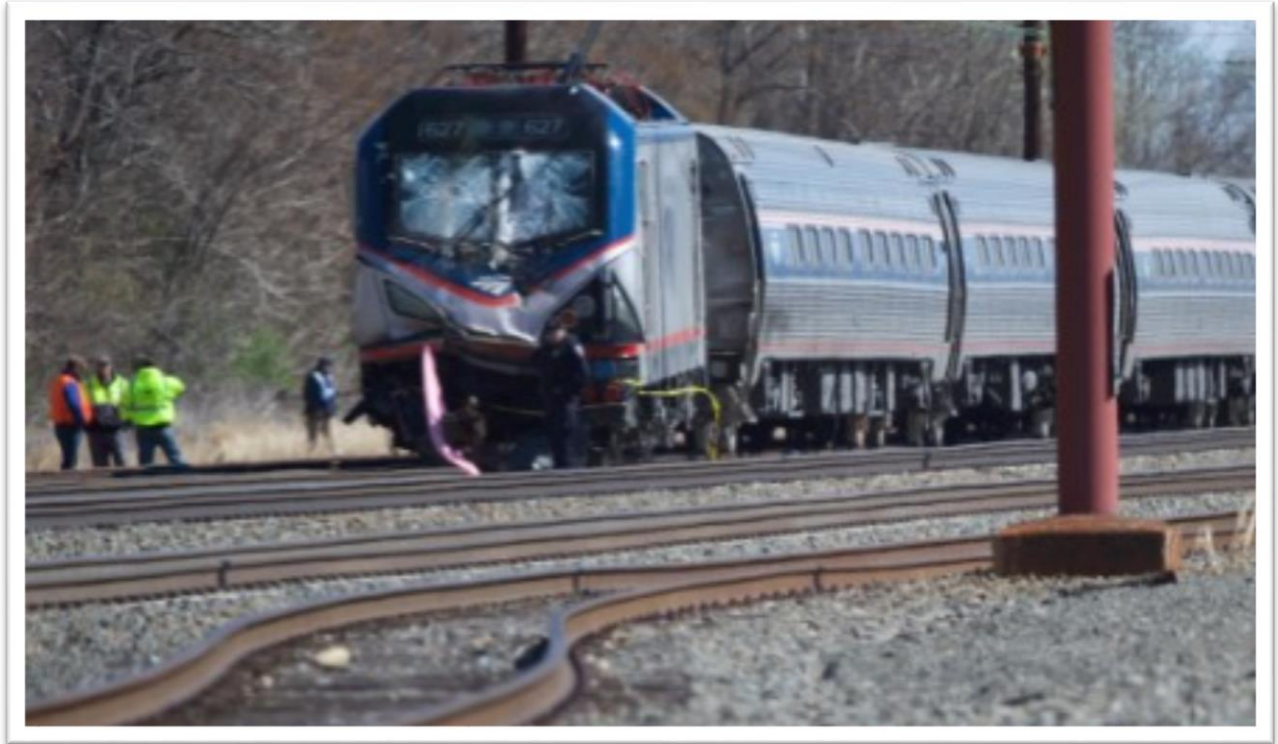




**U.S. Department of  
Transportation  
Federal Railroad  
Administration**



## **Office of Railroad Safety**

### **Summary Report**

**Obstruction Collision of Amtrak Train 89**

**Chester, PA**

**April 3, 2016**

## **Executive Summary**

On Sunday, April 3, 2016, at 7:49 a.m., EDT, southbound National Railroad Passenger Corporation Train 89 (Amtrak 89) was operating on Amtrak's Philadelphia to Washington (PW) segment of the Northeast Corridor (NEC), Track 3 at 106 miles per hour (mph) near Chester, PA when the Engineer noticed maintenance-of-way (MOW) employees and equipment on Track 3. The Engineer initiated an emergency brake application however, the train struck a MOW backhoe at 102 mph. The impact with the MOW backhoe resulted in two fatalities to Amtrak MOW employees, 41 injuries (4 crew members, 1 MOW employee and 36 passengers) and \$3,795,614 in damage. The weather at the time of the accident was clear, winds were from the west at 38 mph gusting up to 50 mph, and a temperature of 50° F. Amtrak MOW employees were working under the direction of a Foreman in Charge of a ballast replacement project on Track 2 near milepost (MP) 15.7. At the time of impact, the fatally injured Backhoe Operator was in the operating compartment of the backhoe fouling Track 3, and the fatally injured Track Supervisor was located on the ground in between Tracks 2 and 3. The Federal Railroad Administration's (FRA) investigation determined that the cause of the accident was a MOW backhoe that was fouling Track 3 without the knowledge and permission of Amtrak dispatchers as required under Title 49 Code of Federal Regulations (CFR) § 214.319. Five factors were identified by FRA inspectors that contributed to the cause or severity of the accident, including; failure of both day and night Foreman to apply a Supplemental Shunting Device (SSD)<sup>1</sup> in accordance with Amtrak Special Instruction 140-S2; failure of both day and night Foreman to apply whistle board signs at the work location in accordance with Amtrak Roadway Worker Protection Manual Rule 339(1); failure of the night Foreman to use the radio when canceling

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<sup>1</sup> An SSD is a device used to provide positive shunt through track occupancy with documented verification to the Dispatcher.

foul time in accordance with Amtrak Special Instruction 716-S2; failure of the day Watchman guarding the work crew to raise orange disc for approaching trains in accordance with Amtrak Roadway Worker Protection Manual Rule 329(a)(4); failure of the day Foremen to provide a safety briefing<sup>2</sup> for on-track safety in accordance with Title 49 CFR § 214.315(b) prior to the work beginning. The investigation also concluded that fatigue was probable for three Amtrak employees directly involved in the accident: The day Watchman, the night Foreman, and the Engineer.

