Log R-676

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: June 25, 1998

In Reply Refer To: R-98-18 through -25

Mr. Jerry Davis
President and Chief Executive Officer
Union Pacific Railroad
1416 Dodge Street
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At 10:52 p.m. on June 22, 1997, Union Pacific Railroad freight trains 5981 North and 9186 South collided head-on in Devine, Texas. The trains were operating on a single main track with passing sidings in dark (nonsignalized) territory in which train movement was governed by conditional track warrant control authority through a dispatcher. The conductor from 5981 North, the engineer from 9186 South, and two unidentified individuals who may have been riding on 5981 North were killed in the derailment and subsequent fire. The engineer from 5981 North received minor injuries, and the conductor from 9186 South was seriously burned. Estimated damages exceeded $6 million.[1]

The National Transportation Safety Board determined that the probable cause of this accident was the failure of the third-shift dispatcher to communicate the correct track warrant information to the traincrew and to verify the accuracy of the read-back information because the UP management had not established and implemented workload policies and operational procedures to ensure a safe dispatching system and the Federal Railroad Administration (FRA) had failed to provide standards and oversight in all aspects of train dispatching operations. Contributing to the accident was the lack of an installed positive train separation control system that would have prevented the trains from colliding by automatically intervening in their operation because of inappropriate actions being taken.

[1]For more detailed information, read Railroad Accident Report--*Collision and Derailment of Union Pacific Railroad Freight Trains 5981 North and 9186 South in Devine, Texas, on June 22, 1997* (NTSB/RAR-98/02).

During the issuance of track warrant 8289 to train 9186 South, the third-shift dispatcher failed to accurately communicate the track warrant information in its entirety to the traincrew from his computer screen as it was apparently displayed. He omitted the after-arrival instructions (hold the main track at Gessner until the arrival of train 5981 North) when formally issuing authorization to train 9186 South to proceed from Gessner to Melon. The recorded radio transcripts of the transmission between the dispatcher and the 9186 South traincrew substantiated that the dispatcher did not include the after-arrival instructions of track warrant 8289 to the crew. When the train 9186 South conductor repeated the track warrant back to the dispatcher, the third-shift dispatcher failed to confirm the accuracy of the read-back information from the crew with the display on the computer screen. Had the third-shift dispatcher done so, he would have noted the discrepancy between the track warrant that was displayed on his computer screen and the read-back information and could have corrected the inconsistency and provided the after-arrival instruction (hold the main track at Gessner until the northbound train had passed). Because train 9186 South was not notified to wait for the northbound train to pass at Gessner, it proceeded from Gessner toward the northbound train, which was earlier authorized to proceed and occupy the block of track from Melon to Gessner. Therefore, the Safety Board concluded that the third-shift dispatcher's failure to accurately issue track warrant 8289 to train 9186 South and his failure to detect and correct the 9186 South conductor's repeat of the track warrant authority limit resulted in the crew receiving an incorrect track warrant that allowed the opposing trains 5981 North and 9186 South to operate on the same track in opposite directions through Devine on June 22, 1997.

The third-shift dispatcher had been operating as a qualified dispatcher since August 1996. Most of his experience had been dispatching trains in dark territories, such as the one in which this accident occurred. He had no previous dispatching violations before June 22, 1997. During the 10 months before the Devine accident, the third-shift dispatcher had demonstrated sufficient knowledge of dispatching duties. He had accurately communicated track warrant information to other traincrews during previous and subsequent issuance of track warrants. However, he failed to accurately communicate the track warrant 8289 information to train 9186 South and to validate the line repeat-back from the conductor of that train.

At the time of the Devine accident, the UP verification process of track warrants relied on the train dispatcher to detect an inaccurate read-back message and to ensure that a complete and accurate transmission was received from the traincrew. This verification process, in which the train dispatcher just followed the oral repeat-back received from the crew, did not provide a redundancy feature that would confirm whether an accurate repeat-back of the original transmission had registered with and been noted by the train dispatcher.

On the day of the accident at Devine, the third-shift dispatcher understood that when communicating a track warrant to a traincrew, his primary tasks were to read the information as presented on the screen and verify its accuracy, comparing the oral read-back from the traincrew with the information on the screen; he believed that he had been following the established UP track warrant communication procedures. The Safety Board concluded that the third-shift dispatcher did not communicate the accurate information in track warrant 8289 to the crew of

train 9186 South. Therefore, the Safety Board believes that the UP should evaluate its dispatcher training program and make necessary revisions to place greater emphasis on all safety critical activities including procedures used to issue and confirm track warrants.

