

Collision of Dakota, Minnesota & Eastern Railroad
Freight Train and 19 Stationary Railcars
Bettendorf, Iowa
July 14, 2009



Accident Summary Report

NTSB/RAR-12/03/SUM
PB2012-916303



**National
Transportation
Safety Board**

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Notation 8396
Adopted April 30, 2012

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**National
Transportation
Safety Board**

490 L'Enfant Plaza, S.W.
Washington, D.C. 20594

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Abstract: On July 14, 2009, about 2:08 a.m., central daylight time, southbound Dakota, Minnesota & Eastern Railroad freight train B61-13 went into Bettendorf Yard in Bettendorf, Iowa, due to a misaligned switch and struck 19 stationary railcars. The impact fatally injured the locomotive engineer and the conductor. There were no wayside signals or other devices to convey the position of the hand-operated switch on the main track leading into the north yard sufficiently in advance to allow the approaching train to stop. The train was moving at the authorized speed of 25 mph and was operating under valid track warrant authority. Track warrants are authorizations issued by a dispatcher for a train to occupy a certain segment of track for a certain period of time. Track warrant authority is obtained and released through communication between train crews and the dispatcher.

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Abbreviations and Acronyms

BNSF	BNSF Railway Company
BNSF local	BNSF Railway local train RCHI4274-13I
CFR	<i>Code of Federal Regulations</i>
DME	Dakota, Minnesota & Eastern Railroad
EO 24	Federal Railroad Administration Emergency Order No. 24
FR	<i>Federal Register</i>
FRA	Federal Railroad Administration
GCOR	General Code of Operating Rules
MP	milepost
NTSB	National Transportation Safety Board
RSAC	Rail Safety Advisory Committee
SPAF	switch position awareness form

Executive Summary

On July 14, 2009, about 2:08 a.m., central daylight time, southbound Dakota, Minnesota & Eastern Railroad freight train B61-13, went into Bettendorf Yard in Bettendorf, Iowa, due to a misaligned switch and struck 19 stationary railcars. The impact fatally injured the locomotive engineer and the conductor. There were no wayside signals or other devices to convey the position of the hand-operated switch on the main track leading into the north yard sufficiently in advance to allow the approaching train to stop. The train was moving at the authorized speed of 25 mph and was operating under valid track warrant authority. Track warrants are authorizations issued by a dispatcher for a train to occupy a certain segment of track for a certain period of time. Track warrant authority is obtained and released through communication between train crews and the dispatcher.

The National Transportation Safety Board determines that the probable cause of the accident was the BNSF Railway local train RCHI4274-13I crew releasing track warrant authority before returning the north yard hand-operated switch to the correct position. Contributing to the accident was the dispatcher for the Dakota, Minnesota & Eastern Railroad granting track warrant authority to Dakota, Minnesota & Eastern Railroad train B61-13 without holding a job briefing, which would confirm the accurate positions of all applicable main track switches. Also contributing to the accident was a hand-operated switch position reflector target that could not be observed by the crew of train B61-13 at a sufficient distance to stop the train and avoid the accident.

The safety issues discussed in this report are the following:

- Incorrect alignment of a hand-operated switch in non-signaled territory
- Inadequate job briefing between train crewmembers
- Inadequate job briefing requirements for train crewmembers and train dispatchers prior to releasing track occupancy authority
- The absence of appropriate switch position technology

Safety recommendations are being issued to the Federal Railroad Administration and the Canadian Pacific Railway.

1 Investigation & Analysis

1.1 Accident Narrative

On July 14, 2009, about 2:08 a.m., central daylight time,¹ Dakota, Minnesota & Eastern Railroad (DME)² freight train B61-13, consisting of two locomotives (DME 4003 and 4001) and 83 railcars, was operating southbound³ under track warrant authority⁴ in non-signaled territory on the main track when it went into Bettendorf Yard via the misaligned north yard hand-operated switch.⁵ Event recorder data showed that the train was operating at 25 mph before the DME train's engineer activated the emergency brakes as the train entered the yard. However, the braking action was only able to slow the train to about 21 mph before it struck 19 loaded railcars on yard track No. 3, derailing 4 of those railcars, in addition to derailing 9 railcars and the 2 locomotives on the DME train. (See figure 1.) The engineer and the conductor on DME train B61-13 sustained fatal injuries. The north yard hand-operated switch had been left incorrectly lined from the main track onto the yard track by the crew of BNSF Railway Company (BNSF) local train RCHI4274-13I (BNSF local).

¹ In this report, all times are central daylight time.

² Dakota, Minnesota & Eastern Railroad is a subsidiary of Canadian Pacific (CP) Railway.

³ DME timetable directions are listed as "northbound" and "southbound," which are geographically west or east, respectively, at Bettendorf, Iowa.

⁴ *Track warrants* are authorizations issued by a dispatcher for a train to occupy a certain segment of track for a certain period of time. The track warrant authority is obtained and released through communication between train crews and the dispatchers.

⁵ A *hand-operated switch* means any type of switch operated by manual manipulation. Under Title 49 *Code of Federal Regulations* (CFR) Section 218.93, "a hand-operated switch does not include switches operated by push button or radio control when such switch is protected by distant switch indicators, switch point indicators, or other visual or audio verification that the switch points are lined for the intended route and fit properly."



Figure 1. Photograph of damaged lead DME locomotive 4003.

The collision occurred on the DME Davenport Subdivision, near milepost (MP) 187.8 in Bettendorf, Iowa. Train movements were authorized by track warrants issued by a DME train dispatcher⁶ located in Sioux Falls, South Dakota. The maximum authorized speed for the main track in the Bettendorf area was 25 mph. There was no signal system to govern train movements or convey information regarding the north yard hand-operated switch position.

The collision occurred in darkness and the weather conditions were clear, with the temperature about 73° F. No fire or evacuation resulted from the collision. The estimated property damage was about \$1.5 million.

1.1.1 Events Preceding the Accident

On Monday, July 13, 2009, a BNSF train crew consisting of an engineer, a conductor, and a brakeman went on duty at 3:30 p.m., in Galesburg, Illinois, and were transported to Barstow, Illinois, to operate the BNSF local that would work in the Bettendorf area. The BNSF local departed Barstow about 8:05 p.m. with two locomotives and 137 mixed freight railcars. En route, the BNSF local made two stops to set out 80 railcars before proceeding north (timetable direction) onto the DME railroad with the remaining 57 railcars, destined for the north end of Bettendorf Yard. After passing the north end of the yard, about 12:15 a.m. on July 14, 2009, the conductor lined the north yard hand-operated switch to enter the yard. This switch, as shown in figure 2, is the only access to the north end of Bettendorf Yard. Prior to the BNSF local's arrival at Bettendorf Yard, yard track No. 2, yard track No. 3, and the north siding were empty.

