

Railroad Accident Report

**Collision of Two Canadian National/Illinois
Central Railway Trains
Near Clarkston, Michigan
November 15, 2001**



**National
Transportation
Safety Board**
Washington, D.C.

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Adopted November 19, 2002**



**National Transportation Safety Board
490 L'Enfant Plaza, S.W.
Washington, D.C. 20594**

National Transportation Safety Board. 2002. *Collision of Two Canadian National/Illinois Central Railway Trains Near Clarkston, Michigan November 15, 2001. Railroad Accident Report NTSB/RAR-02/04. Washington, DC.*

Abstract: On November 15, 2001, about 5:54 a.m., eastern standard time, Canadian National/Illinois Central Railway (CN/IC) southbound train 533 and northbound train 243 collided near Clarkston, Michigan. The collision occurred on the CN/IC Holly Subdivision at a switch at the south end of a siding designated as the Andersonville siding. Train 533 had been operating in a southward direction through the siding and was traveling at 13 mph when it struck train 243. Signal 14LC at the turnout for the siding displayed a stop indication, but train 533 did not stop before proceeding onto the mainline track. Train 243 was operating northward on a proceed signal on the single main track about 30 mph when the trains collided. Both crewmembers of train 243 were fatally injured; the two crewmembers of train 533 sustained serious injuries. The total cost of the accident was approximately \$1.4 million.

In its investigation of this accident, the Safety Board examined one safety issue, the adequacy of rail industry standards and procedures for identifying and reporting potentially incapacitating medical conditions.

As a result of its investigation of this accident, the Safety Board makes safety recommendations to the Canadian National Railway and the Federal Railroad Administration.

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Acronyms and Abbreviations

ATSF	Atchison, Topeka and Santa Fe Railway Company
CFR	<i>Code of Federal Regulations</i>
CN/IC	Canadian National/Illinois Central Railway
CPAP	Continuous Positive Airway Pressure
ENT	ear, nose, and throat
FAA	Federal Aviation Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
MARC	Maryland Rail Commuter
NVIC	Navigation and Vessel Inspection Circular
OSA	obstructive sleep apnea
RSAC	Railroad Safety Advisory Committee
SEPTA	Southeastern Pennsylvania Transit Authority

Executive Summary

On November 15, 2001, about 5:54 a.m., eastern standard time, Canadian National/Illinois Central Railway (CN/IC) southbound train 533 and northbound train 243 collided near Clarkston, Michigan. The collision occurred on the CN/IC Holly Subdivision at a switch at the south end of a siding designated as the Andersonville siding. Train 533 had been operating in a southward direction through the siding and was traveling at 13 mph when it struck train 243. Signal 14LC at the turnout for the siding displayed a stop indication, but train 533 did not stop before proceeding onto the mainline track. Train 243 was operating northward on a proceed signal on the single main track about 30 mph when the trains collided. Both crewmembers of train 243 were fatally injured; the two crewmembers of train 533 sustained serious injuries. The total cost of the accident was approximately \$1.4 million.

The National Transportation Safety Board determines that the probable cause of the November 15, 2001, Canadian National/Illinois Central Railway accident in Clarkston, Michigan, was the train 533 crewmembers' fatigue, which was primarily due to the engineer's untreated and the conductor's insufficiently treated obstructive sleep apnea.

In its investigation of this accident, the Safety Board examined one safety issue:

- The adequacy of rail industry standards and procedures for identifying and reporting potentially incapacitating medical conditions.

As a result of its investigation of this accident, the Safety Board makes safety recommendations to the Canadian National Railway (parent organization of the CN/IC) and the Federal Railroad Administration.

Factual Information

The Accident

On November 15, 2001, about 5:54 a.m., eastern standard time,¹ Canadian National/Illinois Central Railway (CN/IC)² southbound train 533 and northbound train 243 collided near Clarkston, Michigan. The collision occurred on the CN/IC Holly Subdivision at a switch at the south end of a siding designated as the Andersonville siding. Train 533 had been operating in a southward direction through the siding and was traveling at 13 mph when it struck train 243. Signal 14LC at the turnout³ for the siding displayed a stop indication, but train 533 did not stop before proceeding onto the mainline track. Train 243 was operating northward on a proceed signal on the single main track about 30 mph when the trains collided. Both crewmembers of train 243 were fatally injured; the two crewmembers of train 533 sustained serious injuries. The total cost of the accident was approximately \$1.4 million. (See figure 1.)



Figure 1. Accident aftermath. (Train 243 is at the bottom of the picture and train 533 is at the top of the picture.)

¹ All times in the report are eastern standard time.

² The CN/IC is a subsidiary of the Canadian National Railway. The CN/IC operates one of the largest railroad networks in the United States and Canada with 17,986 route miles covering 14 States and 8 Canadian provinces. The CN/IC network was created through the 1999 merger of the rail systems of the Canadian National and the Illinois Central and the subsequent merger of this system with the Wisconsin Central in 2001.

³ A *turnout* is a switch that allows two sets of parallel tracks (one siding track and one mainline track) to merge together into one track.

The crew of CN/IC train 533 had gone on duty at Hamtramck, Michigan, at 7:30 p.m., November 14, 2001. Train 533 consisted of 2 locomotives and 90 loaded and 4 empty container platforms. The train was 6,193 feet long and weighed 4,791 tons. The train departed the yard at 9:45 p.m., after the crew performed the required brake tests and equipment inspections. The conductor was in the lead locomotive with the engineer. The train proceeded without incident to Durand, Michigan, a distance of 67 miles, where cars were to be set out and picked up. Train 533 arrived at Durand at 12:48 a.m., November 15.

In the meantime, the 2-person crew of CN/IC train 243 reported for duty at Flat Rock, Michigan, at 8:00 p.m., November 14, 2001. Train 243 was to travel northward from Flat Rock to Flint, Michigan. Train 243 departed Flat Rock about 9:15 p.m., heading north, after its crew successfully completed the required paperwork and air brake tests.

Train 533 left Durand at 4:49 a.m. on November 15 and proceeded south on the single main track to the north end of the Andersonville siding where, according to signal system event recorders, the signal was displaying a restricting indication. The train was then diverted into the siding. The siding's full length was about 7,140 feet, and it had a "clear space" distance of about 6,830 feet. By rule, the authorized maximum speed in the Andersonville siding was 10 mph. The train 533 locomotive engineer had been qualified over the territory where the accident occurred for 27 years, and he had previously operated his train on the siding, as recently as a week before the accident. According to event recorder data, while operating his train into the Andersonville siding on the day of the accident, the engineer initially made several throttle control maneuvers that accelerated the train to 16 mph while traveling in the siding. According to signal system event recorders, signal 14LC at the south end of the Andersonville siding was displaying a "stop" indication.

No evidence was found that the train 533 engineer made any control maneuvers in response to the stop indication, such as applying the brakes, during the last 2 minutes before the accident.⁴ The engineer told investigators that he had had no conversations with the conductor during their trip up to and through the Andersonville siding; and there is no evidence that the conductor attempted to activate the emergency brakes to stop the train.⁵

Train 533 passed the signal at the south end of the siding without stopping and, about 5:54 a.m., entered the mainline track traveling about 13 mph and collided with the right front corner of northbound train 243, which was operating about 30 mph on a proceed signal. The collision occurred at a point about 163 feet past the stop signal. (See figure 2.) The two crewmembers of train 243 were fatally injured, and the two crewmembers of train 533 sustained serious injuries.

⁴ A locomotive engineer familiar with the Andersonville siding told Safety Board investigators that an engineer would have needed to begin making brake applications about midway into the siding to safely stop the train before it entered the main track.

⁵ This locomotive was equipped with a conductor's emergency brake valve, which the conductor could use to initiate an emergency brake application.

