



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

CORRECTED COPY

Date: OCT 7, 1999

In reply refer to: R-99-54 through -59

Mr. Ike J. Evans
President and Chief Operating Officer
Union Pacific Railroad
1416 Dodge Street, 12th Floor
Omaha, Nebraska 68179

About 2:15 a.m., July 2, 1997, westbound Union Pacific Railroad (UP) freight train NP-01, operating on a siding track, proceeded past a wayside stop signal at the end of the siding and collided with the side of eastbound UP freight train ME-29, which was operating on a mainline track on the UP railroad near Delia, Kansas. The NP-01 train engineer was killed, and the NP-01 train conductor sustained minor injuries.¹

Based on its investigative findings, the National Transportation Safety Board determined that the engineer of the striking train probably fell asleep sometime after his train entered the siding. When the NP-01 engineer did not dim his train's headlight, the train ME-29 operating crew responded by flashing their train's headlight and repeatedly trying to contact him by radio. However, he did not respond at all to repeated radio calls and did not respond timely to the flashing headlight beam. He possibly awoke upon hearing the eastbound train's horn sounding and dimmed his train lights in reaction to meeting an oncoming train, but was either not sufficiently alert or too startled or disoriented to realize that he needed to apply the brakes.

The Safety Board determined that the engineer's continuous hours of wakefulness, together with the time of his work shift likely affected his behavior. His wife stated that he awoke about 8 a.m. on July 1, 1997, and did not nap before reporting for work at 8:30 p.m. The collision occurred about 2:15 a.m. on July 2, 1997, meaning that he had been continuously awake for about 18 hours at the time of the accident.

Sleep research suggests that whenever an individual goes without sleep beyond a normal waking day of 14 to 16 hours, he likely will suffer degraded performance, including attention

¹ For additional information, read *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, D.C.: National Transportation Safety Board, 1999).

lapses. Moreover, the human body maintains a day-night cycle known as circadian rhythm² that affects, among other biological processes, sleep-wake patterns. The circadian cycle has two periods of nadir, between about 1 a.m. and 7 a.m., and between about 1 p.m. and 5 p.m., during which workers typically experience diminished capacity.

The NP-01 engineer had been on vacation for 17 days before returning to work on June 30. His spouse told Safety Board investigators that he had retired each evening between 9 p.m. and midnight and awoke each morning between 5 a.m. and 7 a.m. while on vacation. The accident therefore occurred on the first day after an extended period during which he had firmly established a regular sleep-wake pattern. He likely had not had the necessary period of adjustment for his circadian rhythm to match his new sleep-wake cycle. As a result, he probably was not prepared to stay awake all night.

UP officials indicated that in September 1990, the carrier mailed a fatigue-awareness handbook and video to all of its train service and mechanical service employees and their family members. The Safety Board reviewed the fatigue-awareness handbook and video, which address such topics as the body's need for rest, rotating shift work, body rhythms, the beneficial effects of a nutritious diet and exercise, and lifestyle considerations, including family and social life considerations within the context of shift work and concluded that both the handbook and video provided by the UP to employees were valuable information resources for helping railroad personnel and their families understand fatigue issues.

In testimony, the ME-29 engineer and the NP-01 engineer's spouse said that they were unaware that fatigue-awareness material had been mailed in 1990 or that such a company program existed. The company records of the crewmembers involved in the accident contain no reference or documentation indicating that the material had been sent to them.

The fact that some crewmembers and family members had not heard of the UP's fatigue management program indicates that the carrier's action, although laudable, was not effective. While it is pleased that the UP attempted to provide relevant information about fatigue to its employees, the Safety Board is concerned that the company did not establish and implement procedures for identifying those individuals who had received the training, did not establish effective procedures for disseminating the information to new employees, and did not establish ongoing procedures for assessing the effectiveness of the program. Such procedures would enable the UP to effectively evaluate future training needs in the area of fatigue.

