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**NATIONAL TRANSPORTATION SAFETY BOARD**  
WASHINGTON, D.C.

ISSUED: April 24, 1985

Forwarded to:

Mr. W.A. Drexel  
Chairman and Chief Executive Officer  
Burlington Northern Railroad Company  
777 Main Street  
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SAFETY RECOMMENDATION(S)

R-85-37 through -42

About 3:58 a.m., mountain standard time, on April 13, 1984, Burlington Northern (BN) Railroad Company freight trains Extra 6714 West, and Extra 7820 East, collided head-on on the single main track about 1,027 feet west of the west turnout of the passing track at Wiggins, Colorado. Seven locomotive units derailed and were destroyed in the collision and burning diesel fuel was released from ruptured fuel tanks; 40 cars derailed, 26 of which were destroyed. Five train crewmembers were killed and two were injured. Total damage was estimated to be \$3,891,428. Nine days later at about 4:56 a.m., mountain standard time, on April 22, 1984, eastbound BN freight train Extra 7843 East struck the rear of BN freight train Extra ATSF 8112 East on the main track at Pedro passing track near Newcastle, Wyoming. During the collision and subsequent derailment sequence, several cars of freight train Extra 5533 East, which were standing unattended in the Pedro passing track, were also struck and derailed. As a result, 5 locomotives units, a caboose, and 21 cars derailed. The locomotive units, caboose, and 13 cars were either destroyed or heavily damaged. Two train crewmembers were killed, and two were injured. Total damage was estimated to be \$1,358,993. 1/

Aside from the fact that both accidents occurred within 10 days of each other on the same region of the BN system, there were numerous factors common to both the Wiggins and Newcastle accidents. Both accidents occurred between midnight and 6 a.m., the time of day when human performance under normal conditions is typically at its lowest ebb. Both occurred on busy single-track main lines where trains were operated by the indications of automatic signals of a Centralized Traffic Control (CTC) system. In both accidents, one of the trains involved was not being operated in compliance with restrictive signal aspects because the engineer and a second crewmember on the controlling locomotive unit either fell asleep or was otherwise impaired, or both. None of these men had even minimal bed rest over long periods before the accidents. Moreover, the investigation revealed that the engineers of these trains were under the influence of

1/ For more detailed information, read "Railroad Accident Report: Head-on Collision of Burlington Northern Railroad Freight Trains Extra 6714 West and Extra 7820 East at Wiggins, Colorado, April 13, 1984, and Rear-end Collision of Burlington Northern Railroad Freight Trains Extra 7843 East and Extra ATSF 8112 East Near Newcastle, Wyoming, April 22, 1984 (NTSB-RAR-85-04)."

either alcohol or drugs. The engineer and firemen of Extra 6714 West in the Wiggins accident had been drinking beer for 6 to 7 hours before reporting for duty; the engineer of Extra 7843 East in the Newcastle accident was a marijuana user and admitted that he had smoked a marijuana cigarette before going to work. He refused to say whether or not he had smoked marijuana after going to work, but the evidence established that he had.

Although the conductors of the trains being operated by these engineers were in the cabooses at the ends of the trains, both were afforded unmistakable indications that all was not well on the locomotive. Action on their part could have prevented the accidents. Additionally, the conductor of Extra 6714 West should have observed the restrictive signals at Wiggins before the train reached them-- the weather was clear and the terrain and sight distances involved were such that observation was possible.

The Safety Board's investigations established that there was a lack of uniform understanding of BN Rules 34 and 804(B) which relate to crewmember responsibility for taking action when their engineers fail to comply with restrictive signal aspects. High-ranking divisional, regional, and system officers, including those who headed the safety and rules department, stated that these rules apply to crewmembers on cabooses, as well as to those on locomotives. However, only one of the train crewmembers involved in these accidents interpreted the rules that way. The trainmaster, who directly supervised the train crewmembers in the Newcastle accident, stated the rule did not apply to crewmembers in the caboose. A similar dichotomy appears to have existed in the interpretation of the "subject to duty" provision of BN's Rule G.