The third-shift dispatcher stated that on the night of the accident, his workload was "probably an average night for that position" and that from the start of his shift, he had received several radio calls and "it was busy." Immediately after the shift changeover, he had to process the information just received from the departing dispatcher and prioritize the tasks that he was to perform during the shift. That night the dispatcher's first task was a radio transmission with a delayed Amtrak train still on his territory, which was a rare occurrence for the beginning of this shift. Immediately after this, he turned his attention toward dispatching the UP trains and spent the majority of his initial time on the radio.

The third-shift dispatcher issued the incomplete track warrant information to the crew of train 9186 South within the first 10 minutes of his shift. Veteran dispatchers at the Harriman Dispatch Center (HDC) reported that the most difficult time of a shift is the first 30 minutes, when a dispatcher is "trying to assimilate everything" and mentally planning the operation of the territory. The Safety Board examined the UP dispatcher rule violations data and found that approximately 30 percent of the violations occurred within the first hour after the start of a new, 8-hour shift, particularly on territories of high-operating demands. The Safety Board concluded that the UP dispatchers' elevated workload at the beginning of shifts may contribute to the disproportionately greater number of dispatching violations occurring during this time. Therefore, the Safety Board believes that the UP should conduct an audit of its train dispatching operations to identify specific factors that can lead to dispatching errors and include in the audit and assessment of dispatching errors that occur during or shortly after shift changes or because of improper radio procedures.

The Safety Board is concerned that an error similar to the one committed by the third-shift dispatcher was also committed by two other dispatchers, all of whom were trained in the year before the June 22, 1997, accident. The third-shift dispatcher, although reporting that he believed his training was adequate, stated, "How can training be equal to . . . a dozen radios going off and ten people yelling at you at the same time. . . . Having to deal with that sort of thing is hard." The Safety Board therefore examined the challenges faced by less experienced dispatchers operating in territories of high-operating demands.

Many of the territories to which less experienced dispatchers are initially assigned, such as the Austin subdivision, have nearly doubled in train volume since the early 1990s, when they may have been more easily dispatched because of the fewer trains operating. Such territories often pose operational challenges to even the most experienced dispatchers. Veteran dispatchers reported that under conditions of high-operating demands, less experienced dispatchers may issue track warrants while mentally or physically attending to their next task and not concentrating on the read-back communication from the train crewmembers. The FRA noted during its safety audit of the HDC that dispatchers working under high-workload conditions were not consistently monitoring the computer screens during read-backs of track warrants because of

other task demands, which included answering the telephone, communicating with other dispatchers, and reading lineups and performing transfers with their relief shift dispatchers. Some dispatchers, as a result, may forgo safe dispatching practices in an attempt to manage the high-operating demands.

The Safety Board is concerned that newly qualified dispatchers initially assigned to territories of high-operating demands may not have the opportunity to refine their skills to increase their dispatching efficiency. Rudimentary skills taught to apprentice dispatchers in the initial training program can be further developed as they operate in territories of moderate-operating demands. Those assigned to territories of high-operating demands who have not developed critical skills and strategies to operate efficiently may relinquish safe procedures to manage the high-operating demands. The box 7 after-arrival errors committed by the newly qualified dispatchers were the result of their omitting track warrant verification procedures, perhaps as a means to manage their dispatching duties. The Safety Board concluded that some UP apprentice dispatchers may not have been adequately prepared to be placed and operate safely in territories of high-operating demands immediately after completing the training program.

The majority of all HDC dispatching errors for dispatchers occur in territories of high-operating demands. As train volume increases, the workload demands on the dispatcher likewise increase. The Safety Board is thus concerned that for both veteran and newly qualified dispatchers, the need to manage the steady increase in train traffic may jeopardize their ability to attend to all critical tasks and to dispatch trains safely.