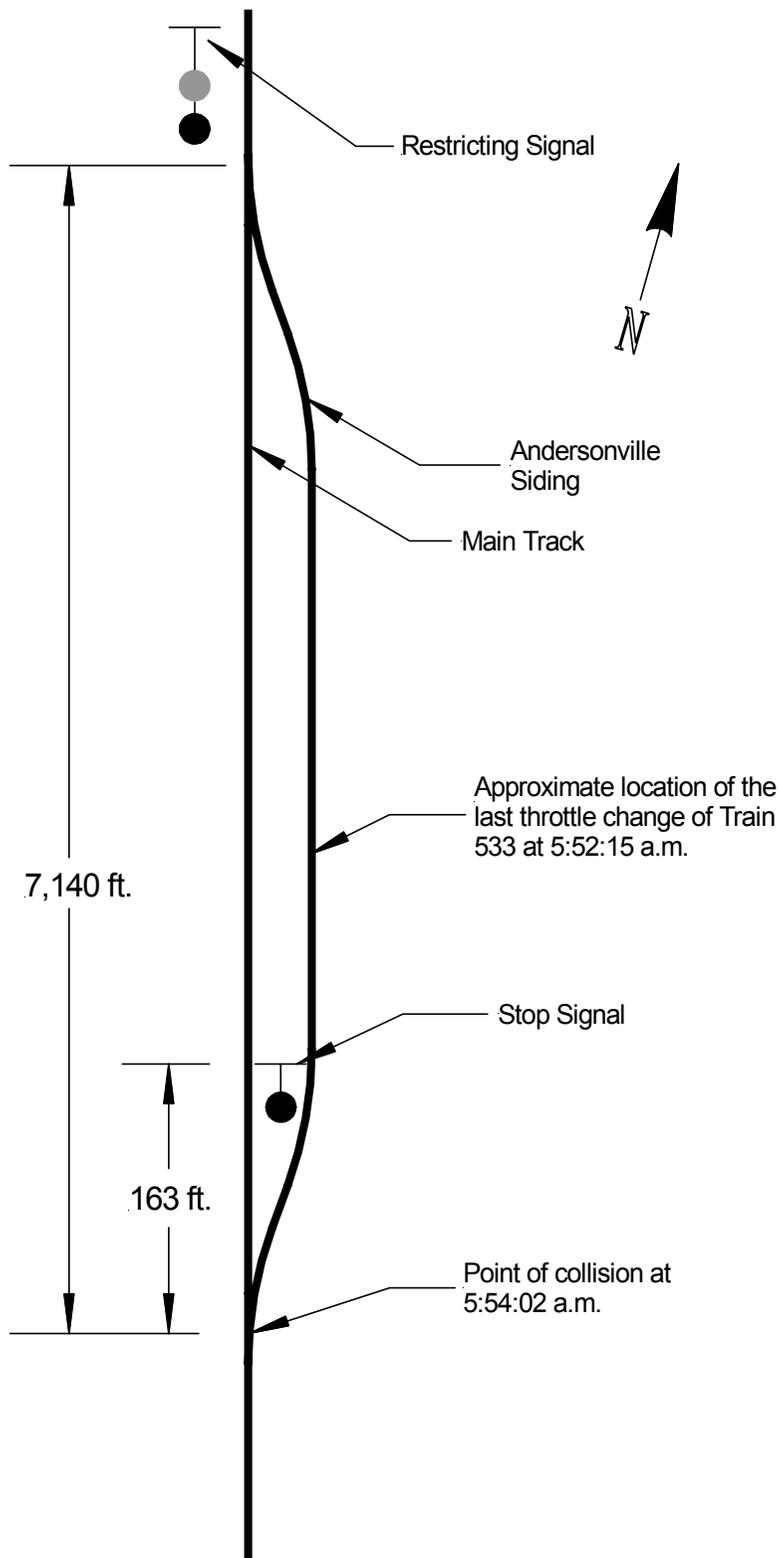


Figure 2. Diagram of the main track and Andersonville siding, showing the approximate locations of the last throttle change for train 533 and the point of collision, based on the estimated times provided by event recorder data.

The chief of the Springfield Township Fire Department reached the area of the accident by 6:10 a.m. He set up a command post and requested the assistance of the Independence Township Fire Department. The engineer and conductor of train 533 were trapped inside the lead locomotive immediately following the accident. Members of the Independence and Springfield Township Fire Departments extricated them from the locomotive. They were airlifted to separate hospitals.

As a result of the derailment, there was a fire. Out of concern for potential leaking of hazardous materials, an area within a 1/2-mile radius and up to 1 mile downwind from the accident scene was evacuated. The evacuation displaced persons from 263 residences, 38 businesses, and 2 schools (affecting about 1,570 people) for 3 1/2 hours.

In his first communication with Safety Board investigators after the accident (through written responses to investigators' questions, provided via the engineer's attorney), the engineer of train 533 indicated that shortly before the accident he had been preoccupied with trying to pull the train into the Andersonville siding and trying to watch the signals behind and in front of him. He also indicated that inclement weather impeded the visibility of the signals in the siding and that some of the signals in the area were malfunctioning. Subsequently, however, the engineer told Safety Board investigators that, "As I was into the siding, I could see the red signals...." He also said the signals were likely functioning properly.

The engineer did not indicate to Safety Board investigators that he had fallen asleep before the accident. The conductor, who had sustained a head injury as a result of the collision, said that he could not recall any of the events related to the accident.

Train 533 Crewmembers

Engineer

The engineer of train 533 began employment with the CN/IC's predecessor railroad (Grand Trunk Western Railroad) on May 15, 1970. He was transferred to the position of fireman on March 17, 1971, and was promoted to yard engineer on July 10, 1973. He became a locomotive engineer on October 1, 1974. His most recent qualification on the operating rules took place on July 12, 2000, and he had last been re-certified on December 29, 2000.

The engineer had worked 7 consecutive days prior to the accident trip. On these days—and for most of his work during the prior month—his on-duty time began at 7:30 p.m., and he would typically remain on duty for 12 hours and often remain in "limbo time"⁶ for up to 2 hours beyond that. Except for one occasion during this 30-day period,

⁶ According to 49 *United States Code* 21103(b)(4), "Time spent in deadhead transportation to a duty assignment is time on duty, but time spent in deadhead transportation from a duty assignment to the place of final release is neither time on duty nor time off duty." The latter time is commonly termed *limbo time*.

each assignment he had worked during the last month was the same trip he was making on the day of the accident.

Each day that the engineer worked, he would leave his house about 6:15 p.m., arrive at the terminal around 7:30 p.m., and go on duty at that time. The engineer was on duty on November 11 from 7:30 p.m. until 8:40 a.m. the next morning. He was on duty again that night (November 12) from 7:30 p.m. until 7:30 a.m., November 13. At 7:30 p.m., November 13, he went on duty and worked until 9:30 a.m., November 14. That evening, he showered and ate before he left his house, about 6:15 p.m., for work. At 7:30 p.m., November 14, he went on duty at Hamtramck and worked until the accident (which took place about 5:54 a.m., November 15).

The engineer stated that on the days leading up to the accident he would arrive home between 8:30 and 9:00 a.m. He would be in bed within a half hour, get up between 4:00 and 5:00 p.m., and then clean up and eat before departing for work. He also indicated that he received about 6 1/2 hours of sleep each day.

As a prerequisite to engineer certification, and in accordance with Federal regulations, the engineer of train 533 underwent routine company physical examinations to determine whether he met the standards for vision and hearing acuity prescribed in 49 *Code of Federal Regulations* (CFR) 240.121. The CN/IC, based on the results of his last physical examination, performed on December 20, 2000, determined that the engineer was fit to perform the duties required of a locomotive engineer. The engineer told Safety Board investigators that, before the accident, his health was “fairly good,” although he stated that he had some minor health problems that he believed did not affect his job performance. During his company physical examinations, he indicated that he had high blood pressure and diabetes that were being treated with prescription medications. He had specified these medications on his examination form. The CN/IC did not find either of these medical conditions or the prescribed medications to be disqualifying. The engineer did not indicate during his company physical examinations that he experienced any type of chronic sleep problem, nor did the examination form request information about sleep disorders.

Safety Board investigators examined the engineer’s medical records from his private physician. In April 1998, in response to the engineer’s complaints about “snoring with pauses,” his private physician referred him to an ear, nose, and throat (ENT) specialist. The ENT specialist noted, in part, that the engineer was being evaluated for “chronic snoring with episodic awakening and daytime somnolence.” After his evaluation, the ENT specialist concluded that the engineer likely suffered from obstructive sleep apnea (OSA),⁷ a chronic sleeping disorder. The specialist had also indicated that he:

Warned [the engineer] of the risks of falling asleep while driving either his car or the train. He appears to understand these risks. I also discussed treatment options...I requested that he have a sleep study performed....

⁷ OSA will be discussed in detail later in this report.

The engineer's private physician was aware of the engineer's occupation and that he likely suffered from OSA. On several occasions following the ENT specialist's diagnosis, the last occasion occurring about a week before the accident, the private physician explicitly warned the engineer that he should make an appointment at a sleep clinic to undergo further evaluation and to learn about treatment options for possible OSA. The private physician's notes indicated that the engineer understood the need for further medical treatment. The engineer did not seek additional medical treatment for this condition. The engineer told Safety Board investigators that he believed he suffered from OSA.

A CN/IC conductor who had worked with the train 533 engineer told Safety Board investigators that on several occasions the engineer had fallen asleep while operating a train and had to be awakened to respond to an upcoming signal or to blow the horn at a grade crossing. Another conductor commented that the engineer "always looked tired."

Conductor

The CN/IC's predecessor railroad hired the conductor of train 533 as a yard brakeman on June 21, 1976. He was promoted to road brakeman and conductor on October 13, 1980. His most recent qualification on the operating rules was on July 5, 2000.

