



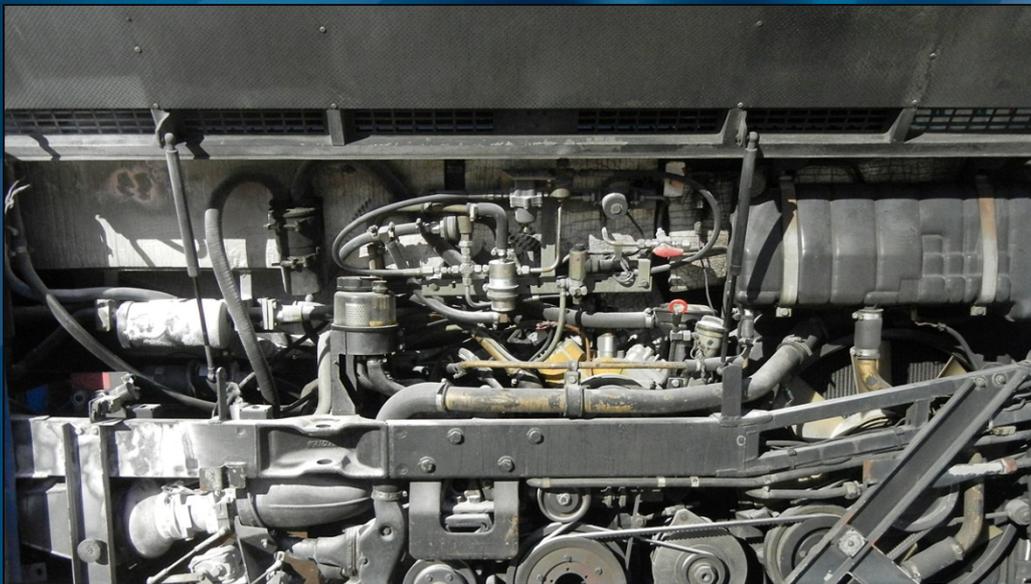
Office of Transport Safety Investigations

BUS INCIDENT FACTUAL FINDINGS

**FIRE INVOLVING STATE TRANSIT AUTHORITY (STA) BUS MO
1222**

NORTH BONDI

7 MAY 2012



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THE OFFICE OF TRANSPORT SAFETY INVESTIGATIONS

The Office of Transport Safety Investigations (OTSI) is an independent NSW agency whose purpose is to improve transport safety through the investigation of accidents and incidents in the rail, bus and ferry industries. OTSI investigations are independent of regulatory, operator or other external entities.

Established on 1 January 2004 by the Transport Administration Act 1988, and confirmed by amending legislation as an independent statutory office on 1 July 2005, OTSI is responsible for determining the causes and contributing factors of accidents and to make recommendations for the implementation of remedial safety action to prevent recurrence. Importantly, however, OTSI does not confine itself to the consideration of just those matters that caused or contributed to a particular accident; it also seeks to identify any transport safety matters which, if left unaddressed, might contribute to other accidents.

OTSI's investigations are conducted under powers conferred by the Rail Safety Act 2008 and the Passenger Transport Act 1990. OTSI investigators normally seek to obtain information cooperatively when conducting an accident investigation. However, where it is necessary to do so, OTSI investigators may exercise statutory powers to interview persons, enter premises and examine and retain physical and documentary evidence.

It is not within OTSI's jurisdiction, nor an object of its investigations, to apportion blame or determine liability. At all times, OTSI's investigation reports strive to reflect a "Just Culture" approach to the investigative process by balancing the presentation of potentially judgemental material in a manner that properly explains what happened, and why, in a fair and unbiased manner.

The Incident

At 2.19pm on 7 May 2012, a bus owned and operated by the State Transit Authority (STA) caught fire on Muriverie Street, North Bondi, while on a regular passenger service with four passengers onboard.

According to the driver, the bus was running “*sluggish and backfiring*” prior to his noticing the fire. He reported this to the STA Control Centre and was advised to continue to Bondi Junction where a replacement bus would be made available. However, after experiencing another loud ‘backfire’, he stopped the bus and saw smoke coming from the rear engine bay area. The driver immediately evacuated the four passengers to an area at a safe distance from the bus. He then shut off the compressed natural gas (CNG) supply by pulling down the emergency shut-off lever situated to the rear of the driving position and switched off the electrical supply at the batteries. He then took a portable dry chemical (powder) extinguisher to the rear of the bus, opened the engine bay hatch and discharged the extinguisher over the engine, putting out the fire.

