



## **ARTSA Heavy Vehicle Fires Conference Record**

The Conference was held at the Royal Randwick Racecourse in Sydney on 15<sup>th</sup> August 2019. Around one hundred attendees from truck and trailer manufacturers and suppliers, transport operators, regulators, Fire and Rescue services and Police, the NBTA, insurers and forensic investigators discussed the causes and prevention methods including improved maintenance and technology such as fire suppression equipment and wheel monitoring devices.

There were 12 presentations. four sponsor companies exhibited equipment or services, and a discussion workshop with delegates in four groups was run to develop the conference themes.

The conference and workshop were partly funded by the National Heavy Vehicle Regulator under the Heavy Vehicles Safety Initiative Program.

The following proceedings was compiled from presentations:

### **1 Common Causes of Fires**

#### **1.1 The common causes of fires on trucks:**

1. Arcs on the starter (or battery cables), alternator, cabin and trailer supply cable.
2. Fuel line rubs or failures that result in leaks / sprays of fuel onto the exhaust.
3. Lubrication/hydraulic oil line failures near to the exhaust.
4. Turbo charger oil seal failures.
5. Flammable material resting against the turbo charger or the exhaust.
6. Electrical failures from hot terminals causing insulation to burn.
7. Overloaded minor electrical cables, hot relays and fuse fires.
8. Tyre rub onto a solid mudguard or between deflated dual tyres.

#### **1.2 The common fire causes of fires on trailers are:**

1. Wheel bearing failures (or seal failures) that result in dragging (drum) brakes.

2. Dragging brakes due to damage to the pneumatic spring brake system.
3. Tyres catching fire because they are flat or poorly inflated or rubbing on hard mudguard surfaces.
4. Friction rubs on mezzanine support brackets, resulting on hard shards accumulating on flammable packaging on the freight.

## **2 Heavy Vehicle Fires - Factors & Protections**

### **2.1 Fires of Electrical Origin**

#### **Factors:**

1. Poor quality connections cause hot terminals.
2. Electrical component manufacturers often over-rate electrical terminal ratings for heavy-vehicle applications.
3. Lack of fire-retardancy standards for insulation on after-market electrical equipment.
4. Lack of fuse/CB protection on alternator cable, cabin cable and add-on wiring.
5. Poor quality terminal connections.
6. Starter motor return cable left off leading to excessive current in minor cables.
7. Return cables and terminals can be overloaded, just as the positive cables and terminals.

#### **Design & Installation Protections:**

8. Designing and install main cables to keep them separate from rub points.
9. Install circuit breakers or fuse protection in all cables except the starter cable.
10. Protect the main cables with conduit that has flame retardant properties.
11. Look for split conduits that have opened and have grabbed a protrusion.
12. Use electrical cables with flame retardant insulation.
13. Use main cables with double insulation.
14. Use suitably rated electrical terminals. Halve the published rating!
15. No more than three ring terminals on a single connection and use a nut retention system.
16. Use rubber block clamps that cannot cut into cables.

### **Maintenance and Inspections:**

17. At every A-service look carefully for rubs on main cables, where they can be easily seen.
18. At every A-service, look out for loose electrical terminals or signs of blackening of cable insulation, where these parts can be easily seen.
19. When the truck is over a pit, look carefully for cable runs at the starter motor terminals.
20. If a driver reports electrical problems, disconnect the batteries until the problem is resolved.

### **Drivers:**

21. Do not ignore the smell of smoke in the cabin.
22. Park vehicles with the battery isolator open, if one is fitted.
23. Sometimes flickering gauges or headlights indicate poor electrical connections. Report then to the workshop.

## **2.2 Fires Starting in the Turbocharger**

### **Factors:**

1. Turbochargers bearing failure can destroy the oil seals.
2. Failure of turbocharger bearing seals can result in the lubrication oil catching fire.
3. If an oil fire gets into the air-boost side, the fire will get out into the engine compartment.
4. High exhaust temperature can be a factor in bearing failure.
5. Intercooler air leaks result in low boost. Controllers respond by over-fueling, which causes the exhaust temperature to be high.
6. LPG top-up fueling via the air intake can also cause the exhaust temperature to be high.

### **Maintenance:**

7. The turbocharger bearings are wearing parts and should be refurbished at a D-service, or beforehand if the service level is onerous.
8. Regularly check that the turbo boost level is normal.