According to CN/IC medical records, the train 533 conductor's last company physical examination took place on July 27, 2001. The examining physician determined that the conductor was fit to perform his duties, with the restriction that he wear hearing protection. (There was evidence of "slight" high frequency hearing loss for both his ears.) The examination also indicated that the conductor had Type II diabetes, diagnosed 1 1/2 years previously, which was being controlled by diet. Nothing in the company's medical records indicated that the CN/IC was aware that the conductor had been diagnosed with, and was being treated for, OSA.

In postaccident interviews with Safety Board investigators, the conductor stated that some years earlier, his personal physician had referred him to a sleep clinic, where he was diagnosed with severe OSA on June 6, 1997. Since then, he had been using a Continuous Positive Airway Pressure (CPAP) device⁸ to treat this condition. He did not return to the sleep clinic for a CPAP titration⁹ study to determine the effectiveness of the CPAP device. The medical records for his last sleep examination at the sleep clinic indicated that his Epworth Sleepiness Scale¹⁰ value was 4 (considered normal), but the

⁸ The *CPAP device* is considered the most effective non-surgical treatment for the alleviation of snoring and OSA.

⁹ The level of air pressure required to keep a person's airway open is determined through an overnight sleep study with a nasal CPAP device; the study is called a *CPAP titration*. After an optimal pressure has been determined, the patient's CPAP unit is set at that pressure for home use.

¹⁰ The *Epworth Sleepiness Scale*, a subjective measure of sleepiness, has a range of 0 to 24. Epworth Scale values for a person without excessive sleepiness would be 10 or less, while values 11 through 24 indicate significant sleepiness.

records also indicated that he said he did not feel that the CPAP pressure was strong enough, that he continued to snore, and that he was tired.

The conductor of train 533 had been assigned to the extra board,¹¹ so he did not work a regular assignment. As a result, both his on-duty and off-duty times varied from assignment to assignment. He had not worked the train 533 job for at least a month prior to the accident trip. His on-duty start times over the month before the accident were never the same on consecutive days, and he had worked both daytime and nighttime shifts on an irregular basis.

In the period immediately before the accident, he had first worked the night shift for a few days. Then the conductor was off duty from about 7:00 p.m. on November 10 through November 12 (he indicated that he was ill). On November 13 at 11:30 p.m., he went on duty and worked until 9:11 a.m., November 14. He went home about 11:00 a.m. and rested/slept until 5:30 p.m., when he received a call from a CN/IC employee to go on duty at 7:30 p.m. at Hamtramck. He remained on duty through the night and worked until the time of the accident.

Postaccident Inspections and Tests

Postaccident inspection of the signals and train equipment indicated that they were functioning properly.

Postaccident sight tests indicated that signal 14LC would have been visible to a southbound train engineer for the entire length of the siding. Sight distance tests (which were designed to take into account the relative speeds of the two trains) also indicated that the headlight of train 243 would have been visible to the engineer of train 533 about 60 seconds before the collision occurred.

Toxicological Information

Pursuant to Federal Railroad Administration (FRA) postaccident toxicological test requirements, as found in 49 CFR Part 219, each surviving crewmember involved in the accident provided specimens that were tested for the presence of alcohol and drugs.¹² Test results were negative.

¹¹ The *extra board* is a list of qualified employees available to fill assignments when the regularly assigned employee is unavailable for duty.

¹² The following drugs were tested for: cannabinoids, cocaine, opiates, amphetamines, methamphetamines, phencyclidine, barbiturates, and benzodiazepines.

Meteorological Information

Meteorological reports for the accident area indicated that shortly after the accident, winds were from the south-southwest at 8 mph with no precipitation.

No CN/IC crew operating in the area before the accident reported poor visibility due to the weather conditions. Emergency responders who were on the scene minutes after the accident reported clear visibility.

Obstructive Sleep Apnea

OSA is a common disorder in which breathing stops during sleep for 10 seconds or more, sometimes more than 300 times a night, due to mechanical blockage of the airway.¹³ When a person with OSA falls asleep, muscles in the throat relax to a point at which the airway collapses and becomes obstructed. As a result, breathing stops and the sleeper awakens to open the airway. The American Sleep Disorders Association rates the average number of OSA events per hour as a Respiratory Distress Index. A Respiratory Distress Index of 0 to 5 is normal; 5 to 20 indicates mild distress; 20 to 40 indicates moderate distress; and over 40 is considered to represent severe distress. Because of these disruptions to normal sleep patterns, patients with OSA tend to suffer from excessive daytime sleepiness, no matter how much sleep they obtain during any period. Patients with OSA often complain of waking up feeling like they have not slept at all.

OSA is characterized by snoring and persistent fatigue, which are often unrecognized, or considered mere annoyances rather than possible symptoms of a medical condition. Consequently, those people with OSA who notice the symptoms frequently dismiss them as insignificant. However, there is increasing recognition in the medical community that OSA has other important consequences, leading to decrements in attention and cognitive performance, as well as impaired quality of life. Persons with OSA are at constant risk of experiencing dangerous events, such as falling asleep while driving, and their fatigue may negatively affect workplace and personal relationships.¹⁴

¹³ According to the National Institute of Neurological Disorders and Stroke.

¹⁴ Source: William C. Dement, M.D., Ph.D., and Robert Koenigsberg.

Research has been conducted analyzing the impact of OSA on the health, sleep, and alertness of railroad workers.¹⁵ The results showed that those railroad workers with OSA indications¹⁶ reported receiving poor quality sleep, had more gastrointestinal problems, and said they sometimes lost concentration and thought they might have missed rail signals. The research further suggested that programs to identify and treat individuals with OSA would improve health and safety in the workplace. Another study concluded that the risk of developing cardiovascular disease is increased in middle-aged subjects with untreated OSA. This study, however, found that efficient treatment of OSA was associated with a significant risk reduction for cardiovascular disease incidence.¹⁷

Studies have shown an increased risk for motor vehicle accidents in patients with OSA when compared with the general population. One study investigating the relationship between sleepiness, driving, and accidents found that men with OSA were about three times as likely as those without OSA to have had a recent traffic accident.¹⁸ At more severe levels of OSA, people were seven times more likely to have had multiple traffic accidents.

The reduction of human fatigue in transportation operations is one of the Safety Board's "Most Wanted" transportation safety improvements. The Safety Board has a long history of making safety recommendations concerning operator hours-of-service requirements. The Safety Board has also made safety recommendations concerning conditions (including sleeping disorders such as OSA) that may affect operator fatigue. (See appendix B for a listing of relevant safety recommendations.)

The Safety Board has investigated other transportation accidents in which an operator involved in the accident suffered from OSA.¹⁹ For instance, on August 15, 2000, a light rail commuter train en route from Baltimore to the BWI Airport struck the hydraulic bumping post at the terminus of track No. 2 at the BWI Airport Station and derailed. The train operator did not apply the brakes to stop his train at the station. He said

¹⁵ A. Aguirre, A. Heitmann, U. Trutschel, K. Mathews, R. Khuri, P. Gerber, and M. Moore-Ede, "Sleep Apnea as a Risk Factor in Railroad Operations." Abstract contained in *Shiftwork International Newsletter*, Vol. 14, No. 1, May 1997. The study is unpublished.

¹⁶ The authors determined that subjects exhibited indications of OSA based on the results of a sleep apnea pre-screening questionnaire, which was based on the Sleep Disorders Questionnaire (SDQ) developed by A. Douglass, R. Bornstein, K. Nino-Murcia, S. Keenan, L. Miles, V. Zarcone, C. Guilleminault, and W. Dement, "The Sleep Disorder Questionnaire I: Creation and Multivariate Structure of SDQ." *Sleep*, 17(2): 160-167 (1994).

¹⁷ Y. Peker, J. Hedner, H. Norum, H. Kraiczi, and J. Carlson, "Increased Incidence of Cardiovascular Disease in Middle-aged Men with Obstructive Sleep Apnea." *American Journal of Respiratory and Critical Care Medicine*, Vol. 166; pp. 159-165 (2002).

¹⁸ T. Young, J. Blustein, L. Finn, and M. Palta, "Sleep-Disordered Breathing and Motor Vehicle Accidents in a Population-Based Sample of Employed Adults." *Sleep*, 20(8): 608-613 (1997).

¹⁹ See the following National Transportation Safety Board reports: *Maryland Transit Administration Light Rail Vehicle Accidents at the Baltimore-Washington International Airport Transit Station near Baltimore, Maryland, February 13 and August 15, 2000*, Railroad Special Investigation Report NTSB/SIR-01/02 (Washington, D.C: NTSB, 2001); and *Grounding of the Liberian Passenger Ship STAR PRINCESS on Poundstone Rock, Lynn Canal, Alaska, June 23, 1995*, Marine Accident Report NTSB/MAR-97/02 (Washington, D.C: NTSB, 1997).

that a restricting signal was the last thing he saw before he went “out” and that he was not aware of anything until he returned to consciousness after the accident. The Safety Board determined that the probable cause of the accident was the operator’s severe fatigue, resulting from undiagnosed OSA, which caused him to fall asleep so that he could not brake the train before it struck the bumping post. The Safety Board recommended fatigue awareness training, including the risks posed by sleep disorders, for the rail transit industry. (See appendix B, Safety Recommendation R-01-27.)

