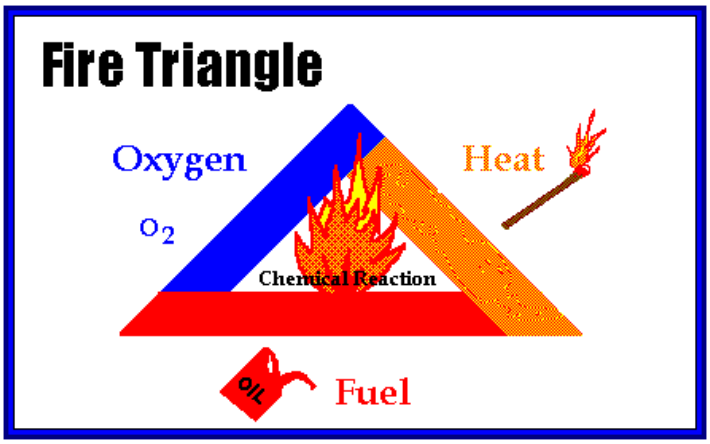
Heavy Vehicle Fires – Steve Bullôt

A fire involving a truck and/or trailer is a frightening and dangerous thing, not to mention costly.

These fires are a prime example of the old adage, 'prevention is better than cure'. But to prevent truck or trailer fires first you must know something of the mechanics of fire;
How does a fire start?
What feeds a fire?
What keeps a fire going?

A fire is the outcome of a chemical reaction between three elements; a heat (ignition) source, fuel and oxygen, often referred to as the Fire Triangle[11].



In this article we will discuss truck and trailer fires and some of the simple precautions that can be taken to reduce the potential for a fire to start.

Fires usually begin small but can easily and quickly accelerate into a situation that becomes uncontrollable. Firefighting should be left to the specialists who are fully trained and have access to the proper equipment.

The origins of a fire

As described, a fire needs these three elements to ignite and keep going. When they come together in the correct proportions fire results and can become self-sustaining quite easily, generating its own heat and pulling the necessary oxygen out of the surrounding air. Understanding each of these elements and how they work together to ignite and sustain a fire can go a long way to preventing a fire in the first place.

1. Ignition; It is often assumed that ignition is caused by a spark or open flame and while these things can be the catalyst of a fire, it is just as likely that heat alone causes a fire by heating the fuel to or past its 'flashpoint', the temperature at which it will spontaneously combust.
2. Fuel; A fuel is anything flammable in the vicinity of the fire.
3. Oxygen, freely available in the air around us; the third pillar required

So, looking at the three elements how do they interact and what is required to prevent them getting the opportunity to do so.

[1] **Retrieved 03/06/2024 from The Fire Triangle (sc.edu)**

Ignition

Without a source of ignition, a fire cannot start so it is imperative that any open flames or sparks are eliminated, and all heat sources are minimised. However, before they can be minimised heat sources must be identified;
The most obvious source of heat, other than an open flame or spark, is friction, caused by the rubbing together of two surfaces such as the tyre and the road surface, the brake pads or shoes interacting with the disc or drum or the wheel bearing and the stub axle. Preventative maintenance is the key to ensuring the friction heat caused by the normal operation of the vehicle is kept within boundaries, so nothing overheats. Ensure brakes are maintained to within the safe tolerances recommended by the equipment supplier thereby reducing the chances of metal-to-metal contact between pad or shoe and disc or drum causing overheating or sparks. Eliminate brake imbalance so the brake on one side of an axle does not have to work harder that the brake on the other side of the axle and thus overheating. Ensure wheel bearings are properly greased with the correct grade of grease as recommended by the manufacturer. Check wheel bearing grease regularly, especially after travelling through lying water that could contaminate or flush out the grease. Incorrect tyre inflation is another source of heat build-up, ensure tyre inflation is within specification, underinflated tyres can overheat and combust. Note that heat build-up can continue once a vehicle is stopped as there is no longer any air movement cooling the tyre.

Fuel

Even if there is a source of ignition it is hard for a fire to take hold if there is no fuel, however, there is huge potential for fuel with any heavy vehicle combination but again, preventative maintenance and good housekeeping are the keys to ensuring safety;

Regular inspection and cleaning of the engine bay and undercarriage to ensure there is no build-up of oily residue that could feed a fire. These regular inspections will also identify any fuel or fluid leaks that could also fuel a fire and enable them to be repaired.