## **CIRCUMSTANCES PRIOR TO THE ACCIDENT**

### *The Maintenance Crew*

Amtrak operates track geometry test vehicles over the NEC to determine locations of developing geometry deficiencies, and schedule maintenance crews to address the identified track geometry deficiencies. Maintenance was scheduled on Amtrak's Main Line, PW segment, at MP 15.7 on Track 2, to correct non-compliant track geometry concerns. Amtrak Engineering personnel developed a program to address areas of fouled ballast using a Loram Vacuum Unit (Figure 1), and a backhoe to facilitate loosening cemented mud locations. The program was scheduled for a 55-hour track outage for the MP 15.7 location on Track 2 beginning April 1, 2016, at 10:00 p.m. EDT.

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<sup>2</sup>When an Amtrak employee or contractor (roadway worker) is assigned a duty that calls for that employee to foul a track, an on-track safety briefing must be provided prior to starting any work or fouling any track. A safety briefing is a meeting conducted prior to going to work. During the safety briefing, the work gang meets to discuss all aspects of the work to be performed and any safety-related concerns. Anyone can conduct a safety briefing, however, the RWIC traditionally holds the on-track safety briefing. A safety briefing for on-track safety shall be deemed complete only after the roadway worker has acknowledged understanding of the on-track safety procedures and instructions presented.



**Figure 1:** *Loram Vacuum Unit*

On April 2, 2016, at 7:10 p.m. EDT, the night Foreman conducted an on-track safety briefing on the right-of-way near MP 15.7 in Chester, PA as required by Amtrak Rule, and Federal Regulation. After the briefing, the night Foreman called the Dispatcher to obtain exclusive track occupancy on Track 2 by means of a “Form-D”<sup>3</sup>. Amtrak Dispatcher issued Form D, number A1403, to the night Foreman on Track 2 between Hook and Baldwin Interlockings. Foul Time was required on adjacent tracks when the Loram Vacuum Unit was working or the backhoe was fouling track. The night Foreman acquired foul time on Tracks 1, 3, and 4 throughout his shift using a company-issued radio as needed per Amtrak Special Instruction 140-S2, so all employees and trains monitoring the radio would be aware. Additionally, per these instructions, if any MOW equipment required foul time in signaled territory, or within interlocking signal pocket<sup>4</sup>, for more than five minutes, application of a SSD would also be required to signal track

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<sup>3</sup> Form D is a form issued by the dispatcher that grants authority to occupy a track, and provides protection from conflicting movement on that track.