⁶ DME also refers to train dispatchers as operations supervisors.

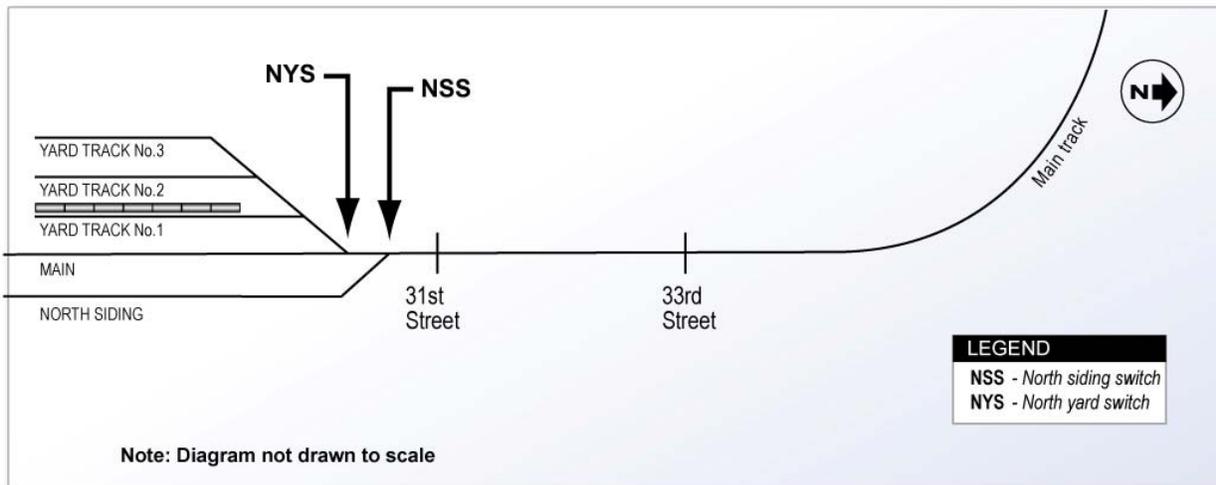


Figure 2: Bettendorf Yard immediately before BNSF local crew placed cars on yard tracks Nos. 2 and 3.

About 1:39 a.m., the crew of the BNSF local placed 20 railcars on yard track No. 2 and 19 railcars on yard track No. 3. The DME dispatcher then instructed the BNSF local engineer to clear the remainder of the train off the main track for a DME train to arrive. The BNSF local engineer requested permission to clear on the north siding. The DME dispatcher authorized the request. The BNSF local moved north about 350 feet with 18 railcars, past the remote-controlled north siding switch and the 31st Street crossing. The engineer successfully lined the remote-controlled north siding switch⁷ and backed the train onto the north siding. (See figure 3.)

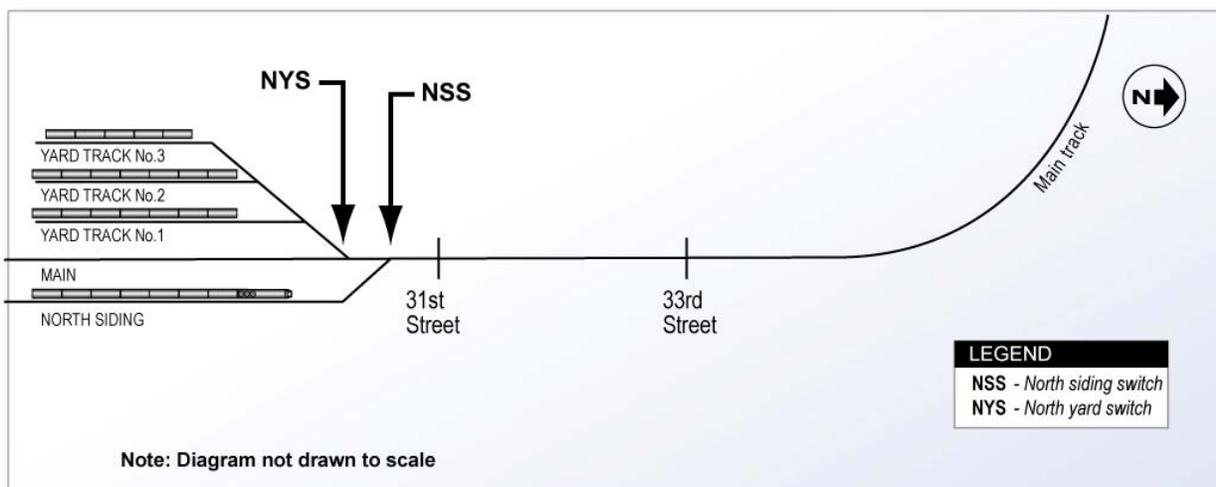


Figure 3. View of Bettendorf Yard after BNSF local cleared onto north siding.

⁷ The remote-controlled north siding switch at Bettendorf Yard was a power-operated switch that was to automatically normalize after a train completed its movement. This switch was lined when the engineer from the BNSF local entered a radio code requesting that the switch be operated. A wayside switch position indicator light then illuminated for that switch only after sending a radio transmission to the BNSF local engineer that the remote-controlled north siding switch was lined.

After the BNSF local completed its movement onto the north siding, the remote-controlled north siding switch automatically lined itself back for the main track. However, the north yard hand-operated switch remained lined toward yard track No. 3. In compliance with the *General Code of Operating Rules (GCOR)*⁸ Rule 5.9.2, the BNSF local engineer turned the locomotive's headlight off to avoid adversely affecting the vision of the crew of the oncoming DME train.

The BNSF local conductor walked to the front of the locomotive, met the brakeman at the front of the train, and boarded the locomotive. At 1:54 a.m., the conductor of the BNSF local released its track warrant authority to the DME dispatcher. While waiting 11 minutes for the DME train to pass, the BNSF local crew conducted a job briefing to discuss the remainder of the work. Neither the BNSF engineer nor the conductor discussed the north yard hand-operated switch that had been used, and they did not follow up or confirm the position of that switch among themselves or with the DME dispatcher.

