U.S. Department of Transportation

Federal Railroad Administration

Office of Railroad Safety
Summary Report

Collision of Amtrak Train P09103 and CSX Train F77703
Cayce, South Carolina
February 4, 2018

EXECUTIVE SUMMARY

On Sunday, February 4, 2018, at 2:27 a.m., EST[1], stationary CSX Transportation (CSX) freight train F77703 (Train 1) was struck by southbound National Railroad Passenger Corporation (Amtrak) passenger train P09103 (Train 2) in the Silica storage track at Milepost (MP) S 367.1. The accident occurred on the CSX Columbia Subdivision in Dixiana, South Carolina[2]. Dixiana is an unincorporated community south of Cayce, South Carolina, in Lexington County.

Train 2 encountered a misaligned switch at MP S 366.9 while traveling 57 mph. Train 2 was directed into the Silica storage track where Train 1 was parked, and struck Train 1 at a recorded 50 mph.

The Engineer and Conductor of Train 1 were killed in the collision. The Assistant Conductor, 6 on-board Passenger Service Attendants, 122 passengers on Train 1, and the Conductor of Train 2 were also injured.

Estimated damages to track and equipment in the accident was $17,336,899.

The normal method of operation on the Columbia Subdivision is a Traffic Control System (TCS), which utilizes color light signals to authorize movement in both directions. On the day of the accident, CSX was in the middle of a three-day signal suspension for signal system upgrades. An active signal system would have likely prevented Train 2 from entering the block where the switch was misaligned.

The Federal Railroad Administration (FRA) investigation determined the probable cause of the accident was the crew of Train 1 leaving the switch at MP S 366.9 improperly lined for the storage track.

Additionally, FRA determined the following to be contributing factors in this accident:

- The crew of Train 1 did not properly release their authority limits back to the CSX Dispatcher.
- The crew of Train 1 did not follow procedures to document the position of main line switches used on non-signaled track.
- The crew of Train 1 did not properly discuss the position of main line switches before releasing their authority.
- The suspension of the signal system on the Columbia Subdivision between MP S 362.5 and S 385.1.

[1] All times throughout this report are Eastern Standard Time (EST) unless otherwise stated.

[2] Dixiana, South Carolina, is commonly referred to as West Columbia, or Cayce. Cayce, South Carolina, will be used throughout this report.

CIRCUMSTANCES PRIOR TO THE ACCIDENT

Train 1 Equipment

Train 1 was a local switcher based out of Cayce Yard, Cayce, South Carolina, consisting of 2 locomotives (CSX 130 and CSXT 36) and 38 loaded auto racks. It was 3,718 feet long and had 2,891 trailing tons when it departed Cayce Yard. Train 1 was scheduled to place the 38 loaded auto racks at the TDSI Dixiana Automotive Distribution Center (auto ramp), and pull 34 empty auto racks.

Train 1 Crew

The crew of Train 1 consisted of an engineer and conductor. Both employees were placed on duty at 3 p.m., at Cayce Yard, their home terminal, after receiving more than the required statutory off-duty period. Due to congestion on the main line, Train 1 was unable to depart Cayce Yard when the crew was placed on duty. Instead, the crew was instructed to perform other work while they were waiting for permission to travel to the auto ramp.

Train 2 Equipment

Train 2 is a regularly scheduled passenger train that operates daily service between New York, New York, and Miami, Florida. At origin, Train 2 consisted of one electric locomotive (ATK 665) and seven cars which included: three coach cars, one dining car, two sleeper cars, and one baggage car. (See Table 1: Train 2 Consist)

Car Number	Equipment Type	Occupied
ATK 47	Locomotive	Yes
ATK 25037	Amfleet II Coach	No
ATK 25072	Amfleet II Coach	Yes
ATK 25020	Amfleet II Coach	Yes
ATK 28002	Amfleet II Café	Yes
ATK 62012	Viewliner Sleeper	Yes
ATK 62008	Viewliner Sleeper	Yes
ATK 61048	Viewliner II Baggage	No

Table 1: Train 2 Consist

Train 2 received a class 1 brake test by qualified Amtrak mechanical personnel at 12:10 a.m., on February 3, 2018, at Amtrak's Sunnyside Yard, New York City. Upon arriving at Union Station, Washington, D.C., ATK 665 was removed, and diesel locomotive ATK 47 was added.

Train 2 Crew

The operating crew of Train 2 consisted of an engineer, conductor, and assistant conductor, and was placed on duty at 10:43 p.m., in Hamlet, North Carolina. Additionally, six onboard service attendants were assigned to Train 2 that were already onboard when the train arrived in Hamlet.

Accident Location

The accident occurred on CSX's Columbia Subdivision in Dixiana, South Carolina. Dixiana is an unincorporated town south of Cayce, South Carolina. Timetable direction on the Columbia Subdivision is south, and will be used throughout the report. Through the accident area, there is a single main line with a storage track (Silica storage track) on the west side of the main line, and an industrial lead (east storage track) to the auto ramp on the east side. The north end of Silica storage track is located at MP S 366.9, and is equipped with a hand throw, electric lock switch. An ascending grade begins about MP S 366.0 to S 367.1 of up to 1.01-percent. Leading up to the accident location, an estimated 4.5-degree, left-hand curve exists before the track becomes tangent through the accident area.

The Columbia Subdivision is signaled territory that is controlled by a dispatcher in Jacksonville, Florida, using a Centralized Traffic Control (CTC)[3] system. However, the signal system in the accident area at the time of the accident was suspended for an upgrade to the signal system. The temporary signal suspension required trains to operate from MP S 362.5 to MP S 385.1 under Track Warrant Control (TWC)[4], where trains would receive an EC-1 authority[5], via radio, granting them authority for movement through the signal suspension limits. The maximum authorized speed throughout the accident area was 59 mph for passenger trains, and 40 mph for freight trains.

Timeline Leading Up to The Accident

Due to the signal suspension, and trains on the Columbia Subdivision, Train 1 was unable to depart Cayce Yard as scheduled. At about 8:32 p.m., on February 3, 2018, the CSX Dispatcher issued Train 1 its authority onto the main track with limits between MP S 365.8 and S 369.7, and Train 1 departed Cayce Yard. At about 9 p.m., Train 1 arrived at the auto ramp and began its scheduled work, which required them to use both switches to Silica storage track, MP S 366.9 and S 367.9, and the switch on the east storage track, MP S 367.0.

At about 11:42 p.m., the crew of Train 2 had taken control and departed from Hamlet, proceeding on their scheduled route towards the accident location.

At about 1:38 a.m., on Sunday, February 4, 2018, Train 1 had completed its scheduled work at the auto ramp. Train 1 pulled out of the north end of the east storage track onto the main track, and continued past the north end of Silica storage track. The Conductor lined the switch on the north end of Silica storage track, and Train 1 proceeded to back into Silica storage track stopping just behind the derail, which was still on the non-derailing position from the previous time Train 1 used the track. The Conductor of Train 1 then lined the derail on the north end of Silica siding

[3] Centralized Traffic Control (CTC) is a method of operation in which all train movements are authorized, and governed, by interlocking signals issued by a centralized train dispatcher.

[4] Track Warrant Control (TWC) is a set of verbal instructions, issued to a train crew, authorizing a train to occupy main tracks and make specific train movements.

[5] An EC-1 is a form used by CSX to document authorization to use the main track, and any intervening switches, under the direction of the train dispatcher where a signal system is not in use.

for the derailing position, walked across the main track and restored the switch on the north end of the east storage track for movement on the main track. He then restored the derail on the east storage track to the derailing position and returned to Train 1 leaving the switch on the north end of Silica storage track lined into the storage track.

Train 1 coupled the two locomotives to the 34 empty auto racks they had pulled, and was now 3,196 feet long, with 1,797 trailing tons. At about 1:51 a.m., the Conductor released the Train 1's authority to occupy the main track to the CSX Dispatcher, reporting that all switches had been restored to their normal position.

At about 2 a.m., Train 2 was at its scheduled stop at Columbia Passenger station. The Conductor of Train 2 moved from the passenger cars to the locomotive to assist the Engineer while they operated through the limits of the signal suspension, and the CSX Dispatcher issued Train 2 its authority to occupy the main track through the limits of the signal suspension, MP S 362.5 and S 385.1.