<sup>4</sup> A section of track located between two interlocking signals that govern movement out of the pocket, with no switches between the two signals.

occupancy to the dispatcher and an oncoming train. The Assistant Track Supervisor arrived at the job site at 8:40 p.m. EDT and the Backhoe Operator arrived at the job site at 11:00 p.m. EDT. Both employees received a safety briefing from the night Foreman and signed the on-track safety-briefing sheet. After the Backhoe Operator received his safety briefing, high winds, and rain prevented the night gang from working. At approximately 12:52 a.m. EDT, April 3, 2016, Amtrak issued the night Foreman foul time on Tracks 1, 3, and 4 and the night gang returned to work. At approximately 6:30 a.m. EDT, the Track Supervisor arrived at the work location and relieved the Assistant Track Supervisor. Thirty minutes later, at 7:00 a.m. EDT, the day Watchman and Trackman arrived at the work site. The two received a safety briefing from the night Foreman and relieved the night Watchman and night Trackman. The day Trackman worked with the Track Supervisor on Track 2, while the day Watchman stood on the field side of Track 4 and assumed Watchman duties<sup>5</sup>.

The day Foreman called the Dispatcher at 7:16 a.m. EDT for a briefing and was instructed to call back in a few minutes for a Form D. At 7:24 a.m. EDT, the day Foreman called back on his company cell phone and the Amtrak Dispatcher issued Form D number A1401 for Track 2 between Hook and Baldwin Interlockings, with an effective time of 7:26 a.m. EDT. When the Dispatcher asked about foul time, he said, "I need to check first". At 7:27 a.m. EDT, the night Foreman called the Dispatcher with his personal cell phone and requested to cancel the Form D and give back foul time on Tracks 1, 3, and 4 while the MOW backhoe was still fouling on Track 3. Before canceling his foul time, the night Foreman informed the Train Dispatcher that the day Foreman was going to "pick them up" (the day Foreman would acquire foul time through the Dispatcher). The time effective for the cancellation of Form D A1403 was at 7:28 a.m. EDT.

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<sup>5</sup> Watchman duties require a designated roadway worker to devote their full attention to detecting the approach of trains and provide audible warning and raising an orange disc or approved light at arm's length above the head to warn roadway workers of approaching trains.

The MOW gang was working on the north-end of the Booth Street under-grade bridge at MP 15.7 on Track 2. The head-end of the Loram Vacuum Unit (LORA048553) was facing south approximately 138 feet north of the bridge and working in the north direction. There were three Loram contractors working with this Loram Vacuum Unit. Two Loram contractors were inside the cab with the day Foreman, and one Loram contractor was on the ground near the front of the Loram Vacuum Unit. The Amtrak Track Supervisor was standing in front of the Loram Vacuum Unit, facing south between Tracks 2 and 3 on the field side<sup>6</sup> of Track 2. The injured Trackman was standing next to the Track Supervisor, in the gage of Track 2, facing west. The backhoe was facing south on Track 3 with the night Backhoe Operator sitting at the controls also facing south, not actively working. The day Watchman was in front of the Loram Vacuum Unit on the right-of-way next to Track 4.

### *The Train Crew*

The southbound crew of Amtrak 89 included a certified and qualified Locomotive Engineer and Conductor, two Assistant Conductors and three on-board Service Attendants. The crew went on duty at 5:25 a.m., EDT, April 3, 2016, at Amtrak's Penn Station in New York, N.Y., which was their home terminal. All crew members received more than the statutory off-duty rest period prior to reporting for duty. Amtrak 89's consist was one electric locomotive, eight coach cars, one café car, and one baggage car. Amtrak 89 departed 30th Street Train Station in Philadelphia, P.A. at 7:32 a.m. EDT, and traveled south on Track 3. Amtrak 89 proceeded through Baldwin Interlocking (MP 11.5) at 106 mph with the Locomotive Engineer at the controls of Locomotive 627 as the train approached the accident area. Amtrak's Main Line in the accident area consists