DME General Order No. A-14 is a DME supplement to the GCOR, including Rules 1.48, 8.3, and 14.7.1. This order, which was effective at the time of the accident, requires that a job briefing, at a minimum, define the work to be done and how the work will be done, identify the potential hazards, name the employees responsible for each task, and include a follow-up job briefing to ascertain all required tasks of the job are complete. The job briefing requirement is general in nature and does not address communication between a train crew and a dispatcher. BNSF rules require such communication between train crews and the dispatcher to confirm switch positions for trains operating on BNSF trackage. These rules did not apply on the DME trackage. BNSF rules did require its crews to maintain a switch position awareness form (SPAF) on both BNSF and other railroads.⁹ The conductor did not complete the SPAF prior to releasing the track warrant authority. However, crews were not required to confirm switch positions with dispatchers on other railroads.

The BNSF local crewmembers cleared the main track at the north siding, just past the north siding switch. At this point, the BNSF local crew had ample opportunity to perform a thorough job briefing to follow up on earlier tasks which would include verifying the position of the north yard hand-operated switch and would also provide an opportunity to correct the position of that switch before releasing track warrant authority.

The NTSB concludes that had the crew of the BNSF local train been required to hold a job briefing with the DME dispatcher to confirm all applicable main track switch positions before releasing track warrant authority, it is likely the north yard hand-operated switch would not have been left lined for yard track No. 3.

⁸ The GCOR is a standard book of operating rules adopted by many railroads in the United States. It was developed by a committee composed of adopting railroads and is updated periodically by the committee. Each railroad that adopts the GCOR remains free to modify the specific rules to better suit its individual operating characteristics.

⁹ *Switch position awareness form* is a term used in Federal Railroad Administration (FRA) Emergency Order No. 24 (EO 24). The requirement to fill out these forms was deleted from FRA regulations before this accident; however, the BNSF still uses the form.

DME train B61-13, consisting of 2 locomotives and 83 railcars (42 loaded and 41 empty), originated at Clinton, Iowa, and headed south, destined for the Nahant Yard in Davenport, Iowa. It had moved about 30 miles when the collision occurred at Bettendorf. Shortly before the accident, the DME dispatcher contacted the DME train and issued track warrant authority from the train's location at MP 185.0 to Nahant at MP 195.7 (south of Bettendorf Yard). The track warrant was effective at 1:57 a.m. Locomotive event recorder data showed that the DME train started moving southward almost immediately. Under DME operating rules, the track warrant authority gave the DME train sole main track occupancy authority, conveying assurance that all switches were lined and locked for main track train movement at the maximum authorized speed. After receiving track warrant authority, the DME engineer keyed in a radio code requesting confirmation that the remote-controlled north siding switch at Bettendorf was lined to the correct position. The remote-controlled north siding switch activated an audible communication to the DME engineer and displayed a green switch position indicator light, indicating that it was lined and locked for main track movement.

At MP 187.68, the switch position indicator light showed the position of the remote-controlled north siding switch. Postaccident sight-distance testing revealed the switch position indicator light was green and first visible from MP 187.2. Although red reflections from the north yard hand-operated switch position reflector target¹⁰ were visible from 33rd Street, it was not readily identifiable as the target for the north yard hand-operated switch until 31st Street.¹¹ At MP 187.7, the north yard hand-operated switch was incorrectly lined leading into the yard. The DME train entered the yard, traveled 168 feet, and struck 19 stationary cars on track No. 3. (See figure 4.)

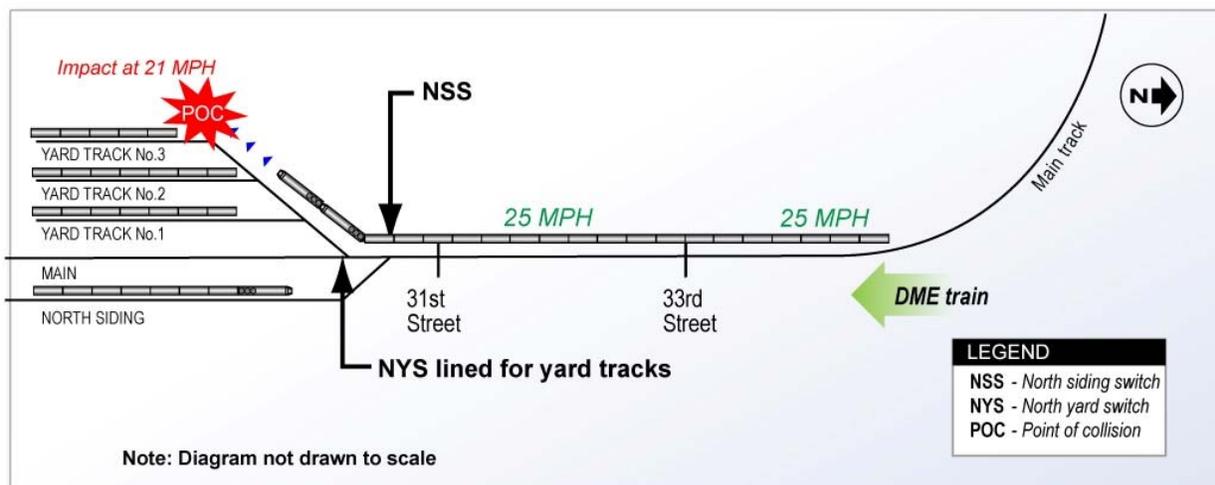


Figure 4. Path of DME train as it approached point of collision.

¹⁰ *Switch position reflector targets* are reflectorized metal flag-like devices that are connected to switch stands. On main track hand-operated switches, the target will be green if the switch is lined normally for the main track and will be red otherwise. There are currently no specific Federal regulations concerning switch targets.

¹¹ The distance from the north yard hand-operated switch to 31st Street is about 210 feet.

The NTSB concludes that the switch position reflector target for the north yard hand-operated switch did not adequately warn the approaching train of the incorrectly lined main track switch at a sufficient distance for the train to stop in time to prevent the accident.

In the mile preceding the collision, the DME train traveled through a series of curves as it approached Bettendorf Yard. After exiting the last curve, the train continued southward on straight track for about 2,600 feet before passing the switch position indicator light at the remote-controlled north siding switch at Bettendorf Yard.¹² The DME engineer made no changes to the throttle approaching the accident location. Figure 5 shows a ground view of both the north yard hand-operated switch and the remote-controlled north siding switch.

