Eliminate Fire Risk in the Southeastern Pennsylvania Transportation Authority Silverliner IV Fleet

Introduction

The National Transportation Safety Board (NTSB) is providing the following information to urge the Southeastern Pennsylvania Transportation Authority (SEPTA) to take immediate action on the safety recommendations in this report concerning electrical fires aboard Silverliner IV railcars in passenger service. We identified this issue during our investigation into a February 6, 2025, fire in Ridley Park, Pennsylvania, and four additional fires involving Silverliner IV railcars over the following months.

Background and Analysis

1.1 Fire Incidents

On February 6, 2025, about 5:56 p.m. local time, the lead railcar of SEPTA train 3223 caught fire as the train departed Crum Lynne Station in Ridley Park, Pennsylvania.[1] The train consisted of six Silverliner IV railcars, all self-propelled by electric traction motors and powered by a catenary.[2] About 2 hours before the fire, the operator reported to a dispatcher that the train was sluggish and that the fault light—an indicator similar to the check engine light in an automobile—was on. A mechanical inspection by a maintenance team found that three railcars, including the one that would later catch fire, were not properly receiving power to the traction systems from the catenary, reducing the train's total tractive power (power being output by the propulsion system) and

[1] (a) Visit the investigation page for this accident (RRD25FR006) at ntsb.gov for additional information. (b) All times in this report are local.

[2] A *catenary* is an overhead wire or other conductor that provides electrical power to a train.

NOTE: This report was reissued on October 2, 2025, with corrections to SEPTA's full name on pages 1, 6, and 9 and to the location of the June 3, 2025, fire on page 2.

causing slow acceleration, but at the direction of the dispatcher, the train remained in service. The operator also reported a strong burning smell in the lead railcar about 5:07 p.m. The train remained in service until the operator noticed smoke behind the lead railcar while departing Crum Lynne Station, stopped the train to inspect it himself, and saw that the lead railcar was on fire. The fire spread from the railcar's undercarriage to its passenger compartment, igniting seats and paneling before reaching the roof. The railcar was destroyed (see figure 1). Everyone aboard—4 crew and about 325 passengers—was evacuated. Four passengers later reported minor injuries.

The NTSB's investigation is ongoing; however, preliminary findings indicate that the fire started in the railcar's undercarriage when electrical components associated with the train's propulsion system overheated and ignited.

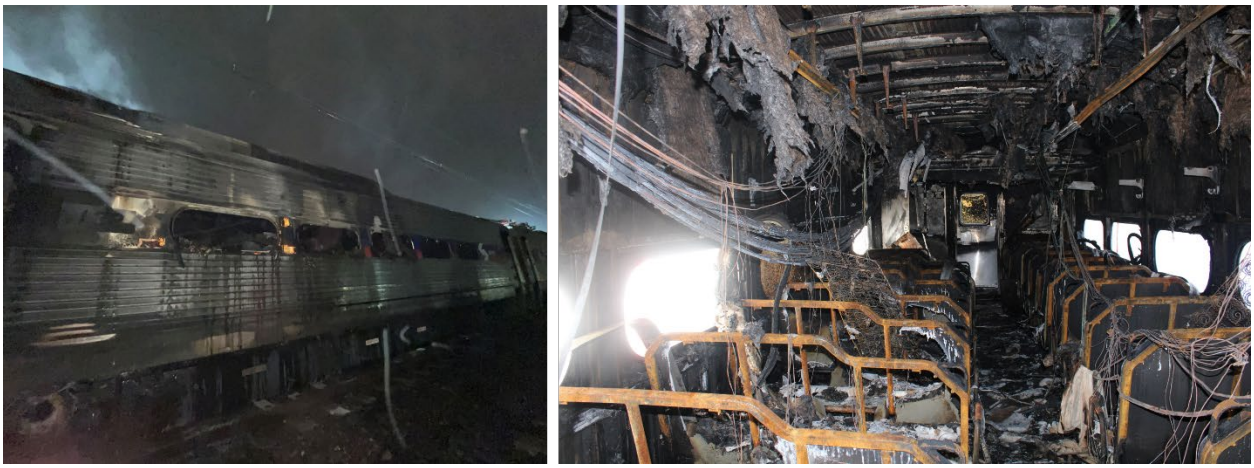

Figure 1. External (left) and internal (right) damage to railcar following Ridley Park fire.