Testimony at the Safety Board's public hearing held in Denver, Colorado, June 4, 1984, produced a broad range of opinions on the part of train service employees and line supervisors as to the meaning of subject to duty under Rule G. While some of this testimony may have been self-serving, the Safety Board believes that the situation was confused and that little effective effort had been made to give the employees and their supervisors a clear and uniform understanding of management's interpretation of the rule. This was particularly unfortunate on the Alliance Division which had one of the worst safety performances of any BN division during the first part of 1984, and where the Employee Assistance Program (EAP) counselor had called for an all out attack on what he perceived to be a serious drug abuse problem on the division. During the 3 months preceding the Newcastle accident, safety meetings and rules examinations were held across the division, but no one used these opportunities to cover central questions such as, "When does the rule apply?" or "When are you under the influence?" and "When do you stop?"

The older and more experienced survivors of the Wiggins accident seemed to understand that they were subject to duty under Rule G and should abstain from drinking when they were "marked up," that is they were available to work whenever fully rested under the 8-hour rule. This could be construed to mean that they understood that they had to refrain from drinking early enough for them to be fit once they could be called to work. But even among these men, it was obvious that there was no common understanding on the subject. The veteran engineer of Extra 7820 East said that he had never heard a time specified in his experience, and that he really didn't know what was meant by subject to duty under Rule G.

Of the younger men who survived the Newcastle accident, six said that they thought they were subject to duty under Rule G when "the phone rang," or 90 minutes before they

had to report to duty. They believed that their use of the prohibited substances had to cease 90 minutes before going on the job, providing of course that their call gave them the requisite lead time. The engineer of Extra 7843 East said it meant 4 to 5 hours before going to work, although he stated it was difficult to predict or to find out for certain when he would be called to work. The engineer of Extra 5533 East thought it meant when he was marked up, fully rested, and could be called. The conductor of Extra 7843 East called the subject, "a very gray area" that he had never heard defined. The trainmaster at Edgemont and his immediate supervisor, the assistant superintendent at Gillette, disagreed with those who said subject to duty started when the phone rang. Their interpretation was similar to that of the engineer of Extra 5533 East, that employees were subject to duty under Rule G after they had "received rest as provided by the hours of service law." Since the law permits putting a train service employee back to work 8 hours after he last went off work, this interpretation could conceivably permit his continued usage of a prohibited substance right up to the minute he reports for duty. As has so often been tragically demonstrated, users of alcohol or drugs characteristically fail to recognize that they are adversely influenced by whatever substance they have been using. Railroad users of alcohol appear to be as prone to this inclination as those from any other segment of society, and their lack of proper judgment in this regard can result in potentially catastrophic impact on their fellow employees and the public.

In recent years, BN and some other railroads have modified and expanded their Rule G, but some of the most critical aspects of the rule remain couched in ambiguous language that leaves far too much to individual interpretation. This is particularly true of the subject to duty provision which has never prescribed specific mandatory periods of abstinence from the use of alcohol and other prohibited substances. The railroad industry management and the railroad brotherhoods, as well as FRA, seem unable and/or disinclined to provide railroad employees with specific timespan guidelines to follow. An example of this attitude was expressed by the assistant vice president in charge of BN's safety and rules department in his testimony that he didn't think the employees could live up to BN's Rule G unless they observed an abstinence period, but he didn't believe that the period needed to be specified "in light of our present Rule G." The Safety Board believes, however, that the interests of the railroad companies, railroad employees, and the public at large demand that the subject to duty provision of Rule G be thoroughly defined, and that its definition be disseminated to and interpreted for railroad employees. Inaction and "band-aid" remedies are not going to solve this problem.

Although train operations were conducted 24 hours a day, 7 days a week in both instances, the supervisors who were directly in charge of the traincrews involved in the Wiggins and Newcastle accidents worked daylight hours. They were heavily burdened with administrative duties, rarely rode trains, and had infrequent contact with their respective traincrews. Except in emergency situations, they did not work between midnight and 6 a.m., and their traincrews had no reason to expect that they would encounter them during those hours.