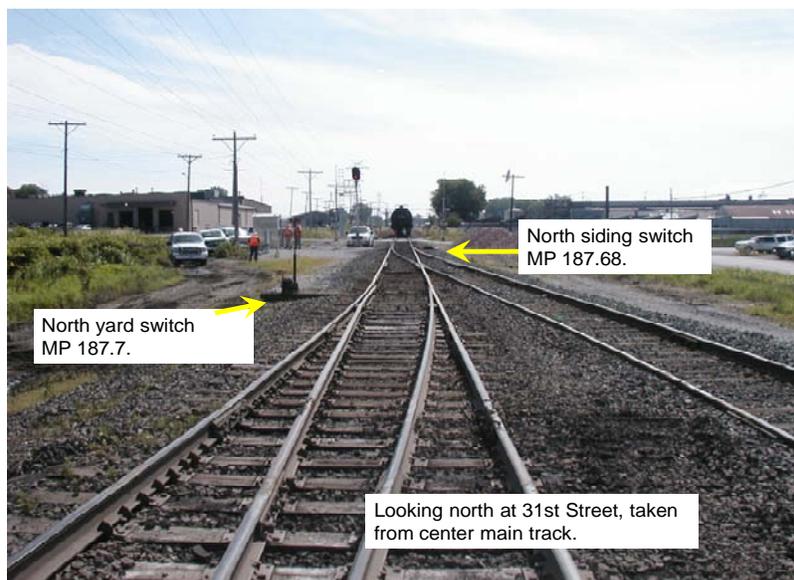


Figure 5. North yard hand-operated switch and remote-controlled north siding switch.

The DME train passed the remote-controlled north siding switch, which was lined in the correct position for main track movement. Then, almost immediately, the train diverted from the main track at the incorrectly lined north yard hand-operated switch.

The brakeman on the BNSF local told investigators that as the DME train was approaching Bettendorf Yard, he observed that the DME train's locomotive headlight was illuminated as it approached 31st Street, which was about 210 feet north of the incorrectly lined north yard hand-operated switch, that was equipped with a reflective target.

NTSB investigators reviewed event recorder data, which showed that the DME train was operating at the authorized 25 mph main track speed when the DME train's engineer activated the emergency brakes. The train slowed to about 21 mph at impact, which was when the

¹² NTSB investigators performed sight-distance tests and determined that the switch position indicator light for the remote-controlled north siding switch was visible upon exiting the curve for the length of the straight track (2,600 feet). The default switch position indicator light displays solid red. It displays a green aspect when correctly lined for main track movement and a flashing red aspect when correctly lined for the siding. The aspect was displayed on both sides of the switch position indicator light. That is, it could be seen when approaching the switch position indicator light from either direction.

event recorder stopped recording. The NTSB concludes that the actions of the DME train crew were appropriate and in compliance with the track warrant authority and track speed limits at the time of the accident.

On impact, two locomotives and nine railcars derailed on the DME train. The impact crushed the locomotive cab compartment of the leading locomotive, DME 4003, and sheared it from the top plate. The 4 closest of the 19 railcars on yard track No. 3 also derailed. (See figure 6.)



Figure 6. Wreckage of DME tank railcars.

1.2 Emergency Response and Other Factors

About 2:08 a.m., immediately after the collision, the crew on the BNSF local radioed “emergency” to the DME dispatcher, advising that the DME train “picked the switch”¹³ at the north yard and requesting that the DME dispatcher call an ambulance. At 2:18 a.m., Bettendorf emergency response personnel and police arrived on scene. They secured the area and helped

¹³ *Picked the switch* is a term that means that a wheel has been lodged between the switch point and the stock rail of a defective or misaligned switch, causing an undesired routing of a locomotive or railcar.

search for the trapped train crewmembers within the damaged leading locomotive.¹⁴ However, the damage to the locomotive limited the responders' ability to extract the trapped crewmembers. Rescue personnel found the deceased crewmembers trapped within the crushed wreckage.

A small fuel leak was stopped on the damaged locomotives of the DME train. There was no fire and no evacuation. The collision, which occurred near the downtown area of Bettendorf, caused only minor traffic delays near the accident site. The Bettendorf Police Department and the Bettendorf Fire Department secured the area and facilitated vehicular traffic movements through the city. The NTSB concludes that the emergency response to this accident was timely and appropriate.

1.3 Rules and Oversight

1.3.1 Operating Rules and Compliance

The DME owns, manages, and operates the railroad where the accident occurred. The BNSF has an operating agreement with the DME, through which BNSF trains operate on DME tracks.

The DME Davenport Subdivision is in non-signalized territory. Remote-controlled switches at passing tracks are equipped with "switch position indicators," which convey only switch positions, not track occupancy. Train movements are authorized by track warrants issued by the DME dispatcher. GCOR Rule 2.14 requires the use of track warrants in non-signalized territory, such as the territory where Bettendorf Yard is located. The rule also contains procedures intended to ensure train crews understand the directives.

The employee receiving a mandatory directive must copy it in writing using the format outlined in the operating rules. Before a mandatory directive is acted upon, the conductor and engineer must each have a written copy and each crew member must read and understand it.

The DME's Operating Rule 1.48¹⁵ also requires that all main track switches be lined and locked for main track movement.

Crew members are jointly responsible to make verbal communication between each other and confirm it is properly understood when any of the following work activities apply to them: switches are properly lined and/or locked visually confirming route to be used before reporting a track release.

Additionally, DME Rules 8.3 and 14.7 require that all main track switches be lined and locked for main track movement before releasing track warrant authority. According to GCOR Rule 8.3, "The normal position of a main track switch is for main track movement, and it must be lined and locked in that position." According to GCOR Rule 14.7 and

¹⁴ At the time of the collision, the short hood of the leading locomotive, DME 4003, was facing forward.

¹⁵ Dakota, Minnesota & Eastern Railroad, *Supplement to Fifth Edition, General Code of Operating Rules*, effective June 13, 2009.

GCOR Rule 14.7.1, “In addition, a train clearing in a siding or other track must comply with requirements outlined in Rule 8.3 before reporting clear of the limits.” In other words, the north yard hand-operated switch leading into Bettendorf Yard should have been lined for main track movement before the BNSF local train crew released the track warrant authority and reported the train clear of the main track.

The crew of the BNSF local failed to follow this critical operating rule. The conductor, the engineer, and the brakeman said they conducted a job briefing; however, they discussed future work in this briefing and failed to address relining the north yard hand-operated switch. The BNSF local’s crew released its track warrant authority to the DME dispatcher without lining and locking the switch for main track movement, thereby allowing the DME dispatcher, who was unaware of the position of the north yard hand-operated switch, to issue a track warrant to the DME train.

