

# NATIONAL TRANSPORTATION SAFETY BOARD

Washington, D.C. 20594



## Safety Recommendation

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**Date:** July 29, 1993

**In Reply Refer To:** R-93-5 through -10

Mr. Gerald Grinstien, Jr.  
President and Chief Executive Officer  
Burlington Northern Railroad Company  
777 Main Street  
Fort Worth, Texas 76102

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On August 30, 1991, the eastbound Burlington Northern Railroad (BN) freight train 602 departed Shelby, Montana, heading south. Westbound BN freight train 603 departed Great Falls, Montana, proceeding north. Both trains were routed over BN unsignaled single track line between Shelby and Great Falls. A branch line dispatcher in Seattle, Washington, controlled the trains' movements by issuing track warrants (TWs) through a computerized track warrant control (CTWC) system.

At 5:50 p.m. mountain daylight time at milepost 85.55 north of Ledger, Montana, the two trains collided head on at a closing speed of 87 mph. After impact, fire ensued from spilled locomotive diesel fuel, burning locomotive units, two freight cars, and grass. Nine locomotive units and 22 cars were destroyed; 9 cars were damaged. Track damage, equipment replacement, and clean-up costs were estimated at \$19 million. Three crewmen were killed, and four were severely injured.<sup>1</sup>

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<sup>1</sup>For more detailed information, read Railroad Accident Report—*Head-on Collision Between Burlington Northern Railroad Freight Trains 602 and 603 Near Ledger, Montana, on August 30, 1991* (NTSB/RAR-93/01).

After its investigation of a train collision at Motley, Minnesota,<sup>2</sup> the National Transportation Safety Board recommended that BN:

R-85-43

Establish and document aptitude and other performance oriented selection criteria which ensure that individuals considered for safety critical positions, such as train dispatchers, are capable of fulfilling the requirements of that position.

*Investigation of the Ledger collision showed that the first-shift dispatcher may not have had the aptitude necessary to perform as train dispatcher. Thus, Safety Board investigators are concerned that BN has yet to implement objective selection/screening criteria for train dispatchers. BN indicated in its last response to this recommendation that it was using outside contractors to identify a viable selection/screening tool to assist management in choosing candidates for dispatcher training. Because BN was actively working to meet the intent of this recommendation, the Safety Board classified Safety Recommendation R-85-43 "Open--Acceptable Response" on August 25, 1987. Since BN has developed a validated personality profile for dispatchers, which was referred to in the Ledger accident investigation report, BN should implement that developed profile in its dispatcher selection process.*

During two separate periods of her railroad career, the first-shift dispatcher had worked controlling trains. Soon after beginning her first service as a shift dispatcher, she was relieved for making an error. She then worked as a clerk and train operator for the next 8 years. She applied for and returned to dispatcher school, completed the training cycle a second time, and worked successfully at various shift dispatching positions in different offices.

Although the first-shift dispatcher demonstrated sufficient knowledge of train control procedures and dispatching duties to perform her TW issuing responsibilities, the Safety Board is concerned that her aptitude for such work had not been determined. The Safety Board concludes that BN has yet to implement an employee selection program as stated in Safety Recommendation R-85-43 that would ensure that individuals considered for safety critical positions, such as dispatchers, are capable of fulfilling the position requirements. Therefore, the Safety Board believes that BN should accelerate and implement an objective identification, selection, and screening program for dispatcher candidates to determine their suitability to successfully perform as dispatchers.

The piecemeal method used to simultaneously formulate and transmit a computerized TW can lead to potentially confusing intermittent pauses. The dispatcher keyboards required information onto the formatted computer screen on an instruction line basis. The dispatcher then

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<sup>2</sup>Railroad Accident Report--*Head-On Collision of Burlington Northern Railroad Freight Trains Extra 6760 West and Extra 7907 East Near Motley, Minnesota, June 14, 1984 (NTSB/RAR-85/06).*

transmits each line of the TW by voice radio before completing the next instruction line. This piecemeal method, combined with voice intonation and poor radio procedure, increases the possibility of a dangerous error. The Safety Board concludes that the first-shift dispatcher's piecemeal method of computerized TW formulation and transmission was known to exist by BN management and fostered an environment in which the misunderstanding of the TW 8851 authority limit occurred. When a dispatcher receives a TW request, a "wait out" should be given so the dispatcher can devote full attention to the TW formulation and acceptance on the CTWC screen. Once an acceptable TW has been developed, the dispatcher can call back the requesting train crew and deliver a clearly communicated, fully attended, and uninterrupted TW. A TW developed and communicated in this manner would not only lessen the possibility for a misunderstanding and provide a more lucid delivery of information, but require less radio transmission time. Therefore, the Safety Board believes BN should require dispatchers to complete formulation and entry of a computer-acceptable TW before transmitting it to the train crew.