The UP has a study under way to determine which territories on its system pose the highest operating demands on its dispatchers. Several operational factors are being assessed, including the train volume, the number of track warrants issued, and the amount of time spent issuing track warrants. The Safety Board notes that this assessment is a critical step in determining where the greatest challenges are for the UP dispatchers but advises that a comprehensive evaluation of operational demands in a given territory needs to consider both the task and the knowledge, skill, and ability of the dispatchers, including the level of task demands, the operator's mental and physical capacity, the work strategy, and the skill level.[2] For instance, one UP dispatcher with many years of experience indicated that handling 18 trains on his territory was not difficult for him; however, a less experienced dispatcher working the same territory felt overloaded by the dispatching demands. The Devine accident demonstrates that not all qualified dispatchers are equally prepared to manage similar operating demands. The errors committed by qualified, but less experienced, dispatchers strongly indicate a need for careful consideration of the placement of dispatchers in territories of high-operating demands. The Safety Board believes that the UP should conduct an audit of its train dispatchers' activities to evaluate the current workload and

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[2]Welford, A.T., "Mental Workload as a Function of Demand, Capacity, and Skill," *Ergonomics*, 21, 1978, pp. 151-167.

should make necessary changes to dispatcher operations to distribute workload based on the individual dispatcher's qualifications, ability, and experience.

Although the UP had a policy that an apprentice dispatcher became a qualified dispatcher only with the full agreement of several officials involved in the training process and would be provided training until ready to work the position, the Safety Board found some instances in which these standards were not being upheld by management. Dispatchers indicated that management has qualified apprentice dispatchers despite opposition from some on-the-job training (OJT) dispatcher trainers involved in the training process, and dispatchers believed that the qualifying process has been compromised to expedite the placement of new dispatchers in the dispatching operations. The Safety Board concluded that the UP may have jeopardized safe dispatching operations by qualifying unprepared apprentice dispatchers and assigning less experienced dispatchers to territories of high-operating demands.

Another area in which the UP did not adhere to its policies was in upholding the experience level of OJT dispatcher trainers for apprentice dispatchers. The UP management reported that qualified dispatchers responsible for conducting the OJT for apprentice dispatchers must have at least 5 years of dispatching experience. According to UP dispatchers, however, dispatchers with less than 5 years of experience were training apprentice dispatchers. Some veteran dispatchers believed that 5 years should be the minimum experience level for an OJT dispatcher trainer. Since the accident at Devine, the UP has increased to 10 years the minimum experience level for the OJT dispatcher trainers. The Safety Board has learned from the UP dispatcher data that fewer than half of the UP dispatchers have attained this experience level and concluded that because the UP did not meet its 5-year experience standard for OJT dispatcher trainers, complying with the higher standard of a minimum 10-year experience level for OJT dispatcher trainers may not be achieved. Therefore, the Safety Board believes that the UP should examine the circumstances in which its policy to require a minimum 5 years of experience to qualify as an OJT dispatcher trainer was not followed and take action to ensure that its qualification policies are followed.

Like many other railroads, the UP had no formal training or procedures for the dispatcher trainers who oversee the apprentice dispatchers during OJT. The FRA reported that in many railroads the OJT had been delegated to subordinates without adequate direction, control, or evaluation methods, which led to unstructured and inconsistent training. Although the FRA found no evidence during its reviews that inadequate dispatcher training directly resulted in train accidents, it noted that training directly impacts train dispatcher efficiency and productivity, which can impact safety. Additionally, the lack of well-defined training may contribute to train dispatcher stress and fatigue, as well as work overload. The Safety Board concurs with the FRA's position. Therefore, the Safety Board believes that the UP should develop and implement a comprehensive program to select and train experienced dispatchers to serve as dispatcher trainers.

The safety of the system is directly dependent on the appropriate actions of those operating in safety-sensitive areas. Management has a responsibility to establish an operating environment most conducive to safe operations. The Safety Board examined the UP management efforts to

ensure a safe and efficient operating environment for the dispatchers. Although the UP policies do address many critical safety-sensitive areas, the Safety Board has identified areas in which actual company practice has fallen short of company standards. The Safety Board understands that apprentice dispatchers have become qualified dispatchers without the concurrence of OJT dispatcher trainers or the apprentice dispatcher trainee. Newly qualified dispatchers have been placed in territories of high-operating demands without the benefit of developing skills through experience. By failing to accommodate the needs of less experienced dispatchers and by not adhering to its own standards, the UP failed to create an environment conducive to safe dispatching operations. Consequently, the Safety Board concluded that the third-shift dispatcher's failure to communicate the information in track warrant 8289 accurately to the 9186 South traincrew and to verify the accuracy of the read-back information resulted from operational shortcomings at the HDC.