Unlike most railroad crew change points, Akron was not the headquarters of a trainmaster, road foreman of engines, or other BN operating department supervisor. After BN closed its dormitory and contracted for crew rest facilities with a motel, the only local employee remaining was the agent who worked the daylight shift. Crews received their calls to duty and were transported as necessary by the motel proprietors. The trainmasters and road foremen of engines responsible for supervising the crews on both sides of Akron were headquartered at the crews' home terminals of Denver and McCook. The crews that worked between Denver and Akron worked under a trainmaster

and a road foreman, both of whom worked nominally daylight tours of duty. No supervisor was assigned to work the territory at night. The trainmaster and road foreman had many administrative duties which took up much of their time and kept them relatively close to Denver. Although the road foreman had been instructed to get out and meet his subordinates, he had only been able to ride about 20 trains in the 3 1/2 months preceding the Wiggins accident, and none of these were between the hours of midnight and 6 a.m. The road foreman had ridden only 6 trains into Akron, and the proprietor of the motel recalled seeing him only 4 or 5 times in the 3 1/2 month period. Even though warned by his predecessor that the engineer of Extra 6714 West might be a problem, the road foreman had yet to contact him and he was not aware that the engineer was used at times on Amtrak passenger trains between Denver and Akron. The Safety Board believes that this was the result of the road foreman's need to set priorities rather than his personal oversight or neglect.

The trainmaster rarely rode trains over the Akron end of his territory, and he never checked out Akron's taverns to see if his crews were drinking there. Although he said he made surprise checks at Akron once or twice a month, the motel proprietors said they only saw him once every 2 months on the average. Before the accident, the trainmaster and road foreman usually made their efficiency checks together, and these were habitually made at the same location. If traincrews knew where and when their supervisors were most likely to make "surprise" efficiency checks, then there was little element of surprise and the purpose of the checks was nullified. If the supervisors predictably rode trains on the Denver end, there was not much chance they would be encountered at Akron. The crew of Extra 6714 West had no reason to fear that a supervisor might observe their off-duty activity at Akron or be on hand to check their fitness when they reported to work. The Safety Board considers that this was a relative certainty and that it contributed to the irresponsible behavior of the crew.

The lack of adequate supervision was also a critical factor in the Newcastle accident. As in the Wiggins scenario, the crew of Extra 7843 East had little contact with supervisors between Edgemont and Gillette--virtually none at night. They had no reason to think they might encounter their trainmaster at night, because they could be reasonably certain that he was at home in bed on any normal night when no emergency existed. The trainmaster at Edgemont was also burdened with many administrative functions, and for more than 2 months prior to the Newcastle accident, he had been the only supervisor overseeing the performance of about 250 train crewmembers over 160 miles of railroad, including 116 miles of one of the busiest single-track railroads in the world. During this period, he had no days off duty and nominally worked a 12-hour day from about 6 a.m. to 6 p.m. In the absence of an emergency, there was no supervision of the trains moving over his territory at night. The trainmaster was able to meet his requirement of riding two trains a month which he usually did during his normal daylight hours of duty.

Given the Alliance Division's poor safety record and the concern over the perceived drug problem on the division, the Safety Board questions the BN's failure to provide the Edgemont trainmaster with the assistance of another supervisor while the Edgemont road foreman of engines was ill and could not work. Both the assistant superintendent at Gillette and the superintendent at Alliance should have made the necessary provisions. The Safety Board believes that their failure to do so is an indication that they were more concerned with supervisory economy than with operational safety. If they had been impressed by the EAP counselor's warnings about the division's drug-abuse problem, they apparently did not perceive that greater supervisory activity might alleviate it. This sense is reinforced by the fact that traffic had at least doubled in the

5 years preceding the accident, yet two supervisory positions added at Edgemont during this period had been abolished. Even before the road foreman became ill, there were no more supervisors than when the traffic level was half that at the time of the accident. The situation was exacerbated by the fact that traffic growth had necessitated the hiring or transfer of hundreds of youthful and inexperienced employees.