Proper radio procedure is vital to clear, concise communication and is particularly important in regulating train movement. Consequently, 49 Code of Federal Regulations (CFR) Part 220 is very specific about radio train order transmission, and the Federal Railroad Administration (FRA) monitors railroad radio procedure. The radio procedure of the first-shift dispatcher and the train 603 crew was poor. The BN dispatcher training manager had counted 15 radio procedure errors in the transcript of the TW 8851 radio transmission. After listening to taped dispatcher/crew radio conversations, investigators found that procedural errors were typical of TW transmissions. Had the dispatcher given an "over" or a "wait out" at the start of the 9-second destination pause, the conductor may have recognized that the destination had not yet been given, and the collision may have been avoided.

The BN Seattle chief dispatcher was asked if he believed proper radio procedure was being followed and replied, "I know that in the past, we, as a company, have addressed that issue and it's getting better than it was. I believe there's room for improvement." However, BN neither offered any examples nor presented any testimony that the poor radio procedure practice was corrected. Although the poor procedure was acknowledged by BN management, no plans were made to change it. In a formal radio procedure to control train movement, such as a TW, 15 errors appear to be excessive. After reviewing other TWs, Safety Board investigators found that such procedural errors were common. Even after the FRA *National Train Dispatcher Safety Assessment 1987-88*, BN management failed to take any steps through a formal or informal plan to improve radio procedure. Although no evidence indicated that BN encouraged poor procedure, such procedure was tolerated by being ignored.

The FRA dispatcher assessment states:

During the assessment, FRA inspectors noted that the radio procedures used by dispatchers were generally average while those of employees conversing on the radio with the dispatcher were generally poor. Notable by their absence were the insistence by

dispatchers that employees initiating a transmission properly identify themselves (occupation and station) before continuing with a transmission and the use of the applicable words "over" or "out" when ending a transmission.

The FRA recommended:

The BN should immediately implement a program to teach and enforce radio procedures by the dispatchers so that they will comply with all applicable federal and carrier radio rules.

Although the FRA recognized that BN had radio procedure problems 3 years before the accident and had so notified BN, it appears that neither the FRA nor BN did anything to significantly improve the situation through stricter regulation enforcement or education. Neither the FRA nor BN could produce any follow-up correspondence or documentation to indicate that corrective action or improvements were made or intended. The Safety Board concludes that the poor radio procedure practices of the first-shift dispatcher and the train 603 crew were not isolated events. Such practices were known to exist by BN management and fostered an environment in which the misunderstanding of the TW 8851 authority limit occurred. Therefore, the Safety Board believes that BN should implement a program to teach and enforce proper radio procedures for dispatchers and train crews so that compliance with applicable Federal and railroad rules will be accomplished.

The Safety Board could not determine for certain why the first-shift dispatcher did not correct the error during the destination repeat. The TW tape recording indicated that the conductor clearly read back the words "west yard limits Shelby," but the first-shift dispatcher could offer no explanation for her error.

The first-shift dispatcher's suitability for her dispatcher position was considered. She had dispatched trains and issued TWs successfully for several months in the Billings, Montana, office before transferring to the Seattle office. Based on that background, the first-shift dispatcher had sufficient TW control knowledge and experience to perform train control duties.

Evidence did suggest that over the previous 11 months during her assignment predominantly as an assistant chief dispatcher (ACD), some dispatcher skills may have deteriorated from normal performance levels. The ACD positions are administrative in nature and do not directly involve train movement or the associated listening skills. The first-shift dispatcher testified that listening and attention skills deteriorate when dispatchers do not regularly work shift dispatching positions. She had been working once a week at another shift position, which did not involve CTWC, as well as the ACD assignments. Safety Board investigators could not evaluate the extent of the first-shift dispatcher's listening skill loss; however, some degree of listening and attention skill degradation had probably taken place over the previous 11 months.

