



Part 4 **Fire investigation guide**

Advice on how to conduct a fire investigation

The Truck Fires Series is in four parts and addresses the many ways in which trucks and their trailers can catch fire.

It also provides advice on how truck and trailer fires can be prevented.

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National Bulk Tanker Association



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In undertaking this work, ARTSA-i and the NBTA enlisted the technical expertise available within the Truck Industry Council (TIC) to assist in the development of the guidance material in these documents.

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1 Introduction

Truck Fires have been a long-standing issue within the heavy vehicle sector. Recognising this risk, ARTSA produced a report in 2006 on “Why Trucks Catch Fire.”¹ Despite highlighting the risks of truck fires, the heavy vehicle sector remains fire-prone.

NTI Insurance are the major heavy vehicle insurer in Australia.

Their report from 2020² states that:

- Over 10% of major losses were due to fire
- 32% of fires were in the engine bay and truck cabin area
- 55% of engine bay and truck cabin fires were due to electrical failure
- The balance of failures were mainly due to wheel and tyre issues

The impact of these fires can far exceed the actual loss of the truck and trailer equipment and its load. The disruption, safety risk to drivers and the public and environmental damage can be wide ranging.

Given the trend in fire claims in the last 10 years, this series of documents looks at the major causes of truck and trailer fires, and how these fires can be reduced.

The guidance material is arranged in four parts.

Part 1 – Fire risk guide	A detailed look at causes of fires in truck and trailers
Part 2 – Drivers guide	What drivers can do to lessen the risk of fires
Part 3 – Maintenance guide	What maintenance staff and fleet controllers can do to prevent fires
Part 4 – Fire investigation guide	Advice on how to conduct a fire investigation

This document is Part 4: **Fire investigation guide**

It includes a post fire check list to assist in the fire investigation.

This guidance is for operators and others involved in fire investigations. Some of the information needs to be passed on to drivers as they play a significant role in the gathering of information to support the fire investigation.

All parts of this guide including the summary can be downloaded from www.artsa.com.au/fires

¹ See <http://www.artsa.com.au/library/index.html>

² See <https://www.nti.com.au/news-resources/research/latest-report>

2 Driver & Operations Reporting

Pre-fire observations:

We all have five senses; sight, smell, hearing, taste and touch. Drivers can provide vital information before the fire event to assist maintenance personnel or investigators in determining the cause of a fire. The driver observing, hearing or smelling telltale signs of a fire is crucial in mitigating the risk of a fire before it happens, or providing useful information in order to determine the cause of the fire after the fire event.

A fire investigators role is to determine where and how a fire was caused. Fires can be caused by mechanical or electrical failures. In some cases, precursory events can cause the mechanical or electrical failure. The extent of relative damage can impact how difficult an investigation can be to undertake. Investigators have a better chance of determining the cause of the fire if the damage is localised. In many cases however, the vehicle can be totally destroyed due to the remoteness of the fire locations, fire brigade response times and the severity of the fire. In such cases, common techniques used to aid in the investigation such as fire pattern analysis can be next to impossible. Drivers, and workshop managers are therefore pivotal in an effective investigation, and can provide important clues or starting points for further investigation.

Fire investigators and forensic engineers are likely to speak to the driver of the vehicle in order to determine what the operating conditions of the vehicle were moments prior to the fire. Drivers should hopefully be aware of their surrounding conditions, and how the vehicle is behaving and operating. If any discrepancies or unusual operations are identified, a driver should record these in safe place such as on their phone or tablet device and contact a maintenance supervisor. This record of information can then be used to assist maintenance personnel and mitigate against potential fire, or be used to aid an investigation.

If driving at night, drivers should take note of any; flickering or dimming of driving lights; flickering or dimming of dashboard lights; and unresolved static disturbances in the UH radio system. These can in some cases be caused by disturbances in the electrical system, such as large current draw during partial short-circuit or component failure and need to be reported to the workshop for further investigation. If such symptoms are identified during a long trip, a driver should document the information on his/her phone and send an email directly to the service manager (notepads and paper records can be important, however, these are often left in the cabin and can be consumed in the fire). In the event of these types of electrical disturbances driver should pull the vehicle over and inspect the main cables for any rubs or deformations before continuing along the journey. It is also important for all fleets to consider an online reporting system via in-cabin electric notepads or tablet devices.

Observe any smells, particularly if hydrocarbon fuel vapour is suspected as it could indicate a high-pressure fuel leak. Identifying smells can also be useful to determine what causes fire to start. For example, there are distinct smells associated with diesel fuel and burning oil when compared to burnt plastics or insulation. During electrical fires, drivers may sometimes report a sweet/plastic smell in the air before any smoke or flames are identified.

Noise and vibrations are crucial to report. Particularly if they are related to the steering system or engine compartment. Steering related vibrations could indicate a deflated tyre on the prime-mover (because the trailer wheel-ends won't be felt), an impending bearing failure or a brake related issue, all of which could result in a wheel-end fire if left unchecked and undiagnosed.



Figure 1: Driver observed a leak under the left-hand fuel tank at his next stop. But continued driving. The truck eventually caught fire.