Rags and other cleaning materials should never be left in the engine compartment or in the cab footwell. If cleaning materials are kept on the vehicle they should be in a container and separated from any potential spark or heat source.

Air

Air contains all the oxygen necessary for the ignition and propagation of any fire, however, it is extremely difficult to eliminate air from around either a heat or fuel source meaning it is imperative that prevention is the first line of defence when it comes to heavy vehicle fires. It should be noted that elimination of air is the main method used to extinguish fires by flooding the fire with a gas, fluid or powder that prevents the fire accessing the oxygen it needs to propagate.

Fires in enclosed freight bodies can be particularly troublesome as a fire that often appears to be minor can quickly accelerate once it is opened to the air. If a fire is suspected in an enclosed freight body the curtain or doors should not be opened to investigate further until professional assistance is on hand.

The main causes of truck and trailer fires.

In their 2023 Major Crash Investigation Report the National Truck Accident Research Centre (NTARC)[2], reported that non-impact truck and trailer related fires in 2022 increased by nearly 10%, the highest total since 2019.

The report says that in 2022 the location of these fires was:

Location	Ratio
Wheel end	48%
Engine bay/cab	44%
Load	4%
Other	5%

Wheel end related fires in 2022 were:

Location	Ratio
Tyre	38%
Bearing	34%
Brake	17%
Unknown	11%

The most common cause of wheel end fires was tyre related, generally incorrect inflation, bearing failures was 36% up nearly 10% on the average for previous years. The report does comment that some of this increase could be due to vehicles transiting flood waters resulting in water ingress to the wheel bearings and their subsequent failure.

Cab and engine bay fires were predominately the result of an electrical fault, 67%, followed by a mechanical fault at 29% with the remaining 3% caused by unknown sources.

Although the information quoted is from Australia it is believed that data from New Zealand would not be dissimilar.

Where does a fire start?

As can be seen from the figures above, sometimes a fire will originate in the load, but, mostly, faulty mechanical items such as tyres, brakes or electrics are the cause. To help prevent fires;

- Ensure tyres are correctly inflated and in good condition
- Ensure brakes are properly adjusted and in good condition within the safe tolerances recommended by the manufacturer.
- Ensure wheel bearings are properly services and in good condition
- Ensure the engine bay is clean and free from contaminants
- Ensure all wiring is safely routed and unable to come into uninsulated contact with metal components.

Also;

- Ensure the load is safe. Ignition sources such as batteries are not packed together with sources of fuel such as cardboard, textiles or paper

Rubbish truck fires.

[2] 2023-NTARC-Report (nti.com.au)

Fires in domestic and industrial rubbish trucks are increasing worldwide. In Auckland there were nine domestic rubbish truck fires in the first five months of 2024 compared to thirteen during 2023. The incorrect disposal of lithium-ion batteries is attributed to most of these fires. This type of battery is commonplace now and can be found in things such as mobile phones, cordless power tools and rechargeable batteries. These batteries are dangerous because they contain a highly flammable electrolyte coupled with high energy intensity, because of this they can overheat and ignite under certain conditions, such as a short circuit, physical damage, improper design, or assembly.

What to do in the event of a fire?

If a fire does start, then it is imperative that;

- There is a plan
- Where possible the vehicle is moved off the roadway
- Emergency services are called
- Vehicles in a combination are separated only if it can be done without undue risk
- Emergency services are advised where the fire was first noticed.
- Where possible, emergency service personnel be provided with a load map to help them identify the seat of the fire and give them guidance on how to fight it.

Fire prevention guidance.

The ARTSA Institute (ARTSA-i), has produce some guidance material related to truck fires, although these are prepared in the context of the Australian road transport environment, they do contain some guidance that could also apply in New Zealand.
In four parts these guided can be accessed at:

Part 1 – Fire risk guide; Fireriskguide30.4.21.pdf (artsa.com.au)

Part 2 – Drivers Guide; Driversguide30.4.21.pdf (artsa.com.au)

Part 3 – Maintenance Guide; MaintenanceGuide30.4.21.pdf (artsa.com.au)

Part 4 – Fire investigation guide; Fireinvestigationguide30.4.21.pdf (artsa.com.au)