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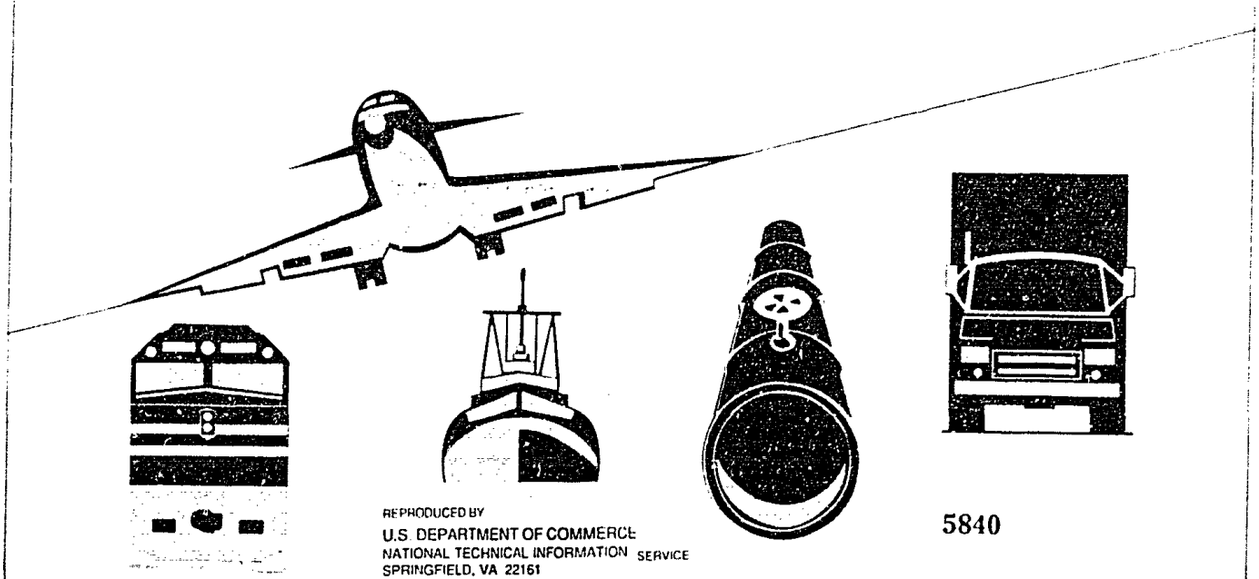
NTSB/RAR-92/02/SUM

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

RAILROAD ACCIDENT/INCIDENT SUMMARY REPORT

KNOX, INDIANA – SEPTEMBER 17, 1991



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Abstract: This publication contains one summary report of an accident investigated by the National Transportation Safety Board in Knox, Indiana, on September 17, 1991. The safety issue discussed in the report is crew coordination and supervision of locomotive operations during locomotive engineer training. A recommendation was made to the Norfolk Southern Railway Company concerning traincrew supervision and locomotive cab discipline.

National
Transportation
Safety Board

Washington, D.C. 20594

RAILROAD ACCIDENT/INCIDENT SUMMARY

Accident Number:	DCA-91-MR-010
Location:	Knox, Indiana
Date and Time:	September 17, 1991, 8 a.m. central daylight time (CDT)
Railroad:	Norfolk Southern (NS)
Type of Trains:	Train 277, container-on-flat-car; train 629, molten sulphur tank cars
Persons on Board:	Train 277 and train 629 had three crewmembers each
Injuries:	One death, one serious injury, and four minor injuries
Damage:	$3.5 million
Type of Occurrence:	Head-on collision, derailment, and hazardous materials release
Phase of Operation:	Train 277--en route west on single main track; train 629--en route east

About 8 a.m. on September 17, 1991, Norfolk Southern (NS) train 277, en route west from Fort Wayne, Indiana, to Chicago, Illinois, struck eastbound train 629 head-on at milepost (MP) 455.1 near Knox, Indiana. The accident occurred on the main track west of the Knox siding. One locomotive and four cars of train 277 and three locomotives and five cars of train 629 derailed. The engineer of train 277 was killed, and the conductor sustained serious injuries. The student engineer of train 277 and all three crewmembers on train 629 sustained minor injuries.

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

- Crew coordination and supervision of locomotive operations while an engineer is being trained.

Following a brief narrative of the accident, this summary report will discuss the postaccident investigation, the safety issue, related operating rule changes, and the NS's emergency response.

I. ACCIDENT

On September 17, 1991, the crew of train 629 went on duty at 3:15 a.m. central daylight time at Calumet Yard in Chicago, Illinois. The crew consisted of an engineer, a conductor, and a brakeman. After the crew completed an initial terminal air brake test, the train, consisting of 3 locomotive units and 95 loaded tank cars of molten sulphur, departed Calumet Yard about 5:20 headed eastbound for East Wayne Yard in Ft. Wayne, Indiana.

The engineer was operating the train from the control stand on the right side of the first locomotive unit--the normal procedure when the locomotive is being operated with the short hood forward, as it was in this case. The brakeman was sitting on the left side of the first locomotive unit, and the conductor was sitting in the engineer's seat on the second unit. The traincrew received "clear" signals from Calumet Yard (MP 510) to MP 468, and the train proceeded at its authorized speed of 50 mph.

