



National Transportation Safety Board

Washington, D.C. 20594

Railroad Accident

Accident No.: DCA12FR008
Location: Mason City, Iowa
Date: July 31, 2012
Time: 2:25 a.m. central daylight time¹
Railroad: Union Pacific Railroad
Property Damage: None
Fatalities: 1
Type of Accident: Employee Fatality – Switching Accident

The Accident

On July 31, 2012, at 2:25 a.m., a Union Pacific Railroad (UPRR) switchman was killed after being crushed between two rail cars in the Mason City, Iowa, rail yard. The switchman was assigned to yard job YMC04. He went on duty on July 30, 2012, at 10:30 p.m., along with an engineer and a footboard yardmaster.² During switching operations, the switchman discovered a coupler knuckle³ with a missing pin. While making repairs to the coupler knuckle, he was struck and fatally injured by two rail cars that rolled into him.

After reporting on duty, the footboard yardmaster retrieved work orders for switching rail cars. He held a job briefing with the switchman to review their assigned work. Meanwhile, the engineer inspected the locomotive the crewmembers would be using during their shift and did not participate in the job briefing.⁴ The footboard yardmaster and switchman left the rail yard office and instructed the engineer to move the locomotive to track 11. The crew then began switching rail cars.

After about 2 hours of switching rail cars, the crew completed the work it was assigned at the beginning of the shift. The footboard yardmaster returned to the rail yard office, updated the

¹ All times in this report are recorded in central daylight time.

² A *footboard yardmaster* is a designated engine foreman on duty at a rail yard that does not have a yardmaster on duty. Crews on incoming trains call the footboard yardmaster for track assignments and set-out and pick-up information. Footboard yardmasters also update any track data that has changed during their shift.

³ A *coupler* is a device located at both ends of all cars and locomotives in a standard location to provide a means for connecting one rail vehicle to another. The coupler uses a pivoting *knuckle*, a hook-like casting that automatically locks when the knuckle is pushed closed, either manually or by a mating coupler. The knuckle fits into the head of a coupler and rotates about a vertical pin to either the open position (to engage a mating coupler) or to the closed position (when fully engaged).

⁴ UPRR rules and procedures require all crewmembers to participate in all job briefings.

track location of the switched rail cars into the computer, and retrieved the next set of work orders. Meanwhile, the switchman entered the rail yard office. The footboard yardmaster and the switchman held a job briefing and discussed the next set of tasks to be done—once again, the engineer did not participate.

Just after 2:00 a.m., the footboard yardmaster and the switchman left the rail yard office and instructed the engineer to couple the locomotive to the rail cars on track 2. The crew pulled 15 rail cars north from track 2 to clear the switch. The plan was to kick⁵ 2 rail cars from the south end of the 15-car cut,⁶ allowing them to roll into track 3. The footboard yardmaster planned to uncouple the two rail cars from the cut, while the switchman positioned himself near a group of standing rail cars on track 3 to confirm that the kicked rail cars coupled with the ones already on the track.

However, the footboard yardmaster was unable to uncouple the two rail cars, WREX 2051 and WREX 2054, from the 15 rail cars coupled to the locomotive. Therefore, he instructed the switchman to uncouple two rail cars from the cut further down track 2. The switchman repositioned himself in preparation to uncouple the two rail cars. He then told the engineer to shove the rail cars, stop, and back up⁷ into track 3. The switchman uncoupled the two rail cars, which then rolled into track 3. The switchman could not verify that the two rail cars kicked into track 3 had coupled to the rail cars standing on track 3 from the location where he had uncoupled the two rail cars.

The switchman then discovered that the coupler knuckle pin was missing from rail car UTLX 203998, which was the end rail car of the 13 still coupled to the locomotive. He instructed the engineer to stop shoving the railcars, and asked for three-point protection, which is referred to as a red zone.⁸ The engineer responded, “set and centered,”⁹ which meant that the brakes on the locomotive were applied and that the reverser¹⁰ was in the center position. This prevents movement of the locomotive.

According to the engineer and the footboard yardmaster, after about 60 to 90 seconds, the 13 rail cars coupled with the locomotive moved suddenly toward the locomotive. The engineer said he radioed the footboard yardmaster and asked what caused the movement; but neither of them knew the cause. The engineer stated that he remembered the switchman’s command for a red zone, meaning the switchman intended to move between the gage¹¹ of the track and was, therefore, exposed if any rail cars moved. The engineer said that both he and the footboard yardmaster tried to contact the switchman by radio, but there was no response.