The Engineer of Train 1 questioned the Conductor about the position of the switch at the north end of Silica storage track.

After departing the passenger station in Columbia, Train 2 stopped momentarily at MP S 362.5 for permission past the stop signal, and into the signal suspension. At 2:21 a.m., the CSX Dispatcher confirmed Train 2 had authorization into the signal suspension, and Train 2 began to proceed south.

In the moments leading up to the accident, the Engineer of Train 1 was on the ground walking in the direction of the switch at MP S 366.9, while the Conductor remained on locomotive CSXT 130. On Train 2, the Engineer and Conductor were seated on locomotive ATK 47, and the Assistant Conductor was seated in the dining car.

At the time of the accident, it was dark, cloudy, and 39° F.

THE ACCIDENT

As Train 2 was rounding the 4.5-degree left-hand curve at 57 mph, it encountered the switch at the north end of Silica storage track, MP S 366.9, and was unexpectedly directed from the main into the storage track where Train 1 was parked. The Engineer of Train 2 initiated an emergency brake application 659 feet before the collision, at 2:27:24.

The Engineer from Train 1, who was walking north in the direction of the switch at MP S 366.9, ran west up the embankment of the Charleston Highway overpass when Train 1 entered the storage track. The Conductor of Train 1, also seeing Train 2 enter the siding, ran from the cab of CSXT 130 through the rear door behind the engineer seat and down the walkway on the east side of the locomotive.

Train 2 collided head-on with Train 1 at 2:27:27 a.m., still traveling 50 mph. (See Figure 1: Accident Site) ATK 47 overrode CSXT 130, with the nose and operating cab of ATK 47 folding completely under its deck. ATK 47 then rolled over on its left side and off CSXT 130 coming to rest on its side about 150 feet from the point of impact. The first coach car, ATK 25037, followed ATK 47 atop CSXT 130 before also rolling to the left and on its side. It experienced buckling in the roof and partial loss to the occupant volume in the front third of the car. The second coach car, ATK 25072, derailed the lead trucks coming to rest upright. The third coach car, ATK 25020, did not derail. The café car, ATK 28002, buckled over 90-degrees in the

middle into a "V" shape. The two sleeper cars, ATK 62012 and ATK 62008, and the baggage car, ATK 61048, all derailed and came to rest upright.

Figure 1: Accident Site

Train 1 was shoved back 15 feet from the impact. The collision posts of CSXT 130 were sheared off as ATK 47 overrode the locomotive, but none of the cars or locomotives from Train 1 were derailed.

After checking on the passengers from the café car, the Assistant Conductor made an emergency broadcast over the radio, and established communication with the CSX Dispatcher. The Engineer of Train 1 returned to the POI, and located the Conductor from Train 1 between CSXT 130 and ATK 47, covered in diesel fuel, with no visible injuries. The Engineer's cell phone was still on the locomotive when the accident occurred, so he borrowed the Conductor's cell phone and called the CSX Yardmaster at Cayce.

First responders to the accident began to arrive at 2:35 a.m., and included:

- Lexington County Emergency Medical Services (EMS);
- Lexington Police Department;
- Lexington County Sheriff's Office;
- Richland County Sheriff's Office;
- Cayce Police Department;

- Springdale Police Department;
- South Carolina State Police;
- Cayce Fire Department;
- Lexington County Fire Department;
- West Columbia Fire Department; and,
- Columbia Fire Department.

Also on scene were the National Transportation Safety Board (NTSB), Federal Bureau of Investigation (FBI), Volpe National Transportation Systems Center (Volpe), U.S. Department of Homeland Security, South Carolina Governor Henry McMaster, South Carolina Secretary of Transportation Christy Hall, James Ray (Office of the Secretary of Transportation, U.S. DOT), and South Carolina Environmental Protection Agency.

On Train 2, the Engineer and Conductor were fatally injured, and the Assistant Conductor, 6 Passenger Service Attendants, and 122 passengers reported injuries. Emergency response reports reflect 61 individuals were transported to 5 area hospitals:

- Lexington Hospital;
- Park Ridge Hospital;
- Baptist Hospital;
- Palmetto-Richland Hospital; and,
- Veterans Affairs Hospital.