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<sup>6</sup> The face of the rail pointing away from the track, or outside face.

of four main tracks equipped with wayside block signals, on-board cab signals and Advanced Civil Speed Enforcement System (ACSESII) as prescribed by Amtrak's Timetable Special Instructions. The timetable maximum authorized speed (MAS) for Tracks 2 and 3 was 110 mph between Baldwin and Hook Interlocking, and the railroad timetable direction and geographic direction of the train was south.

## **THE ACCIDENT**

At 7:49:15 a.m. EDT, Amtrak 89 approached the accident area, traveling 106 mph. Shadows cast from the Loram Vacuum Unit obstructed the Engineer's view of the work site on Tracks 3 and 4. At 7:49:41 a.m. EDT, the Engineer recognized the MOW backhoe fouling Track 3 and initiated an emergency air brake application 450 feet before impact. The train slowed to 102 mph when the collision occurred at 7:49:44 a.m. EDT based on data collected from the lead locomotive's event recorder (Figure 2).



**Figure 2:** *Last Amtrak 89 Collision Site*

Approximately 138 feet past the point of impact (POI), Amtrak Locomotive 627 derailed its front truck (F-end) due to backhoe debris. Amtrak 89 continued south with the lead truck of the locomotive derailed for 2,510 feet before coming to a stop. After reviewing the outward-facing camera on Amtrak 89's locomotive, it was determined that the MOW backhoe was facing in the south direction with front bucket facing south and resting on the west rail. Both outriggers were down and the rear window was in the open position. The rear boom was also down with the cribbing bucket resting on the ballast between two concrete ties inside the gage of the track, and the rear work lights were on. The night Backhoe Operator was sitting in the Operator's seat and facing south, and the train struck the rear of the backhoe, at the rear boom. The outward-facing camera cut off at the POI due to damage to the locomotive's electrical system after impacting the backhoe (Figure 3).





**Figure 3:** *Last Amtrak 89 Outward-Facing Camera Image*

Upon collision, the backhoe virtually exploded, separating all the main components of the machine and throwing them in different directions and distances. The Backhoe Operator sustained fatal injuries directly from the collision. The Track Supervisor sustained fatal injuries, and the Trackman suffered a broken arm by flying debris from the backhoe. The train came to a stop about 2,648 feet south of the POI. After the train stopped, the Engineer stayed on the locomotive and attempted to establish radio communications with the Dispatcher however, the radio equipment was inoperable due to damage from the impact. The Engineer remained on the locomotive until first responders arrived. The Conductor and Assistant Conductors remained in the coach cars and assisted the passengers. Less than two minutes after the accident, at 7:51:25 a.m. EDT, the day Foreman called the Dispatcher. The day Foreman asked the Dispatcher if the night Foreman still had foul time. The Dispatcher informed him that the night Foreman gave up his foul time. The day Foreman informed the Dispatcher that a train struck the MOW gang's backhoe, MOW employees were injured and they required medical assistance. Amtrak's

Assistant Chief Dispatcher called the APD Dispatcher at 7:54:47 a.m. EDT, to inform him that Amtrak 89 struck a MOW backhoe and there were “multiple injuries”. Chester Fire Department (Station 82) arrived on scene at 8:00 a.m. EDT.

## **INVESTIGATION FINDINGS AND ANALYSIS**

FRA’s investigation team was comprised of a Chief Inspector, who served as the Inspector in Charge (IIC), and inspectors from the Motive Power and Equipment (MP&E), Operating Practices (OP) and Signal and Train Control (S&TC) disciplines.