⁵ *Kicking cars* refers to the sequential process of pushing rail cars with the locomotive, uncoupling the rail cars, stopping the locomotive, and allowing the rail cars to continue to roll.

⁶ *Cut* refers to a group of rail cars.

⁷ *Back up* is the proper command to kick the rail cars.

⁸ *Union Pacific Safety Rules*, July 30, 2007, updated December 4, 2009: “81.13.1: Going between Cars”.

⁹ *Set* means that the brakes are applied and *centered* means that the locomotive reverser lever is placed in a neutral position and power cannot be applied to the traction motors.

¹⁰ A *reverser* is the handle on a locomotive control stand that selects the direction in which the locomotive will move.

¹¹ As defined in Title 49 *Code of Federal Regulations* (CFR) Part 213, *gage* is measured between the heads of the rails at right angles to the rails in a plane 5/8 of an inch below the top of the rail head.

As the switchman made repairs, the two rail cars that were kicked into track 3, rolled back and crushed him against rail car UTLX 203998. The hand brakes were not applied on either rail car and the switchman never verified that the two rail cars had successfully coupled to the secure rail cars on track 3.

The footboard yardmaster found the fatally injured switchman on the ground between the rail car that was being repaired and the two rail cars that had been kicked into track 3.

The Investigation

When the NTSB investigator arrived on scene, the UPRR had placed the rail cars as they were found after the accident. Marks on the ground indicated where the fatally injured switchman and his personal belongings (gloves, radio, lantern, and so on) were found. Additional marks on the rail indicated the position of the rail cars on track 3.

The *Union Pacific Safety Rules*, effective on July 30, 2007, and updated on December 4, 2009, require that the following conditions be met before an employee steps between the gage of the track for any reason:

- The rail cars must be separated by at least 100 feet.
- Crewmembers must allow the slack¹² to adjust.
- On tracks where rail cars are likely to roll together, crewmembers must apply no less than two hand brakes on the unattached portion before going between cars.¹³

The NTSB investigator determined that, although the distance between the standing rail cars previously in track 3 and the two kicked rail cars was measured to be 107 feet, the requirements were not met. To have met the UPRR requirements, the switchman would have had to wait to go into the gage until after at least two hand brakes were applied to the kicked rail cars or until after he verified the coupling of the rail cars to the secured equipment. Excerpts from the *Union Pacific Operating Rules* can be found in appendix A, and excerpts from the *Union Pacific Safety Rules* can be found in appendix B.

UPRR rules also require a job briefing be held with all crewmembers before anyone enters the gage of the rail between equipment.¹⁴ This job briefing should have included a review of the rule requirements needed to perform the task safely—including allowing the slack to adjust and applying sufficient hand brakes on the two rail cars to prevent movement. This job briefing was not held.

Accident Re-enactment

A re-enactment of the accident was performed on August 1, 2012, under similar lighting conditions and with comparable ambient noise as at the time of the accident. Two rail cars were

¹² *Slack* is unrestrained free movement between the cars in a train.

¹³ *Union Pacific Safety Rules*, July 30, 2007, updated December 4, 2009: “81.13.1: Going between Cars”.

¹⁴ *Union Pacific Safety Rules*, July 30, 2007, updated December 4, 2009: “81.5.4: Understanding Between Crew Members Before Crossing Through or Fouling Equipment”.

placed next to the cut of rail cars on track 3. The hand brakes were applied on the two rail cars, but they were not coupled to the other cars in track 3. The other 13 rail cars were placed where the switchman was repairing the coupler knuckle, the same as they were on the night of the accident. The distance between the two rail cars and the point of collision was verified to be 107 feet. Handheld radar was used to measure the speed of the two rail cars when their hand brakes were released. The rail cars traveled the 107 feet in about 68 seconds, with a recorded maximum speed of 3.9 mph. The participants in the re-enactment all agreed that it would have been difficult for the switchman, with his back toward the rolling rail cars, to detect them before being struck.¹⁵

Other Investigative Factors

Portable Electronic Devices

The portable electronic device records for all crewmembers were obtained by the NTSB investigator and inspected for activity. The records did not indicate any calls or text messages for those devices at the time of the accident.