The second incident occurred on June 3, 2025, in Levittown, Pennsylvania, about 7:10 a.m., when the rearmost railcar of SEPTA train 7206 caught fire as the train stopped at Levittown Station. Train 7206 consisted of five Silverliner IV railcars and had about 150 passengers on board. The crew evacuated the train's passengers, and no injuries were reported. The crew did not report a fault light before the fire. The fire was mostly confined to the roof area of the railcar and a rooftop ventilation duct (see figure 2).

As part of the investigation into the earlier Ridley Park fire, the NTSB examined the damaged railcar from Levittown and found signs of overheating on the dynamic brake resistor banks, which normally convert mechanical energy into heat when the dynamic brakes are applied.[3] Preliminary findings indicate that a cam controller pilot motor (part of the system that controls the railcar's dynamic brakes) failed and that the dynamic

[3] *Dynamic brakes* use a train's electric motors as generators to convert the train's kinetic energy into electricity and ultimately into heat, slowing the train and ultimately dissipating this heat in banks of resistors.

braking pressure switch (which engages or cuts out the dynamic brakes during air brake applications) was out of calibration. Together, these two issues allowed this railcar's braking system to become stuck in dynamic braking mode as the train remained in motion and under power, causing the resistor grid to overheat and ignite a fiberglass rooftop ventilation duct.

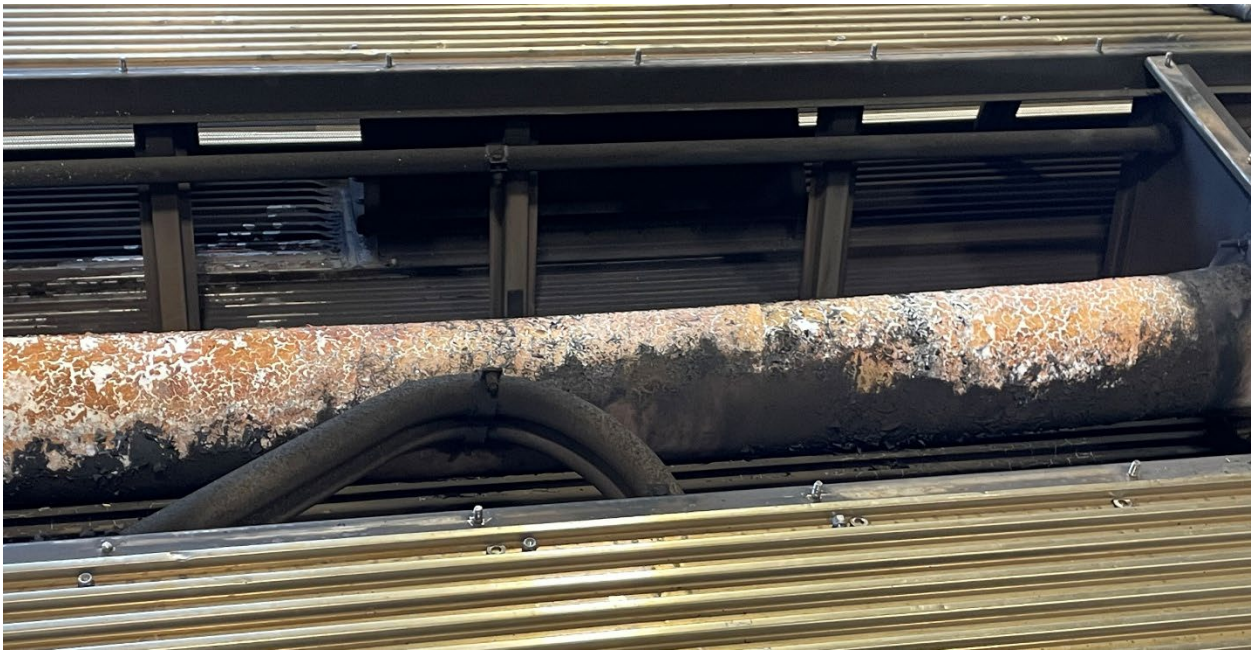

Figure 2. Fire-damaged ventilation duct on railcar following Levittown fire.