BN supervisors acceded that it is likely listening and attention skills deteriorate with nonuse. Nonetheless, no evidence was found that BN management recognized a possible problem of skill deterioration during assignments not involving computerized TWs or radio listening skills. Moreover, when dispatchers returned to a position requiring CTWC operating and radio listening skills and requested refresher training, supervisors discouraged these requests. The Safety Board concludes that BN had no recurrent CTWC operating training and radio skills program for shift dispatchers. Therefore, the Safety Board believes that BN should establish within its qualification program a formal requalification program for dispatchers and supervisors who intermittently work such positions.

The first-shift dispatcher's failure to correct the train 603 conductor's repeat probably resulted from a combination of several factors. Some factors were related to her admitted lack of proficiency on the CTWC equipment that, in turn, made her dispatching tasks more demanding. Another dispatcher testified that if dispatchers need extra time to operate the computer, they get behind in their train control activities. The first-shift dispatcher was not keeping up with her work that afternoon as evidenced by her testimony that she was unable to finish lunch or to take a rest room break. She probably attempted to recover the time she had lost reformulating TWs on the CTWC equipment by transitioning to her next task before the train 603 conductor read back the TW. This premature task transition divided her attention. The dispatcher training manager stated that under high workload conditions, dispatchers sometimes initiate their next task before concluding TW repeat. The Safety Board could not verify the first-shift dispatcher's susceptibility to this tendency; however, premature task transition would have circumvented the purpose of the readback procedure.

The skills and attention needed by train dispatchers are much like those required by air traffic controllers. In National Aeronautics and Space Administration (NASA) research on communication errors between air traffic controllers and flight crews, controllers reported that moderate to heavy air traffic conditions had frequently been present when overlooked incorrect readbacks occurred. Neither the NASA research on the hearback problem nor the Ledger accident investigation could establish a causal relationship between hearing incorrect information and workload conditions. However, considerable generic evidence exists that demanding workload conditions reduce attention and that stressful operating circumstances may exacerbate this problem when self-induced operating errors are included.<sup>3</sup>

The first-shift dispatcher issued TW 8851 about an hour before her shift ended at a time when she might be more fatigue prone. Asked if it was any busier near the end of the shift than the beginning, she replied:

At that point in the afternoon, I believe that things were a little hectic in there. There were operators -- I guess, last minute things

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<sup>3</sup>Sandra G. Hart and Michael R. Bortolussi, "Pilot Errors as a Source of Workload," *Human Factors*, 26, 1984, p. 555.

before everybody is at the end of their shift -- everybody else wants to get their work done too. So basically there was -- I would say there was quite a bit of activity at that point.

According to the first-shift dispatcher, because of the railroad traffic volume and her inexperience on the CTWC equipment, she could only have a sandwich at her desk and make "a quick trip to the bathroom" on her shift. Neither her testimony nor other evidence indicates that she was physiologically stressed; however, more frequent variations in her intonations were heard later in her shift on the transmission tape. The change in her verbal delivery to a more conversational style suggests a decline in her capacity to maintain the disciplined monotonic delivery preferred by experienced dispatchers. The Safety Board concludes that her one comfort break during her shift may not have been sufficient to maintain the required mental ability for a complete shift, and BN made no effort to periodically schedule relief or extra dispatchers on positions. Therefore, the Safety Board believes that BN should evaluate each dispatcher position to determine the number of adequate breaks necessary to maintain optimum mental ability.

Unlike many management positions, dispatcher supervisors, such as chief dispatchers and ACDs, are first-line supervisors who may be required to substitute for shift dispatchers who have unscheduled absences because of sudden illness or labor strike. This is particularly important when a shortage of dispatcher personnel is already evident, as at the BN Seattle office, and becomes crucial in consolidated offices, where a limited number of dispatchers control the entire railroad. Consequently, it is critical that supervisors have the necessary skills to operate electronic equipment, such as CTWC, which are the tools of the dispatcher's trade and an integral part of the dispatcher's job. Equipment proficiency is also a factor in the ability to properly supervise dispatchers. Therefore, the ability to effectively evaluate, monitor, test, or assist a shift dispatcher is directly related to the supervisor's understanding of and skill on the electronic tools that directly or indirectly control the trains.