Fatigue Education at the CN/IC

The CN/IC has a fatigue awareness training program that includes a guidebook for CN/IC employees and their families from Circadian Technologies, Inc., entitled “Lifestyle and Fatigue Countermeasures.” The course material addresses many fatigue-related issues, such as shift work, work-rest schedules, and proper regimens of health and diet, as well as sleeping disorders, including OSA. The course is not part of a required CN/IC training program, and the CN/IC does not document which of its employees have taken the course. The train 533 engineer and conductor (as well as some CN/IC operating crewmembers interviewed after the accident) could not recall having taken the course.

Medical Examinations of Railroad Employees

A railroad employee’s medical condition may be discovered through the company-mandated physical examination or through an “elective” medical examination conducted by the employee’s private physician.

Company-Mandated Medical Examinations

Regulations and Requirements. FRA regulations require that an engineer be certified as a qualified locomotive engineer at least once every 3 years.²⁰ The medical examination, which is a prerequisite to engineer certification, focuses on specific vision and hearing acuity standards.²¹ The regulations do not provide guidance regarding general or specific medical conditions that should be considered in the course of the examination. The regulations require locomotive engineers to report deteriorating hearing and vision to company officials whenever deterioration may occur, but neither the engineers nor their private physicians are required to report a deterioration of any other medical condition that might affect their performance. (Although not a Federal regulation, many railroads require employees in safety-sensitive positions to notify a medical official of their use of prescribed or over-the-counter medications.)

²⁰ See 49 CFR 240.201.

²¹ See 49 CFR 240.121.

Medical Examination Forms. No standard medical examination form is used in the U.S. railroad industry. The Safety Board reviewed a sample of the medical examination forms used by Class I railroads and found that the typical medical examination form does not include questions regarding sleep problems. Similar to the other forms the Safety Board reviewed, the form used by the CN/IC had no questions that specifically addressed sleeping problems or disorders.

The Safety Board examined the medical examination forms used in other modes of transportation to determine the extent to which they request medical information about sleep disorders.

In the maritime industry, the Merchant Marine Physical Examination/Certification Report²² asks the examining physician if the applicant has or had suffered from “sleepwalking.” This is the only question on the form related to sleep. However, in February 1998, the Coast Guard published a Navigation and Vessel Inspection Circular (NVIC) to provide guidelines for evaluating the physical condition of an applicant for the merchant marine license or document. The NVIC states, in part, that:

Without specific guidelines for conducting the examination, or without a general familiarity with and appreciation for the rigors of employment in the maritime environment, most medical personnel are unable to fully evaluate the applicant’s medical qualifications; therefore, this NVIC provides guidance to assist medical personnel in conducting these examinations.

The NVIC prompts the examining physician to inquire about various sleep problems, including narcolepsy and somnambulism, and:

Any other disease...medication (side effects), sleep disorders or therapy which would result in gradual deterioration of performance of duties, sudden incapacitation or otherwise compromise shipboard safety, including required response in an emergency.

In the highway industry, the driver undergoing a physical examination (used to determine the physical qualification of commercial motor vehicle drivers operating in interstate commerce) is to complete the health history section of the Federal Motor Carrier Safety Administration’s (FMCSA’s) revised medical examination form,²³ and the medical examiner is encouraged to discuss with the driver the severity of any problems the driver reports. The form’s history section requests that the driver answer “yes” or “no” to a variety of medical condition questions. Any “yes” response requires further clarification

²² U.S. Department of Transportation Coast Guard form CG-719K (Rev. 7/01), required of an applicant for certain merchant marine licenses or documents.

²³ The updated medical examination form currently used was revised as of October 5, 2000, and appears at 49 CFR 391.43(f). According to the FMCSA, the revised form has been organized to (1) gain simplicity and efficiency, (2) reflect current medical terminology, and (3) be a self-contained document (that is, the form will, to the extent possible, include all relevant information necessary to conduct the physical examination and certification). Although the Safety Board supports the majority of the revisions to the form, the Board has expressed some concern regarding such issues as the appropriate distribution of the form, the lack of training for examiners, the lack of a tracking mechanism for the examinations, and other major flaws in the commercial drivers’ medical certification process.

by the driver, including the onset date, diagnosis, treating physician's name and address, any current limitation, and any prescribed or over-the-counter medications used regularly or recently. The history section specifically inquires about sleep problems, asking the driver if he or she has experienced "Sleep disorders, pauses in breathing while asleep, daytime sleepiness, loud snoring." These symptoms, as discussed earlier, are indications that the operator may have OSA.

In the aviation industry, the Federal Aviation Administration (FAA) does not have any questions on its medical certification form specifically eliciting information regarding sleep disorders, but guidance to FAA Aviation Medical Examiners in the Fall 2001 Federal Air Surgeon's Bulletin notes that:

[A]s for the medical certification of sleep apnea, the [Aviation Medical Examiner] should defer the case to the Regional Flight Surgeon or the [Aerospace Medicine Certification Division]... we will require... a polysomnogram... operative notes of any surgical procedures... current status of the medical condition to include any current treatment and whether the treatment has been successful. If... symptoms are persistent or not completely successful, we will require a Maintenance of Wakefulness Test....

CN/IC's Policy of Reporting Medical Conditions. The CN/IC indicated that it has an established policy²⁴ that, if an employee misses work due to a medical condition that might affect the employee's ability to work safely, the employee is required to report the condition to company officials. The CN/IC, in a letter to the Safety Board, stated:

If an employee is off work due to that condition, our Medical Department demands a statement from the treating physician that includes a diagnosis and a medical opinion about the safety of the employee returning to his/her former duties. The Medical Department will also send the employee for a 'fit for duty' physical, including the statement from the treating physician, and possibly a job description. Unfortunately, under current laws designed to protect privacy rights, the CN/IC cannot demand that a person divulge all medical issues if the person and the physician see no reason that the condition would affect the ability of the employee to perform their job. CN/IC is at the mercy of the employee and their doctor to provide us with critical information. Most often, employees afraid of losing their jobs will not voluntarily communicate protected, and/or privileged medical information.

The CN/IC medical records for the engineer of train 533 show no evidence that the engineer had ever missed work due to the effects of OSA. Because he had not missed any duty time due to his OSA, the engineer did not violate any CN/IC rule requiring documentation of a physician's diagnosis of his condition.

Private Medical Examinations and Reporting Requirements

United States. In the United States, no Federal regulations for the railroad industry require a private physician to report a patient's medical conditions to his employer.

²⁴ Included in CN/IC Substance & Alcohol Free Environment (SAFE) Policy B-2.

The Safety Board is aware of at least one transit company, the Southeastern Pennsylvania Transit Authority (SEPTA), which has implemented a program whereby its operating employees bring medical conditions requiring the use of prescribed medications to the attention of SEPTA's medical department. Under the SEPTA program, if the employee has been prescribed a medication that may affect the employee's performance, he or she is required to report such medication use to the SEPTA medical department using a form provided by SEPTA that must be completed by the physician. The physician may either return the completed form to the employee (who is to provide it to SEPTA) or fax it directly to the SEPTA medical department. The form is designed primarily to report medication use, but it does have a section in which the physician is to provide the patient's diagnosis, enabling the SEPTA medical department to determine whether the condition itself may affect the employee's performance of safety-sensitive duties. (The SEPTA medical director told Safety Board staff that he receives several of these forms each week.)

Canada. Unlike U.S. Federal regulations, Canadian regulations require that a physician or optometrist immediately disclose to the company any potentially hazardous medical condition of a railroad employee that might affect the employee's performance. In September 2000, Bill C-58 of the Canadian Railway Safety Act²⁵ came into effect, discussing elements of the medical examinations for employees in safety-critical operations. According to Transport Canada (the Canadian Government department with responsibility for air, sea, and land transportation policy and regulation), the purpose of this section is to ensure that persons in positions critical to safe rail operations are fit for duty. This bill, in part:

- Requires physicians and optometrists to notify the railway company's medical adviser if an employee has a medical condition that could be a threat to safe railway operations (a copy of this notice is to be sent to the employee);
- Places the responsibility on the patient to inform the physician that he or she holds a designated position;
- Allows the company to use information provided by a physician or optometrist in the interest of safe railway operations;
- Prohibits any legal, disciplinary, or other proceedings against a physician or optometrist for such information given in good faith; and,
- Prohibits further disclosure, or use as evidence, of such medical information, except with the permission of the patient.

²⁵ The Canadian Railway Safety Act was implemented in 1989 to address the many changes that had taken place in the rail transportation industry in recent years. It was designed to achieve the objectives of the national transportation policy relating to the safety of railway operations. The act gave direct jurisdiction over safety matters to the Minister of Transport, to be administered by Transport Canada, where responsibility for other federally regulated modes (that is, air, highway, and marine modes) resides.