Engine compartment fires where a fuel leak, engine failure or a turbo-charge malfunction occurs will often result in a minor explosion that can be heard. Performance issues, leading up to the failure may also occur and should be reported. For example, a fuel leak can result in rough running and under fueling the engine because it is escaping elsewhere. Electrical fires are often considered silent because they do not create any noise before the fire has started, other than electrical disturbance noise in the radio.

Post and during-fire observations:

Once a fire has broken out the driver should do the following:

1. Assess the situation (Make sure YOU and others around you are safe),
2. Shut down the vehicle / disconnect batteries / Use Isolation switch (DG Vehicles).
3. If practical and safe to do so, attempt to fight the fire.
4. If practical and safe to do so, decouple the trailer to separate the vehicles.
5. Call 000.
6. Call the supervisor/ head of operations and explain the situation.
7. Start the reporting process.

Drivers should not rely on their memory as an investigation can take several months or even years to conduct. A driver may not be contacted for a long period of time and Investigators rarely inspect the

burnt vehicle at the scene. Therefore, drivers should record all their observations. As most phones are equipped with cameras, photos should be taken as soon as practical (after all fire fighting efforts have been exhausted and authorities have been notified).

Driver's should record their observations from the pre trip inspection and note any abnormal smells, noises, vibrations or visual observations prior to and during the fire. Each observation should be recorded against a time (roughly) so that a chronological order of events can be established. The more detail, the better, and should include:

1. When burning smell was first observed,
2. Where smoke was first observed,
3. Where flames were first observed,
4. Where the flames spread (one area to another),
5. Environmental factors such as wind or rain that could have impacted the fire,
6. What noises they heard before the fire and during the fire,
7. Was there a fire on the road-way / did fire drop underneath the engine, wheel-end etc.
8. Where practical, photos of the surrounding area and/or a diagram should be drawn.



Figure 2: Photo of an engine compartment fire in a cab-over prime mover. Taken by the driver.

After a fire has developed and taken hold of the vehicle, scene preservation is of utmost importance. Drivers and supervisors/operations managers should ensure that the extinguished remains are preserved during the recovery process. This means that clean-up or recovery crews should not place debris in the cabin. All debris should be placed in bags or boxes than can later be inspected separately to the vehicle. This also means taking photos of the vehicle and its surroundings before it is moved and ensuring when the vehicle is moved from the scene to a depot or yard that all components remain with the vehicle. Operators should ensure that the damaged vehicle is marked accordingly and protected against access by unauthorised personnel.

The safety of all drivers and witnesses is paramount. Therefore, recording, taking photos and so on should only be conducted when it is safe to do so. If a Dangerous Goods cargo is being transported, then the area must be cleared, passers-by should be notified. Ensure that in each case the driver is standing upwind and away from the fire.



Figure 3: Photo of a trailer fire at early stages. Note the wind direction can be clearly identified. Taken by the driver.

3 Workshop Documentation

Workshops must keep detailed and up-to-date maintenance/repair/work orders that describe what work was conducted, and capture the vehicle details and any driver remarks. It is likely that an investigator will request this information in order to review the work done on the vehicle. Typically 6-12 month records are requested, where often the most recent maintenance conducted on the vehicle is reviewed in very fine detail. A lack of maintenance, and/or a lack of detail or inconsistency in maintenance reports is likely to be scrutinised by investigators. Refer to the guidelines in Part 2 (for drivers) and Part 3 (for maintenance personnel) on what checks drivers and maintenance personnel should conduct to mitigate against fires.

Operators should periodically review the workshop documents in order to make sure that they are readily available and being adequately maintained. Operators should also review these documents immediately after a fire has occurred and discuss the most recent work conducted on the vehicle with the repairer/worker that was most recently involved with the vehicle. The specifics of the most recent task should then be revisited and recorded. For example, if the most recent work involved replacing wheel bearings on an axle, the subject axle, wheel bearing, torque, procedure, grease/or oil, preload etc. needs to be recorded in detail.

If defects are identified on vehicles, operators may consider taking photos of the defect, followed by photos after the issue has been rectified. This provides photographic evidence of the maintenance for the vehicle and can be invaluable after the event of a heavy vehicle fire.

Are you the usual operator of this vehicle? Y / N
<p>If YES to above, List any relevant service / repair or discrepancies identified in the last month:</p> <ol style="list-style-type: none"> 1. 2. 3.
<p>Moments before the fire started was there a burning smell? Y / N</p> <p>If YES, describe it:</p> <p>E.g. Smelt like plastic / smelt like fuel / smelt like burning oil</p>
Where was smoke first observed?
Where were flames first observed?
<p>Describe the spread of fire?</p> <p>E.g The fire was first noticed in engine compartment and spread to cabin. Or I saw flames drop on the ground at the firewall.</p>
<p>What environmental factors are at play such as wind, rain and their direction.</p> <p>E.g Light wind from left to right when facing front of vehicle.</p>
Attach 6 months maintenance and repair records if applicable (Applicable for workshop and operators).

On the diagram below mark and note where smoke was first identified, flames were first identified, and where you believe the fire was emanating from:

