NO 95-104

TRAIN F04

LOCOMOTIVE FIRE

RIMUTAKA TUNNEL

4 FEBRUARY 1995

ABSTRACT

On 4 February 1995, Train F04 was a non-scheduled service conveying passengers from the Wellington area to Featherston for the Martinborough Fair. At 0958 hours, about 3 km into the 8.8 km tunnel, the crew noticed an engine fire on the locomotive. The Locomotive Engineer elected to shut the engine down once the train was in a position to coast clear of the tunnel. None of the crew or passengers was injured. Safety issues identified were a replacement regime for fuel header lines, and emergency response plans for the Rimutaka Tunnel.

TRANSPORT ACCIDENT INVESTIGATION COMMISSION

RAIL INCIDENT REPORT NO 95-104

Train Type and Number:	Passenger, F04
Locomotive:	DX 5448
Date and Time:	4 February 1995, 0958 hours
Location:	Rimutaka Tunnel, Wairarapa Line
Type of Occurrence:	Fire on locomotive
Persons on Board:	Crew: 4 Passengers: 400 approximately
Injuries:	Nil
Nature of Damage:	Minor fire damage to locomotive
Information Sources:	Transport Accident Investigation Commission field investigation
Investigator in Charge:	Mr A J Buckingham

1. NARRATIVE

1.1 On 4 February 1995, train F04 was a New Zealand Rail Ltd "extra" service conveying passengers from the Wellington area to Featherston, where they were to transfer to buses to the Martinborough Fair. The train, consisting of eight standard passenger cars, was hauled by DX 5448, a General Electric U26C locomotive. (Note - for the purposes of this report, the terms "locomotive" and "engine" are not used synonymously. "Engine" refers to the diesel engine which is the locomotive's prime motive power.)

1.2 The train was crewed by a Locomotive Engineer (LE) and two Guards, as well as a second Locomotive Engineer who had been rostered on the train for shunting duties at Masterton. The second LE rode in the locomotive, occupying the left (Train Operator's) seat.

1.3 About 3 km into the 8.8 km Rimutaka Tunnel, the second LE drew the attention of the driving LE to an apparent fire in the vicinity of the exhaust stack. The driving LE crossed the cab to check, and confirmed that there was indeed a fire, and by the time he returned to the driving position, the fire was visible from that side as well.

1.4 At this point, the train was travelling at approximately 90 km/h up the 1 in 400 gradient in the western portion of the tunnel; 4.1 km into the tunnel, the gradient changes to 1 in 180 down to the eastern portal. The LE tried reducing power to see if it made any difference to the fire's intensity, with no apparent result.

1.5 The LE contacted the Guard in the front car by radio, and requested him to move the passengers rearward from the front two cars as a precaution. This request was complied with and the cars vacated promptly. There was no sign of fire visible from the passenger cars. The LE determined that the only sources of fire in the exhaust area would be from either fuel or lubricating oil on the hot exhaust, and elected to keep the diesel engine running until the train reached the point of gradient change. The alternative was to stop the train and run the risk of not being able to control the fire or restart the train, with the attendant risk of asphyxiating the passengers and crew.

1.6 Once established on the downgrade, the LE shut the engine down and the train coasted towards the eastern tunnel portal. The fire reduced in intensity, and was out by the time the train emerged from the tunnel. The LE contacted Train Control and reported the problem, continuing at this time to coast downhill towards Featherston, some 9 km ahead.

1.7 The engine was restarted in order to recharge the airbrake reservoirs, but as this resulted in a further outbreak of fire, it was shut down again. The LE requested that the Fire Service meet the train at Featherston.

1.8 On arrival at Featherston, the train was stopped short of the station to minimise the fire risk to the building, and the small remaining fire was extinguished by the LE, using the hand-held extinguisher from the locomotive cab. The passengers disembarked from the train and transferred to their buses as planned.

1.9 After allowing the area affected by the fire to cool down, the crew opened the engine access doors to investigate the problem. They found that a low-pressure fuel line had ruptured, permitting diesel fuel at a pressure of 207 to 276 kPa (30 to 40 psi) to spray onto the hot exhaust manifold (centrally located on the top of the engine), where it ignited. The fire damage was confined to scorching of the paintwork on some of the engine access doors.

1.10 A rag was wrapped around the hole in the fuel line to prevent further spraying, and the engine was restarted to facilitate moving of the train the few remaining metres into station limits. The engine was then shut down again, and later, the entire train was coupled to a freight train and moved to Masterton, where repairs were effected. The train later completed its return to Wellington as planned.