Medical Condition and Fitness-For-Duty Evaluations

Federal regulations discuss the role of a treating medical practitioner or a physician designated by the railroad in making a good faith judgment to determine if employees taking prescribed or over-the-counter medications are fit to perform their assigned duties safely.²⁶ These regulations allow a company to disqualify an employee from performing his or her duties if the medical practitioner or designated railroad physician determines that the medications could affect the employee's ability to perform the job safely.

FRA guidance regarding medical certification is limited to regulations concerning medications and minimum vision and hearing standards.²⁷ There is no FRA guidance regarding any general or specific medical conditions. No regulations require a medical physician to disqualify an employee from performing duties based on a particular medical condition (other than conditions that might affect vision or hearing), regardless of whether that condition could incapacitate the employee or impair the employee's performance.

Recorded Information for Postaccident Analysis

For several years, the Safety Board has been a proponent of installing and using locomotive cab audio recorders to help determine the cause of accidents. In the Clarkston accident, audio recordings would have captured the voices of the train 533 crewmembers if and when they discussed train operations and called out signal indications to one another, as required by CN/IC operating rules. An audio recorder would have captured any conversations between the engineer and the conductor, and this information could have been used to determine how the crewmembers were interacting. Audio data might also have indicated whether the crewmembers were fully alert and attentive as they transited the Andersonville siding.

In its investigation of the February 16, 1996, accident in Silver Spring, Maryland, involving the collision of a Maryland Rail Commuter (MARC) train and an Amtrak passenger train,²⁸ the Safety Board identified the need for train operating cabs to have voice recording devices similar to the type installed in the cockpits of aircraft. The Board noted that, although current locomotive event recorders had great utility in providing mechanical response data, they could not answer some human performance questions about the crewmembers' actions. In the case of the Silver Spring accident, the Safety Board concluded that if the MARC locomotive had been equipped with an audio recorder, investigators could have determined from the communications before the collision the

²⁶ See 49 CFR 219.103.

²⁷ The vision and hearing minimum standards relate only to locomotive engineers.

²⁸ 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, February 16, 1996*, Railroad Accident Report NTSB/RAR-97/02 (Washington, D.C: NTSB, 1997).

factors that may have affected the MARC train operator's actions. The Safety Board, therefore, made the following recommendation to the FRA:

R-97-9

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.

In a May 21, 2001, response to the Safety Board concerning this recommendation (among others), the FRA indicated that although it had raised the issue of voice recorders with its Railroad Safety Advisory Committee (RSAC), the RSAC declined to consider the subject.

In its report on a collision of three Consolidated Rail Corporation freight trains near Bryan, Ohio, during which a train crew was killed when the crewmembers failed to comply with restrictive signal indications while operating in dense fog,²⁹ the Safety Board again noted that an audio recorder would have provided vital clues to the cause of the failure to comply with signals. As a result of that investigation, on June 12, 2001, the Safety Board reiterated Safety Recommendation R-97-9 to the FRA.

As the Safety Board stated in its September 19, 2001, letter to the FRA concerning this safety recommendation (among others), the Board understands that the FRA told the RSAC event recorder working group at its March 1998 meeting that the group would not be handling voice recorders as part of its work because the FRA considered such recorders too expensive to realistically include in a standard. The use of automatic information recording devices is one of the Safety Board's "Most Wanted" safety improvements. In its September 19, 2001, letter, the Board stated that it is disappointed with the FRA's position and lack of progress on this issue and considers that there is more than enough experience in the other modes of transportation for the FRA to begin the process leading to the use of locomotive cab audio recorders. Accordingly, Safety Recommendation R-97-9 remains classified "Open—Unacceptable Response," pending implementation of the recommendation.

²⁹ 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, D.C: NTSB, 2001).

Analysis

The Accident

On November 15, 2001, about 5:54 a.m., eastern standard time, CN/IC southbound train 533 and northbound train 243 collided near Clarkston, Michigan. The collision occurred on the CN/IC Holly Subdivision at a switch at the south end of a siding designated as the Andersonville siding. Train 533 had been operating in a southward direction through the siding and was traveling at 13 mph when it struck train 243. Signal 14LC at the turnout for the siding displayed a stop indication, but train 533 did not stop before proceeding onto the mainline track. Train 243 was operating northward on a proceed signal on the single main track about 30 mph when the trains collided.

General

Postaccident investigation showed that the signal system had been operating appropriately for the train movements at the time of the accident and that signal 14LC at the south end of the Andersonville siding was showing a stop indication for train 533 as it approached the signal. Consequently, the Safety Board concludes that the signal system operation was not a factor in this accident.

Locomotive event recorder information indicated that the train 533 engineer did not make any control maneuvers in response to the stop indication, such as applying the brakes, during the last 2 minutes before the accident. In addition, the authorized maximum speed for the Andersonville siding was 10 mph, and train 533 was recorded as reaching speeds as high as 16 mph while on the siding. Even at the time of the collision, the train was traveling at 13 mph, which was above the authorized speed by 3 mph.

The Safety Board attempted to determine what might have caused the crew of train 533 to exceed the Andersonville siding speed limit and to fail to respond to the stop signal indication.

Both crewmembers were experienced and had worked this route previously.

The engineer of train 533 first indicated (in responses to investigators' questions provided via his attorney) that inclement weather had impeded the visibility of the signals in the Andersonville siding. No other CN/IC crew operating in the area before the accident reported poor visibility due to the weather conditions, and emergency responders who were on the scene minutes after the accident reported clear visibility and no fog. Meteorological reports for the area indicated that shortly after the accident, winds were from the south-southwest at 8 mph with no precipitation. Postaccident sight distance tests indicated that signal 14LC would have been visible to a train engineer for the full length of

the siding (about 7,140 feet or 1.35 miles). Subsequently, during an interview with investigators, the train 533 engineer changed his account and indicated that as he entered the siding he had seen the red stop signal at its south end. Sight distance tests also indicated that the headlight of train 243 would have been visible to the engineer of train 533 about 60 seconds before the collision occurred. Consequently, the Safety Board concludes that the engineer of train 533 should have been able to see the stop indication on the signal at the south end of the Andersonville siding and the headlight of train 243 before the accident.

Postaccident toxicological drug and alcohol test results were negative, so the Safety Board concludes that no evidence indicates that the engineer or the conductor of train 533 had been under the influence of alcohol or illegal drugs at the time of the accident.

Train 533 Crewmembers

Engineer

A CN/IC conductor who had worked with the engineer told Safety Board investigators that on several occasions the train 533 engineer had fallen asleep while operating a train and had to be awakened to respond to an upcoming signal or to blow the horn at a grade crossing. Another conductor commented that the engineer “always looked tired.” Safety Board investigators examined the train 533 engineer’s work schedule and found that in the days before the accident, he typically had the opportunity to sleep 7 to 8 hours between his assignments.

As a prerequisite to engineer certification, and in accordance with Federal regulations, the engineer of train 533 underwent routine company physical examinations to determine whether he met the standards for vision and hearing acuity prescribed in 49 CFR 240.121. The CN/IC, based on the results of the engineer’s last physical examination, performed on December 20, 2000, determined that, despite his having high blood pressure and diabetes and using some prescription medications, the engineer was fit to perform the duties required of a locomotive engineer. The engineer did not indicate during his company physical examination that he experienced any type of chronic sleep problem, nor did the examination form request information about sleep disorders.

Safety Board investigators examined the engineer’s medical records from his private physician. In April 1998, in response to the engineer’s complaints about “snoring with pauses,” his private physician referred him to an ENT specialist. The ENT specialist noted, in part, that the engineer was being evaluated for “chronic snoring with episodic awakening and daytime somnolence.” After his evaluation, the specialist concluded that the engineer likely suffered from obstructive sleep apnea (OSA), a chronic sleeping disorder.

The ENT specialist had also indicated that he warned the engineer about the risk of the engineer's failing asleep while driving his car or a train. The ENT specialist told the engineer that he should have a sleep study performed, but the engineer did not have such a study conducted.

The engineer's private physician was aware of the engineer's occupation and that he likely suffered from OSA. On several occasions after the ENT specialist's 1998 diagnosis, the last time about a week before the accident, the private physician warned the engineer that he should make an appointment at a sleep clinic to further evaluate, and provide treatment options for, possible OSA. The private physician's notes indicated that the engineer understood the need for further medical treatment, but the engineer did not seek medical treatment for OSA. The engineer told Safety Board investigators that he believed he suffered from OSA.

OSA is a common disorder in which, due to mechanical blockage of the airway, breathing stops during sleep for 10 seconds or more, sometimes more than 300 times a night. When a person with OSA falls asleep, muscles in the throat relax to a point at which the airway collapses and becomes obstructed. As a result, breathing stops and the sleeper awakens to open the airway. Because of these disruptions to normal sleep patterns, people with OSA typically suffer from excessive daytime sleepiness, no matter how much sleep they obtain.