The Engineer and Conductor of Train 1 were transported to the hospital by CSX officers for toxicological testing and later released. The Engineer and Conductor of Train 2 were removed from the scene by the coroner. Pine Ridge Middle School was set up as a shelter for all passengers who were not transported to the hospital.

Estimated damages to track and equipment in the accident were $17,336,899. No hazardous materials were in either train; however, a contractor was hired to mitigate the diesel fuel that was released from the locomotives.

INVESTIGATION FINDINGS AND ANALYSIS

FRA investigated this accident, with participation from NTSB, Volpe, Amtrak, and CSX. The investigation included collecting physical evidence, performing tests and inspections, conducting interviews, and reviewing records of the personnel and equipment involved in the accident.

Motive, Power, and Equipment

Motive, Power, and Equipment (MP&E) inspectors from FRA participated in an inspection of the cars and locomotives at the accident site. Both trains had received all pre-departure inspections and air brake tests required by federal regulation.

The physical inspection of Train 1 revealed a single defect for a broken uncoupling lever on a railcar, but nothing that would have contributed to the cause or severity of the accident.

Similarly, the physical inspection of Train 2 revealed minor defects to the interior signage and markings of the passenger cars, but nothing that would have contributed to the cause or severity of the accident.

FRA determined that while several minor defects were identified in the post-accident mechanical inspection, none of the identified defects would have affected the operation of either train.

Therefore, the mechanical condition of Train 1 and Train 2 did not contribute to the cause or severity of the accident.

Forensics

In the accident, the lead locomotive of Train 1, CSXT 130, experienced a total loss of survival space. (See Figure 2: CSXT 130) The collision posts of CSXT 130 were displaced and found resting horizontally on the deck, sheared off at the floor. The cab structure of CSXT 130 was removed, resulting in a cleared deck, and the truck bolster from the first coach car in Train 2 was found on the deck. Both stairways of CSXT 130 were compressed, and the car body displaced rearward.

Figure 2: CSXT 130

The lead locomotive of Train 2, ATK 47, also experienced a total loss of survival space. (See Figure 3: ATK 47) The front end of the locomotive crushed and bent to the right, penetrating the cab compartment. The locomotive deck folded 180-degrees underneath the locomotive so the lead coupler was facing the opposite direction of travel. The fuel tank on ATK 47 ruptured, and the locomotive toppled over onto the left side.

Figure 3: ATK 47

Passenger car ATK 25037 was unoccupied. The lead truck assembly disconnected from the car body, and the truck bolster was detached and found on the deck of CSXT 130. A sharp buckle was found around the circumference of the car near the second window from the leading end of the car, causing the displacement of the window and the ceiling and luggage rack falling to headrest level. (See Figure 4: ATK 25037)

Figure 4: ATK 25037

Passenger car ATK 25072 and ATK 25020 were both occupied. Both cars experienced damage in the accident; however, there was no loss of survival space in either car.

Café car ATK 28002 was occupied by the Assistant Conductor and one passenger. The car experienced complete structure failure near the fourth window from the leading end. The car came to rest in a "V" shape with a large opening at the apex. (See Figure 5: ATK 28002) The floor of the car deformed upward near the middle of the car, where the car was broken in half, which resulted in the loss of survival space.

Figure 5: ATK 28002

Cars ATK 62012, ATK 62008, and ATK 61048 were damaged, but there was no loss of survival space within any of the cars.

Signal System

The signal system on CSX's Columbia Subdivision from MP S 359.7 to MP S 497.2 consisted of a Traffic Controlled System (TCS) that governed movement in both directions. The Train Dispatcher for the Columbia Subdivision was in Jacksonville, Florida. The normal method of operation was by signal indication of the TCS.

At the time of the accident, the signal system was suspended for the installation of Positive Train Control (PTC) components. The dispatcher was using TWC as an alternate method of train operation. During the signal suspension, controls and indications were disabled from the Dispatcher, and all power-operated switches were in hand-throw mode.