9. If the engine has a pyrometer, get the driver to regularly report the maximum observed temperature. Respond if it is rising.
10. At each engine inspection, check for and repair oil leaks at the turbocharger oil line.

## **2.3 Fires Due to Fuel-System Failures**

### **Factors:**

1. Hydrocarbon fuels, oils, (some) refrigerants and glycol do not ignite when in contact with the engine block. They will ignite if in contact with exhausts, turbochargers and very hot brake drums.
2. Low pressure fuel hoses run too close to exhausts.
3. Polyamide fuel lines sitting on sharp metal edges, particularly close to exhausts.
4. High-pressure fuel line cracks due to vibrations / pulses.
5. Failure 'spray zones' oriented towards exhaust pipes.

### **Design and Installation Protections:**

1. Keep combustible material away from exhaust pipes or turbochargers – at least 200 mm.
2. Lag Exhausts in dangerous locations where debris could get close to the exhaust.
3. Install shields on exhausts to protect hoses, cables, etc where they run closer than 200 mm.

### **Inspection and Maintenance:**

4. At every A-service look carefully for rubs on fuel lines where they can be easily seen.

### **Drivers:**

5. Look for fuel and oil leaks under the vehicle when it is parked. Determine the source and resolve.

## **2.4 Fires due to Dragging Brakes:**

### **Factors:**

1. Fires due to dragging spring brakes mainly occur on drum brakes. The tyre bead bakes and may ignite.
2. Aluminum rims transmit the heat from the drum to the tyre better than do steel rims.
3. Dragging disk brakes can cause the wheel seals to fail, causing minor oil fires that can spread to the inner tyre.
4. Low slung brake actuators and brake hoses are vulnerable to road strike, leading to damaged spring actuators.
5. Carbon particles (from oil) are generated in unloader-type air compressors on long journeys. These carbon particles, mixed with water, can clog-up the spring-brake relay valve, which can cause the spring brakes to drag.
6. Poorly maintained spring brake relay valves are vulnerable to leaks.
7. Dragging service brakes occur rarely. If the return springs fail or the S-cam wear

#### **Design & Installation:**

8. Low slung actuators and air brake hoses are vulnerable to road strike. Avoid having these parts below the bottom of the axle.
9. If it is impractical to avoid low-slung brake components, install a shield.

#### **Inspection and Maintenance:**

10. Check the condition of brake hoses, especially at the actuator. Look for creases or developing splits.
11. Look for dints on brake actuators and replace if necessary.
12. Check that the air compressor intake filter is clean and not faulty.
13. Use soapy water to check for air leaks at fittings at the spring-brake relay valve.

#### **Drivers:**

14. Never ignore wisps of smoke coming from the wheels.
15. If you drive over a mattress on the road, or other large debris, stop the vehicle when safe and inspect for damage or dragging material.
16. A wheel end fire can only be effectively fought using water or foam. Water is needed to take heat away from the brake drum and hot tyre.
17. If you are close to a fire station, drive slowly to it.

## **2.5 Fires due to Tyre Rubs:**

### **Factors:**

1. Mainly occur on trailers and not trucks because drivers cannot see developing signs.
2. Principal cause is deflated air suspension.
3. Air suspensions with a single levelling valve will sit down level. This situation is harder for the driver to see than a dual levelling valve control, which will probably lean if one air hose fails. It is easier for a driver to see a leaning trailer in the mirrors than a trailer riding low but level.
4. Secondary cause is deflated inner tyre causing a rub.
5. Occasionally tyres rubbing on heavy duty mudguards cause fires.

### **Design & Installation:**

Take care with air suspension line routing to avoid creasing the air line or rubbing air lines on metal edges.

### **Inspection and Maintenance:**

Have a tyre pressure inflation policy.

Put caps on tyre inflation valves to protect them.

Check that outrigger brackets for mudguards (particularly heavy-duty rubber strip guards) are not cracked and drooping.

### **Drivers:**

Check the tyres when starting again after a long break from driving. Strike each tyre to check for low air pressure.

Check that the suspension airbags are fully inflated before starting driving.

## **2.6 Fires due to Bearing Failures:**

### **Factors:**

1. Failure of bearing lubrication due to inadequate maintenance.
2. Poor quality bearings.
3. Water into hubs because vehicles were driven through fording water.
4. Excessive pre-load adjustment.

