).

[18] The Pipeline and Hazardous Materials Safety Administration was subsequently assigned regulatory jurisdiction over this area after a U.S. Department of Transportation reorganization in 2004.

information in a timely manner. Given the critical importance of providing timely and accurate information to emergency responders about the hazardous materials on an accident train, the Safety Board does not consider a railroad's reliance upon the on-board consist as the only up-to-date listing to be prudent or responsive, especially when a railroad is transporting hazardous materials. The Safety Board concludes that to ensure the safety of emergency responders and the public, railroads must have the ability to quickly provide emergency responders complete information about the specific hazardous materials being transported on a train and their location within it, regardless of the availability of the on-board consist.

At the time Safety Recommendation R-90-38 was issued, computer and communications technologies were far less advanced than they are today. Although some railroads have experimented or are experimenting with various electronic technologies to maintain available and up-to-date consist information, other railroads have not. Electronic tracking systems and modern computer and communication systems can provide a railroad with the flexibility and capability to generate, maintain, retrieve, and promptly deliver up-to-date consists for any of its operating trains to emergency responders. Therefore, the Safety Board believes that the FRA should assist the Pipeline and Hazardous Materials Safety Administration in developing regulations to require that railroads immediately provide to emergency responders accurate, real-time information regarding the identity and location of all hazardous materials on a train.

Locomotive Cab Voice Recorders

The Safety Board has a long history of investigating railroad accidents involving human performance failures by train crewmembers. Knowing crewmembers' actions in these cases would have helped reveal the key circumstances leading up to the accident; however, frequently their recollection of events was limited, or they were not available to be interviewed. As a result of its investigation of the collision between a Maryland Rail Commuter train and an Amtrak train near Silver Spring, Maryland, on February 16, 1996,[19] in which there were no surviving operating crewmembers, the Board recommended that the FRA

> R-97-9
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> Amend 49 *Code of Federal Regulations* Part 229 to require the recording of train crewmembers' voice communications for exclusive use in accident investigations and with appropriate limitations on the public release of such recordings.

After the Safety Board investigated another railroad accident in which there were no surviving crewmembers that occurred in 1999 in Bryan, Ohio,[20] the Board reiterated Safety Recommendation R-97-9 to the FRA. The FRA responded to the Board in a letter dated May 5, 2003, that it

[19] NTSB/RAR-97/02.

[20] 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).

> has reluctantly come to the conclusion that this recommendation should not be implemented at the present time. . . . FRA appreciates that, as time passes and other uses are found for recording media that may create synergies with other public and private purposes, the Board's recommendation may warrant re-examination. However, for the present FRA requests that the Board accept FRA's judgment with respect to overall railroad safety priorities and place this recommendation in the status of "Closed—Reconsidered."

Based on this response and further meetings, the Board classified Safety Recommendation R-97-9 "Closed—Unacceptable Action."

Beyond the value gained during accident investigations from analyzing the verbal communication between operating crewmembers, investigators have used voice recorders to analyze nonverbal sounds originating from the vehicle. From these sounds, parameters, such as engine rpm, system failures, speed, and the time at which certain events occur, can often be determined. Safety Board investigators have used voice recordings to analyze specific events that were not captured by any other measures. For instance, investigators used the cockpit voice recorder (CVR) recovered from the 1982 Air Florida accident in Washington, D.C.,[21] to analyze the engine sounds and determine an approximate engine power ratio[22] throughout takeoff and determine that the anti-ice systems had not been activated. During the investigation of the 1988 Pan Am 103 bombing over Lockerbie, Scotland, the CVR provided critical evidence that there was nothing wrong with the aircraft or unusual with the flight crew, and investigators were able to identify the loud noise on the aircraft as an explosion. The CVR also has been used in conjunction with the flight data recorder to help analyze an event. In the investigation of the 1994 USAir accident near Aliquippa, Pennsylvania,[23] investigators noted three "grunts" or "explosive exhalations" from the first officer. When compared to data from the flight data recorder, investigators corresponded the first officer's exhalations with particular control movements and suggested that the flight officer was straining in an attempt to manipulate the controls of the aircraft to override uncommanded rudder movements.