1.11 The failure occurred in a flexible fuel hose, which was part of the header line supplying fuel to the injector pumps. On the locomotive's diesel engine, a General Electric 7FDL 12 (a turbocharged V-12), the injector pumps are located on each of the 12 individual cylinder heads, and are mechanically actuated by push rods driven by the engine camshafts. A high-pressure stainless steel line connects the injector pump to the injector nozzle in each head. Each injector pump has a "tee" inlet connection, to which are connected the flexible hoses comprising the header line.

1.12 The fuel is drawn from the tank by an electrically-driven booster pump, which supplies fuel to the injector pumps at a pressure which varies from about 276 kPa (40 psi) at idle down to as low as 159 kPa (23 psi) when the engine is operating at maximum load. Maximum pressure in the header line is limited by a regulating valve, which returns excess fuel to the tank.

1.13 The flexible hoses consist of an elastomer inner, sheathed by steel braid, which in turn is sheathed with a braided textile outer cover. Coupling to the injector pump inlet fittings is accomplished by threaded female unions at each end of the hose. The hoses were the standard items as supplied by the engine manufacturer.

1.14 NZRL have experienced a number of failures of this type of hose in recent years, with the failures generally being attributed to length of time in service. The engine manufacturer's overhaul schedule had called for a four-yearly replacement regime for the hoses, but in the period 1990-92, during regular maintenance reviews, NZRL had decided to change the replacement criterion to "on condition". A further review of this item in September 1994 restored the four-yearly replacement regime.

1.15 At the time of this incident, DX 5448 was not due for overhaul, and was still equipped with hoses of indeterminate age. As a result of their investigations, NZRL initiated a fleet-wide inspection of the flexible fuel lines on their DX locomotives, requiring replacement of any that appeared to be in poor condition, regardless of the time remaining before overhaul. In addition, it was decided that the hose replacements at engine overhaul would be of the heavier-duty version as used on the DXR, and that the tee connections to which the hoses attach would also be replaced by the more robust DXR equivalent.

1.16 This incident highlighted to both NZRL and the New Zealand Fire Service (NZFS) the need to formalise a response system to deal with an emergency in the Rimutaka Tunnel. Representatives from both agencies met to discuss the matter, and the outcomes are as follows:

a. Road vehicle access to the eastern portal is to be upgraded, to allow more ready access by emergency services vehicles.

b. NZRL is providing NZFS with a detailed access plan to the western portal at Maymorn.

c. In the event of a tunnel emergency, NZRL will assist NZFS by providing Hi-rail vehicles[1] to transport personnel and equipment to the scene. NZRL would routinely call out their track staff at either Upper Hutt or Masterton (or both) to a tunnel emergency, the staff at both locations being equipped with Hi-rail vehicles.

[1]Utility vehicles modified by the addition of retractable flanged wheels, enabling running on rail or road as required.

d. Compatibility between NZRL and NZFS rescue equipment is being examined.

e. The emergency procedures review is being expanded to include other areas with tunnels carrying passenger traffic.

1.17 The section of line through the Rimutaka Tunnel is track-circuited, and when a train is transitting the tunnel, the fact that the track circuit is occupied is displayed on the CTC[2] panel at Upper Hutt station. A timer is incorporated in the tunnel track circuit, and activates an alarm buzzer on the panel if the circuit is occupied for more than 15 minutes. This gives an automatic indication of a breakdown or other emergency halting a train in the tunnel.

1.18 Radio communication with Train Control is not available from inside the tunnel, as the cost of installing the necessary equipment was considered by NZRL to be prohibitively expensive. With the advent of single-man locomotive crewing on Wairarapa passenger trains in 1993, the number of track telephones in the tunnel was increased to 21. This means that in the worst case, a Locomotive Engineer (or Guard) would have to walk a maximum of 250 m to the nearest telephone in the event of a train stranding.

2. FINDINGS

2.1 The train was being operated normally prior to the incident.

2.2 The Locomotive Engineer took appropriate action on discovering the fire, minimising the danger to passengers and crew.

2.3 The fire was caused by the failure of a low-pressure fuel line, permitting diesel fuel to spray onto the hot exhaust manifold.

2.4 The fuel line failure was probably due to deterioration with age.

2.5 The fuel hoses were intended by the engine manufacture to be changed at four-yearly intervals, but this requirement had been overridden as a result of a maintenance review during the period 1990-1992.

2.6 At the time of the incident NZRL had initiated action to restore the four-yearly requirement for the fuel hoses.

2.7 Appropriate action was taken by NZRL after the incident to minimise the possibility of a similar occurrence.

2.8 Emergency procedures relating to the Rimutaka Tunnel have been reviewed jointly by NZRL and NZFS, and the review is being expanded to include other relevant tunnels.

21 June 1995

J Fish
Acting Chief Commissioner

[2] Centralised Traffic Control