The UP company policy did not require that corridor managers have previous dispatching experience, and some did not. Although during normal operations this typically does not pose a problem, dispatchers expressed frustration with what they perceived as poor decisions by some corridor managers during more complex operating situations. Dispatchers reported that during the daily safety and production meetings, some corridor managers lent support to the dispatchers' workload challenges on their territories, and other corridor managers were not interested in discussing the problems experienced by the dispatchers. As a result, dispatchers sought advice from other sources, such as upper management officials, when confronting certain complex situations. The Safety Board concluded that some UP corridor managers did not consistently provide appropriate technical support to the train dispatchers. Therefore, the Safety Board believes that the UP should evaluate and determine the technical expertise required of corridor managers and make the necessary changes to ensure that corridor managers are qualified to provide proper dispatching assistance to the train dispatchers.

The UP train dispatchers also expressed concern about the noise level originating from adjacent dispatching stations at the HDC. The noise level is highest during the shift changeover when the dispatchers brief their replacements about the status of their territories. Waist-high barriers separate dispatchers from each other, but do not block out distracting conversations. Higher partitions, used at some dispatch centers, serve better as sound barriers and provide a quieter working environment. The Safety Board concluded that although no evidence was found that adjacent noises in the dispatching area contributed to the third-shift dispatcher's inattention to the track warrant 8289 information in the Devine accident, a dispatcher's performance may be affected by unnecessary, avoidable sound distractions. Therefore, the Safety Board believes that the UP should identify all distractions, evaluate their effects on dispatchers, and take action to establish a working environment conducive to safe dispatching operations.

The use of after-arrival instructions creates an inherent danger by giving a traincrew conditional authority, under which, if a condition is met, their train is allowed to proceed into a block of track even though that track is occupied by an opposing train. (In the Devine accident, the condition was the physical passing of another train.) Should a failure occur in the transmission or comprehension of a track warrant that results in the omission or inaccurate

communication of the condition, two opposing trains may occupy the same block of track at the same time. Once an error has occurred in dark territory and two trains are on the same track at the same time, no wayside signals are available to warn one train of the presence of the other.

The Safety Board has investigated other railroad accidents in which the avoidance of a collision depended on the use of a rule or standard operating practice that proved to be insufficient to prevent an accident. In the Devine accident, the third-shift dispatcher failed to adhere to procedural policy and to follow verbatim the read-back message from the traincrew. The system employed by the UP at the time of the Devine accident allowed for such a failure to occur and permitted the third-shift dispatcher to overlook a critical element during the issuance of track warrant 8289. Hence, the UP method used for dark territory operations needs to be revised to ensure that an oversight by a dispatcher cannot occur. The Safety Board concluded that had the UP after-arrival system in dark territory operations not been used in the Devine accident area, the opposing trains 5981 North and 9186 South would not have been occupying the same block of track. Therefore, the Safety Board believes that the UP should discontinue permanently the use of after-arrival orders in dark (nonsignalized) territory.

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

Evaluate your dispatcher training program and make necessary revisions to place greater emphasis on all safety critical activities including procedures used to issue and confirm track warrants. (R-98-18)

Conduct an audit of your train dispatching operations to identify specific factors that can lead to dispatching errors and include in the audit an assessment of dispatching errors that occur during or shortly after shift changes or because of improper radio procedures. (R-98-19)

Conduct an audit of your train dispatchers' activities to evaluate the current workload and make necessary changes to dispatcher operations to distribute workload based on the individual dispatcher's qualifications, ability, and experience. (R-98-20)

Examine the circumstances in which your policy to require a minimum 5 years of experience to qualify as an OJT dispatcher trainer was not followed and take action to ensure that your qualification policies are followed. (R-98-21)

Develop and implement a comprehensive program to select and train experienced dispatchers to serve as dispatcher trainers. (R-98-22)

Evaluate and determine the technical expertise required of corridor managers and make the necessary changes to ensure that corridor managers are qualified to provide proper dispatching assistance to the train dispatchers. (R-98-23)

Identify all distractions, evaluate their effects on dispatchers, and take action to establish a working environment conducive to safe dispatching operations. (R-98-24)

Discontinue permanently the use of after-arrival orders in dark (nonsignalized) territory. (R-98-25)

In addition, the Safety Board issued Safety Recommendations R-98-26 through -30 to the FRA and Safety Recommendation R-98-31 to the Texas Railroad Commission. The Safety Board also reiterated Safety Recommendation R-87-16 to the FRA.

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-98-18 through -25 in your reply. If you need additional information, you may call (202) 314-6430.

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations.

By: Jim Hall
Chairman