Likewise, locomotives produce distinctive sounds associated with various functions that may help identify problems with the equipment or determine the actions of the crew. For example, such sounds might include those made by an operating engine, brake application, throttle manipulations, and alarms, or sounds made by other activities, such as crewmembers moving about the cab or opening doors to electrical equipment, the bathroom, or the exterior. Identifying sounds external to the locomotive also may be relevant to an investigation. Such sounds might include noises made while operating over crossovers, turnouts, or switches; operating over broken rails; or sounds from crossing gate bells and whistles or horns from other trains in the area. Locomotive cab voice recorders could provide investigators with a wealth of valuable data not currently available that would better define the circumstances of each accident.

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[21] National Transportation Safety Board, *Air Florida, Inc., Boeing 737-222, N62AF, Collision With 14th Street Bridge Near Washington National Airport, Washington, DC, January 13, 1982*, Aviation Accident Report NTSB/AAR-82/08 (Washington, DC: NTSB, 1982).

[22] CVRs are often used in accident investigations to analyze engine sounds.

[23] National Transportation Safety Board, *Uncontrolled Descent and Collision With Terrain, USAir Flight 427, Boeing 737-300, N513AU, Near Aliquippa, Pennsylvania, September 8, 1994*, Aviation Accident Report NTSB/AAR-99/01 (Washington, DC: NTSB, 1999).

The value of voice recorders extends beyond accidents in which crewmembers suffer serious or fatal injuries. During postaccident interviews, surviving crewmember testimony to investigators regarding preaccident conversations or other activities may be validated with sounds recovered from the voice recorders. Further, the presence of voice recorders in the operating compartment may further compel crewmembers to be more forthcoming during their testimony to investigators and motivate greater crew discipline and adherence to prescribed operating procedures.

Eleven years have passed since the Silver Spring accident that originally prompted the Safety Board to recommend that locomotive cabs be equipped with voice recorders. As noted previously, on May 5, 2003, the FRA told the Safety Board that this recommendation should not be implemented at that time. However, since then, the Board has continued to investigate accidents in which voice recorders would have provided valuable information to help determine probable cause and develop safety recommendations. For example, in the Gunter, Texas, accident,[24] recordings of conversations between the engineer and conductor on the southbound train might have helped investigators understand the crew's error in operating their train contrary to the information contained in their track warrant. The Gunter, Texas, and Anding, Mississippi, accidents, as well as many other railroad accidents[25] investigated by the Board in which crew actions or communications could not be confirmed, further validate the need for voice recorders.

As a result of the accident in Anding, all crewmembers on both trains were killed, and autopsies with toxicological tests could not be performed on the northbound train crewmembers. Consequently, the Safety Board was unable to determine if there was any incapacitating change in the northbound train crewmembers' physical conditions during the accident sequence. Further, the Board was not able to gain an understanding of the northbound train crewmembers' actions and decision-making processes that resulted in their train passing the *stop* signal at North Anding.

A voice recorder would have been useful in this rail accident investigation and others conducted by the Safety Board. However, the usefulness of a voice recorder depends not only on its presence but also on its capabilities, such as crashworthiness, fire resistance, and extended recording of the cab environment and radio communications. Over the years, the Safety Board has investigated aviation accidents in which pertinent CVR information was overwritten and lost because of a 30-minute recording limitation. Experience has shown that most of the significant events leading up to an accident are usually recorded within the final minutes, but this is not always the case. The Board also has investigated accidents in which the damage to the vehicle was not severe enough to interrupt the power supply to the recorder and some or all of the useful information was subsequently overwritten. The Board notes that railroad accidents often occur in remote locations, and there may be a significant delay before the recorder information can be retrieved. Therefore, the length of time recorded by a voice recorder should be of sufficient

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[24] National Transportation Safety Board, *Collision Between Two BNSF Railway Company Freight Trains Near Gunter, Texas, May 19, 2004,* Railroad Accident Report NTSB/RAR-06/02 (Washington, DC: NTSB, 2006).

[25] (a) National Transportation Safety Board, *Collision of Union Pacific Railroad Train MHOTU-23 With BNSF Railway Company Train MEAP-TUL-126-D With Subsequent Derailment and Hazardous Materials Release, Macdona, Texas, June 28, 2004,* Railroad Accident Report NTSB/RAR-06/03 (Washington, DC: NTSB, 2006). (b) National Transportation Safety Board, *Collision of Two Union Pacific Railroad Freight Trains, Texarkana, Arkansas, October 15, 2005,* Railroad Accident Brief NTSB/RAB-06/04 (Washington, DC: NTSB, 2006).

duration to avert the constraints imposed by 30-minute recordings. To address this problem, the aviation industry has begun equipping airliners with a minimum 2-hour continuous loop CVR. Further, the Board notes that although the length of the sound recording was a problem in the past due to technology constraints, it is not an issue with current flash memory technology.