Since its 1990 mailing, the UP has expanded its fatigue-awareness program, contracting specialists to study its operations and to prepare additional countermeasures material for employees. Because the UP cannot readily identify which employees have received past fatigue-awareness material and because it has developed and is developing additional fatigue-awareness material, the Safety Board believes that the railroad needs to provide all employees with current

² Circadian rhythm is a term used to describe cyclical biological processes that occur at approximately 24-hour intervals in approximate synchrony with the earth's day-night cycle. Sleep-wake patterns, body temperature, hormone levels, and metabolism are some of the processes that have recurring and predictable variations throughout a 24-hour period.

fatigue-awareness material regarding shift work, work-rest schedules, and proper regimens of health, diet, and rest. To further ensure the effectiveness of its fatigue-awareness program, UP management should enlist the support of the labor unions in advising employees about the operating danger of working while fatigued.

The Delia accident investigation determined that while the NP-01 engineer's train was traversing the siding, he lacked the necessary sensory stimulus to keep him alert. The conductor had been absent from the locomotive cab for 20 minutes before the collision. Moreover, the cab was not equipped with an alerter. Computer-aided dispatching records show the striking train took 9 minutes 24 seconds to cover the distance between the control point signal at the entry of the siding and the signal at the end of the siding. If the NP-01 cab had been equipped with an alerter, depending on the set timing intervals of the device and the time that the engineer began to fall asleep, the device may have sensed a lack of movement and awakened him sooner, which may have enabled him to stop the train or at least avoid being fatally injured.

By his extended absence from the cab, the conductor did not properly perform his duties and provide the necessary safety oversight as required in the *General Code of Operating Rules* (GCOR). Had he been present in the locomotive cab and calling out the intermediate signal indications after train NP-01 left Soldier Creek, Kansas, his interaction with the engineer may have provided the necessary stimulus to keep him awake. At the very least, an alert conductor probably would have detected that the engineer was suffering from fatigue and could either have awakened him or taken actions to stop the train.

As the GCOR requirements suggest, the safe operation of a freight train requires a team effort between the engineer and the conductor. By working in concert, backing each other up, they provide a redundant safety system. When one individual departs the cab, the safety of train operations is compromised. Effective crew resource management is particularly important on the UP railroad system, given that most of its freight trains do not have devices providing technological redundancy, such as automatic speed control systems and alerters. The UP also does not have a Positive Train Separation system, which could have averted this accident, in active operation anywhere on its railroad system.

An operating train must have an adequate level of either human or technological safety redundancy. Although the procedure is not actually stipulated in the GCOR or UP operating rules, the train must be stopped when the engineer has to leave the operating cab for any reason. The Safety Board is convinced that this practice should apply when the conductor has to leave the locomotive cab for tasks that do not actively support safety redundancy in train operations. The Board is aware that the conductor has operating responsibilities that require leaving the cab, including switching operations, flagging duties at highway-railroad grade crossings, and so forth. However, when performing these tasks, the conductor is still an integral part of the safety redundant system.

Therefore, the National Transportation Safety Board recommends that the Union Pacific Railroad:

Issue to all employees, including management personnel, current fatigue awareness material regarding shift work, work-rest schedules, and proper regimens of health, diet, and rest. (R-99-54)

Revise your fatigue awareness program to include a process for documenting which employees receive the currently available fatigue awareness material, any new or updated fatigue-related information, or both, and for determining whether the recipients understand the dangers of working while fatigued. (R-99-55)

Establish, at a minimum, an annual management oversight review process for the fatigue awareness program to ensure its effectiveness and to identify ways of improving it. (R-99-56)

In conjunction with the operating unions, discuss the circumstances of this accident with employees and advise them about the operating danger of working while fatigued. (R-99-57)

Require that freight trains not equipped with cab signals, speed control, and alerter, or with a positive train separation system stop when either one of the two operating crewmembers must leave the operating cab, except in instances when the conductor must perform operating tasks actively supporting safety redundancy in train operations. (R-99-58)

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. (R-99-59)

Also, the Safety Board issued safety recommendations to the Federal Railroad Administration, the Brotherhood of Locomotive Engineers, and the United Transportation Union.

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is interested in any action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you regarding action taken or contemplated with respect to the recommendations in this letter. Please refer to Safety Recommendations R-99-54 through -59 in your reply. If you have any questions, you may call (202) 314-6436.

Chairman HALL, Vice Chairman FRANCIS, and Members GOGLIA and BLACK concurred in these recommendations. Member HAMMERSCHMIDT did not concur with the issuance of Safety Recommendations R-99-58 and -59.

By: Jim Hall
Chairman