The Edgemont trainmaster realized that he had far too little contact with his employees, but there was little he could do about it. He also had too little training on the rules--his interpretations of Rules G, 34, and 804(b) were improper, judged in the light of their interpretations by higher management. This was unfortunate since the preponderance of employees working under the trainmaster were young and relatively inexperienced, and the trainmaster had a key role in the conduct of safety meetings and rules examinations for the employees during the critical months preceding the accident. Traditionally, the trainmaster is a teacher as well as an enforcer. He must understand the rules if he is to interpret them correctly for his employees.

Traffic also had greatly increased on the Denver-Akron territory without any increase in the number of supervisors. These failures to keep supervisory levels apace of traffic appear to be a direct result of BN management policy. The senior vice president of regional operations said he believed BN ought to rely more heavily on conductors and engineers for the management of its train operations, and thus, avoid overmanaging the employees. On the other hand, he stated that supervising a railroad's operations was much more difficult than overseeing a stationary work operation, such as a factory. On the basis of figures he provided at the Safety Board's public hearing, the average BN line operating officer, excluding those assigned to terminals, supervises 220 miles of railroad 24 hours a day. The same imbalance between day and night supervision evident in the territories involved in the Wiggins and Newcastle accidents probably exists elsewhere on the BN system. While the senior vice president said BN was "looking at" the possibility that such an imbalance might exist, the Safety Board is convinced that BN does have serious inadequacies in this area.

As a result of the Safety Board's investigation of a railroad accident at Glaise Junction, Arkansas, it made the following recommendation to all member railroads of the Association of American Railroads:

Establish supervisory procedures at crew-change terminals to insure that all operating department employees coming on duty at any hour of the day are physically fit and capable of complying with all pertinent operating rules. (Class II, Priority Action) (R-83-60)

On July 27, 1983, BN responded that it had recently increased its efficiency testing program, including checks of employees prior to their departure on trains, as well as stopping trains en route and checking their crews. However, BN replied that, "To establish supervisory procedures at all points where crews change or at all outlying terminals where crews go on duty would prove extremely difficult...and would necessitate many additional supervisors." BN said, however, that it would continue the program of making checks more frequently where supervisors were not on duty.

The investigations of these accidents indicated that, contrary to BN's response to Recommendation R-83-60, there was no increase in the checks being made at Akron, and the ability of supervision to maintain even a modicum of nighttime activity at Edgemont and on the line between there and Gillette was significantly reduced by the failure to

replace the Edgemont road foreman while he was unable to work. The Safety Board believes BN's policy of reducing its supervisory force in the face of increasing traffic is self-defeating and unrealistic. This tendency, along with the failure to make adequate provision for night supervision, particularly at outlying points, were probably factors in both the Wiggins and Newcastle accident.

The Safety Board's investigation established that BN's Denver Region employees were required to attend rules classes every two years and that the classes were essentially limited to an examination on the rules usually preceded by a slide presentation covering changes to the rules and instructions. The lack of discussion on critical rules and their provisions failed, in the opinion of the Safety Board, to comply with Federal regulations 49 CFR Part 217.11 which required the railroads to periodically instruct each employee governed by the rules "on the meaning and application" of those rules. Further, an examination composed of multiple-choice questions that could be passed with a relatively low mark and taken repeatedly until it was passed was not necessarily an accurate gauge of the employees' knowledge of the rules. Since not all the employees were tested simultaneously, some could always find out what was in the test from those who had taken it. When an employee failed a test and then passed it later without retraining other than "boning up," there is little reason to expect long-term improvement in his knowledge. If an employee may miss one-fourth of the questions and still be passed, he may have missed many questions dealing with critical areas such as Rule G, the signal aspects, and defined speeds. Although BN's director of safety and rules stated that the employee would be failed in such an instance, the judgment was probably left to the immediate supervisor who gave and graded the test. The Safety Board's investigation of another BN accident indicated that such a decision was entirely discretionary and could permit an employee to continue to be qualified on a job without any knowledge of rules critical to that assignment.