Even though the DME engineer applied the emergency brake near the incorrectly lined north yard hand-operated switch, the train continued to move about 240 feet before colliding with the railcars on yard track No. 3. The locomotive’s event recorder showed that the DME engineer had placed the train into emergency braking and had fully applied the locomotive independent brake.

During the postaccident inspection, investigators found that the north yard hand-operated switch was still lined for yard track No. 3, the switch lock was still unlocked, and the switch lock was hanging in the switch locking hasp.¹⁶ (See figure 7.)

The NTSB concludes that had the crew of the BNSF local train relined the north yard hand-operated switch for main track movement before releasing its track warrant authority, as required by operating rules, the accident would not have occurred.

¹⁶ The switch has a pin with a hole in each end for dual locking of the switch. The pin is inserted into the switch locking hasp. The DME lock is used on one side of the pin and the BNSF lock is used on the other. Either railroad can use the switch by locking and unlocking it.



Figure 7. Bettendorf Yard north yard hand-operated switch with unlocked BNSF lock.

The BNSF Chicago division general manager told investigators that train crews that operate on BNSF tracks are required to conduct job briefings with each other and with the BNSF dispatcher when releasing a track warrant authority on a main track in non-signaled territory, at both hand-operated and remote-controlled switch locations. This requirement was put in a System Special Instruction on July 16, 2008, and is now found in Rule 14.10 in the BNSF supplement to the sixth edition of the GCOR, effective April 7, 2010.

In non-signaled territory or double track ABS [automatic block signals] territory (outside of restricted limits or yard limits), a crew member will job brief with the train dispatcher about the position of main track switches and those switches operated are locked within the limits being released, referencing completion of the Position of Switch form or stating no entries required.

DME's Executive Vice President of Operations told NTSB investigators that DME does not require a SPAF. In addition, when a train crew reports clear of the main track in a remote-controlled siding switch on DME trackage, crews are not required by either DME rules or Federal Railroad Administration (FRA) regulations to have a job briefing with the DME dispatcher, as is required when releasing track authority at a hand-operated switch.

According to the DME Executive Vice President of Operations, DME used not only the GCOR operating rules, but also an additional DME supplement to the fifth edition of the GCOR rules. This document (known as DME Supplement) was issued on June 13, 2009.

The DME GCOR supplemental rules are consistent with FRA regulations, which require crewmembers in non-signaled territory, unless specifically directed otherwise by a dispatcher, to report that hand-operated switches used to clear a train from the main track (but not remote-controlled switches) have been restored to their correct positions and locked. (See

Title 49 *Code of Federal Regulations* (CFR) Section 218.105(d.) This report is to be made only after a job briefing has been conducted between the train crew and the dispatcher. The dispatcher must repeat the reported hand-operated switch position to the crewmember and ask for confirmation from the crewmember that the information is correct.

Because the BNSF local crew cleared the train from the main track at a remote-controlled switch, the requirement for confirmation of switch positions by the DME dispatcher did not apply to the remote-controlled north siding switch. According to the DME superintendent responsible for the Davenport subdivision, “They didn’t clear at a hand-operated switch, so it’s not required to say at what switch that they cleared the main track at. They would tell him that they were in the clear on a Bettendorf siding.”

1.3.2 Federal and Carrier Oversight

Job briefings are required for certain critical tasks in accordance with 49 CFR 218.103(b)(1): (1) before the work begins, (2) each time a work plan is changed, and (3) at the completion of the work. Such job briefings ensure that crewmembers working together understand the tasks they are intending to perform and exactly what is expected of them and their colleagues. The following additional requirements are found in 49 CFR 218.105(c) and (d):

(c) Additional job briefing requirements for hand-operated main track switches.

(1) Before a train or a train crew leaves the location where any hand-operated main track switch was operated, all crewmembers shall have verbal communication to confirm the position of the switch.

(2) In the case of exclusive track occupancy authority established under § 214.321, foul time under § 214.323, or train coordination under § 214.325, when a roadway worker qualified to operate hand-operated main track switches is granted permission by the roadway worker in charge to occupy or otherwise use the limits of the exclusive track occupancy, such employee receiving permission to occupy the working limits shall report the position of any such switches operated upon expiration of the authority limits to the roadway worker in charge or to a designated intermediary employee who shall convey the switch position to the roadway worker in charge.

(d) Releasing authority limits. In non-signalized territory, before an employee releases the limits of a main track authority and a hand-operated switch is used to clear the main track, and, prior to departing the switch's location, the following conditions are required:

(1) The employee releasing the limits, after conducting a job briefing in accordance with this subpart, shall report to the train dispatcher that the hand-operated main track switch has been restored to its normal [correct] position and locked, unless the train dispatcher directs that the hand-operated main track switch be left lined and locked in the reverse position and the necessary protection is provided [automatic switches are exempt from the hand-operated switch regulations];

- (2) If the report of the switch position is correct, the train dispatcher shall repeat the reported switch position information to the employee releasing the limits and ask whether that is correct; and
- (3) The employee releasing the limits shall then confirm to the train dispatcher that this information is correct.

On February 13, 2008, the FRA published in the *Federal Register* (FR), *Railroad Operating Rules: Program of Operational Tests and Inspections* and *Railroad Operating Practices: Handling Equipment, Switches, and Fixed Derails* (73 FR 8442–8505, amending 49 CFR Parts 217 and 218). Included in these publications was the following summary.

Human factors are the leading cause of train accidents, accounting for 38 percent of the total in 2005. Human factors also contribute to employee injuries. This final rule establishes greater accountability on the part of railroad management for administration of railroad programs of operational tests and inspections, and greater accountability on the part of railroad supervisors and employees for compliance with those railroad operating rules that are responsible for approximately half of the train accidents related to human factors. Additionally, this final rule will supplant Emergency Order 24, which requires special handling, instruction and testing of railroad operating rules pertaining to hand-operated main track switches in non-sigaled territory.