The third incident occurred on July 22, 2025, about 10:53 p.m., when the fifth railcar of SEPTA train 3553 caught fire as the train stopped at Paoli Station in Paoli, Pennsylvania. Train 3553 consisted of six Silverliner IV railcars. Two crews operated the train in the hours before the fire, and both crews reset the fault light at least once. When interviewed by the NTSB, both crews said they reported slow acceleration to the dispatcher, but the train remained in service. The second crew discovered the fire when the train lost motive power and the conductor left a railcar near the front of the train to reset the fault light again, encountering smoke in the rear railcars. The crew evacuated the train's 14 passengers. The conductor was transported to a local hospital for treatment for smoke inhalation; no other injuries were reported. The railcar that caught fire was destroyed (see figure 3). The NTSB examined the involved railcar from train 3553, again as part of the ongoing investigation of the Ridley Park fire. Preliminary findings indicate that the fire began in the undercarriage with electrical components in the train's propulsion system and spread to the passenger compartment, similar to the February 6 fire in Ridley Park.

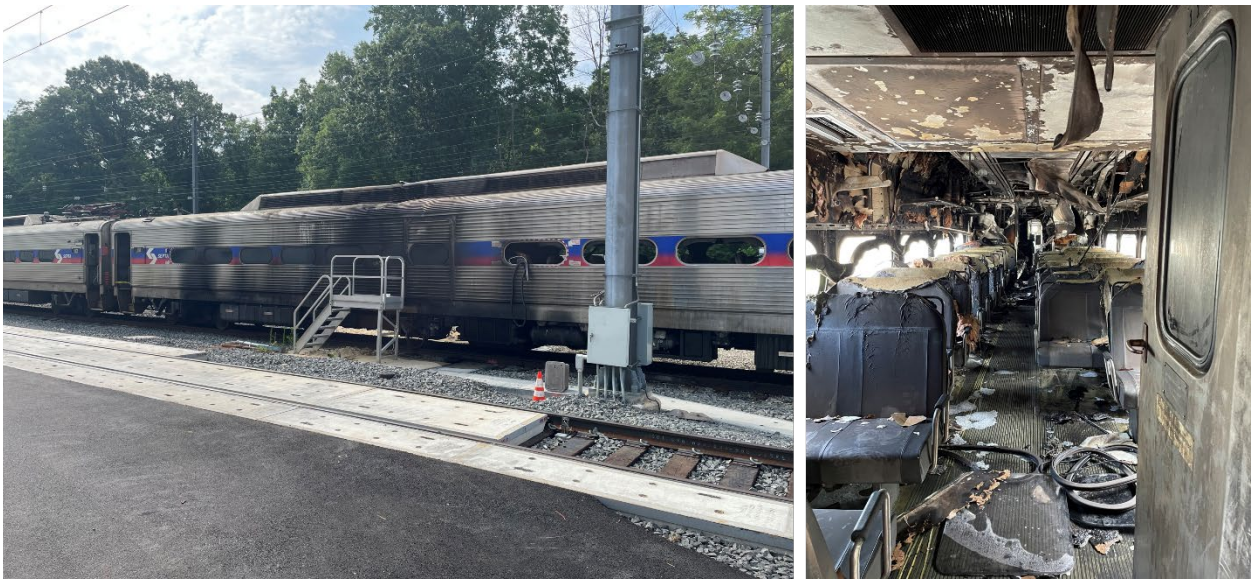

Figure 3. External (left) and internal (right) damage to railcar following Paoli fire.