Fire and Rescue NSW units attended and made certain the fire had been extinguished.

The prompt action by the driver prevented the fire spreading through the engine bay and into the interior of the bus and ensured nobody was injured. The driver had eight years experience driving buses for the STA and held a current NSW bus driver authority.

The Bus

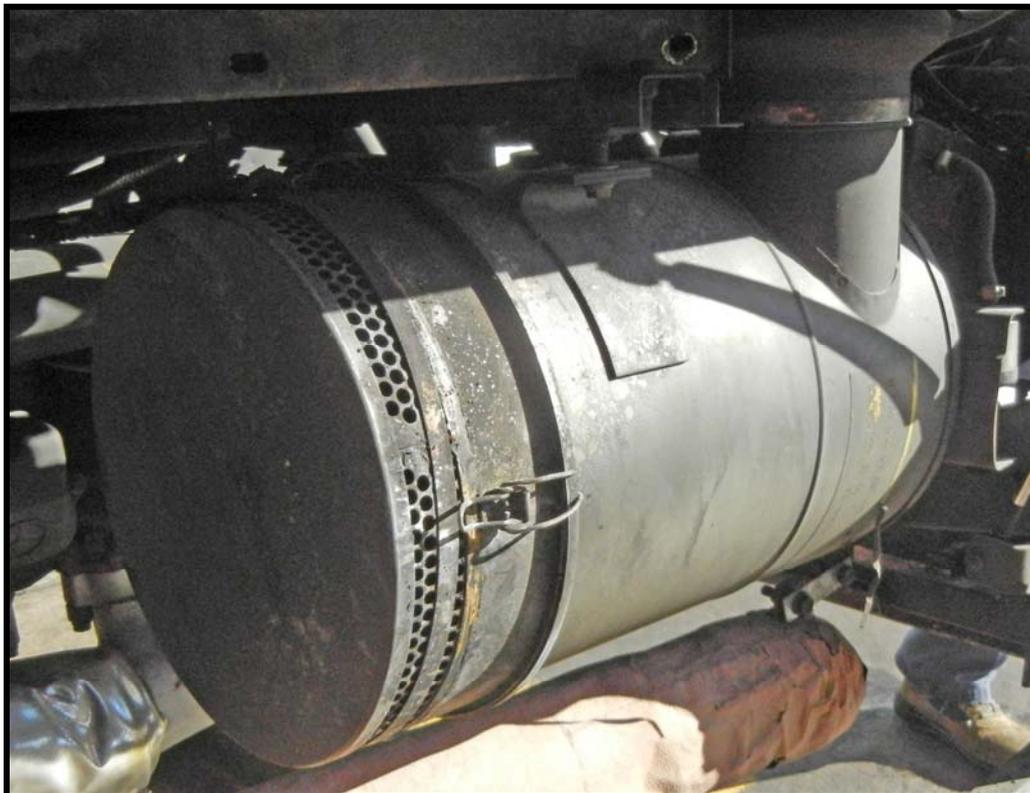
The bus was a Mercedes Benz 0405NH model powered by CNG, one of 299 of that model currently owned and operated by STA. It was first registered in December 2000 and was used on town passenger commuter services. At the time of the incident the odometer reading was 633241km. The bus was normally attached to the Botany Depot but was on loan to the Waverly Depot at the time of the fire.

The bus was fitted with two bi-fold opening doors on the near side, one at the front and the other midway along its length, and had standard emergency window exits. It was not equipped with fire detection or suppression systems.