Federal regulations limit to 12 hours the maximum consecutive period of time employees in railroad train service may be actually on duty. The minimum time they must be allowed off duty between work assignments is 8 hours. Off-duty time begins when the employee goes off duty, not when he actually reaches his home or away-from-home lodging, and it ends when he reports for his next assignment. Typically, the employee is notified 90 minutes before his reporting time. Thus, he can be allowed as little as 6 1/2 hours of time in which to rest and from this value must be deducted whatever period of time he needs to travel from his duty location to his home or lodging. It is essential that employees working under such conditions be provided with reasonably reliable advance information as to when they may be recalled to duty. While the Safety Board recognizes that many factors impact on the predictability of train movements and crew utilization, the investigation of the Newcastle accident indicated that traincrews laying over at Gillette sometimes had to resort to guesswork in the absence of accurate information as to when they could expect to be called to duty.

The median age of the crewmembers of Extra 6714 West in the Wiggins accident was 32; that for those assigned to Extra 7843 East in the Newcastle accident was 30. The engineers of the two trains were 34 and 27, respectively. As far as could be determined, all of the crewmembers of the two trains were in good health. Typical of railroad train service employees who work in road freight pool service or who are assigned to the extra board, their work schedules were habitually irregular and unpredictable, and they probably were accustomed to going for long periods without bed rest. It would not be unusual for them to avoid sleeping altogether when away from home, particularly if they worked in a relatively short-haul time freight pool, such as that between Denver and Akron. Since

they could normally expect to make the trip home to Denver in 3 to 4 hours, some might spend their off-duty hours at Akron awake and wait until they get home to sleep. This tendency, which is not unusual in railroading, is probably aggravated by the fact that often the sleeping rooms available to them do not afford the proper environment required for restful sleep.

The engineer of Extra 7843 East had a total of 6 1/2 hours sleep, including about 4 hours at Gillette on the evening of April 21, during the 48 hours preceding the Newcastle accident. The head brakeman, who said he was extremely exhausted, had at the most, an hour of sleep at Gillette and probably no more than a total of 4 hours sleep during the 51 hours preceding the accident. Both of these men were unquestionably suffering from fatigue and were unfit for duty when they went to work. The conductor, who at 38 was 9 to 10 years older than any other man on the crew, was also the best rested, having slept 7 1/2 hours while laying over at Gillette. The rear brakeman had only slept about 3 1/2 hours.

The engineer and head brakeman said that they delayed going to bed at Gillette because they thought they would be there about 16 hours and wanted to be rested when they went to work. They said they based this calculation on the supposition that the 16 crews ahead of them in the calling rotation would be used at the rate of one an hour. As it turned out, they were actually called 9 1/2 hours after going off duty, because the crews had been used faster than they had thought they would be. However, this was not a valid reason for their failure to get adequate sleep as their conductor had done. They should have rechecked the rate crews were being called and recalculated their estimate of when they would be recalled to duty. Instead, they chose to spend their time in other activity. The Safety Board believes that this may have been characteristic of these men. When they were last at their home terminal of Edgemont, the engineer had been off duty for nearly 17 hours, but had slept only 2 1/2 hours; the head brakeman had slept only 3 to 3 1/2 hours of the 10 hours he had been off duty.

Of all the crewmembers of Extra 7843 East, the engineer had worked the least during the 72 hours preceding the accident--20 hours, 16 minutes. He had worked 11 hours, 15 minutes going from Edgemont to Gillette, but he had worked only 3 hours 5 minutes on his previous trip. It cannot be said that the engineer had been overworked--he had only worked 17 trips in the 30 days before the accident and a number of these were of only a few hours duration. Although the head brakeman had worked 22 trips during the 30 days preceding the accident, he, too, had been afforded periods of time off during this period. The most recent of these, during April 16-19, had spanned 58 hours. During subsequent off-duty periods between trips, he had failed to get adequate sleep as a matter of choice. It is not surprising that he fell asleep after leaving Gillette, and it was probably not an isolated incident of irresponsible behavior.

In summary, the Safety Board concludes that a contributing cause of both accidents was the head-end crewmembers' fatigue resulting, in part, from their voluntary lack of sleep during their off-duty time. In the Wiggins case, the fatigue was aggravated by the irregular work/rest cycle to which the men were subjected. In the Newcastle case, the work/rest cycle was somewhat irregular; however, the work schedule was much more unpredictable than that of the Wiggins crew. The Newcastle crew had plenty of opportunity to obtain rest, but the unpredictability of when they would be called for work was more of a problem than it was for the Wiggins crew.