### ***Track***

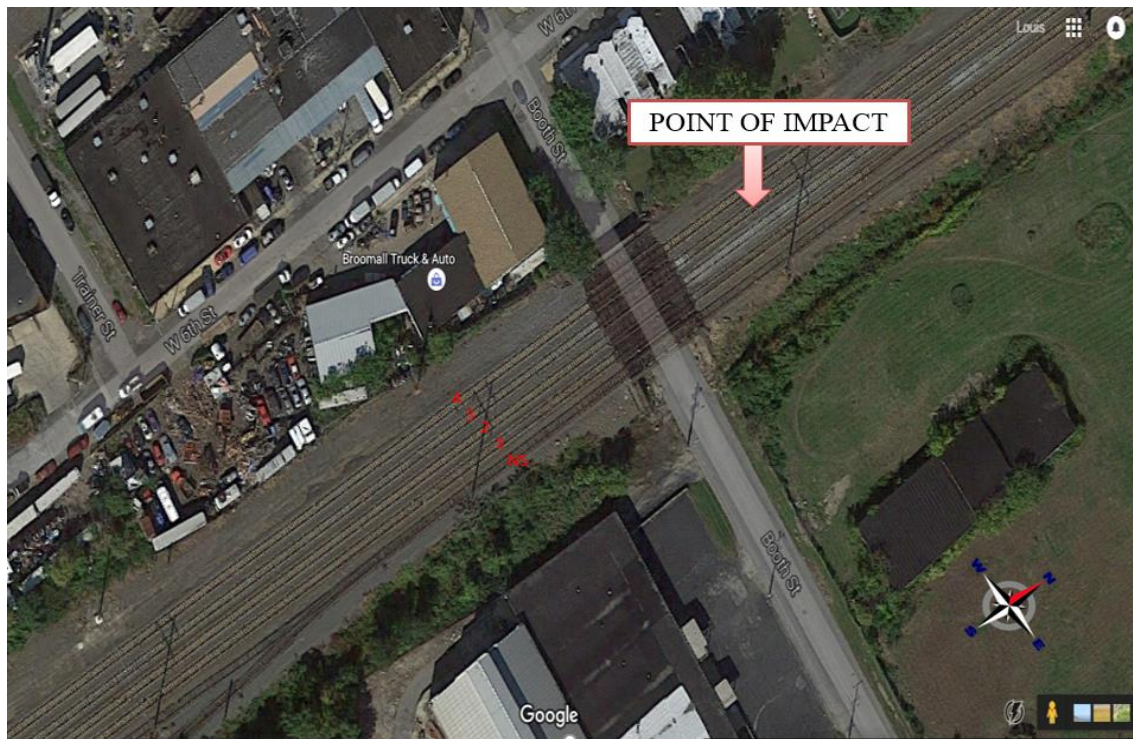
The PW segment consists of four main tracks. Amtrak numbers their tracks, from east to west, Track 1, 2, 3 and 4. Amtrak operates and maintains Tracks 2 and 3, near the accident as FRA Class 6 with a MAS of 110 mph for passenger trains. Amtrak operates and maintains Tracks 1 and 4, near the accident as FRA Class 5 with a MAS of 90 mph for passenger trains.

Investigators observed wheel flange marks departing the west rail down the gage face of the railhead<sup>7</sup> to the base of the rail and trailing southward as those marks angled towards the center of the concrete crossties. A companion set of marks were observed where flange marks went up and over the east-head of the rail and dropped outside to the field side of the east rail. The marks trailed southward and angled away from the east rail towards the outside edge of the concrete crossties. The Engineering department investigation team established the POD at MP 15.69, or about halfway between the POI and the center of the Booth Street under grade bridge. Amtrak

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<sup>7</sup> The inside side of the rail surface between the two rails of a track.

Locomotive 627 was the only rolling stock derailed and it came to rest upright approximately 2,510 feet from the POD. (Figure 4)



**Figure 4:** *ATK 89 Point of Impact*

Amtrak found no geometry defects during the post-accident inspection and the prior automated (Geometry Car) and walking inspections did not find an exception near the POD. There are no indications of any rail or track defects that would be a cause or contributing factor in this derailment.