At MP 468, the dispatcher radioed the crew and inquired about the train's location and speed. After the engineer responded, the dispatcher first informed the crew that the train would meet two westbound trains at the Thomaston siding. The dispatcher then changed his plan and instructed the crewmembers that their train would meet the westbound trains at the Knox siding. (See figure 1.) Train 629 was to enter the siding at Knox, allowing the westbound trains to pass on the mainline track.

As train 629 neared signal C (MP 456.2), the "approach signal" for the west end of the Knox siding (see figure 1), the signal changed unexpectedly from "approach diverging" (the traincrew should be prepared to enter the siding at 25 mph) to "restricting" (the train should not exceed 15 mph and the traincrew should be prepared to stop the train short of an obstruction or another train). The unexpected signal change indicated that there was a problem, such as a broken rail or another train, between the signal and the west end of the siding. The engineer stated that the train was traveling about 46 mph when he first saw the "approach diverging" signal and applied the dynamic brake. To comply with the "restricting" signal, he increased the dynamic brake and later applied the automatic brake.

Shortly after passing signal C, all three crewmembers saw the headlight of a westbound train (train 277). The engineer of train 629 applied the emergency brake, and the crew jumped off. The data from the event recorder recovered after the accident indicated that train 629 was traveling about 25 mph when it collided with train 277.

On September 17, the crew of train 277 went on duty at 5 a.m. in Ft. Wayne, Indiana (MP 366). The crew consisted of an engineer, a conductor, and a student engineer. The engineer performed the required air brake test. At 5:22 a.m., the train departed East Wayne Yard westbound for Chicago, Illinois. The train comprised one locomotive unit and seven loaded container-on-flat car (COFC) double stack cars.[1] All three crewmembers rode in the control compartment of the

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[1]Train 277 consisted of seven loaded cars; each car was made up of a five-unit, articulated, double-stack car, designed to hold two COFC containers per unit, or 10 per car. Car MAEX 10[illegible]5 (256 feet long) was damaged in the collision; four of its 51-foot long units derailed.