Examination

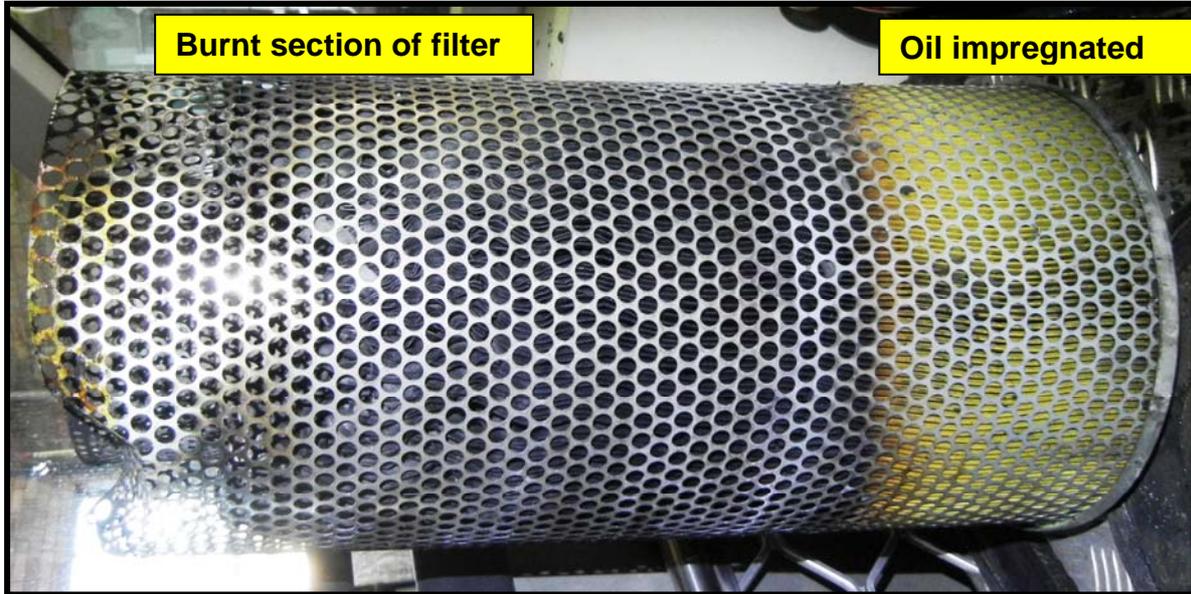
The bus was towed to the Waverly Bus Depot where it was quarantined awaiting examination by OTSI and STA Investigators. On 8 May 2012 the bus was examined with a view to determining the cause of the fire.

From an inspection of the engine bay it was evident that the likely seat of the fire had been in or around the air filter which was located low on the nearside of the engine. The fire pattern on the filter housing indicated the fire had been at its most intense at the retaining lid end of the housing as evidenced by the distortion of the lid (see *Photograph 1*). The air filter housing had contained the fire and restricted its spreading to other parts of the engine. However, there was some relatively minor heat and smoke damage to areas above the filter including the nearside back window.



Photograph 1: Air filter housing

On removal of the air filter cartridge, the interior paper filter was found to have been reduced to ash and charcoal at the retaining lid end. At the opposite end, it was impregnated with oil (see Photograph 2). Further, oil residue could be seen in the air filter housing after the cartridge was removed (see *Photograph 3*).



Photograph 2: Air filter cartridge



Photograph 3: Inside air filter housing

The bus was equipped with an emission control system known as positive crankcase ventilation (PCV), its purpose being to prevent the escape of engine combustion gases and oil fumes from the crankcase to the atmosphere. In simplified terms, this is achieved by connecting the crankcase to the engine's inlet through a control system that uses the low pressure in the inlet to extract fumes from the crankcase and mix them with air flowing from the air filter into the engine. A valve, known as a PCV valve, controls the flow between the crankcase and the engine's inlet. In this case a separator was also fitted to remove excessive oil from the crankcase gases, and the gases then entered the inlet through a diffuser on the air filter housing.

This system was examined, with the PCV showing evidence of oil contamination. The separator drain plug was removed and approximately 120 ml of oil which had accumulated was collected (see *Photo 4*).