**Design & Installation:**

5. Use quality bearings.
6. Use quality grease / oil.
7. Apply a factor of safety of at least two for bearing load calculations.

**Inspection and Maintenance:**

8. The heavier the axle loads and the poorer the road conditions, the more bearing wear can be expected.
9. Lift each wheel at every A-service. Spin the wheel to listen for excessive noise. Shake the wheel to sense slack in the bearings.
10. Tightening up bearings to overcome slackness will not make old bearings new!
11. Inspect and re-lubricate the bearings when the driver reports the vehicle went through water over the road.
12. Have a bearing preventative maintenance policy. Change them with each brake reline.

**Drivers:**

13. Feel hub temperatures when you start a long break from driving. An abnormal hub temperature indicates a developing bearing failure.
14. Report water fording events.

**2.7 Fires due to Mezzanine Support-Bracket Rubs****Factors:**

1. Soft metal support brackets that are prone to fretting. The hot rubbings build up on combustible freight underneath the bracket location.

**Design & Installation:**

2. Use brackets with a hardened surface.
3. Consider installation a polyamide or polyurethane captive wear pad.

**Inspection and Maintenance:**

4. At every A-service, inspect the support brackets for wear and rubbings. Rubbings build up on the trailer floor and can be discovered by sweeping the trailer floor.

**Drivers:**

5. When loading the trailer, look out for metal rubbings on the trailer floor. Report any to the workshop.

### **3 Air Conditioning Fire Risks**

- There is a transition occurring with refrigerants. The transition was originally from R12 (ozone depleting greenhouse gas), to R134A (no ozone depleting potential but a greenhouse gas) and then to R-1234yf (no ozone depleting potential and minimal greenhouse gas).
- R12 and R134a have no flammability.
- R-1234yf is mildly flammable.
- Other hydrocarbon refrigerants are being sold in the after-market that are cheaper than R-1234yf. They are highly flammable.
- There was a recent example when a condenser fan failure resulted in a rupture of the air conditioning system, which released a highly flammable non-OEM refrigerant into the cabin. The gas ignited somehow and fire came out the face air vents, which burnt the occupants.

### **4 Discussion Points Arising From Presentations**

- Manufacturers are on notice that chronic fire problems on a model should not be ignored and should result in a campaign repair.
- New Fire and Rescue training centre – Toll Transport is providing tankers for exercises.
- Thirty fires since Jan 2019. Eighteen on Freightliners
- Load and fridge fires well under 10% of all HV fires.
- Truck fires close to 60% of all HV fires.
- Wheel end fires close to 30% of all HV fires.
- Electrical and cabin fires almost equal as part of the truck fire cause
- Fires on trailer wheels are split between hubs, tyres and brakes
- Conduit flammability – NTI plans to do tests.
- Safety culture – It is important that the driver is willing to respond to suggestions
- Power cable replacement? Should the electrical cables be regarded as wearing parts.
- New equipment: still an issue



- Need to call it out – “Freightliner Coronado”
- 190k trucks registered in NSW.
- 400k pass through each day.
- Subbie risk
- We know the problems...
- NSW – the nations checking station.... ‘NSW putting in the greatest resources
- Water supply an issue
- Strategy at times is “let it burn” as water supply is becoming more critical
- Evidence at a HV fire scene is often contaminated or destroyed.
- Driver must prepare notes on what happened, what led up to the fire...
- Fire suppression systems: AS5062 for suppression systems in trucks and road vehicles
- Attributes of water versus dry chemical powder
- Water appears to be the better system due to secondary ignition risk from DCP
- Looking for legislation to mandate systems
- Detecting wheel fires
- 33% of fires start in wheel well
- Technology can provide a solution to prevention
- Tyre monitoring mandated overseas and will come to Australia for passenger cars
- Not for trucks
- Some States recommend or have regulations for certain users
- RVS Act is being reworked
- Under new law there is no power for a recall but ACCC can force such things
- Design is off shore and parent company makes decision
- It might result in a service campaign rather than a recall
- Does TIC have a guide for service campaigns? – no
- Working with Regulator on a possible campaign.
- If the manufacturer does not participate then the ACCC does not have the power to force a recall on a foreign product. ACCC protects consumers and not business.
- NHVR investigated the leaking of fuel tubes on a particular engine.
- Aware that if you ask the manufacturer they will give you a new damper kit
- Engine manufacturer did offer a campaign on the tubes but did not make it public.