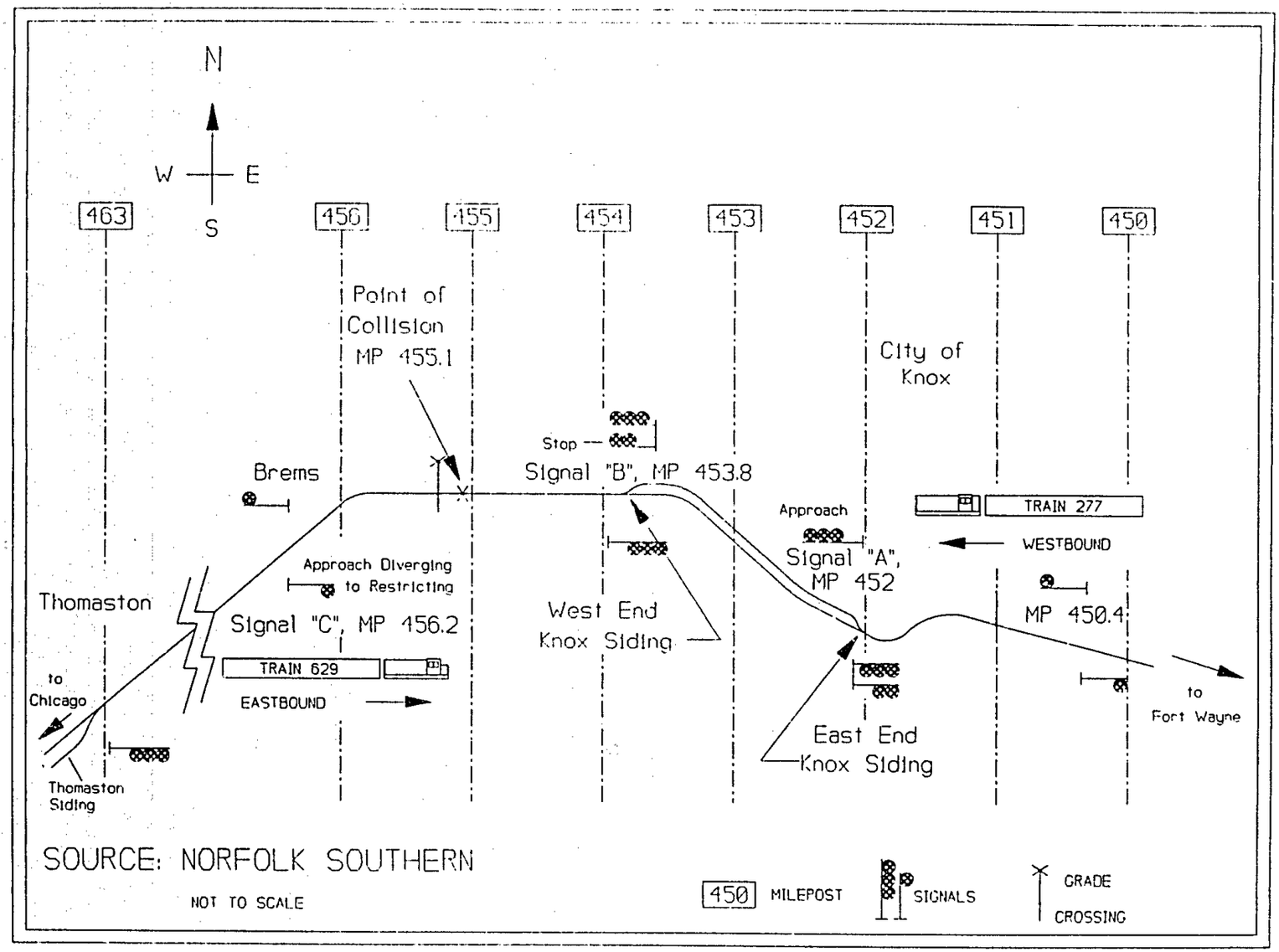

Figure 1.-- Knox siding.

locomotive, which was being operated with the long hood forward. The engineer operated from MP 366.3 to MP 419.8, at which location he allowed the student engineer to begin operating the train.

The student engineer said that the only problem observed was that the train's speed indicator registered the train's speed about 5 miles more than it was actually traveling. He stated that the engineer frequently stood behind him and instructed him on train handling operations.

According to the student engineer, the crew did not talk to the dispatcher after leaving East Wayne. The student engineer stated that he did hear a conversation between the dispatcher and another train, but he could not identify the train or the contents of the conversation. He also heard the dispatcher instructing train 144 to "get in the clear" and to permit train 277 to "run around it" at the MP 431 siding. The student engineer saw the other train in the siding when he passed.

The student engineer said that near MP 446 he started reducing the train's speed to 30 mph, as required by the timetable for the city of Knox. When the train reached MP 449, it was in full dynamic braking, and he applied about 10 pounds of automatic brake, further reducing the train's speed to about 25 mph. Shortly thereafter, he released the automatic brake and gradually took the train out of dynamic braking. He estimated that the train's speed was 21 mph when the locomotive neared MP 451.5 in the city of Knox. He stated that the engineer had been standing behind him giving train handling and braking instructions as the train passed through the city. When it was clear of the city, and thus the speed restriction, the student engineer began increasing the train's speed.

The student engineer said that he saw signal A (MP 452; see figure 1), the "approach" signal for the east end of the Knox siding, and thought it was clear, he did not describe the combination of colors that the signal showed. He also said he assumed the engineer saw the signal because the engineer was standing behind him. According to the student engineer, neither he nor the engineer called out the signal as required by operating rule 34. The student engineer stated that "as far as I know" (but he was not sure), the conductor called the signal clear.

The student engineer reported that the conductor then made the statement, "I guess we'll meet them at Thomaston," adding that he did not know to whom the conductor was referring. The conductor denied making the statement but said that he heard the dispatcher talking over the radio to the crew of another train.

Signal B (MP 453.8), the signal for the west end of the Knox siding, was clear, according to the student engineer. The investigation showed, however, that signal B, which is a "remote control" signal controlled by the dispatcher, displayed a "stop" signal. Train 277 should have stopped at signal B, which governs movement of trains on the main track at the west end of the siding. The student engineer stated that he observed "green over red" (the color combination that signifies clear) on the left column of signal lights. He said that neither he nor the engineer, who was in the middle of the cab at the time, called the signal. The conductor had moved from the rear seat to the front seat on the left side, and he called "clear," according to the student engineer, who said the signal was clear as the train passed it. The student engineer reported that he did not notice which way the switch was lined (whether it was set to allow train 277 to proceed on the main track or to allow train 629 to enter the siding). He estimated the train's speed at 35 mph and increasing when the locomotive passed the signal and switch.

According to the conductor, the crew had called all signals before reaching the Knox siding. However, the conductor said that he did not call the signals at either end of the siding or say anything about going to Thomaston. He stated that he was in the washroom from the time the train approached the siding to just before the collision. He said that when he entered the washroom, the engineer was seated on the left side of the locomotive and was not standing behind the student engineer, as the latter reported. He stated that when he came out of the washroom, the train was on single track and had already passed signal B, and he observed the engineer standing in the middle of the locomotive cab.

The conductor and the student engineer saw a light after they had passed signal B and at first thought it was the reflection of the sun from a metal building. All three crewmembers then realized that it was a locomotive headlight. The student engineer applied the emergency brake and jumped off the south side of the locomotive. The conductor said that he and the engineer did not have time to get off; instead, they sat on the floor and braced for the impact.

The trains collided about 8 a.m. on straight, level track at MP 455.1, about 6,812 feet west of the west end of the Knox siding. (See figure 2.) The weather was clear, and the temperature was 62 degrees F.

Within minutes of the accident, a track foreman working in the area notified the dispatcher, who, at 8:05 a.m., notified the Starke County police dispatcher. The police dispatcher immediately notified the Starke County and Knox police departments, the Starke County emergency medical service (EMS), and the Knox fire department. About 8:20 a.m., fire department personnel arrived at the crash site and observed the wreckage on fire. EMS personnel found four crewmembers immediately; the four had sustained minor injuries when they jumped from their locomotives. Three were from train 629, and the fourth was the student engineer from train 277. They were treated by EMS personnel and taken to Starke Memorial Hospital.

The fire department incident commander set up a command post at the site as soon as he arrived. The emergency was effectively handled even though the NS and the Knox emergency services had not developed any procedures before the accident for coordinating with each other. After the crew of train 629 told the State police that the train carried hazardous materials, about 30 families within a 2 mile area were voluntarily evacuated. The evacuation began at 9:10 a.m., and the families were permitted to return that evening after the fire was extinguished

The conductor of train 277 had been knocked unconscious, and the EMS personnel were unable to find him in the smoke-filled wreckage until he awakened on the ground and called for help. He was found in the wreckage on the north side of train 277 about 11:10 a.m. His injuries were serious, and he was taken first to Starke Memorial Hospital by ambulance and then to Parkland Hospital by helicopter. After the fire was extinguished, the burned remains of the engineer of train 277 were found in the locomotive. How the engineer died could not be determined

The NS estimated the damage to the locomotives, equipment, signals, and track at $3,476,788. One locomotive (NS 6134) and four cars of train 277 were destroyed. Three locomotive units (NS 6207, 8642, and 4636) of train 629, as well as five hazardous-material tank cars carrying molten sulphur, were destroyed. The fuel tanks on all four locomotive units were ruptured by the impact. The leaking diesel

Figure 2.--Accident site.

fuel ignited and burned the wreckage. The switch at the west end of the Knox siding and 212 feet of track at the point of the collision were destroyed. (See figure 3.)

The Safety Board's investigation team determined that the switch had been destroyed when train 277 passed through it while it was lined to allow train 629 to enter the siding. Train 277 bent the points and throw rods on the switch assembly.

The only event recorder on train 277 was destroyed in the accident. Train 629 had three locomotive units, each with an event recorder; two of the event recorders were destroyed by fire. The data pack from the event recorder on the third locomotive, NS 4636, was retrieved. Its data about braking and speed were read under the supervision of the Safety Board investigation team; the data verified the crew's statements.

II. POSTACCIDENT INVESTIGATION

In determining the cause of the accident, the Safety Board considered the following: the condition of the track and signals, the NS's operating procedures, the visibility of the signals, the distance required for train 277 to be stopped, and the background and qualifications of the crewmembers of both trains.

Track and Signals.--Investigators determined that neither the track nor the traffic control (TC) system had any deficiencies and that both had been maintained in accordance with the requirements of the NS and of the Federal Railroad Administration.

The signal relay tests performed after the accident, the printout from the dispatcher's TC machine, and the dispatcher's log show that the dispatcher had set the signals and the switch at 7:35 a.m. to allow train 629 to enter the west end of the Knox siding. The dispatcher's action automatically changed signal A at the east end of the Knox siding to an approach aspect and changed signal B to a stop indication for train 277 on the main track at the west end of the siding. (The TC system provides stop signals; it does not separate trains if the crews fail to comply with the signals.)

When signal C changed to "approach diverging," signal A was "approach" ("be prepared to stop at the next signal," signal B). If the crew on train 629 had been calling signals over the radio and if the crew on train 277 had been monitoring radio communications, the latter crew would have been aware that train 629 had an "approach diverging" signal and would, therefore, have known that train 277 was about to arrive at a "stop" signal.

Safety Board investigators found evidence in the TC computer log that train 277 failed to stop short of signal B: the log had recorded a change in the switch position and an occupancy of the track circuit over the switch when the train went through the switch. Thus, the investigation disclosed a lack of vigilance by the crew of train 277.

Method of Operations.--Trains operating in the Lake Division of the Chicago District are governed by the NS's bulletins and operating rules and by the Lake Division timetable No. 1 dated December 9, 1990. The dispatcher in East Wayne, Indiana, controls the TC signal system. A train receives authorization to move from TC signals. The train's speed is governed by bulletins, timetable special instructions,

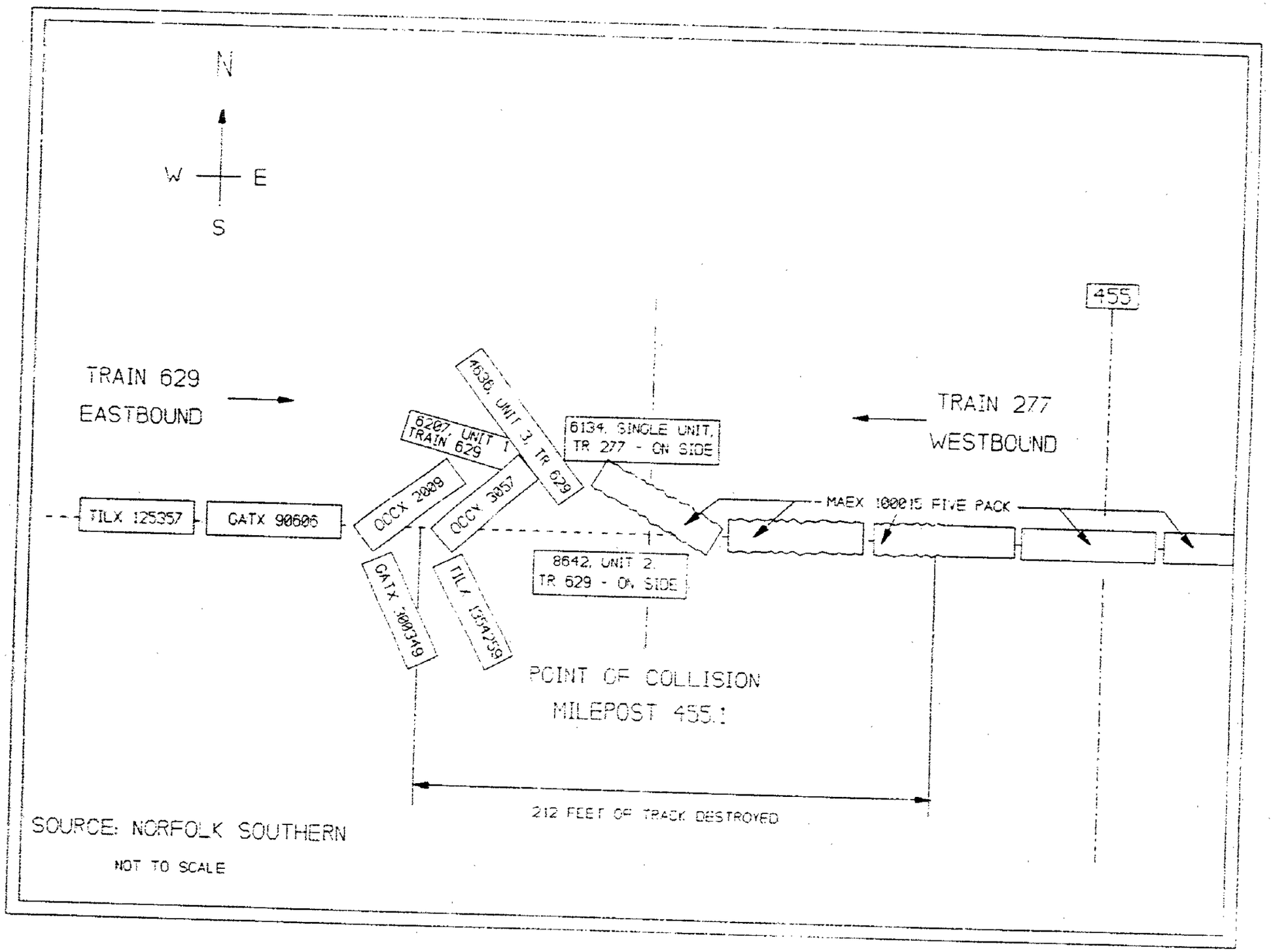

Figure 3.-- Collision site.

and TC signals. A COFC or stack train may not exceed 60 mph; a freight train may not exceed 50 mph.

Train crewmembers are responsible for complying with the carrier's operating rules. The NS's operating rule 34 states in part:

> The engineer must comply with the indication of each block, interlocking, and other signal that affects the movement. Crew members. . .must maintain a vigilant lookout for signals and conditions along the track that may affect the movement. Employees located in the operating compartment. . .must communicate to each other in an audible manner by its name the indication of each signal affecting the movement of their train or engine as soon as the signal is clearly visible. . .Each signal must be called. . . It is the responsibility of the engineer to have each employee comply.

The NS's operating rule 106 states, "The conductor, [and] engineer . . . are jointly responsible for the safety of the train. . .and for the observance of the rules." The conductor and engineer are required to instruct their crewmembers on performing in accordance with the rules. When necessary, the conductor and engineer must also take action to stop the train.

According to the NS's operating rules, if a "proceed" signal changes to a "stop" signal while a train is approaching or if the train encounters a "stop" signal not indicated by the "preceding" signal, the train must be stopped as soon as practicable without damaging it. The NS's train braking rules direct the engineer to apply the dynamic brakes first and to augment them with the automatic air brakes. The NS does not have a rule about how the engineer should handle the train if he encounters a "proceed" signal that is followed by a "restricting" signal (as happened to the engineer of train 629). However, NS rule 108 advises: "In case of doubt or uncertainty, the safe course must be taken." Thus, the crew of train 629 should have reduced the train to the restricted speed.

Before a train leaves its terminal, its traincrew is required to verify the dispatcher's bulletins. The crews of trains 277 and 629 each verified and accepted the dispatcher's bulletins.

Train 277 was a COFC train, and dispatchers normally handle COFC trains on a priority basis because the trains carry priority freight and operate at faster speeds. Nonetheless, a dispatcher may delay a COFC train if he believes the delay is necessary to expedite the movement of all trains. In this case, for example, the dispatcher planned to hold train 277 on the main track at signal B for a few minutes so that train 629 could enter the siding. Had the dispatcher instead held train 629 at the Thomaston siding until train 277 arrived, train 629 would have been delayed for much longer than a few minutes. It might have had to stay at Thomaston until train 144, which was behind train 277, reached the siding. Thus, the dispatcher acted in accordance with standard procedures.

Visibility and Sight-Distance Tests.--Because all three crewmen aboard train 277 failed to respond to either signal A or B, the investigators tested sight distance and visibility.

According to the NS, there is no record of frequent mishaps in the [illegible] area. Nor is there any record of traincrews complaining that visibility is poor or t[illegible]gnals are poorly placed or obscured by fog, glare, or other visual obstructions.

A traincrew in a locomotive that has a long hood forward has to be especially careful because the hood limits diagonal visibility.[2] The fireman and the brakeman/conductor have seats on the left side of the cab. Their view of the right side of the track is severely limited, particularly in a right-hand curve, such as the one train 277 was making when it passed signal A. A crewman who wants to call out the signals, as rule 34 dictates, must move from the left side of the locomotive to a position behind the engineer, who sits on the right. From that position, the crewman can look out the engineer's window to see and confirm signals.

Safety Board sight-distance tests indicated that the student engineer, who was sitting on the right, could have seen signal A, but only for 934 feet. It was not possible for the conductor or the engineer of train 277 to see signal A from the left side of the locomotive. According to the TC log, the train's average speed was 29 mph, or 42.5 feet per second, on the main track from the east to the west end of the Knox siding. At this speed, the student engineer, as well as anyone standing behind him, would have had approximately 22 seconds to see the signal before going past it.

After the train passed signal A, signal B would have been visible to anyone sitting on the left side for 3,600 feet, or 90 seconds, and to anyone sitting on the right side for 2,400 feet, or 55 seconds.

Tests showed that the crewmembers should have had one other warning to stop before they reached signal B. When they were still 4,000 feet east of signal B, they should have been able to see the headlight of train 629 from both sides for about 14,000 feet.

The testimony of the student engineer and the conductor of train 277 conflicted. The former said that the engineer was standing in the middle of the cab and that the conductor was seated on the left side, suggesting that both men were poorly placed for viewing signal A. The student engineer did not indicate that the conductor had left his seat. However, the conductor testified that he was in the locomotive's washroom when the train approached Knox, making it impossible for him to see the signals.

While on the ground following the collision, the conductor of train 629 stated that he talked to the student engineer of train 277. The former asked the latter, "What really happened?. . .Was you bull--------?" and the student engineer replied, "We were bull--------."

Because of the conflicting testimony of train 277's crewmembers, Safety Board investigators could not determine the exact position of each person as the train operated through Knox. The Safety Board concludes that the crewmembers of train 277 could have seen both signals, A and B, and that the sight distance was sufficient

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[2]Most locomotives have the short hood forward and the control stand on the right side. Some specially ordered locomotives have the long hood forward and the control stand on the right side.

for proper train operations. Regardless of where they were in the locomotive, the crewmembers should have been vigilant and should have observed signals A and B.

Speed and Stopping-Distance Tests.--Tests indicated that even if the crewmembers on train 277 had not seen signal A, the engineer could have stopped the train before it reached signal B, assuming that the train's speed was 29 mph and that he started to brake at MP 453.3, the point at which he was first able to see signal B. He could have used normal operating procedures, which require dynamic braking. A test train similar to train 277 was operated at 29 mph, the average speed of train 277, past signal A. The engineer of the test train used moderate dynamic braking to slow the train. A light application of the automatic air brake stopped the train about 482 feet short of signal B.

Tests also indicated that even if the train had been traveling faster than 29 mph, the engineer could have stopped it in time to prevent the accident, assuming again that he started to brake at MP 453.3. The test train departed MP 450.4 on a "clear" signal, passing signal A at 29 mph. After the train cleared the 30-mph restriction at MP 452, the engineer advanced the throttle to the number 8 power position. He kept the throttle in that position until signal B came into view. The train's speed at that point was 43 mph. Upon sighting signal B, the engineer applied a full-service automatic brake and gradually reduced the throttle from power 8 position to idle. The train stopped 850 feet beyond signal B. The collision occurred 6,812 feet beyond signal B.

Another test, conducted by the NS, revealed that had the engineer used the emergency brake, he could have stopped the train before it reached signal B. The test train departed MP 450 and operated at 43 mph until signal B came into view. The engineer applied the emergency brake, and the train stopped 497 feet short of the signal.

The Safety Board concludes that had the crewmembers of train 277 been vigilant and had they observed the signals as they were required to do by rule 34, they could have stopped the train, using normal or emergency braking, before reaching signal B, even if they had not seen signal A; thus, they could have avoided the accident.

Personnel.--The NS's records showed that all crewmembers on both trains had attended operating and safety rules classes in the past year. In accordance with the Hours of Service Act, all of them had been off duty for 8 or more hours before they reported for duty. All had recently passed medical examinations. After the accident, the NS had ComPuChem Laboratories test samples from each crewmember for toxicants. All results were negative.

III. CREW COORDINATION

Train 629.--The crewmembers of train 629 appear to have been vigilant. They communicated among themselves and with the dispatcher.

The dispatcher radioed the engineer on train 629 about a meet with two trains at Thomaston. When the engineer told the dispatcher that he was running at 50 mph, the dispatcher replied, "Okay, I got you lined up at Knox," indicating that he had lined the track switches to permit train 629 to enter the Knox siding. According to the engineer, the train went through a "clear" signal at Thomaston, MP 463, and

proceeded to Brems, MP 456.2, where signal C showed "approach diverging," indicating that the train was to enter the siding. (See figure 1.)

When the brakeman saw signal C, he called "approach diverging." The engineer had already started braking because he was expecting to enter the siding. Upon reaching signal C, both the brakeman and the engineer called "approach diverging" again, but just before they passed the signal, it unexpectedly changed to "restricting." When the signal changed, the engineer looked at the brakeman, who called the signal, and then back at the conductor, who was riding in the second locomotive unit. Both affirmed that the signal was "restricting." To comply with the signal, the engineer applied full dynamic braking, which he later augmented with the automatic train brake. When he and the other crewmembers saw train 277, he applied the emergency brake.

In summary, the three crewmembers of train 629 kept a vigilant watch as they approached Knox. The engineer anticipated and listened for the brakeman to call signals. Since the engineer was aware that he was to meet two trains, he approached the siding with caution and took added braking precautions when the signal unexpectedly changed from "approach diverging" to restricting. When the engineer realized that the collision was imminent, he instructed the brakeman to leave the train, and they both jumped off. The Safety Board believes that even had the crewmembers of train 629 managed to stop the train, the collision would still have occurred because train 277 was gaining speed.

Train 277.--The engineer and the student engineer had completed 11 training runs over this territory together between September 3 and September 15, 1991. The engineer knew that the student had a college education, a rarity in this craft, and he also knew that the student was one of the top pupils in the NS's school in Georgia. These factors, coupled with the fact that no unusual occurrences were reported during the training trips, may have led the engineer to be overly confident about the student's abilities. Consequently, the engineer may have relaxed his vigilance, even though he was an instructor engineer.

Even though the student had made 11 trips over the Knox territory, he was not qualified on the physical characteristics of the territory and may not have been watching for the signals. When Safety Board investigators interviewed him, he said he was unfamiliar with the territory. His unfamiliarity should have heightened his vigilance, as well as that of his supervisors (the engineer and the conductor), so that he would not be taken by surprise and would be prepared to respond to operational track situations.

Because of the long hood forward, the conductor and the engineer could not have seen signal A unless they were on the engineer's side of the cab looking forward. Moreover, in a locomotive with the long hood forward, it is difficult to see the control panel from any position other than in or directly behind the engineer's seat. Thus, the engineer and/or the conductor should have been on the right side of the cab when necessary to see signals blocked by the locomotive hood.

For several reasons, all crewmembers might have expected that the train would not be stopped at the Knox siding but would instead meet train 629 at Thomaston:

- The conductor on train 277 may have overheard only part of the radio conversation between the train dispatcher and train 629. If he did not hear what the engineer of train 629 said, he possibly did not realize that the dispatcher had changed the meeting place from Thomaston to Knox.

- Train 277 was a double-stack, COFC train, which dispatchers usually handle on a priority basis.

- Because the "approach" signal at MP 450.5 displayed a clear aspect, the crewmembers knew before reaching signal A that the track was lined to allow them to take the main track through the siding. This routing down the main track through the siding suggested that the train would be able to proceed without stopping because a train usually is not held on the main track when it is the first train to reach a siding.

Regardless of these circumstances, train 277 should have complied with signals A and B; crewmembers should have stopped the train at the "stop" signal displayed by signal B. Since the conductor and engineer were not properly positioned to see signal A, the crewmembers possibly missed the only available advance warning that they had to stop the train at signal B. Nonetheless, the crewmembers on train 277 did not comply with rules 34 and 106: the engineer and the conductor did not adequately supervise the student engineer, and none of them called the signals as they were required to do.

Good crew coordination is imperative, especially when one crewmember is receiving on-the-job training. The engineer had been an engineer for 19 years and had a very good performance record. He had been a successful instructor of student engineers during that time. However, in this case, the engineer and the student engineer apparently did not talk about the Knox siding, the speed and handling of the train, or the other operational subjects that one would expect them to discuss in a training situation. In fact, the engineer was neither vigilant nor in charge of operations as his responsibilities dictated.

The Safety Board concludes, based on the statements of both conductors and the student engineer, that there was inadequate crew coordination as the train approached the siding and that the conductor and engineer made little or no effort either to supervise the student engineer or to observe and confirm signals.

IV. OPERATING RULE CHANGES

One day before the Knox accident, the Safety Board issued Safety Recommendation R-91-30 to the NS as a result of the Safety Board's investigation of a collision at Sugar Valley, Georgia.[3]

The safety recommendation asked the NS to "revise the Carrier's Operating Rules 34 and 106 to incorporate systemwide the language of the Georgia Division Superintendent's bulletin 0-108, dated October 4, 1990, which requires all

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[3]Railroad Accident Report--"Collision and Derailment of Norfolk Southern Train 188 with Norfolk Southern Train G-38 at Sugar Valley, Georgia, August 9, 1990" (NTSB/RAR-91/02)

crewmembers to acknowledge on the radio the indication of each control signal to the engineer." On November 8, 1991, less than 2 months after the Knox accident, the NS incorporated Safety Recommendation R-91-30 throughout its system.