Toxicological Information

The engineer and the footboard yardmaster were tested for illegal drugs and alcohol. Toxicological testing was also performed on the fatally injured switchman. The test results for all three crewmembers were negative for illegal drugs and alcohol.

Weather Information and Visibility

A weather report from the Mason City Municipal Airport, about 8 miles west of the rail yard, indicated that, at the time of the accident, visibility was 10 miles or greater, skies were clear, winds were calm, and the temperature was 62°F.

The yard was illuminated by exterior pole lights for night operations, and rail yard employees were typically provided with handheld lanterns to aid visibility. However, crewmembers pointed out during interviews with the NTSB investigator that the lighting diminished toward the center of the rail yard, which was where the accident occurred. Further, the NTSB investigator determined through visual inspection that the lighting appeared to be brighter near the switches at the north end of the rail yard.

Equipment Information

The NTSB investigator inspected the rail cars involved in the accident: rail car UTLX 203998¹⁶ with the missing coupler knuckle pin, and the two rail cars, WREX 2054 and WREX 2051. No mechanical defects were found.

¹⁵ The switchman's injuries showed that he had been struck from behind.

¹⁶ The coupler knuckle of the railcar was replaced prior to the tests and inspections.

Personnel Information

The 35-year-old switchman had nearly 10 years of railroad experience and had worked as a switchman/brakeman for over 6 months prior to the accident. He attended all mandatory training classes and passed all required tests. He completed several training classes on safely switching rail cars, entering into the red zone between the rails, and understanding the hazards associated with coupling rail cars.

Other Information

In 1998, representatives from the Federal Railroad Administration, railroads, and railroad labor unions formed a working group to study switching operations fatality analysis (SOFA). This working group, known as the SOFA working group (SWG), has issued three major reports. The first report, issued in 1999, listed the following five SOFA “lifesavers”:

- Secure equipment before action is taken.
- Protect employees against moving equipment.
- Discuss safety at the beginning of a job or when a project changes.
- Communicate before action is taken.
- Mentor less-experienced employees to perform service safely.

The UPRR incorporated these items into its operating procedures and included them in its training programs. All employees involved in this accident had been trained on the SOFA material, specifically the five SOFA lifesavers.

Further, the UPRR utilizes a program called “Total Safety Culture.” In this program, employees voluntarily allow their peers to observe and record all of their work habits.¹⁷ If a peer witnessed an unsafe action of another employee, the peer would record the event and notify the employee. The unsafe action would not result in disciplinary action by management, even if it was simultaneously observed by a supervisor, unless the action was a violation of federal regulations. This program also allows peers to report appropriate and safe actions and behavior, resulting in positive recognition for the employees who are observed performing actions correctly.

Teams made up of nonsupervisory employees gathered the data recorded from the observations and identified specific areas for overall employee performance improvement. Those results were then provided to the employees at the work site where the data was gathered. Processes, procedures, and training were then developed to address those areas that needed improvement. The Total Safety Culture program was practiced at the Mason City rail yard, where the employees interviewed said the program enhanced safety and improved the individual performance of the employees.

¹⁷ Under the terms of this program, an employee could decline to be observed.

UPRR Managerial Oversight

Operational Testing

Title 49 CFR Part 217 contains specific requirements¹⁸ for the observation and testing of operating employees while performing duties. The UPRR maintained an operational testing/observation program to monitor the performance of employees operating trains on the UPRR, along with the employees' compliance with railroad rules and federal laws.

The switchman's operational testing records included 93 entries during the 7-month period between January 2012 and the accident date at the end of July. Each observation represented an operating or safety rule performed correctly by the switchman while being observed by a supervisor. Several entries pertained to the same rule, but were entered on different dates; which was common practice because employees who perform repetitive tasks from day to day are regularly tested on the applicable rules. During this 7-month period, the switchman was once observed properly separating railroad equipment. On 21 occasions during this same time period, he was also observed complying with the safety rules applicable to working around railroad equipment—including maintaining the proper distance while walking around equipment, being alert, and following the proper procedures for walking across tracks. There were no entries in the operational testing records for compliance with job briefing rules.¹⁹

UPRR Postaccident Actions

Following this accident, on August 2, 2012, the UPRR issued a Safety Alert Bulletin²⁰ (see appendix C) that gave a brief description of the accident and listed operating practices that require more focused attention. The Safety Alert Bulletin was distributed to all managers, train crews, engine crews, and yard employees throughout the UPRR.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was the switchman not ensuring the two rail cars on track 3 were properly secured before attempting to repair the coupler knuckle on rail car UTLX 203998. Contributing to the accident was the lack of a thorough job briefing by the rail yard crew, specifically a review of securement requirements, before the switchman entered the gage of the rail.