## **5 Discussion Points Arising from the Workshop**

- As terminals get hot, a copper oxide layer forms. This further increases the contact resistance.
- Cannot change ADRs because they need to align with ECE and there are no explicit fire regulations in the ECE.
- Confusion caused by Feds controlling new vehicles and the regulatory in service vehicles with the states.
- Standard operating guidance can provide direction – better than regulation.
- Industry codes better than regulation. Industry has ownership.

- Service repairs – tick and flick lists do not work – proper education is needed.
- Industry needs guidance about what to look for.
- Wheel fires. Tyre air pressure monitoring and temperature sensing should be promoted; especially for DG vehicles.
- Industry and regulators need a risk management approach.
- Mandating reporting – NHVR looking at in future
- Get rid of non pre-set wheel bearings.
- Need to provide advice to 000 operators re truck fire procedures.
- We need to get fire reduction processes into HVNL review.
- Industry and truck manufacturers need to sign up to codes/standards intended to protect against fires.
- OEM vs non genuine parts issue.
- Some imported tyres are poor quality.
- Sub-standard wheel bearings, even when they are reputable brands. Some bearings are made to a price.
- Answer: Compliance of parts is needed e.g. brake boosters.
- Needs improved standards on replacement parts.
- “industry going backwards” on quality of replacement parts.
- Maintenance, training and compliance is needed for replacement parts including tyres.
- Often difficult to identify whether an electrical cable arc melt was the cause or the effect.
- There is often no water supply on main roads and the fire fighters can struggle to find water.
- Waste trucks are vulnerable to fires starting in the load.
- Sound deadening materials in the engine compartment can fall onto the exhaust and catch fire.
- Brake fitting connections on trailers can be incompatible, Imperial v metric mixed etc.,
- Metal touching high tension power lines can start fires.
- Zip ties on cable bundles can fail because they are too thin.
- Concern about the quality of new wheel bearings.
- Some problems are caused by body builder modifications. Relocation of components can move them too close to the exhaust pipe.
- Thorough maintenance is essential to pick-up developing problems.
- Legislation is needed to improve the quality of replacement parts; especially brakes, steering, coupling, suspension, tyres.
- Both legislation and enforcement are needed.
- Entry standards are needed for new operators.
- Technical competence is a real issue. Maintenance is only as good as the ability of the maintainer.
- Driver education – industry guide needed for operators.

- Some manufacturer's do not use conduit on the starter cable. They rely on the double insulated cable sheath.
- Pre-delivery inspection may pick up rub points on cables and fuel lines.
- Education. Driver and mechanic need incentives for good practice.
- Non-compliant spare parts an issue
- Electronic tools/computer program needed to monitor maintenance
- Need heat indicators on hubs
- Maintenance intervals need to decrease– intervals checks between main services for high k units
- OEM's could do monitoring of many items – technologies are available
- Performance based on risk – eg offering more access if you have: - TPM, fire suppression etc incentivise “best practice” – PBS (Performance based safety), rather than a regulator driven process, possibly involving telematics to assist with monitoring
- How to incentives versus mandate – eg use of insurance premiums

## **6. Conclusion**

Following the conference, TIC and ARTSA have started the development of guidance materials that will be widely promoted throughout the transport industry and to manufacturers.

The Truck Fires guidance will be developed using a collaborative approach and industry associations and government regulatory bodies will be asked to input into the development of the guidance materials.

The NBTA are strong supporters of the initiative and at the recent NBTA Conference had a session on Truck Fires.

**For further information please contact Greg Rowe at [exec@artsa.com.au](mailto:exec@artsa.com.au)**



C O N F E R E N C E

## Heavy Vehicle Fires Causes and prevention

A recognised project under the NHVR's *Heavy Vehicle Safety Initiatives* program

15TH AUGUST, ROYAL RANDWICK RACECOURSE, SYDNEY



Truck and trailer fires are a major issue in the heavy vehicle sector. Why they occur and what can be done to prevent these fires is the focus of this one day event.

The conference will bring together forensic experts, policy makers, manufacturers, operators, regulators and component suppliers to share their experience on what is one of the largest claims categories for insurers in Australia. It is an issue that can cause massive inconvenience as well as considerable environmental and public safety risk.