### ***MP&E***

Amtrak towed the equipment from the accident site to the 30th Street Station in Philadelphia where the inspection was completed and car damage documented. The locomotive was equipped with an automatic train control (ATC) system. The system is a combined 9-Aspect ATC and ACSSES configuration that ensures safe operation of the locomotive. The ATC portion of the

system includes Automatic Speed Control (ASC)<sup>8</sup> and Automatic Train Supervision (ATS)<sup>9</sup> capabilities. All systems on the locomotive worked as designed, however the event recorders failed to record any data after the initial impact with the backhoe at 7:49:44 a.m. EDT due to damage sustained to the locomotive's electrical system in the collision.

Post-accident inspections of the equipment did not disclose any defective condition that would have contributed to the accident.

### *S&TC*

FRA, NTSB, and Amtrak S&TC investigators inspected the route Amtrak 89 traveled between CP Baldwin located at MP 11.70, and CP Hook located at MP 16.80 on the PW segment of the NEC. The ACSES system was functional on Track 3 where the train was operating. All testing and inspections revealed no abnormalities that would contribute to the train accident. There was no damage sustained to the right of way signal equipment.

### *OP*

The OP investigation included review of event recorder data, training and compliance records of the train crew and roadway worker group, interviews, fatigue analysis study and toxicological testing.

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<sup>8</sup> The ASC feature protects the locomotive from exceeding speed limits established by track signals.

<sup>9</sup> The ATS system is responsible for monitoring and controlling the rail system to ensure that it conforms to an intended schedule and traffic pattern to optimize railway operations and service reliability.

#### Review of Event Recorder Data

Based on the event recorder data, FRA and Amtrak validated train handling methods and compliance with MAS demonstrated by the Engineer. The Engineer's operation of the locomotive was not a contributing factor to the accident.

#### Review of Training and Compliance Records of Train Crew

FRA OP Investigators reviewed employee training, qualifications and certifications and no discrepancies were noted. Employee hours of service (HOS) documents demonstrated compliance with the HOS Regulations, and Amtrak 89 was governed by the Dispatcher and operated by the train crew in compliance with Operating Rules, Timetable and Special Instructions, special publications and procedures.

#### Review of Rules Compliance by the Dispatcher

The Dispatcher failed to use the radio when issuing mandatory directive Form D number A1401 to the day Foreman, and cancellation of Form D number A1403 by the night Foreman, as required by federal regulations. Had this been done, the transmission would have been broadcast over the radio for all employees in the area to hear as they were monitoring the same radio channel. This failure was determined to be a contributing factor to the accident.

#### Review of Training and Compliance Records of Roadway Worker Group

FRA reviewed employee training, qualifications and certifications and no discrepancies were noted.

Additionally, FRA reviewed Amtrak's training for roadway worker protection (RWP) following the accident. FRA found that Amtrak's RWP manual and related training material conflicted

with Special Instruction 140-S2 which requires use of SSDs in certain circumstances.

Specifically, Amtrak's Special Instruction 140-S2 states that an SSD must be applied in signal pockets. However, the most recent training prior to the accident, 2015 RWP PowerPoint training, covering SSD usage highlights an exception that an SSD is not required in signal pockets. Also as part of a 2015 revision to their RWP training, Amtrak removed pages that covered usage of SSDs.

The use of SSDs were required by Special Instruction 140-S2 and specifically listed on the "on-track safety briefing sheet" (Form NRPC 3044), however FRA determined that they were neither properly addressed in the safety briefing, nor applied at the job site. The backhoe and the Loram Vacuum Unit consistently fouled track during both shifts in signaled territory for more than five minutes. These actions required the day and night Foreman to apply SSDs, however, on April 2 and April 3, they did not apply SSDs and checked the "no" box of their "on-track safety briefing sheet".

The use of whistle board signs<sup>10</sup> was required by Amtrak Roadway Worker Protection Manual Rule 339(1), however FRA determined that they were neither properly addressed in the safety briefing, nor applied at the job site. The night and day shifts of this 55-hour outage had work groups of more than five persons, and the duration was over 1-hour. These activities required the day and night Foreman to apply whistle board signs in advance of the work site., however, on April 2 and April 3, they did not apply whistle board signs and checked the "no" box of their "on-track safety briefing sheet" on the line that states "Are the whistle boards up?"