The FRA periodically audits efficiency testing programs of railroad operating rules. Both the DME and the BNSF have programs of instruction, training, and examinations to ensure that crews are aware of railroad operating rules, safety rules, and special instructions. Crewmembers are tested annually to ensure they comprehend the intent of railroad operating and safety rules and have the qualifications to work safely. To monitor compliance with operating and safety rules, the DME and the BNSF conduct operational tests. In addition, they have initial and periodic rules training and examinations. In the 6 months prior to the accident, the BNSF local crew was observed/evaluated on the BNSF Railway with testing on multiple operating rules on 139 occasions. Of the operational tests administered to the BNSF crew, there were 10 tests for clearing a track warrant, 5 tests for completing a SPAF, and 3 tests for operating a main track hand-operated switch. No exceptions were reported as a result of these tests. During the same period, the DME crew was observed/evaluated with 71 operational tests on the DME Railroad. Of the operational tests given to the DME crew, there were 10 tests for job briefings, 11 tests for operating a main track hand-operated switch, and 1 test for releasing track warrant authority to the train dispatcher. No exceptions were reported as a result of these tests.

There are no records to indicate that the BNSF and the DME made any joint operational tests on BNSF train crews operating on DME property prior to the accident. However, the BNSF and the DME are now performing joint testing, including tests on applicable switch rules, on DME property.

1.3.3 Previous NTSB Accident Investigations

The NTSB has investigated previous accidents in which incorrectly positioned switches on non-sigaled track had catastrophic results.

On January 6, 2005, a Norfolk Southern Railway Company freight train encountered an incorrectly lined hand-operated switch at Graniteville, South Carolina, after a local train crew had left its train on a siding in non-sigaled territory and failed to reline the main track hand-operated switch.¹⁷ A large quantity of extremely hazardous chlorine gas was released in the collision, resulting in nine fatalities. In response to the Graniteville accident and other similar accidents, the FRA issued Safety Advisory 2005-01 on January 10, 2005,¹⁸ warning railroads of an increase in incidents involving hand-operated switches that had inadvertently been left incorrectly lined, allowing trains to enter sidings unintentionally, resulting in collisions. The advisory stated that if the number of accidents of this type did not decrease, the FRA would be required to take additional action to address this situation.

On September 15, 2005, another accident occurred at Shepherd, Texas, on the Union Pacific Railroad, where a train crew inadvertently left a hand-operated switch in the incorrect position, causing a collision, loss of life, and release of flammable materials.¹⁹

On November 29, 2005, the NTSB adopted the report on the Graniteville, South Carolina, accident.²⁰ In that report, the NTSB stated that in its view, more than SPAFs and rule changes were needed to prevent recurrences of accidents such as those in Graniteville and Shepherd.

While any operating rule change designed to enhance safety is welcomed, the Safety Board does not believe that rule changes or the use of forms is sufficient to prevent recurrences of accidents such as the one at Graniteville. The Safety Board notes that only 2 days after the Graniteville accident, a BNSF freight train was unexpectedly diverted into an industrial siding in California where it struck two loaded cars and derailed. This accident occurred less than 3 months after the BNSF implemented the rule referenced in the FRA advisory, a rule similar to those the FRA is urging other railroads to adopt and to the rules adopted by the NS [Norfolk Southern Railroad] after the accident. The Safety Board further notes that the UP [Union Pacific Railroad] had also adopted such a rule before the issuance of the advisory, but this did not prevent the September 15, 2005, collision of a southbound UP freight train with a standing local train in Shepherd, Texas, that resulted in a fatality and several injuries.

At Graniteville, the brakeman whose job it was to reline the switch said that he believed everything was correct when he left the scene, and there is no reason to believe that, even in his haste to return to the terminal, he would knowingly have left the switch improperly lined. While it is possible that a discussion with the dispatcher specifically regarding switches would have caused him to think through his actions and remember that he had neglected the switch, it is also possible that during such a discussion he would simply have confirmed his belief that he had left the site properly secured. He was certainly aware that when he cleared the track warrants with the dispatcher he was certifying that

¹⁷ *Collision of Norfolk Southern Freight Train 192 With Standing Norfolk Southern Local Train P22 With Subsequent Hazardous Materials Release at Graniteville, South Carolina, January 6, 2005*, Railroad Accident Report NTSB/RAR-05/04 (Washington, D.C.: National Transportation Safety Board, 2005). <<http://www.ntsb.gov>>

¹⁸ *Federal Register*, vol. 70, no. 9 (January 13, 2005), p. 2455.

¹⁹ *Collision of Two Union Pacific Railroad Trains at Shepherd, Texas, September 15, 2005*, Railroad Accident Brief NTSB/RAB-06/01 (Washington, D.C.: National Transportation Safety Board, 2006). <<http://www.ntsb.gov>>

²⁰ NTSB/RAR-05/04.

the main line was ready for use by other trains. He would not likely have done this if he had any doubt about how he had left the track. Finally, under normal conditions, the conductor would have cleared the track warrants with the dispatcher. He likely would have assumed that the brakeman had relined the switch and would have reported it to the dispatcher accordingly, especially if the brakeman had already departed.

Similarly, the use of forms, such as the switch position awareness form, has not been shown to be particularly effective in preventing railroad accidents. For example, some railroads, in order to lessen the chance that a traffic control signal will be missed or misinterpreted by a crew, require that conductors record signal indications as they are encountered en route. But the Safety Board has investigated a number of accidents in which such forms, although required and used, did not prevent crews from missing signals and causing accidents.

1.3.4 FRA Emergency Order 24

On October 19, 2005, in response to the railroad accidents in Graniteville and Shepherd, the FRA issued Emergency Order 24 (EO 24) to address the use of hand-operated main track switches in non-signaled territory.²¹ This order, in part, stated the following:

Before releasing the limits of a main track [warrant] authority, the employee releasing the limits must report to the train dispatcher that all hand-operated main track switches operated have been restored to their normal position, unless the train dispatcher directs otherwise. The train dispatcher must confirm the switch positions with the employee releasing the [track warrant authority] limits before clearing the limits of the authority.

On November 18, 2005, the FRA issued an update to EO 24.²² The update, in part, stated the following:

Some railroads requested eliminating the requirement that the train dispatcher confirm that both the conductor and engineer have initialed the SPAF. FRA has denied this request because of strong safety reasons for its retention. ... the dispatcher's confirmation provides an additional level of communication so that the crewmember releasing the train's [track warrant] authority ensures that both the engineer and conductor have properly recorded on the SPAF the position of all switches operated and that there is no confusion among crewmembers as to the alignment of those switches.

However, in its November 29, 2005, report on the Graniteville accident, the NTSB stated its opinion that EO 24 did not offer sufficient guidance to ensure the prevention of future accidents.

The FRA itself acknowledged the ineffectiveness of the safety advisory [FRA Safety Advisory 2005-01]^[23] when, in October 2005, it issued Emergency Order 24 in response to a number of accidents involving improperly lined switches that occurred after promulgation of the advisory. While the Safety Board acknowledges the timeliness with

²¹ *Federal Register*, vol. 70, no. 204 (October 24, 2005), p. 61496.