The fourth incident occurred on September 23, 2025, about 4:46 p.m., when the crew of SEPTA train 3592 observed smoke coming from the roof of the fifth railcar while the train was approaching Fort Washington Station in Fort Washington, Pennsylvania. Train 3592 consisted of six Silverliner IV railcars. Four crew members and about 350 passengers were on board; all were evacuated at the station. No injuries were reported. This incident involved the same railcar that caught fire in Levittown. The NTSB examined the involved railcar from train 3592, and preliminary findings indicate that the fire began with electrical components near the dynamic brake resistor banks on the railcar's roof. The electrical components had been replaced during repairs and maintenance after the Levittown fire; preliminary findings indicate that the fire was associated with these repairs rather than the defects that led to the Levittown fire. As in the Levittown fire, the fire did not spread to occupied compartments.

The fifth incident occurred on September 25, 2025, about 7:00 a.m., when the crew of SEPTA train 705 noticed the second railcar on fire while stopped at Gravers Station in Philadelphia, Pennsylvania. Train 705 consisted of five Silverliner IV railcars. Four crew members and about 25 passengers were on board; all were evacuated at the station. No injuries were reported. Based on the NTSB's interviews with crew members and maintenance personnel, the train had been operating since the previous day with an illuminated fault light. Multiple crews operated the train during this period. The NTSB examined the involved railcar from train 705. Preliminary findings indicate that the fire started on a traction motor in the train's undercarriage and that a crew member put out the fire with a handheld extinguisher.

1.2 Fleet History and Design Issues

The Silverliner IV fleet entered service in batches from 1974 to 1976. The fleet was operated by the Reading Company until Reading's absorption into Conrail in 1976. SEPTA took over commuter rail operations and the Silverliner IV fleet from Conrail in 1983. As of 2025, Silverliner IVs represent 225 of the 390 passenger-carrying railcars (which include passenger coaches, cab cars, and self-propelled units) in SEPTA's regional rail operations fleet. The Silverliner IV fleet has not been refurbished since its original deployment.

The Silverliner IV design predates federal fire safety standards established in 1999 and most recently amended in 2002.[4] Under Title 49 *Code of Federal Regulations* (*CFR*) Part 238.103, new railcars and refurbishments must meet the performance standards, design standards, and testing procedures described in Appendix B of the same part. Appendix B standards and tests related to the containment of fires include:

> A structural flooring assembly separating the interior of a vehicle from its undercarriage shall meet the performance criteria during a nominal test period as determined by the railroad. The nominal test period must be twice the maximum expected time period under normal circumstances for a vehicle to stop completely and safely from its maximum operating speed, plus the time necessary to evacuate all the vehicle's occupants to a safe area. The nominal test period must not be less than 15 minutes.
>
> Portions of the vehicle body which separate major ignition sources, energy sources, or sources of fuel-load from vehicle interiors, shall have sufficient fire endurance as determined by a fire hazard analysis acceptable to the railroad which addresses the location and quantity of the materials used, as well as vulnerability of the materials to ignition, flame spread, and smoke generation. (49 *CFR* Part 238 Appendix B)

The investigation into the fire performance of the Silverliner IV railcars involved in all three fires is ongoing, but preliminary findings from the Ridley Park and Paoli fires indicate that fires spread from exterior electrical compartments to interior occupied compartments, a type of failure current design standards are intended to limit or prevent.

The Silverliner IV design also does not include modern feedback systems to give the operator detailed information when dynamic brakes or other electrical systems are not functioning normally. Instead, each railcar has a single fault light in the operator's cab

[4] See 64 *Federal Register* 25660 and 67 *Federal Register* 42909.

for all electrical problems regardless of system or severity. Preliminary information from interviews with SEPTA employees indicates that SEPTA kept railcars in passenger service with the fault light on and, as occurred in the Ridley Park fire, with confirmed electrical or mechanical problems. Keeping defective equipment in operation increased the safety risk associated with operating aging railcars because the Silverliner IV is susceptible to catastrophic failure when electrical faults are not identified and addressed, as the recent fires illustrate. The NTSB concludes that the outdated design of Silverliner IV railcars, in combination with SEPTA's maintenance and operating practices, represents an immediate and unacceptable safety risk because of the incidence and severity of electrical fires that can spread to occupied compartments.

1.3 SEPTA Mitigation Efforts

On July 25, 2025, SEPTA issued a memorandum to its mechanical division, operations division, and dispatcher center in response to the recent fires, directing that Silverliner IV railcars or consists be removed from service for maintenance if crews encounter:

- Dynamic brakes not functioning normally.
- An electrical fault recurring after the system is reset.
- Repeated electrical arcing or circuit breaker trips.
- Multiple railcars in a consist displaying electrical faults.
- Smoke or a burning smell.

These instructions are intended to improve operational practices and reduce risks to the travelling public and SEPTA personnel by removing defective railcars from service before electrical faults can lead to fires. The changes do not address the underlying causes of the electrical faults and related fires, which remain under investigation, and their effectiveness depends on quick recognition of any defect that could precede a fire.

On August 22, 2025, SEPTA provided the Federal Railroad Administration (FRA) an outline of its plan to mitigate fire risks in its fleet, clarifying operational changes and expanding the scope of its actions to include vehicle maintenance and engineering. In addition to the directions provided in the July memorandum, maintenance and operational actions described in the letter include:

- Reducing use of Silverliner IV railcars by using other equipment.
- Revising vehicle fault reporting forms. (SEPTA reports that this action is complete.)

- Developing a plan for improved radio communications for train crews operating on Amtrak territory.
- A one-time inspection of high-voltage cabling, resistor banks, and other electrical components in all Silverliner IV railcars. (SEPTA reports in its outline that this action is complete.)
- Expanding testing of traction motor cables.
- Replacing fiberglass roof air ducts with stainless steel.
- Developing a plan to install support brackets for high voltage cables.
- Increasing the frequency of tests and inspections related to propulsion and dynamic braking systems.
- Assigning mechanical division personnel to ride trains and monitor fault indications.

Engineering-related actions from the August 22 plan include:

- Installing thermal protection circuits to shut down propulsion and auxiliary circuits if elevated operating temperatures are detected.[5]
- Reviewing the last 5 years of "thermal and smoke events."
- Hiring a contractor to assist with a root cause analysis of the three thermal events from 2025. (The letter describes a plan to hire a contractor within 90 days and to complete the analysis within 180 days.)
- Using the results of the root cause analysis to address problems with components and review the current overhaul or replacement schedule for the Silverliner IV fleet. (This action includes descriptions of numerous specific potential follow-up actions, including changing troubleshooting procedures, upgrading components, performing postmitigation risk analyses, and auditing component suppliers.)

Two fires have occurred since SEPTA issued its memorandum to mechanical, operations, and dispatcher personnel on July 25, and since it reported completion of the one-time equipment inspection and fault form revisions described in its August 22 letter to the FRA. The September 23 fire involved a railcar that SEPTA returned to service after being damaged in a previous fire; the September 25 fire involved a railcar remaining in

[5] A *thermal protection circuit* is a safety mechanism designed to interrupt the flow of electricity to an overheating device.

service with an illuminated fault light. The NTSB concludes that SEPTA's current operating practices for the Silverliner IV fleet are insufficient to protect passengers and crews because railcars with electrical faults are not being identified and promptly removed from service.

The September 25 fire involved a railcar with an illuminated fault light that, under the procedures described in the July 25 memorandum and August 22 letter, should not have been in service. The investigation into why the railcar continued in service in this condition with several different crews is ongoing, but multiple SEPTA crews' failure to respond to an indicated electrical fault suggests an organizational gap between the proposed mitigations and their execution, such as ineffectual rules enforcement or other breakdowns in safety assurance. The NTSB concludes that the recurrence of fires despite SEPTA's attempted operational, maintenance, and engineering changes is consistent with organizational factors preventing proposed risk mitigations from being effectively deployed. The NTSB recommends that SEPTA suspend operation of the Silverliner IV fleet until it has determined the root causes of fires, developed and implemented a plan to address these causes, and identified and corrected the organizational factors that have prevented effective risk mitigations.