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<sup>10</sup> Signs that Roadway Workers apply to the wayside of tracks that require trains to provide audible warning.

### Interviews

During the post-accident interview, the Engineer stated that he “had no health issues” and that his overall health was “good.” He also stated that he felt alert when he went on duty the morning of the accident.

The post-accident interview of the day Foreman revealed that he did not conduct a proper safety briefing. Further, he had some of the employees and contractors sign the “on-track safety briefing sheet” without a safety briefing. The day Foreman went on to state that this was a preliminary safety briefing and a proper safety briefing was pending.

### Fatigue Analysis Study

FRA performed a fatigue analysis using the Fatigue Avoidance Scheduling Tool (FAST)<sup>11</sup>. FRA uses an overall effectiveness rate of 77.5 percent as the baseline for fatigue analysis. At or above this baseline, the FRA does not consider fatigue as probable for any employee. Inputs into the FAST software vary based on information obtained from each employee. FRA obtained fatigue-related information, including a 10-day work history, for nine employees involved in this accident, including the MOW Backhoe Operator, the MOW Track Supervisor, the night Foreman, day Foreman, Trackman, Watchman, Engineer, Conductor, and Assistant Conductors. FRA concluded fatigue was not probable for the Track Supervisor, day Foreman, Trackman, or Conductor. However, the day Watchman, night Foreman, and Engineer were cognitively impaired by fatigue at the time of the accident.

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<sup>11</sup> FAST is designed to identify fatigue based on work-rest cycles from inputs from the subjects and is not intended to diagnose medical conditions.

### Toxicological Testing

This accident met the criteria for Title 49 Code of Federal Regulations Part 219, Subpart C, Post Accident Toxicological Testing. In accordance with Federal regulations, following the accident, toxicological testing was conducted on the operating crewmember from Amtrak Train 89 and the two deceased MOW employees. The results of the toxicology testing were positive for all three employees. The Engineer was positive for marijuana in both his urine and blood. The concentration levels suggest possible recent or regular use of the drug, with the Engineer's last use potentially occurring within a few hours of the accident. Additionally, the results indicated the presence of morphine in the Engineer's urine. Morphine was medically administered after the accident to treat his injuries which likely explains the positive test for this drug.

The deceased Track Supervisor was positive for two opioid narcotics in his blood, morphine and oxycodone. The Track Supervisor did not survive the initial impact, therefore neither drug could have been medically administered after the accident.

The deceased Backhoe Operator was positive for cocaine and cocaine metabolite in his urine, as well as cocaine metabolite in his vitreous<sup>12</sup>. The concentration levels suggest very recent use of the drug, but due to the lack of sufficient vitreous, no more specific results could be obtained.

The Engineer and Backhoe Operator screenings suggested very recent or habitual use of narcotics.

### **CONCLUSIONS**

1. Failure to use the radio when issuing mandatory directives, Form D A1401, and cancellation of Form D A1403, as required by Title 49 CFR § 220.61(a) contributed to the accident.

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<sup>12</sup> The clear fluid that fills the space between the lens and retina in the eye.



2. Failure of the night and day Foremen to apply SSDs and portable whistle board signs are contributing factors to the severity of the accident.
3. The night Foreman's failure to release working limits without notifying roadway workers, as required by Title 49 CFR § 214.319(c)(1), was a contributing cause of the accident.
4. Failure of MOW Foreman to use radio when canceling foul time in accordance with Amtrak Special Instruction 716-S2; was a contributing cause of the accident.
5. Failure of MOW Watchman to raise orange disc on approach of train in accordance with Amtrak Roadway Worker Protection Manual Rule 329(a)(4); contributed to the severity of the accident.
6. Failure of MOW Foremen to provide a safety briefing for on-track safety in accordance with Title 49 CFR § 214.315(b); was determined to be a contributing factor.
7. Fatigue was probable for three Amtrak employees directly involved in the accident: The day Watchman, the night Foreman and the Engineer. It cannot be determined if this contributed to the cause or severity of the accident.
8. While toxicology testing determined a positive result for all three employees that were required to submit a screening under Title 49 CFR Part 219, Subpart C, it cannot be determined if this contributed to the cause or severity of the accident.