Because he likely suffered from untreated OSA, the train 533 engineer almost certainly had persistent fatigue. Therefore, on the basis of the available medical information (and in the absence of any other likely cause), the Safety Board concludes that the chronic fatigue the engineer of train 533 was experiencing due to untreated OSA likely incapacitated him to the extent that he did not take any action to stop the train before the collision.

Conductor

If he had noticed the engineer's failure to take appropriate action, the train 533 conductor could have alerted the engineer or used the conductor's emergency brake valve on the train to initiate an emergency brake application. However, Safety Board investigators found no indication that the conductor ever attempted to activate the emergency brakes or to consult with the engineer about the excessive speed or the failure to respond to the stop signal during the trip through and out of the Andersonville siding.

Investigation indicated that fatigue might also have incapacitated the conductor. Some years before, the conductor's private physician had referred him to a sleep clinic, where he was diagnosed with severe OSA on June 6, 1997. The conductor did not ever inform the CN/IC that he was being treated for medically diagnosed OSA. (Nor was he required or requested to do so.)

The conductor told investigators that he had been treating his OSA condition with use of a prescribed Continuous Positive Airway Pressure (CPAP) device. However, he had not undergone a CPAP titration study at the sleep clinic to determine the effectiveness

of the CPAP device he was using. Such a study would have determined the appropriate pressure setting for the CPAP device to keep the conductor's airway open during sleep. Because the titration study was never performed, the degree to which the CPAP device was effective in eliminating the impairing effects of the conductor's OSA cannot be determined.

Although the conductor's medical records indicated that during his last sleep examination at the sleep clinic his Epworth Sleepiness Scale value was 4 (out of 24), which is considered normal, he had stated that he did not feel that the CPAP pressure was strong enough, that he continued to snore, and that he was tired. Thus, even though the conductor was receiving treatment for his OSA and told investigators that the treatment had helped his condition, no study was done to determine the CPAP device's effectiveness, and the conductor's complaints to his physician suggest that it did not provide optimal treatment for his condition.

In addition, the effects of the train 533 conductor's work schedule may have reduced his alertness on the day of the accident. The conductor had been assigned to the extra board and therefore did not work a regular assignment. As a result, both his on-duty and off-duty times varied from assignment to assignment, often with little notice.³⁰ His on-duty start times during the month before the accident were never the same on consecutive days, and throughout the month he had worked both daytime and nighttime shifts on an irregular basis. His schedule during the week leading up to the accident was particularly irregular and demanding. He had worked the night shift for a few days, then he reverted to a schedule during which he slept at night during the 3 days (more than 72 hours) he was off with an illness, and then he rotated back to working the night shift, which he was working when the accident occurred. The conductor's lack of a regular work schedule resulted in irregular rest periods, a situation which has been identified as a prime cause of fatigue.

The Safety Board has previously investigated accidents in the railroad industry in which an operator's irregular work schedule resulted in fatigue. One example is the November 7, 1990, collision of the Atchison, Topeka and Santa Fe Railway Company (ATSF) freight trains ATSF 818 and ATSF 891 on the ATSF Railway in Corona, California.³¹ The Safety Board determined that the probable cause of the collision was:

The failure of the engineer of train 818 to stop his train at the stop signal because he was asleep. Contributing to the accident was the failure of the conductor and the brakeman to take action, probably because they too were asleep, to stop the train. Also contributing to the accident were the irregular, unpredictable work schedule of the engineer on train 818, the Atchison, Topeka and Santa Fe Railway

³⁰ Several studies have documented an elevated prevalence of OSA in workers on irregular schedules. See R. Stoohs, L. Bingham, A. Itoi, C. Guilleminault, and W. Dement, "Sleep and Sleep-disordered Breathing in Commercial Long-haul Truck Drivers," *Chest* 107(5): 1275-82 (Palo Alto, California: Stanford Sleep Disorders Clinic and Research Center, 1995).

³¹ National Transportation Safety Board, *Atchison, Topeka and Santa Fe Railway Company (ATSF) Freight Trains ATSF 818 and ATSF 891 on the ATSF Railway, Corona, California, November 7, 1990*, Railroad Accident Report NTSB/RAR-91/03 (Washington, D.C: NTSB, 1991).

Company's lack of a policy or procedure for removing crewmembers from service when they are not fit for duty because of a lack of sleep, and the inadequacy of the Federal rules and regulations that govern hours-of-service.

The Safety Board noted that both the engineer and conductor on train 818 were similarly subjected to the same irregularity and unpredictability of work schedules and, as a consequence, likely suffered from sleep deprivation.³²

In addition, the Safety Board's investigation of a 1995 collision involving two New York City subway trains on the Williamsburg Bridge, in Brooklyn, New York,³³ concluded that the motorman of the striking train failed to take action to stop his train because he likely fell asleep. The Board noted that the motorman's rotating schedule of working nights during the week and sleeping at night on the weekends made it difficult for his internal biological, or circadian,³⁴ clock to change.³⁵

In the case of the train 533 conductor involved in the Clarkston accident, the conductor's existing fatigue, caused by his less than optimally treated OSA, appears to have been exacerbated by the irregular schedule he was following as an extra board employee. Therefore, the Safety Board concludes that the conductor of train 533 likely was incapacitated by fatigue, caused by the combined effects of the less than fully successful treatment of his OSA and his irregular and unpredictable work schedule.

CN/IC Fatigue Awareness Program

The CN/IC has a fatigue awareness training program that includes a guidebook for CN/IC employees and their families from Circadian Technologies, Inc. The course material addresses many fatigue-related issues, such as shift work, work-rest schedules, and proper regimens of health and diet, as well as sleep disorders, including OSA. The Safety Board commends the CN/IC for its development and use of such a program in addressing the important safety consequences of fatigue. However, the program is not part of a required CN/IC training program, and the CN/IC does not document which of its employees have taken the course. Neither the engineer nor the conductor of train 533 could recall having taken the course. The Safety Board concludes that ensuring that all

³² See appendix B for Safety Recommendations R-91-41 and -42, which the Safety Board issued as a result of the Corona accident.

³³ National Transportation Safety Board, *Collision Involving Two New York City Subway Trains on the Williamsburg Bridge in Brooklyn, New York, June 5, 1995*, Railroad Accident Report NTSB/RAR-96/03 (Washington, D.C.: NTSB, 1996).

³⁴ *Circadian rhythms* describe the regular recurrence, in cycles of about 24 hours, of biological processes or activities, such as sensitivity to drugs and stimuli, hormone secretion, sleeping, and feeding. This rhythm seems to be set by a "biological clock" that appears to be regulated by recurring daylight and darkness. Also see M.R. Rosekind, *Fatigue in Transportation: Physiological, Performance, and Safety Issues*. Prepared for the National Transportation Safety Board, Washington, D.C., April 1999.

³⁵ See appendix B for Safety Recommendations R-96-20 through -22, which the Safety Board issued as a result of the Williamsburg Bridge accident.

railroad employees who carry out safety-sensitive duties receive training in fatigue awareness will make these employees more aware of the dangerous and debilitating effects of fatigue on performance and could reduce the incidence of fatigue-related employee impairment. Therefore, the Safety Board believes that the Canadian National Railway should require all its employees in safety-sensitive positions to take fatigue awareness training and document when employees have received this training.

Detection of Employees' Conditions

The Safety Board is concerned that in this case, both crewmembers of train 533 had been told by their private physicians that they had (or likely had) OSA, but neither employee informed the CN/IC of his potentially incapacitating condition. Further, the CN/IC did not detect the conditions through other means, such as medical examinations.

Medical Examination

The company physical examinations performed for the CN/IC did not include questions about sleeping disorders or other chronic problems that might cause performance-impairing fatigue.

FRA regulations require that engineers be certified as qualified locomotive engineers at least once every 3 years.³⁶ The medical examination, which is a prerequisite to engineer certification, focuses on specific vision and hearing acuity standards.³⁷ FRA regulations do not provide guidance regarding general or specific medical conditions that should be considered in the course of the examination. Many railroads use questionnaire-type forms filled out by the employee in conducting these examinations.

No standard medical examination form is used in the U.S. railroad industry. The Safety Board reviewed a sample of the medical examination forms used by Class I railroads and found that the typical medical examination form does not include questions regarding sleep problems. Similar to the other railroad forms the Safety Board reviewed, the form used by the CN/IC had no questions that specifically addressed sleeping problems or disorders. The Safety Board next evaluated the medical examination forms used in other modes of transportation to determine the extent to which they request medical information about sleep disorders.

In the maritime industry, the Coast Guard published an NVIC in 1998 to provide guidelines for evaluating the physical condition of a merchant marine license (or document) applicant. Among other guidance, the NVIC prompts the examining physician to ask the applicant about various sleep problems, including narcolepsy and somnambulism, and any other condition that could result in performance deterioration.

³⁶ See 49 CFR 240.201.

³⁷ See 49 CFR 240.121.

A driver undergoing a physical examination for commercial motor vehicle licensing must complete the health history section of the FMCSA's medical examination form, and the medical examiner is encouraged to discuss with the driver the severity of any problems the driver reports. The form's history section requests that the driver answer "yes" or "no" to a variety of medical condition questions. Any "yes" response requires further clarification by the driver, including the onset date, diagnosis, treating physician's name and address, any current limitation, and any prescribed or over-the-counter medications used regularly or recently. The history section includes a question specifically inquiring about sleep problems, asking the driver if he or she has experienced "Sleep disorders, pauses in breathing while asleep, daytime sleepiness, loud snoring."

For the aviation industry, guidance to FAA Aviation Medical Examiners in the Fall 2001 Federal Air Surgeon's Bulletin notes that:

[A]s for the medical certification of sleep apnea, the AME [Aviation Medical Examiner] should defer the case to the Regional Flight Surgeon or the AMCD [Aerospace Medicine Certification Division].... If... symptoms are persistent or [treatment is] not completely successful, we will require a Maintenance of Wakefulness Test....

The Safety Board considers that the U.S. rail industry, as well as the marine, highway, and aviation transportation modes, should take into account the serious effects that sleeping disorders could have on the performance of its employees who fulfill safety-sensitive duties. The Safety Board concludes that because the U.S. rail industry does not have a comprehensive medical examination form that includes questions about sleeping disorders, railroads may find it difficult to identify employees at risk for fatigue impairment due to the effects of sleeping disorders. Therefore, the Safety Board believes that the FRA should develop a standard medical examination form that includes questions regarding sleep problems and require that the form be used, pursuant to 49 CFR Part 240, to determine the medical fitness of locomotive engineers; the form should also be available for use to determine the medical fitness of other employees in safety-sensitive positions.

Reporting of Medical Conditions

Aside from requiring regular engineer certification (involving medical examination), Federal regulations provide little guidance concerning when, how, or if rail employees should report medical conditions such as sleeping disorders to their railroads. No Federal regulation requires that a railroad employee notify the railroad of a medical condition, even if the employee considers that the condition could affect his or her performance. (Although not a Federal regulation, many railroads require employees in safety-sensitive positions to notify a medical official of their use of prescribed or over-the-counter medications.)

No Federal regulation for the railroad industry requires a physician to report a patient's medical conditions to his employer. Federal regulations do require locomotive engineers to report deteriorating hearing and vision to company officials whenever

deterioration may occur,³⁸ but neither the engineers nor their private physicians are required to report a deterioration of any other medical condition that might affect their performance. Consequently, unless the railroad employee is diagnosed with a particular condition during his company's required physical examination or voluntarily provides the railroad with medical information from a private physician, the railroad may never learn of a safety-critical employee's potentially performance-impairing medical condition.

The CN/IC, in a letter to the Safety Board, stated:

Unfortunately, under current laws designed to protect privacy rights, the CN/IC cannot demand that a person divulge all medical issues if the person and the physician see no reason that the condition would affect the ability of the employee to perform their job. CN/IC is at the mercy of the employee and their doctor to provide us with critical information. Most often, employees afraid of losing their jobs will not voluntarily communicate protected, and/or privileged medical information.

In the rail transit industry, the Safety Board is aware of at least one company, SEPTA, which has implemented a program under which its operating employees bring medical conditions requiring the use of prescribed medications to the attention of SEPTA's medical department. Under the SEPTA program, if the employee has been prescribed a medication that may affect the employee's performance, he or she is required to report such medication use to the SEPTA medical department, using a form provided by SEPTA that must be completed by the physician. The form is primarily designed to report medication use, but it does have a section in which the physician is to provide the patient's diagnosis, enabling the SEPTA medical department to determine whether the condition itself may affect the employee's performance of safety-sensitive duties.

Although the SEPTA program is a positive step with respect to ensuring that transportation systems are notified of significant medical issues affecting their personnel who fulfill safety-sensitive duties, the program's narrow focus on medications limits its value. In the case of the Clarkston accident, for example, because people with OSA typically are not prescribed medications for this condition, neither the train 533 engineer nor the conductor would likely ever have been required, under the SEPTA program, to report this condition. Therefore, had a reporting program identical to SEPTA's been implemented by the CN/IC, the railroad would have been no more likely to have been informed of the crewmembers' OSA.

Unlike U.S. regulations concerning medical reporting within the railroad industry, Canadian regulations require a physician or optometrist to immediately disclose to the company any potentially hazardous medical condition of a railroad employee that might affect the employee's performance. In September 2000, Bill C-58 of the Canadian Railway Safety Act, which concerns elements of the medical examinations for employees in safety-critical operations, became effective. The Canadian regulations, in part, require

³⁸ See 49 CFR 240.121.

physicians and optometrists to notify the railway company's medical adviser if an employee has a medical condition that could be a threat to safe railway operations.

Had the reporting system now being used in Canada been in effect in the United States, the physicians who treated the two train 533 crewmembers would have been required to report to the CN/IC any condition that they considered posed a threat to safe railway operations. Consequently, the crewmembers' physicians might have been more likely to inform the CN/IC that the two train 533 crewmembers had (or likely had) OSA.

The Clarkston accident demonstrates that a medical condition such as OSA, which neither the employee nor the employee's physician is currently required to report to the railroad, can impair the performance of, or even incapacitate, an employee responsible for safety-sensitive duties. OSA is widely recognized as a chronic condition that can cause fatigue and excessive daytime sleepiness. Research has been conducted analyzing the impact of OSA on the health, sleep, and alertness of railroad workers.³⁹ With respect to rail safety, the research found that those railroad workers with OSA indications reported that they sometimes lost concentration and might have missed track signals. In the Clarkston accident, a train engineer with indications of OSA and a conductor with less than optimally treated OSA did miss a stop signal, resulting in a fatal collision. Consequently, the Safety Board concludes that because current Federal regulations do not require railroad employees who carry out safety-sensitive duties to report to the railroad any medical condition that might result in incapacitation or significant impairment, such employees are less likely to notify their railroads about medical conditions that could negatively affect their performance of safety-critical tasks.

The Safety Board notes that medical conditions that might lead to incapacitation or significant impairment cover a broad range of disorders, including, for example, heart disease, seizure disorders, insulin-dependent diabetes, migraine headaches, psychiatric disorders, severe asthma, etc., as well as fatigue-related conditions such as sleeping disorders and chronic fatigue. Consequently, for a railroad to be able to proactively safeguard its operations, the railroad must be notified whenever its employees in safety-sensitive positions have any such medical condition at a level of severity likely to incapacitate or significantly affect the performance of the employee. Therefore, the Safety Board believes that the FRA should require that any medical condition that could incapacitate, or seriously impair the performance of, an employee in a safety-sensitive position be reported to the railroad in a timely manner.

Fitness-For-Duty Evaluations

Federal regulations discuss the role of a treating medical practitioner or a physician designated by the railroad in making a good faith judgment of whether employees taking prescribed or over-the-counter medications are fit to perform their

³⁹ See "Sleep Apnea as a Risk Factor in Railroad Operations." Abstract contained in *Shiftwork International Newsletter*, Vol. 14, No. 1, May 1997.

assigned duties safely.⁴⁰ These regulations allow a company to disqualify an employee from performing duties if the medical practitioner or designated railroad physician determines that the medications could affect the employee's ability to perform the job safely. However, FRA guidance regarding medical certification is limited to regulations concerning medications and minimum vision and hearing standards. (The vision and hearing minimum standards relate only to locomotive engineers.)

No FRA guidance addresses medical conditions affecting railroad employees. No regulations require the railroad's designated medical physician to disqualify an employee from performing duties because of a particular medical condition (other than those conditions that might affect vision or hearing or involve medication use), regardless of whether the condition could potentially incapacitate the employee or impair the employee's performance.

In this accident, the train 533 crewmembers were incapacitated at least in part due to the effects of the medical condition OSA, which their private physicians had either detected or strongly suspected. Neither employee provided this medical information to the CN/IC, nor did their physicians notify the CN/IC. However, under current Federal regulations, even had the CN/IC-designated medical physician been aware of the crewmembers' OSA, the CN/IC would not have been required to evaluate the crewmembers for fitness for duty because of their OSA. That is, because the train 533 crewmembers were not taking medications for OSA and because it did not affect their hearing or vision, this condition would not, under Federal law, necessarily have disqualified them from operating a train. Under current regulations, therefore, railroad companies decide for themselves if an employee's existing medical condition will be evaluated to determine whether the crewmember can safely perform his or her duties. The Safety Board concludes that limiting a railroad's required medical regulation of employees responsible for safety-sensitive duties to issues of vision, hearing, and medication use fails to address a range of medical conditions that may negatively affect employee performance.