The chief dispatchers and other supervisory personnel did not have proficiency on all shift dispatching computer equipment. The chief dispatcher testified that he could not operate the CTWC equipment and did not know any chief dispatcher who had received training on it. The Safety Board recognizes that chief dispatchers are promoted from the shift dispatcher positions to ensure that office oversight reflects the specialized technical expertise required for train control activities. Without basic skills on the major dispatching equipment, chief dispatchers lose some ability to effectively enforce high standards of dispatcher performance and cannot provide direct assistance if needed. Chief dispatchers and shift dispatchers now resolve technical operating problems by dependence on other employees who have special computer expertise and may, by chance, be working on the same shift. The Safety Board concludes that BN management neither provided personnel specifically to relieve, help, or monitor dispatchers nor adequately trained supervisors in the use of computer equipment. Therefore, the Safety Board believes that BN should provide adequate personnel and equipment resources to effectively monitor, test, evaluate, help, and relieve shift dispatchers.

The BN efficiency testing program consisted of testing dispatchers every 180 days. However, when questioned whether he was able to take time from immediate job demands to devote to efficiency testing, the chief dispatcher said no. He was asked whether it was "viewed as an extra duty, something that was perhaps important to be done but there was [sic] other pressing duties that might have tended to take precedent" and replied, "I would agree with that." This attitude casts doubt on supervisors' ability to conduct an effective efficiency testing program and makes suspect recorded tests.

In addition, the BN testing program in effect at the time of the accident was misunderstood and not applied according to the BN plan. Regulated railroads must submit to the FRA a testing plan to ensure employees understand and comply with the carrier operating rules (49 CFR Part 217.9). The BN plan required operating employees and dispatchers to be tested every 180 days and every 90 days, respectively. According to the chief dispatcher, dispatchers were not tested every 90 days, as required by the BN plan, but every 180 days. Furthermore, the first-shift dispatcher had not been tested in 1991, although she had been working dispatching positions at least a night a week. Except for the irregular testing, no dispatcher monitoring or oversight by BN supervision was evident.

The BN efficiency testing program had not included the first-shift dispatcher because dispatchers working positions that do not directly control train movement are exempt from the testing program requirements. BN management explained that the first-shift dispatcher's work assignment as an ACD (no train control responsibilities) had caused the testing discrepancy; however, the first-shift dispatcher had worked periodically at train control positions. Also, BN allowed dispatchers "temporarily" exempted from the testing program to work shift dispatching jobs and, as the first-shift dispatcher did, to periodically work positions.

If the testing program remains the only system monitor of shift dispatcher performance, BN should establish rigorous record controls for tested employees, and supervisors should have available documentation on the performance strengths and weaknesses of each dispatcher. In addition, untested dispatchers should be withheld from shift dispatching positions until the required testing is performed and/or break-in training with qualification on the positions is completed. The Safety Board concludes that BN had an inadequate dispatcher quality control program and an ineffective dispatcher testing program. Therefore, the Safety Board believes that BN should establish a dispatcher audit/quality control program and implement an effective periodic dispatcher testing program.

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

Accelerate and implement an objective identification, selection, and screening program for dispatcher candidates to determine their suitability to successfully perform as dispatchers. (Class II, Priority Action) (R-93-5)

Require dispatchers to complete formulation and entry of a computer-acceptable track warrant before transmitting it to the train crew. (Class II, Priority Action) (R-93-6)

Implement a program to teach and enforce proper radio procedures for dispatchers and train crews so that compliance with applicable Federal and railroad rules will be met. (Class II, Priority Action) (R-93-7)

Establish within your qualification program a formal requalification program for dispatchers and supervisors who intermittently work such positions. (Class II, Priority Action) (R-93-8)


Evaluate each dispatcher position to determine the adequate number of breaks necessary to maintain optimum mental ability; provide adequate personnel and equipment resources to effectively monitor, test, evaluate, help, and relieve shift dispatchers. (Class II, Priority Action) (R-93-9)

Establish a dispatcher audit/quality control program and implement an effective periodic dispatcher testing program. (Class II, Priority Action) (R-93-10)

Also, the Safety Board issued Safety Recommendations R-93-11 and -12 to the Federal Railroad Administration, R-93-13 and -14 to the Association of American Railroads, and R-93-15 to the Railway Progress Institute.

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 vitally 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-93-5 through -10 in your reply. If you need additional information, you may call (202) 382-6840.

Chairman VOGT, Vice Chairman COUGHLIN, and Members LAUBER, HART, and HAMMERSCHMIDT concurred in these recommendations.



By: Carl W. Vogt  
Chairman