In both the Wiggins and Newcastle accidents, as with numerous other train accidents investigated by the Safety Board, the conductors or other train crewmembers on the rear of the trains failed to take the timely and requisite action that would have prevented the accidents or mitigated their consequences. This has been invariably true even though conductors on all railroads are in charge of their trains, are held responsible for their safety, and almost universally have the advantage of end-to-end radio communication. The attitude of most of the conductors and brakemen who survived the Wiggins and Newcastle accidents seemed to be that they ought not interfere with the engineers' management of their trains. One seasoned trainman went so far as to emphatically say that he was not going to run the train from the rear end. The veteran conductor of Extra 7820 East at Wiggins stated that even if he recognized that his engineer was failing to comply with a restrictive signal aspect, he probably would not call him on his radio, much less set the air brakes from the caboose.

Given this attitude, which Safety Board investigators have repeatedly encountered during the investigation of catastrophic railroad accidents, there should be no question of the value, from a train safety standpoint, of equipping locomotives with modern and relatively foolproof safety backup devices. Over a span of many years, the Safety Board has recommended to individual railroads and the Association of American Railroads (AAR) the use of such devices. The Safety Board has also repeatedly called upon the Federal Railroad Administration (FRA) to promulgate regulations requiring the installation, use, and maintenance of safety backup devices on locomotives. The specific areas of concern that have been addressed by the Safety Board have been, (1) the universal need for a fail-safe alerting device that will stop a train if the engineer becomes incapacitated, falls asleep, or is otherwise impaired while operating the locomotive, and (2) the need for a backup device such as automatic train control, with cab signals, that will stop a train if its engineer fails to control it in compliance with signal aspects.

There is undeniable merit in the argument that the "deadman" pedals and some early designs of alerting devices were costly to maintain and were largely ineffective because their purpose could be, and often was, easily defeated by the engineers. BN advanced these reasons for its removing the pedals and alerters formerly installed on its locomotive units. However, before the Wiggins and Newcastle accidents, there was apparently no serious study given to the use of automatic train control or to the newer and improved alerter devices being used extensively by other major railroad systems. The Wiggins and Newcastle accidents may have brought about a significant change in BN policy in this area, for BN has ordered Train Sentry alerters for its new locomotive units and is considering retrofitting a large number of its existing locomotive units with similar devices. The Safety Board commends BN management for this action and urges BN to pursue positive and timely action in this direction on the existing fleet and future locomotive purchases.

Therefore, the National Transportation Safety Board recommends that the Burlington Northern Railroad Company:

Provide enhanced nighttime supervision of train operations. (Class II, Priority Action) (R-85-37)

Define the "subject to duty" provision of Rule G and provide all train service employees a uniform interpretation of its requirements. (Class II, Priority Action) (R-85-38)



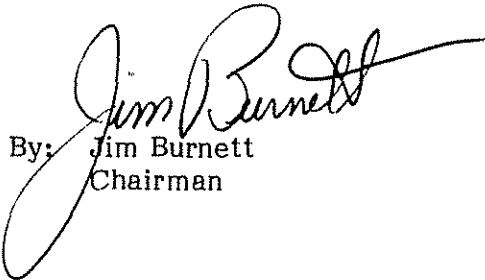
Improve its capability to provide accurate and timely information as to when traincrews laying over at Gillette, Wyoming, and other outlying points may expect to be called to duty. (Class II, Priority Action) (R-85-39)

Improve its training program to provide first line supervisors with a uniform understanding of the meaning and application of BN operating rules. (Class II, Priority Action) (R-85-40)

Modify its program of periodic training of train service employees to include instruction on the meaning and application of the operating rules as required under 49 CFR Part 217.11. (Class II, Priority Action) (R-85-41)

Equip its locomotive units with crew alerters or other backup devices that will stop a train in the event its engineer becomes incapacitated or impaired. (Class II, Priority Action) (R-85-42)

BURNETT, Chairman, GOLDMAN, Vice Chairman, and BURSLEY, Member, concurred in these recommendations.

  
By: Jim Burnett  
Chairman