As the Clarkston accident indicated, employees who carry out safety-sensitive duties and who have potentially incapacitating or performance-impairing medical conditions (such as OSA) may need to be medically assessed before they can be considered fit for duty. Therefore, the Safety Board believes that the FRA should require that, when a railroad becomes aware that an employee in a safety-sensitive position has a potentially incapacitating or performance-impairing medical condition, the railroad prohibit that employee from performing any safety-sensitive duties until the railroad's designated physician determines that the employee can continue to work safely in a safety-sensitive position.

⁴⁰ See 49 CFR 219.103.

Conclusions

Findings

1. The signal system operation was not a factor in this accident.
2. The engineer of train 533 should have been able to see the stop indication on the signal at the south end of the Andersonville siding and the headlight of train 243 before the accident.
3. No evidence indicates that the engineer or the conductor of train 533 had been under the influence of alcohol or illegal drugs at the time of the accident.
4. The chronic fatigue the engineer of train 533 was experiencing due to untreated obstructive sleep apnea likely incapacitated him to the extent that he did not take any action to stop the train before the collision.
5. The conductor of train 533 likely was incapacitated by fatigue, caused by the combined effects of the less than fully successful treatment of his obstructive sleep apnea and his irregular and unpredictable work schedule.
6. Ensuring that all railroad employees who carry out safety-sensitive duties receive training in fatigue awareness will make these employees more aware of the dangerous and debilitating effects of fatigue on performance and could reduce the incidence of fatigue-related employee impairment.
7. Because the U.S. rail industry does not have a comprehensive medical examination form that includes questions about sleeping disorders, railroads may find it difficult to identify employees at risk for fatigue impairment due to the effects of sleeping disorders.
8. Because current Federal regulations do not require railroad employees who carry out safety-sensitive duties to report to the railroad any medical condition that might result in incapacitation or significant impairment, such employees are less likely to notify their railroads about medical conditions that could negatively affect their performance of safety-critical tasks.
9. Limiting a railroad's required medical regulation of employees responsible for safety-sensitive duties to issues of vision, hearing, and medication use fails to address a range of medical conditions that may negatively affect employee performance.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the November 15, 2001, Canadian National/Illinois Central Railway accident in Clarkston, Michigan, was the train 533 crewmembers' fatigue, which was primarily due to the engineer's untreated and the conductor's insufficiently treated obstructive sleep apnea.

Recommendations

As a result of its investigation of the Clarkston, Michigan, railroad accident, the National Transportation Safety Board makes the following safety recommendations:

To the Canadian National Railway:

Require all your employees in safety-sensitive positions to take fatigue awareness training and document when employees have received this training. (R-02-23)

To the Federal Railroad Administration:

Develop a standard medical examination form that includes questions regarding sleep problems and require that the form be used, pursuant to 49 *Code of Federal Regulations* Part 240, to determine the medical fitness of locomotive engineers; the form should also be available for use to determine the medical fitness of other employees in safety-sensitive positions. (R-02-24)

Require that any medical condition that could incapacitate, or seriously impair the performance of, an employee in a safety-sensitive position be reported to the railroad in a timely manner. (R-02-25)

Require that, when a railroad becomes aware that an employee in a safety-sensitive position has a potentially incapacitating or performance-impairing medical condition, the railroad prohibit that employee from performing any safety-sensitive duties until the railroad's designated physician determines that the employee can continue to work safely in a safety-sensitive position. (R-02-26)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

CAROL J. CARMODY
Acting Chairman

JOHN A. HAMMERSCHMIDT
Member

JOHN J. GOGLIA
Member

GEORGE W. BLACK, JR.
Member

Adopted: November 19, 2002

Appendix A

Investigation

The National Transportation Safety Board was notified of the Clarkston, Michigan, accident about 8:45 a.m., eastern standard time, on November 15, 2001, and dispatched a major railroad accident investigation team to the accident scene. Investigative groups examined the operation, track, signals, radio communications, mechanical, survival factors, human performance, and event recorder aspects of the accident. No Board Member was on the scene during the on-site investigation.

Parties to the investigation were the Federal Railroad Administration, the Canadian National/Illinois Central Railway, The Brotherhood of Locomotive Engineers, the United Transportation Union, the Brotherhood of Railroad Signalmen, the Oakland County Sheriff, and the Springfield and Independence Townships Fire Departments.

No public hearings or depositions were held in connection with this accident.

Appendix B

Previous Safety Board Recommendations Concerning Sleeping Disorders and Other Related Issues Affecting Operator Fatigue

Accident	Safety Recommendation	Recipients	Status
Railroad Special Investigation Report NTSB/SIR-01/02: <i>Maryland Transit Administration Light Rail Vehicle Accidents at the Baltimore-Washington International Airport Transit Station near Baltimore, Maryland, February 13 and August 15, 2000</i>	R-01-27: Ensure that your fatigue educational awareness program includes the risks posed by sleeping disorders, the indicators and symptoms of such disorders, and the available means of detecting and treating them.	U.S. rail transit systems (31)	6 Closed-Acceptable Action 2 Open-Acceptable Response 23 Open-Await Response
Marine Accident Report NTSB/MAR-97/02: <i>Grounding of the Liberian Passenger Ship STAR PRINCESS on Poundstone Rock, Lynn Canal, Alaska, June 23, 1995</i>	M-97-41: Advise pilots about the effect of fatigue on performance and about sleeping disorders such as sleep apnea.	U.S. Coast Guard	Closed-Acceptable Action
	M-97-42: Review, in consultation with experts in occupational health, your medical standards, guidelines, and examination forms to ensure that they require the disclosure and appropriate evaluation of the history or presence of any medical conditions, symptoms, or medication use that would affect an individual's fitness to pilot a vessel.	U.S. Coast Guard	Open-Acceptable Response
	M-97-44: Advise pilots about the effect of fatigue on performance and about sleeping disorders such as sleep apnea.	State pilot commissions (26)	17 Closed-Acceptable 1 Open-Await Response 8 Closed-Unacceptable
	M-97-45: Review, in consultation with experts in occupational health, your medical standards, guidelines, and examination forms to ensure that they require the disclosure and appropriate evaluation of the history or presence of any medical conditions, symptoms, or medication use that would affect an individual's fitness to pilot a vessel.	State pilot commissions (26)	14 Closed-Acceptable 1 Open-Await Response 11 Closed-Unacceptable

<p>Railroad Accident Report NTSB/RAR-96/03: <i>Collision Involving Two New York City Subway Trains on the Williamsburg Bridge in Brooklyn, New York, June 5, 1995</i></p>	<p>R-96-20: In cooperation with the American Public Transit Association, develop a fatigue educational awareness program and distribute it to transit agencies to use in their fitness-for-duty training for supervisors and employees involved in safety-sensitive positions.</p>	<p>Federal Transit Administration</p>	<p>Closed-Acceptable Action</p>
	<p>R-96-21: Assist the Federal Transit Administration in developing a fatigue educational awareness program for transit agencies to use in their fitness-for-duty training for supervisors and employees involved in safety-sensitive positions.</p>	<p>American Public Transit Association</p>	<p>Closed-Acceptable Action</p>
	<p>R-96-22: Develop and disseminate a training and education module to inform train operators and other employees involved in safety-sensitive positions about the hazards of performing their duties while fatigued.</p>	<p>New York City Transit</p>	<p>Closed-Acceptable Action</p>
<p>Railroad Accident Report NTSB/RAR-91/03: <i>Atchison, Topeka and Santa Fe Railway Company (ATSF) Freight Trains ATSF 818 and ATSF 891 on the ATSF Railway, Corona, California, November 7, 1990</i></p>	<p>R-91-41: In cooperation with the operating unions, develop an educational and counseling program designed to improve crewmembers' knowledge of health and diet regimens and methods of avoiding sleep deficits and sleep deprivation.</p>	<p>Atchison, Topeka and Santa Fe Railway Company</p>	<p>Closed-Acceptable Action</p>
	<p>R-91-42: In cooperation with the Association of American Railroads and the operating unions, develop a policy that would allow the carrier to stop an employee from accepting assignments and that would allow an employee to report off duty when the employee is impaired by lack of sleep.</p>	<p>Atchison, Topeka and Santa Fe Railway Company</p>	<p>Closed-Acceptable Action</p>
<p>Railroad Accident Report NTSB/RAR-89/02: <i>Head-End Collision of Consolidated Rail Corporation Freight Trains UBT-506 and TV-61 Near Thompsontown, Pennsylvania, January 14, 1988</i></p>	<p>R-89-19: Cooperate with the Consolidated Rail Corporation and the other railroads in the implementation of voluntary education and counseling programs designed to improve train crewmembers' knowledge of proper health and diet regimens, as well as the necessity to avoid sleep deprivation.</p>	<p>Brotherhood of Locomotive Engineers</p>	<p>Closed-Acceptable Action</p>