A post-accident inspection of the switch located at MP S 366.9 was completed. No damage occurred to the switch or the equipped electric lock. The switch was found locked in the reverse position, lined into the storage track, with a switch lock.

The post-accident inspection found all signal equipment secured with no indications of tampering or vandalism. Had the signal system had been in service, trains would have been authorized by CTC signals, and the system would have recognized the misaligned switch on the north end of Silica storage track, and stopped Train 2 until the switch was restored.

FRA determined that while the suspended signal system did not contribute to the cause or severity of the accident, the signal suspension itself contributed to the cause of the accident.

Track

A complete inspection of the track and road bed from MP S 366.6 to MP S 367.5 was conducted by an investigation team comprised of maintenance of way (MOW) personnel from FRA, NTSB, CSX, and Amtrak. This inspection included the single main track, east storage track, and Silica storage track. Track geometry measurements taken at the scene complied with the FRA Track Safety Standards for the intended class. Special attention was given during the inspection of the switch and sliding derail at the north end of Silica storage track. All damage found at the switch is damage that was caused by Train 2 traveling through the switch at a speed higher than the track is designed to withstand.

The investigation team found nine defective conditions. None of these defects would have contributed to or caused this accident. The investigation team determined the track alignment was uniform with compliant crosstie conditions. No unacceptable track surface conditions existed. Track drainage conditions were acceptable. The main track was maintained to Class 3 track standards.

As part of the investigation, a complete review of CSX's track inspection records, geometry test records, internal rail test records, regulatory track inspection history, and FRA automated track inspection program reports were made by the investigation team. No exceptions were noted.

FRA determined the track and roadbed did not contribute to the cause or severity of the accident.

Operating Practices

Event Recorder Data

FRA analyzed event recorder data provided by CSX and Amtrak. CSX event recorder data indicated both CSX locomotives were shut down and stationary for more than 25 minutes prior to the collision. CSXT 36, Train 1's trailing locomotive, indicated the impact occurred at 2:27:27 a.m.

ATK 47's event recorder data prior to the collision indicated train handling was consistent and expected for the train movements made. About 300 feet, or approximately four seconds, prior to impact, the data shows the Engineer initiated an emergency application of the air brakes, changed throttle position from T-8 to Idle, and sounded the horn with the bell on. The speed decreased from 57 mph to 50 mph prior to impact. No additional data was retrievable beyond this point.

CSXT 130's, Train 1's lead locomotive, forward-facing video captured a northward view of Train 1 departing the auto ramp onto the single main track. The video shows Train 1 then

making a reverse move into the north end of Silica storage track. As CSXT 130 moved southward past the north end of Silica storage track switch, it was evident the switch remained aligned for Silica storage track. The Train 1 Conductor was visible stepping down from the front west side of CSXT 130 near the derail at the north end of Silica siding. The Train 1 Conductor was then seen manually operating the Silica storage track derail to the derailing position, and locking the handle. The Train 1 Conductor then walked east towards the north end East storage track switch, lined it for normal movement (on the main track), and locked the handle. The Train 1 Conductor then walked south and lined the derail on the north end East storage track to the derailing position, and locked the handle. The Train 1 Conductor was last seen in the video walking south to the rear of the locomotive consist to make the coupling. The locomotive consist was coupled to the empty auto racks, and at 1:54 a.m., the headlight was turned off.

At 2:25:55 a.m., CSXT 130 was stationary when the headlight was illuminated to bright and then extinguished. Based on post-accident interviews, FRA concluded the crew of Train 1 did this to verify the position of the switch at the north end of Silica storage track. At about 2:26 a.m., a light consistent with that of a flash light was observed shining on the CSXT 130 windshield, and then on the ground on the east side of CSXT 130. The video showed the Engineer walking, with his flashlight, on the west side of Silica storage track towards the switch when Train 2's headlight was visible as it approached Silica storage track at 2:26:54 a.m.

The CSXT 36 forward-facing video captured a southward view of the locomotive movement out of the auto ramp onto the single main track. The view then shows the reverse move from the main track, through the switch, and onto the north end of Silica storage track before coming to a stop. At 1:47 a.m., the video showed the movement continued southward and CSXT 36 coupled to the first empty auto rack on Silica storage track. At 2:27:27 a.m., the video shows the locomotive lurched, and moved about 15 feet south.