Adopted: October 18, 2013

¹⁸ Title 49 CFR §217.9 (a). *Program of operational test and inspections; record keeping*. “(a) Requirement to conduct operational tests and inspections. Each railroad to which this part applies shall periodically conduct operational tests and inspections to determine the extent of compliance with its code of operating rules, timetable, and timetable special instructions...”

¹⁹ *Union Pacific Safety Rules*, effective July 30, 2007, revised December 4, 2009: “70.3: Job Briefing”.

²⁰ *Union Pacific Safety Alert Bulletin*, effective August 2, 2012.

Appendix A: Excerpts from *Union Pacific Operating Rules, Sixth Edition*, effective April 7, 2010, includes updates as of February 8, 2012

1.0: General Responsibilities.

1.1: Safety.

Safety is the most important element in performing duties. Obeying the rules is essential to job safety and continued employment.

1.1.2: Alert and Attentive.

Employees must be careful to prevent injuring themselves or others. They must be alert and attentive when performing their duties and plan their work to avoid injury.

1.20: Alert to Train Movement.

Employees must expect the movement of trains, engines, cars, or other moveable equipment at any time, on any track and in either direction.

Employees must not stand on the track in front of an approaching engine, car or other moving equipment.

Employees must be aware of the location of structures or obstructions where clearances are close.

Appendix B: Excerpts from *Union Pacific Safety Rules*, effective July 30, 2007, includes updates as of December 4, 2009

81.0: Working Around Tracks or Being on Equipment:

81.13.1: Going between Cars.

Do not go between or in front of a moving engine or car to arrange knuckles or couplers, to manipulate other appliances or for any other reason.

When it is necessary to separate equipment to make adjustments, the following applies:

- Separate the equipment at least 100 feet.
- Allow the slack to adjust.
- On tracks where cars are likely to roll together, apply sufficient hand brakes, but not less than two, on the unattached portion to prevent movement before going between cars.

Appendix C: Excerpts from *Union Pacific Safety Alert Bulletin*, effective August 2, 2012

Review with All Managers and TE&Y Employees

Incident Description

Mason City, Iowa, at approximately 2:30 a.m., the morning of July 31, 2012.

After releasing two cars into a yard track during a “car kicking” operation, a member of the three-man conventional yard switch crew noticed a knuckle improperly positioned on the point car of the cut and stopped the switching operation.

The switchman called for a red zone, and was acknowledged, and proceeded to reposition the knuckle. The cars that had previously been kicked into the same track rolled back towards the switchman, striking him, resulting in fatal injuries.

Preliminary investigation indicates the cars that rolled had failed to make a joint with the standing cut in that track and were not otherwise secured.

Applicable Rules and Areas of Focused Attention

81.5.4: Understanding between crew members before crossing through or fouling equipment. This rule describes how to protect against moving equipment when you must work or move in foul of a track. It consists of four steps: 1. Request Red Zone, 2. Determine Action (Job Brief), 3. Confirm Red Zone, and 4. Release Red Zone.

81.13.1: Going between cars. This rule specifies these criteria before performing work on couplers, knuckles or other work in the Red Zone:

- Separate by a minimum of 100 feet.
- Allow slack to adjust.
- Apply sufficient hand brakes on the portion not coupled to the locomotive to prevent movement. However, on tracks where cars are likely to roll together, at least two hand brakes must be applied.

Focus your attention on the third bullet of 81.13.1: sufficient hand brakes.

Risk

Beyond what is directed in the rules, we must also assess the potential risks unique to the move being made. We have to think beyond what is in the rules and be aware of other conditions that could influence the safety of a move. For example: weather, time of day, track condition and grade to name a few.

In this particular incident, the yard tracks were known to allow cars to roll back in the direction of the switching move.

In addition, all locations where cars are switched must perform and document RIM analysis documenting by track and location the direction of movement free standing equipment will roll. These RIM analyses will be reviewed with all employees and included in job profiles and familiarization procedures.

PINS code SF114 will be entered upon completion of the review of this alert bulletin.