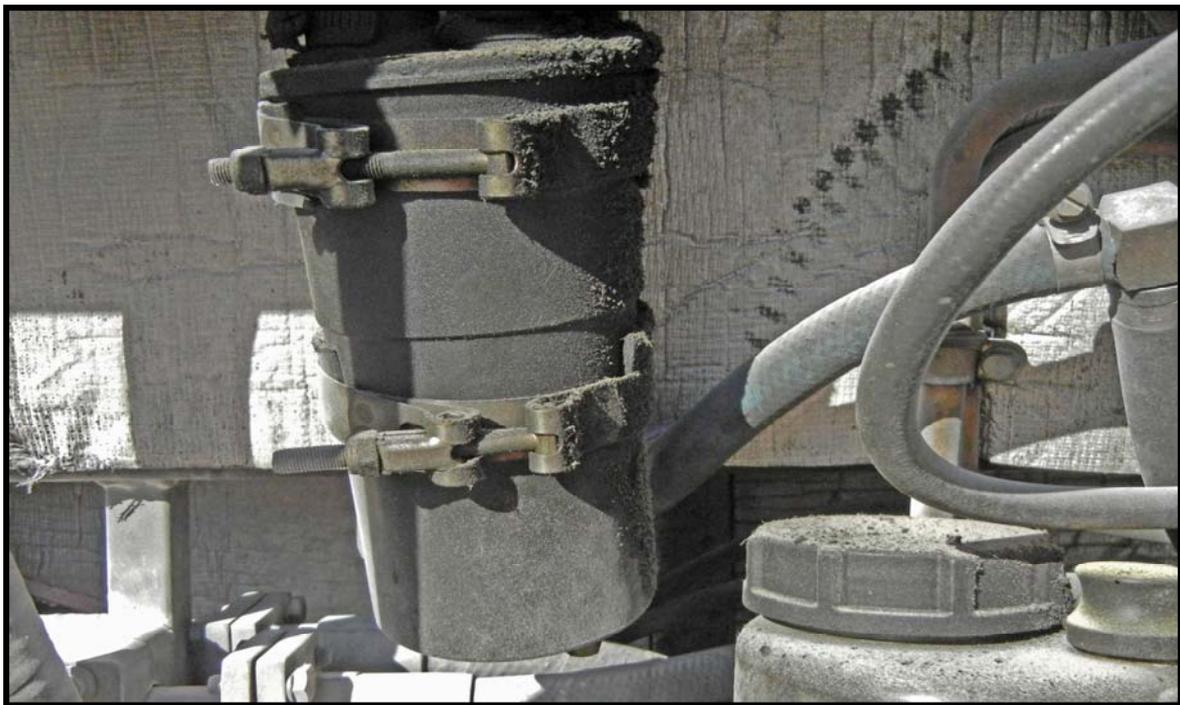


Photo 4 Separator

Examination of the diffuser attached to the air filter also revealed an accumulation of oil which had not been retained in the separator. Oil had also passed the diffuser causing the previously noted contamination of the air filter cartridge.

As the engine had been backfiring immediately before smoke was seen, it is considered most likely that the backfiring ignited the oil-soaked air filter cartridge. In

order to determine the cause of the backfiring, the electrical wiring around the coils situated on top of the engine, and the high tension leads to the spark plugs, were examined. There was no visible fault found with these items.

However, a connection for a power supply lead in the system was found sealed with silicone (see *Photo 5*) This type of repair was known to have been carried out on buses of this model which had experienced fires, to overcome electrical shorting caused by condensation or water pooling on top of the engine. Any short circuiting could result in the spark plugs firing out of order and cause the engine to backfire.

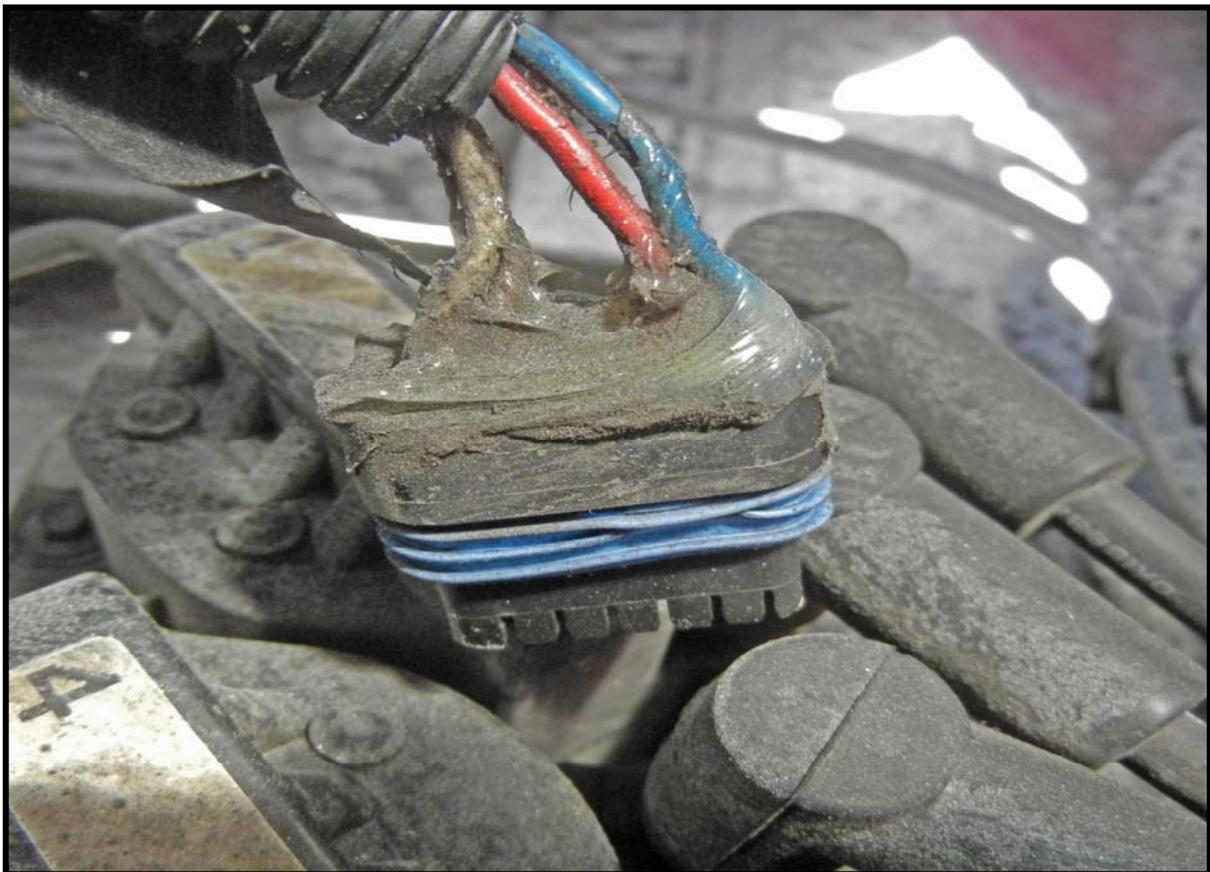


Photo 5 Silicone covered electrical lead

Bus Servicing and Maintenance

An examination of the maintenance and servicing records for MO 1222 revealed that a service scheduled for 6 February had not been undertaken. This meant that oil had not been drained from the separator since the previous service which had been conducted on 6 July 2011. Draining oil from the separator is a set servicing requirement to be completed every six months.

Remedial Action Taken

As a result of this fire, STA has taken the following action:

- identified buses which were overdue for mandatory services and immediately serviced those buses;
- circulated a maintenance alert to all depots where Mercedes Benz 0405 NH model buses are based, requiring maintenance staff to regularly inspect the air filter elements and drain oil separator units; and
- issued a notice to all depots setting out the requirement for regular on-time servicing of all buses to the specified STA servicing standards.

Conclusions

It was concluded that the fire was the result of the engine misfiring and igniting excess oil which had collected in the air filter housing and saturated the air filter.

The oil had been allowed to build up because a scheduled service was not undertaken which resulted in the separator being left undrained for much longer than the six months allowed for in servicing procedures.

The actions of the bus driver in ensuring the safety and well-being of his passengers and shutting off the CNG fuel supply were commendable.

Given the immediate and appropriate remedial action taken by STA, OTSI has determined that the circumstances of this incident do not require further investigation under the provisions of Section 46BA (1) of the *Passenger Transport Act 1990*.

A copy of these Findings has been provided to the State Transit Authority, the Independent Transport Safety Regulator and Transport for NSW.

Acknowledgement

OTSI acknowledges the cooperation and assistance of the STA in facilitating the inspection of the bus and in the timely provision of documentation for examination.