SEPTA's proposed changes to operational and maintenance procedures, and the installation of thermal protection circuits, are intended to manage known risks, not address the still-undetermined root cause. Even if successfully implemented, they are not a substitute for identifying and correcting issues with the design of the Silverliner IV railcar itself, such as the lack of modern feedback mechanisms, and they do not reduce the risk to passengers and crew if a fire occurs. Further, the engineering changes proposed in SEPTA's August 22 letter do not specifically commit to bringing the Silverliner IV fleet into compliance with fire safety standards that have been required for new equipment for more than 20 years under 49 *CFR* Part 238. The NTSB concludes that the risks posed by the Silverliner IV's outdated design cannot be fully addressed without an extensive fleet retrofit or replacement. The NTSB recommends that SEPTA create an expedited procurement or retrofit schedule and seek funding from appropriate sources as soon as possible to accelerate the replacement of the Silverliner IV fleet or its retrofit to include modern feedback systems and meet Title 49 *CFR* Part 238 fire safety standards for new railcars.

The NTSB further concludes that operational, maintenance, and engineering changes undertaken by SEPTA require ongoing monitoring to verify that they are mitigating risks to passengers. The NTSB recommends that, pending replacement or retrofit of the Silverliner IV fleet, SEPTA implement a plan to monitor the success of its risk-mitigation approach to the Silverliner IV fleet, including provisions for immediately removing the fleet from service again if its mitigations fail to prevent fires.

Conclusions

Findings

1. The outdated design of Silverliner IV railcars, in combination with the Southeastern Pennsylvania Transportation Authority's maintenance and operating practices, represents an immediate and unacceptable safety risk because of the incidence and severity of electrical fires that can spread to occupied compartments.
2. The Southeastern Pennsylvania Transportation Authority's current operating practices for the Silverliner IV fleet are insufficient to protect passengers and crews because railcars with electrical faults are not being identified and promptly removed from service.
3. The recurrence of fires despite the Southeastern Pennsylvania Transportation Authority's attempted operational, maintenance, and engineering changes is consistent with organizational factors preventing proposed risk mitigations from being effectively deployed.
4. The risks posed by the Silverliner IV's outdated design cannot be fully addressed without an extensive fleet retrofit or replacement.
5. Operational, maintenance, and engineering changes undertaken by the Southeastern Pennsylvania Transportation Authority require ongoing monitoring to verify that they are mitigating risks to passengers.

Recommendations

To the Southeastern Pennsylvania Transportation Authority

Suspend operation of the Silverliner IV fleet until you have determined the root causes of fires, developed and implemented a plan to address these causes, and identified and corrected the organizational factors that have prevented effective risk mitigations. (R-25-12) (Urgent)

Create an expedited procurement or retrofit schedule and seek funding from appropriate sources as soon as possible to accelerate the replacement of the Silverliner IV fleet or its retrofit to include modern feedback systems and meet Title 49 *Code of Federal Regulations* Part 238 fire safety standards for new railcars. (R-25-13) (Urgent)

Pending replacement or retrofit of the Silverliner IV fleet, implement a plan to monitor the success of your risk-mitigation approach to the Silverliner IV fleet, including provisions for immediately removing the fleet from service again if your mitigations fail to prevent fires. (R-25-14) (Urgent)

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Report Date: September 30, 2025

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For more detailed background information on this report, visit the NTSB Case Analysis and Reporting Online (CAROL) website and search for NTSB accident ID RRD25FR006. Recent publications are available in their entirety on the NTSB website. Other information about available publications also may be obtained from the website or by contacting –

National Transportation Safety Board
Records Management Division, CIO-40
490 L'Enfant Plaza, SW
Washington, DC 20594
(800) 877-6799 or (202) 314-6551