*The program (overleaf) includes speakers from:*

- Fire & Rescue NSW
- National Heavy Vehicle Regulator
- Truck Industry Council
- NSW Police
- NTI Insurance
- Holmwood Group
- Forensic Engineering consultants
- Fire Technology Specialists

The event will launch an **updated heavy vehicle fires advisory** that will be useful for all parties involved in manufacturing, operating and maintaining heavy vehicle equipment.

Registration is now online at [www.artsa.com.au/conferences](http://www.artsa.com.au/conferences)  
or fill out the registration form following and return to [exec@artsa.com.au](mailto:exec@artsa.com.au)

- S U P P O R T E R S -



For more information contact:  
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# TRUCK FIRES CONFERENCE 15 AUGUST AT ROYAL RANDWICK

## - P R O G R A M -

9.00am	Arrival – Tea & Coffee	
9.30am	Welcome Address Housekeeping & Introduction of Sponsors	Dr Peter Hart – ARTSA Executive & Justin Keast NBTA Chairman
	<b>The Scale of the Problem</b>	
9.40am	What the Data Shows	Adam Gibson – Transport and Logistics Risk Engineer – NTI Insurance
9.50am	Bulk Tanker Incidents	Rob Perkins Executive Director, NBTA
10am	Managing the Incident	Superintendent Peter Cleary – HAZMAT – Fire & Rescue NSW
10.10am	When it hits the Fan	Chief Inspector Philip Brookes – NSW Police Force
10.20am	10 Things that Cause Fires	Dr Peter Hart – ARTSA Executive
10.30am	Panel Session	Dr Peter Hart, Adam Gibson, Rob Perkins, Peter Cleary, Phil Brookes
11.00am	Morning Tea - Sponsored by Sandvik	
11.30am	<b>Technology and Forensic Investigation</b>	
11.30am	Understanding the Fire Scene	Bob McKay – Managing Director – McKay Forensic Investigations
11.40am	Fire Suppression Technology	Kieran McHatton – General Manager – Fogmaker
11.50am	Detecting Wheel Fires	Peter Woodford – Managing Director – LSM Technologies
12.00pm	Fires & Refrigerants	Brett Meads – Vice President VASA
12.10pm	Ten things that Prevent Fires	Jas Babalija – Mechanical Engineer – Hartwood Consulting
12.20pm	Panel Session	Bob McKay, Kieran McHatton, Brendan Villiers, Brett Meads, Jason Staples, Jas Babalija
12.45pm	Lunch - Sponsored by Fogmaker (Including Fogmaker Demonstration near front entrance)	
	<b>Opportunities and Solutions</b>	
1.30pm	What Can Be done at the National Level	Kym Farquharson-Jones A/Manager Safety Standards and Assurance NHVR
1.45pm	Risk minimisation in the Workshop and on the Road	Chris Loose – Technical Officer – Truck Industry Council
2pm	Workshop – National Strategy to Tackle Fires	All
	Wrap Up	
4pm	Close	



C O N F E R E N C E

## Heavy Vehicle Fires Causes and prevention

A recognised project under the NHVR's *Heavy Vehicle Safety Initiatives* program

15TH AUGUST, ROYAL RANDWICK, SYDNEY



## REGISTRATION FORM

### Personal details:

*Please use block letters*

Title	First name	
Surname		
Position		
Organisation		
Business Address		
Suburb	Postcode	
Phone		
Email		

### Send Completed Form to:

Email to: [exec@artsa.com.au](mailto:exec@artsa.com.au)  
 Post to: ARTSA  
 PO Box 1076  
 Glen Waverley 3150  
 Fax to: 03 9818 6534  
 Enquiries: Email your enquiry to:  
[exec@artsa.com.au](mailto:exec@artsa.com.au)

### Registration Fee:

# Tickets	Type	Amount
	\$440 pp (Inc gst)	\$
Total \$		

### Payment:

*Registration requests without payment will not be processed. Faxed registration forms must include full credit card details. Payment in Australian dollars.*

I enclose my cheque / money order payable to 'Australian Road Transport Suppliers Association'

### Or charge to:

<input type="checkbox"/> Mastercard	<input type="checkbox"/> VISA
Name of Card Holder	
Card Number	
Expiry date:	CVV No:
/   /	
Signature	
Total Cost \$	

### Cancellations / Substitutes / Refunds:

*Cancellations received in writing by 1st August will receive a full refund less an administration fee of \$75. After this date no refunds will be issued.*