## **PROBABLE CAUSE**

Through its investigation FRA determined that the primary cause of the accident was a MOW backhoe fouling Track 3 without working limits as required under Title 49 CFR § 214.319 and referenced by FRA Train Accident Cause Code M404 (Object or equipment on or fouling track).

## **FRA ACTIONS**

FRA investigation of the Amtrak 89 accident revealed that Amtrak was noncompliant with multiple Federal Railroad Regulations at the time of the incident. These failures contributed to the cause and severity of the accident. Accordingly, FRA has taken the following steps to address the non-compliant conditions: FRA recommended disqualification from safety-sensitive service for the Engineer, Watchman and both Foreman that were involved in the accident. FRA F6180.96 Inspection Report number FJW-48 dated May 10, 2016 and FRA F6180.96 Inspection Report number MRB-113 dated July 20, 2016, were submitted for these individual liabilities. FRA Region 2 inspectors involved in the Amtrak 89 accident investigation submitted the following inspection reports recommending civil penalties regarding non-compliances with maximum penalty requested: FRA F6180.96 Inspection Report number FJW-47, dated May 10, 2016, FRA F6180.96 Investigation Report number LLT-54, dated May 25, 2016, and FRA Investigation Report number JDG-69, dated May 26, 2016.

In addition, the FRA initiated a safety stand down of all Amtrak employees. The FRA required Amtrak to cease normal operations to emphasize safety. Specifically, during the stand down FRA required Amtrak to address all non-compliant conditions identified during its investigation of the Amtrak 89 accident.

In addition, the FRA initiated the Corridor On-Track Safety Initiative (COTSI) to conduct focused RWP observation on Amtrak along the NEC as well as associated branch lines operated and maintained by Amtrak. FRA determined that the primary cause of the confusion regarding use of SSDs and other procedures governing track occupancy, such as shunting barricades, was they were removed from the RWP manual and placed in the special instructions section of the timetable. FRA recommended that Amtrak place all rules and procedures governing track

occupancy back in the RWP manual as required by 49 CFR § 214.309, and the training on the use of SSDs in interlockings coincide with their existing Rule 140-S2.

FRA recommended Amtrak do internal testing of cell phone use when talking to the dispatcher. Cell phone conversations are only allowed when getting on track protection when radio use is not possible per Amtrak rule. The principle benefit of radio use; other employees near a radio can hear when track authority is being released. This provides for a secondary safety measure that helps inform roadway workers or pick up mistakes.

Because of the field inspections and findings, the FRA will continue to monitor Amtrak at a priority in an effort to achieve the safest railroad operation possible. Recommend twice-monthly (minimum) follow up inspections in FRA Regions 1 and 2 to include team inspections or single inspectors.

## **RAILROAD ACTIONS**

After the Amtrak 89 accident, Amtrak revised their RWP manual and training PowerPoint for RWP so it adequately covered all the requirements detailed in Special Instruction 140-S2 as required by 49 CFR § 214.309. Amtrak requested the FRA's assistance in observing their roadway workers through their 1872 efficiency testing. To that end Amtrak initiated, and FRA participated in, the Amtrak Roadway Worker Joint Efficiency Testing (ARJET) project. ARJET was scheduled for a period of 74 days, over which 179 observations were made and 74 failures were identified and addressed.

Due to the failure of the event recorder to continue recording/storing data after impact with the backhoe, Amtrak and Siemens engineers are looking for a solution to the failure by connecting the event recorder to another power source or protected circuit to prevent loss of event recorder data in future accidents. The working group developed a plan to rewire the Event Recorder on

ACS-64 Locomotives from the current circuit to a direct battery power circuit to prevent the loss of event recorder data in the future. The modification has been completed on 51 of the 66 ACS-64 locomotives currently in service.