On November 18, 1991, the NS's Lake Division (the division in which the Knox accident happened) issued the following bulletin:

> Operating Rule 34 is supplemented as follows:
>
> A crew member on the controlling locomotive will communicate by radio the name and location of each signal affecting his movement as soon as the signal becomes clearly visible.
>
> If there are crew members on the trailing units and/or caboose they will acknowledge the transmission, repeating the information to crew member(s) on the controlling locomotive.
>
> Examples of correct procedure to initiate or acknowledge the radiotransmission are:
>
> > Engineer Jones, NS Train 187, has an Approach signal at MP 179.3 for Cumberland Falls, over.
> >
> > Brakeman Smith, NS Train 187, acknowledging the Approach signal at MP 179.3 for Cumberland Falls, out.
> >
> > Conductor Scott, NS Train 194, has a Diverging Approach signal at the north end of Philpott, over.
> >
> > Brakeman Hodges, NS Train 194, acknowledging the Diverging Approach signal at the north end of Philpott, out.

The change in rule 34 permits crewmembers on a train to listen to crewmembers from other trains calling signals on the radio. Thus, crewmembers are more likely to be aware of the location of a train close to them. The change also makes it easier for the NS, by monitoring the radio, to find out whether crewmembers are calling signals.

Had rule 34 been changed before the Knox accident, the crewmembers of both trains, 629 and 277, would have been required to call the signals and their locations over the radio as they approached the Knox siding. Since the crewmembers of train 277 stated that their radio worked and that they had earlier monitored communications between the dispatcher and other trains, they probably would have monitored the communications among train 629's crew. Having done so, the crewmembers on train 277 would have been alerted to three facts: train 629 was coming toward them, train 629 was to enter the Knox siding, and train 629 had an "approach diverging" signal.

When signal C changed to "approach diverging," signal A was at "approach" ("be prepared to stop at the next signal"; in this case, signal B). Had the crewmembers on train 277 been aware that train 629 had an "approach diverging" signal, they would have known that train 277 was about to encounter a "stop" signal.

The Safety Board believes that had the NS implemented rule 34 systemwide after the Sugar Valley accident, the accident might not have occurred

V. NORFOLK SOUTHERN'S EMERGENCY RESPONSE

During the on-site accident investigation, the Safety Board found that the emergency response effort was effective, even though the fire department incident commander mentioned a lack of coordination with NS management on scene. NS personnel notified the Starke County police dispatcher of the accident but did not immediately contact the county incident commander upon arrival at the scene because they thought that the emergency effort was well organized and because they were involved with other accident-related activities, such as caring for injured crewmembers, clearing the accident site, and investigating the accident. Better on-scene coordination between the NS and the fire department might have been helpful, given the large amount of molten sulphur involved; and the Safety Board has addressed this issue previously.

As a result of its 1991 safety study on hazardous-materials transportation by rail,[4] the Safety Board issued Safety Recommendations R-91-15 and -16 to the NS on July 1, 1991. Recommendation R-91-15 urged that procedures be implemented for coordinating activities between the railroad and emergency response personnel, including conducting disaster drills to test emergency response plans. Recommendation R-91-16 addressed training procedures and methods of evaluating the knowledge that supervisors, traincrews, and emergency response personnel have of the emergency procedures to use when hazardous materials have been accidentally released.

Before the Knox accident, the NS had begun a training program for fire department personnel in communities alongside the tracks that it uses to transport hazardous materials. Because of the large number of communities that qualified, the NS provided training only on request. Between 1988 and 1991, the NS had conducted training sessions for the fire departments of 53 communities. The city of Knox was not aware of the training and had not requested it.

After the accident, in compliance with Safety Recommendations R 91-15 and -16, the NS began contacting all communities on its routes to offer them training and the opportunity to test their emergency response plans during disaster drills. On December 17, 1991, the Safety Board classified both safety recommendations as "Closed--Acceptable Action."

VI. CONCLUSIONS

1. The engineer and the conductor of train 277 failed to properly supervise the student engineer while approaching the siding at Knox.

2. Train 277s crew demonstrated a lack of vigilance and crew coordination in failing to stop at signal B.

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[4]Safety Study--"Transport of Hazardous Materials by Rail" (NTSB/SS-91/01).

3. Train 277s crew could have seen signals A and B, and the sight distance was sufficient for proper train operations.

4. The crewmembers of train 277 could have stopped the train in time to avoid the accident, using either normal or emergency braking, had they seen and responded appropriately to either signal A or B.

5. Changing rule 34 to require that crews call signals over the radio should help to prevent future accidents.

6. Before the accident, Norfolk Southern and the Knox-area communities had not implemented adequate measures to ensure on-scene coordination

VII. PROBABLE CAUSE

The National Transportation Safety Board determines that the probable cause of this accident was the failure, due to a lack of vigilance, coordination, and discipline, of the crew of train 277 to comply with the signals at Knox. Contributing to the accident was the inadequate supervision of the student engineer by the engineer and conductor.

VIII. RECOMMENDATION

As a result of its investigation of this accident, the National Transportation Safety Board recommended that the Norfolk Southern Railway Company:

> Review and revise your programs for traincrew supervision, locomotive cab discipline, and training of student engineers in light of the circumstances of this accident, and make necessary improvements. (Class II, Priority Action) (R-92-09)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

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September 28, 1992