²² *Federal Register*, vol. 70, no. 226 (November 25, 2005), p. 71183.

²³ FRA Safety Advisory 2005-01, *Position of Switches in Non-Signaled Territory*, (January 13, 2005).

which the FRA has addressed this safety issue, the Board is concerned about the effectiveness of the emergency order in preventing future accidents. The primary concern of the Board is that the emergency order largely requires what the previous safety advisory had recommended, which has been shown to be of questionable effectiveness.

On January 29, 2008, the FRA issued a final rule that supplanted EO 24.²⁴ The preamble of the final rule included the following:

The [final] rule retains the requirement in EO 24 that an employee releasing the limits of a main track [warrant] authority in non-signaled territory communicate with the train dispatcher that all hand-operated main track switches operated have been restored to their normal position, unless the train dispatcher directs otherwise, but only to the extent that the switches are at the location where the limits are being released. With the elimination of [the requirements for] a SPAF, it would be difficult for an employee to recall the condition of any particular hand-operated main track switch operated and there would likely be a reaction for an employee to believe he or she left all such switches in proper position without much opportunity to double-check [*sic*] the condition of those faraway switches at that time.

Therefore, the FRA regulations and the DME rules did not require discussion between the DME dispatcher and the BNSF local crew when the BNSF train released its track warrant authority for the main track on the remote-controlled north yard siding switch.

In the preamble to the final rule, the FRA quoted preamble language from EO 24 stating that “reliance solely on employee compliance with railroad operating rules related to the operation of hand-operated main track switches in non-signaled territory, without a Federal enforcement mechanism, is inadequate to protect the public safety.”

The circumstances of the Bettendorf accident show that current FRA regulations could allow a situation in non-signaled territory in which a train dispatcher grants track warrant authority without having to confirm with a train crew that all previously used switches in the limits of the track authority were restored to their correct positions. The NTSB concludes that the FRA’s decision to discontinue the EO 24 requirement that employees releasing track warrant authority report to the train dispatcher that all hand-operated main track switches have been restored reduces the safety of train operations on non-signaled main tracks.

1.3.5 Previous NTSB Recommendations

Safety Recommendation R-05-14

As a result of its investigation of the Graniteville, South Carolina, accident, the NTSB made the following safety recommendation to the FRA:

Require that, along main lines in non-signaled territory, railroads install an automatically activated device, independent of the switch banner that will,

²⁴ *Federal Register*, vol. 73, no. 30 (February 13, 2008), p. 8442.

visually or electronically, compellingly capture the attention of employees involved with switch operations and clearly convey the status of the switch both in daylight and in darkness. (R-05-14)

Safety Recommendation R-05-14 is currently classified “Open—Acceptable Alternate Response.” Although the FRA has taken no regulatory action to date, it has facilitated several initiatives to encourage railroads to deploy technology for hand-operated switches on non-signaled rail lines. Also, on September 23, 2010, the FRA issued a new task to its Rail Safety Advisory Committee (RSAC) to prescribe standards, guidance, regulations, or orders governing the development, use, and implementation of rail safety technology in non-signaled territory, as required by Section 406 of the Rail Safety Improvement Act of 2008.²⁵ The RSAC accepted this task, is working on the issue, and will make recommendations to the FRA. While the NTSB appreciates that the FRA has tasked the RSAC with developing guidance in this area, there is concern that accidents involving misaligned switches in non-signaled territory will continue to occur unless prompt action is taken. For this reason, the NTSB is reclassifying Safety Recommendation R-05-14 “Closed—Superseded by Safety Recommendation R-12-27,” which is aimed at further mitigating this risk.

Safety Recommendation R-05-15

As a result of the January 6, 2005, accident in Graniteville, South Carolina, the NTSB also made the following safety recommendation to the FRA on November 29, 2005:

Require railroads, in non-signaled territory and in the absence of switch position indicator lights or other automated systems that provide train crews with advance notice of switch positions, to operate those trains at speeds that will allow them to be safely stopped in advance of misaligned switches. (R-05-15)

In response to Safety Recommendation R-05-15, the administrator of the FRA stated the following in a letter dated June 30, 2006.

However, I am very concerned that Recommendation R-05-15, which asks us to restrict trains operating in non-signaled territory to speeds that will allow them to be safely stopped in advance of misaligned switches, advances a concept that is impractical and contrary to safety. It is overbroad in that it would apparently apply to all trains, regardless of lading. It would likely introduce unfavorable safety trade-offs, since it would exacerbate train handling challenges for locomotive engineers. Further, this recommendation fails to take into account the impact of disrupting train operations on the capacity of the Nation’s intermodal transportation system. Although FRA normally looks forward to sustaining conversations regarding recommendations that cannot be immediately implemented, the subject recommendation is so remote from any action FRA could reasonably undertake that this will be our final response to it. Accordingly, for the reasons stated in the enclosure, FRA requests that this recommendation be classified “Closed—Reconsidered.”

²⁵ Public Law 110-432. Rail Safety Improvement Act of 2008. Act of October 16, 2008. 49 *United States Code* 20101.

The NTSB expressed disappointment that the FRA had not fully acknowledged the issue and responded as follows in a letter dated June 7, 2007.

The FRA states that this recommendation is not feasible for operational and economic reasons, believes that it may increase risk, and asks that it be withdrawn. The Safety Board is concerned that the FRA has not fully acknowledged there is a problem that needs to be addressed, nor has it offered an alternate course of action. Nevertheless, given FRA's statement that "... the subject recommendation is so remote from any action FRA could reasonably undertake that this will be our final response to it," the Board believes that further dialogue on this issue would prove futile and that it is clear that the FRA and the Board will have to agree to disagree. Consequently, Safety Recommendation R-05-15 is classified "Closed—Unacceptable Action."

1.3.6 DME Actions Taken Since the Accident

On February 18, 2010, DME issued General Order C-21, requiring that after operating the north yard hand-operated switch and before leaving the Bettendorf Yard location, crews must report to the train dispatcher that the north yard hand-operated switch has been restored to the correct position. The crewmember who lines, locks, and checks the north yard hand-operated switch must also give the DME dispatcher his or her employee identification number and last name and verbally confirm the position of the switch. General Order C-21 applies only to the north yard hand-operated switch in Bettendorf Yard. DME did not make this requirement applicable to all similar switch locations on its railroad.