Voice recorder data collected could be critical in determining probable cause or identifying safety issues calling for recommendations. The Independent Safety Board Act of 1974, as amended, specifically addresses surface vehicle recordings and limits the circumstances under which information gathered from them may be divulged.[26] This statutory safeguard is similar to the safeguard established for CVRs.

Knowing the communication (or possible lack thereof) between the northbound train conductor and the engineer and knowing the circumstances that led to the crew passing a *stop* signal are important factors in understanding this accident. The Safety Board concludes that had a locomotive cab voice recorder been installed in the northbound train and had it survived the collision and fire, its data would yield a better understanding of the cause of the accident and of the ways it might have been prevented. The technology for locomotive cab voice recorders is readily available. In fact, the Board notes that many railroads are installing recorders that capture external sounds and video images ahead of their locomotives. In 2003, the FRA acknowledged to the Board that as time passed the need for locomotive cab recorders may warrant reexamination. Since then, the railroad industry has continued to experience serious accidents in which locomotive cab voice recorders would have provided crucial information to help determine what happened and how to prevent future accidents. Therefore, the Safety Board believes that the FRA should require the installation of a crash- and fire-protected locomotive cab voice recorder, or a combined voice and video recorder, (for the exclusive use in accident investigations and with appropriate limitations on the public release of such recordings) in all controlling locomotive cabs and cab car operating compartments. The recorder should have a minimum 2-hour continuous recording capability, microphones capable of capturing crewmembers' voices and

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[26] SURFACE VEHICLE RECORDINGS AND TRANSCRIPTS.--

(1) CONFIDENTIALITY OF RECORDINGS.--The Board may not disclose publicly any part of a surface vehicle voice or video recorder recording or transcript of oral communications by or among drivers, train employees, or other operating employees responsible for the movement and direction of the vehicle or vessel, or between such operating employees and company communication centers, related to an accident investigated by the Board. However, the Board shall make public any part of a transcript or any written depiction of visual information that the Board decides is relevant to the accident--

(A) if the Board holds a public hearing on the accident, at the time of the hearing; or

(B) if the Board does not hold a public hearing, at the time a majority of the other factual reports on the accident are placed in the public docket.

(2) REFERENCES TO INFORMATION IN MAKING SAFETY RECOMMENDATIONS.-- This subsection does not prevent the Board from referring at any time to voice or video recorder information in making safety recommendations.

49 U.S.C. §1114(d).

sounds generated within the cab, and a channel to record all radio conversations to and from crewmembers.

Therefore, the National Transportation Safety Board makes the following recommendations to the Federal Railroad Administration:

> Require railroads to ensure that the lead locomotives used to operate trains on tracks not equipped with a positive train control system are equipped with an alerter. (R-07-1)
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> Assist the Pipeline and Hazardous Materials Safety Administration in developing regulations to require that railroads immediately provide to emergency responders accurate, real-time information regarding the identity and location of all hazardous materials on a train. (R-07-2)
>
> Require the installation of a crash- and fire-protected locomotive cab voice recorder, or a combined voice and video recorder, (for the exclusive use in accident investigations and with appropriate limitations on the public release of such recordings) in all controlling locomotive cabs and cab car operating compartments. The recorder should have a minimum 2-hour continuous recording capability, microphones capable of capturing crewmembers' voices and sounds generated within the cab, and a channel to record all radio conversations to and from crewmembers. (R-07-3)

The Safety Board also issued safety recommendations to the Pipeline and Hazardous Materials Safety Administration, the Occupational Safety and Health Administration, the CN, and all Class I railroads.

Please refer to Safety Recommendations R-07-1 through -3 in your reply. 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

Safety Recommendation Reiteration List

SR Number	Reiteration Number	Report Number	Report Date	Accident Description	Accident City	Accident State	Accident Date
R-07-002	1	RAR-12-01	2/14/2012	Derailment Of CN Freight Train U70691-18 With Subsequent Hazardout Materials Release And Fire	Cherry Valley	IL	6/19/2009
R-07-002	2	RAR-14-01	7/29/2014	Conrail Freight Train Derailment W/Vinyl Chloride Release	Paulsboro	NJ	11/30/2012