The ATK 47 forward-facing video captured the southward movement until about 2:26:30 a.m. At that time, the ATK 47 was .9 miles from the accident site. The video between 2:26:30 a.m. and the POI was not recovered due to the damage to ATK 47.

The investigation team requested Amtrak provide a copy of an example video of what the Train 2 Engineer and Conductor may have seen just prior to the MP S 366.9 switch. Amtrak provided a previously recorded video from March 2018 of Amtrak Train P09103, operating at the same time, same speed, and in similar weather conditions. The video showed the approach to the MP S 366.9 switch. The team concluded that a person could not recognize the position of the switch until a locomotive was already on top of the switch. This would not allow time for the engineer to take corrective action, even under ideal circumstances.

FRA determined train handling did not contribute to the cause or severity of the accident.

Fatigue Analysis

FRA uses an overall effectiveness rate of 77.5 percent as the baseline for fatigue analysis. At or above this baseline, FRA does not consider fatigue as probable for any employee. Software sleep settings vary based on information obtained from each employee. If an employee does not provide sleep information, FRA uses the default software settings.

FRA obtained fatigue-related information, including a 10-day work history, for the operating crews of both Train 1 and Train 2. The analysis identified that fatigue was not probable for the crew of Train 1, but was possible for the crew of Train 2 due to the irregular work-rest cycles.

FRA determined that, while fatigue was possible for the crew of Train 2, the existence of any possible fatigue did not contribute to the cause or severity of the accident.

Toxicological Testing

This accident met the criteria for Title 49 Code of Federal Regulations (CFR) part 219, subpart C, *Post Accident Toxicological Testing*. FRA Post Accident Forensic Toxicology Result Reports indicate all crew members from Train 1 and Train 2 were negative for drugs and alcohol.

FRA determined alcohol and drug use did not contribute to the cause or severity of this accident.

Crew Operating Performance

A review of all training and certification records was conducted for all the operating crew members and dispatchers; no exceptions were noted. The review included the employees' work history, discipline history, operational tests, efficiency tests, and physical characteristics tests.

The crew of Train 1 had worked together in the past, but not on a regular basis. The Engineer indicated it had been about a year and a half since he last worked the auto ramp, while the Conductor worked this job multiple times in January 2018. Both had been called from the extra board to work Train 1.

The crew of Train 1 received a safety briefing from the Trainmaster at the start of their shift. They needed an EC-1 track authority to operate the train through the signal suspension area, with additional permission to operate three switches at MP S 366.9, MP S 3367.0, and MP S 367.9. It was required that the crew report to the Dispatcher the time that each switch was reversed, and the final time the switch was restored to its normal position[6], before releasing their EC-1 track authority. The times each switch was used is also required to be recorded on the Switch Position Awareness Form (SPAF)[7], and signed by both employees prior to releasing their EC-1 track authority. Prior to reporting the times to the Dispatcher, the Engineer and Conductor were required to have a briefing regarding the position of the switches and the times they were restored. Both crew members had received training on this process, and on using EC-1 track authority when operating on non-signaled territory.

The Conductor of Train 1, working without a watch, asked the Engineer to keep track of time for him during their shift. In a post-accident interview, the Conductor of Train 1 stated the switch times on the SPAF "was a mess" because he forgot to remind the Engineer to record the time each switch was restored.

The Train 1 Conductor applied the handbrake on CSXT 130 while the Engineer walked back and secured CSXT 36. While the Engineer was securing CSXT 36, the Conductor contacted the Dispatcher and released their EC-1.

The Dispatcher recalled the Train 1 Conductor called him and gave him the times when the three switches were restored to normal position. He repeated the times back to Train 1 and asked the Conductor if the switches were restored to normal position, and if the SPAF was completed and

[6] The normal position for a switch on the main line is for movement on the main track.

[7] A Switch Position Awareness Form (SPAF) is a form used by a train crew to document the times a switch is reversed and restored. The form must be completed, and signed by both crew members prior to a train crew releasing their track authority.

initialed. Based on a voice recording between the Conductor and Dispatcher, the switch times that were reported to the Dispatcher were:

- MP S 366.9 was reversed at 8:12 p.m., and restored at 8:15 p.m.
- MP S 367.0 was reversed at 8:32 p.m., and restored at 10:10 p.m.
- MP S 367.9 was reversed at 8:48 p.m., and restored at 8:49 p.m.

The SPAF was not recovered following the accident.

FRA's investigation revealed the times reported to reverse and restore the two north end switches (MP S 366.9 and MP S 367.0) were not actual times. EC-1 No. 93537 was issued to Train 1 at 8:32 p.m., which was after the times reported by Train 1 that the switch at the north end of Silica storage track. FRA determined the actual times the crew of Train 1 operated the switches were not recorded as required by CSX Operating Rules, resulting in inaccurate times being reported to the dispatcher.

In a post-accident interview, the Engineer of Train 1 reported that he questioned the Conductor multiple times about lining the switch at the north end of Silica storage track back for the main line, and the Conductor insisted he had lined the switch. A review of CSXT 130 forward facing video confirmed the Conductor did not restore the main track switch at the north end of Silica storage track.

The Train 1 Conductor failed to properly align the switch at MP S 366.9 for the main line prior to releasing his track authority, as required by Title 49 CFR § 218.105(d)(1).

FRA determined the failure of the Train 1 crew to restore the switch at the north end of Silica storage track, MP S 366.9, was the probable cause of the accident. (See Figure 6: Switch Entering Silica Storage Track)

Figure 6: Switch Entering Silica Storage Track

Positive Train Control

Positive Train Control (PTC) is a processor-based/communication-based train control system designed to prevent certain train accidents. With limited exceptions and exclusions as described within Title 49 CFR part 236, subpart I, *Positive Train Control Systems*, PTC is required to be installed and implemented on Class I railroad main lines handling poisonous- or toxic-by-inhalation (PIH/TIH) materials and any railroad main lines with regularly scheduled passenger intercity and commuter operations.

PTC technology is capable of automatically controlling train speeds and movements should a train operator fail to take appropriate action for the conditions at hand. PTC uses communication-based/processor-based train control technology that provides a system capable of reliably and functionally preventing:

- Train-to-train collisions;
- Overspeed derailments;
- Incursions into established work zone limits; and,
- Movement of a train through a main line switch in the improper position.

In 2015, Congress passed the Positive Train Control Enforcement and Implementation Act of 2015 (PTCEI Act), which extended the deadline for full PTC system implementation from December 31, 2015 to December 31, 2018. In addition, under the PTCEI Act, Congress permitted a railroad to request FRA's approval of an "alternative schedule" with a deadline extending beyond December 31, 2018, but no later than December 31, 2020, for full PTC system implementation. FRA has approved an alternative schedule for CSX, for full PTC implementation by December 31, 2020.

The Columbia Subdivision was not equipped with an active PTC system. The signal suspension between MP S 362.5 and MP S 385 was to install PTC equipment. PTC did not contribute to the cause or severity of the accident; however, a properly functioning PTC system would have prevented the accident.

CONCLUSIONS

The investigation concluded the switch at MP S 366.9 was not lined by the crew of Train 1 for movement on the main track. The forward-facing rail view camera of CSXT 130 confirmed the switch was not restored by the Conductor of Train 1 after the locomotive consist entered Silica storage track.

The times the crew of Train 1 operated the switches at MP S 366.9, S 367.0, and S 367.9 were not recorded or provided to the Dispatcher properly. The transcripts of the radio communications show the crew provided incorrect times, some before Train 1 received its authority.

The signal system for the CSX Columbia Subdivision was under a planned signal suspension to install PTC components. This signal suspension required trains to operate under TWC instead of CTC. An active signal system would have likely prevented Train 2 from entering the block where the switch was misaligned.

PTC was not operational on the CSX Columbia Subdivision, and components were being installed at the time of the accident. An active PTC system would have prevented the accident.

PROBABLE CAUSE

The FRA investigation determined the probable cause of the accident was the crew of Train 1 leaving the switch at MP S 366.9 improperly lined for the storage track.

Additionally, FRA determined the following to be contributing factors in this accident:

- The crew of Train 1 did not properly release their authority limits back to the CSX Dispatcher.
- The crew of Train 1 did not follow procedures to document the position of main line switches used on non-signaled track.
- The crew of Train 1 did not properly discuss the position of main line switches before releasing their authority.

The suspension of the signal system on the Columbia Subdivision between MP S 362.5 and S 385.1

FRA ACTIONS

Following the accident, FRA published Safety Advisory 2018-02, dated November 20, 2018, in the Federal Registrar addressing railroad operations under temporary signal suspensions. (FRA-2018-0037). FRA issued this Safety Advisory addressing railroad operations under temporary signal suspensions. This Safety Advisory recommends the use of industry best practices when planning and implementing temporary signal suspensions, including when conducting rail operations under temporary signal suspensions. This Safety Advisory also recommends that railroads develop and implement procedures and practices consistent with the identified best practices and that railroads take certain other actions to ensure the safety of railroad operations during temporary signal suspensions. FRA believes that actions consistent with this Safety Advisory will reduce the risk of serious injury or death both to railroad employees and members of the public.

Best practices within the industry when temporarily suspending a signal system include:

- Take all practical measures to ensure sufficient personnel are present to continue signal work until the system is restored to proper operation. If sufficient personnel are not present, terminate the signal suspension until sufficient personnel are on hand.
- If a railroad elects to allow train traffic through signal suspension limits:
- Establish the smallest limits possible for the signal suspension;
- Minimize the duration of the signal suspension to the shortest time period possible;
- Take all practical measures to ensure only through-traffic is allowed to operate within the limits (avoiding any train meets or any movements requiring the manipulation of switches within the suspension limits).

FRA recommends that railroads take immediate actions consistent with the following:

1. Before initiating a planned temporary suspension of a signal system, perform a risk assessment to determine the most effective and safest way to implement the suspension.
2. Develop and implement procedures and practices consistent with the industry best

practices for rail operations conducted under temporary signal suspensions.

3. Inform employees of the circumstances surrounding the February 4, 2018, accident in Cayce, South Carolina, and the March 14, 2016, accident near Granger, Wyoming.
4. Review, and as appropriate, revise all operating rules related to operating hand-operated main track switches (including operating rules required by Title 49 CFR 218.105), to enhance them to ensure (a) train crews and others restore switches to their normal position after use, and (b) the position of switches are clearly communicated to train control employees and/or dispatcher(s) responsible for the movement of trains through the area where the signal system is temporarily suspended.
5. Increase supervisory operational oversight and conduct operational testing on the applicable operating rules pertaining to the operation of hand-operated main track switches.
6. Enhance instruction on the relevant operating rules concerning the operation of hand-operated main track switches in non-signaled territory.
7. Stress to T&E employees the importance of thorough and accurate job briefings when operating hand-operated main track switches, particularly in areas where the signal system is suspended, and specifically when releasing main track authority.

Additionally, FRA Region 3 Operating Practices Inspectors and State Operating Practices Inspectors conducted a comprehensive Title 48 CFR Part 217 program audit on CSX Transportation to determine the level of compliance with Federal Regulations.

RAILROAD ACTIONS

In response of the accident, Amtrak took the following actions:

- A Special Employee Advisory was issued on February 4, 2018 that detailed the accident, and called on every employee to improve safety by remaining focused on safe operations every day, and on every train.
- Southern Region General Order Number 2018-04, effective March 4, 2018, requires additional safety measures beyond the requirements of the host railroad during a signal suspension.
- The required Title 49 CFR § 239.105 debriefing and critique session was held on March 29, 2019, to determine the effectiveness of the emergency preparedness plan.

Additionally, CSX took the following actions:

- An On-Board Train Blitz was conducted between February 11, 2018 through February 24, 2018, which required all transportation officers to board a minimum of five trains and perform operational testing.
- The Transportation Signal Suspension Operating Plan (System Bulletin 019) was issued March 7, 2018, to incorporate additional safety measures for signal suspensions.