1.4 Safety Issues

In cases where a train crew clears a train from a main track at a remote-controlled switch location in non-signaled territory and contacts a dispatcher to release a track warrant, the dispatcher is not required by either DME operating rules or FRA regulations to have a job briefing with the crew to discuss the position of applicable switches. The NTSB concludes that the lessons learned from the Graniteville, South Carolina; Shepherd, Texas; and now Bettendorf, Iowa, accidents highlight the need for measures to ensure safety redundancy that is greater than those provided by current rules or regulations. Train dispatchers must have assurance that the track ahead of train movements in non-signaled territory is clear of other trains or equipment and that switches are in their correct positions before track warrant authorities are issued to trains. Therefore, the NTSB recommends that the FRA require railroads to install, along main lines in non-signaled territory not equipped with positive train control, appropriate technology that warns approaching trains of incorrectly lined main track switches sufficiently in advance to permit stopping. Because this recommendation expands upon and reinforces the intent of Safety Recommendation R-05-14, that recommendation is reclassified "Closed—Superseded."

The NTSB also recommends that the FRA revise 49 CFR 218.105(d)(1) to require that until the appropriate switch position technology is installed on main track switches in non-signaled territories that are not equipped with positive train control, train crews releasing track authority to the dispatcher must hold job briefings with the dispatcher and clearly convey the position of all main track switches that were used prior to releasing track warrant authority.

The NTSB further recommends that the FRA require that until appropriate switch position warning technology is installed on main track switches (in non-signaled territory not equipped with positive train control), when a main track switch has been reported relined for a main track, the next train to pass the location approach the switch location at restricted speed. That train crew should then report to the dispatcher that the switch is correctly lined for the main track before trains are allowed to operate at maximum authorized speed.

The NTSB recommends that CP require both train dispatchers and train crews to document switch positions and to hold job briefings to ensure that all main track switches in non-signaled territories are correctly lined before releasing track warrant authority. Finally, the NTSB recommends that CP require that until appropriate switch position warning technology is installed on main track switches (in non-signaled territory not equipped with positive train control), when a main track switch has been reported relined for a main track, the next train to pass the location approach the switch location at restricted speed. That train crew should then report to the dispatcher that the switch is correctly lined for the main track before trains are allowed to operate at maximum authorized speed.

2 Conclusions

2.1 Findings

1. The emergency response to this accident was timely and appropriate.
2. The actions of the Dakota, Minnesota & Eastern Railroad B61-13 train crew were appropriate and in compliance with the track warrant authority and track speed limits at the time of the accident.
3. Had the crew of BNSF local train RCHI4274-13I relined the north yard hand-operated switch for main track movement before releasing its track warrant authority, as required by operating rules, the accident would not have occurred.
4. Had the crew of BNSF local train RCHI4274-13I been required to hold a job briefing with the Dakota, Minnesota & Eastern Railroad dispatcher to confirm all applicable main track switch positions before releasing track warrant authority, it is likely the north yard hand-operated switch would not have been left lined for yard track Number 3.
5. The Federal Railroad Administration's decision to discontinue the Emergency Order 24 requirement that employees releasing track warrant authority report to the train dispatcher that all hand-operated main track switches have been restored reduces the safety of train operations on non-signaled main tracks.
6. The switch position reflector target for the north yard hand-operated switch did not adequately warn the approaching train of the incorrectly lined main track switch at a sufficient distance for the train to stop in time to prevent the accident.
7. The lessons learned from the Graniteville, South Carolina; Shepherd, Texas; and now Bettendorf, Iowa, accidents highlight the need for measures to ensure safety redundancy that is greater than those provided by current rules or regulations.

2.2 Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was the BNSF Railway local train RCHI4274-13I crew releasing track warrant authority before returning the north yard hand-operated switch to the correct position. Contributing to the accident was the dispatcher for the Dakota, Minnesota & Eastern (DME) Railroad granting track warrant authority to DME train B61-13 without holding a job briefing which would confirm the accurate positions of all applicable main track switches. Also contributing to the accident was a hand-operated switch position reflector target that could not be observed by the crew of train B61-13 at a sufficient distance to stop the train and avoid the accident.

3 Recommendations

As a result of its investigation of this accident, the National Transportation Safety Board makes the following safety recommendations:

To the Federal Railroad Administration:

Require railroads to install, along main lines in non-signaled territory not equipped with positive train control, appropriate technology that warns approaching trains of incorrectly lined main track switches sufficiently in advance to permit stopping. (R-12-27)

Revise Title 49 *Code of Federal Regulations* Section 218.105(d)(1) to require that, until the appropriate switch position technology is installed on main track switches in non-signaled territories that are not equipped with positive train control, train crews releasing track authority to the dispatcher must hold job briefings with the dispatcher and clearly convey the position of all main track switches that were used prior to releasing track warrant authority. (R-12-28)

Require that until appropriate switch position warning technology is installed on main track switches (in non-signaled territory not equipped with positive train control), when a main track switch has been reported relined for a main track, the next train to pass the location approach the switch location at restricted speed. That train crew should then report to the dispatcher that the switch is correctly lined for the main track before trains are allowed to operate at maximum authorized speed. (R-12-29)

To the Canadian Pacific Railway:

Require both train dispatchers and train crews to document switch positions and to hold job briefings to ensure that all main track switches in non-signaled territories are correctly lined before releasing track warrant authority. (R-12-30)

Require that until appropriate switch position warning technology is installed on main track switches (in non-signaled territory not equipped with positive train control), when a main track switch has been reported relined for a main track, the next train to pass the location approach the switch location at restricted speed. That train crew should then report to the dispatcher that the switch is correctly lined for the main track before trains are allowed to operate at maximum authorized speed. (R-12-31)

3.1 Previously Issued Recommendation Reclassified in This Report

After a similar accident on January 6, 2005, on the Norfolk Southern Railroad in Graniteville, South Carolina, in which a train cleared the main track at a hand-operated switch, the National Transportation Safety Board made the following safety recommendation:

To the Federal Railroad Administration:

Require that, along main lines in non-signaled territory, railroads install an automatically activated device, independent of the switch banner that will, visually or electronically, compellingly capture the attention of employees involved with switch operations and clearly convey the status of the switch both in daylight and in darkness. (R-05-14)

Safety Recommendation R-05-14, previously classified “Open—Acceptable Alternate Response,” is reclassified “Closed—Superseded by Safety Recommendation R-12-27.”

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

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Adopted: April 30, 2012