

Report 11-101: Wrong line running irregularity,
leading to a potential head-on collision, Papakura - Wiri, 14 January 2011

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Final Report

Rail inquiry 11-101
Wrong line running irregularity,
leading to a potential head-on collision,
Papakura-Wiri,
14 January 2011

Transport Accident Investigation Commission

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The Transport Accident Investigation Commission (Commission) is an independent Crown entity responsible for inquiring into maritime, aviation and rail accidents and incidents for New Zealand, and co-ordinating and co-operating with other accident investigation organisations overseas. The principal purpose of its inquiries is to determine the circumstances and causes of occurrences with a view to avoiding similar occurrences in the future. Its purpose is not to ascribe blame to any person or agency or to pursue (or to assist an agency to pursue) criminal, civil or regulatory action against a person or agency. The Commission carries out its purpose by informing members of the transport sector, both domestically and internationally, of the lessons that can be learnt from transport accidents and incidents.

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Citations and referencing

Information derived from interviews during the Commission's inquiry into the occurrence is not cited in this final report. Documents that would normally be accessible to industry participants only and not discoverable under the Official Information Act 1980 have been referenced as footnotes only. Other documents referred to during the Commission's inquiry that are publicly available are cited.

Photographs, diagrams, pictures

Unless otherwise specified, photographs, diagrams and pictures included in this final report are provided by, and owned by, the Commission.



Location of incident

Source: Paper Plus New Zealand touring atlas

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Abbreviations

Commission	Transport Accident Investigation Commission
Veolia	Veolia Transport Auckland Limited

Glossary

blocking	a term that describes the process of holding a signal(s) at stop to prevent a train movement entering a section of line on which occupancy/authorisation has already been authorised
collar	a hollow tube that fits over a miniature signal lever on a Westinghouse power-operated signal panel
Mis.60	a numbered track and time authority issued by train control to protect train movements where additional safeguards are necessary. This includes train movements required to travel wrong line in double-line automatic signalling areas
Signal 3 lever	the Signal 3 lever controlled 5 separate signals at the north end of Papakura. The signalling system automatically detected which signal to clear by which way the point(s) was set. Only one of the 5 signals could be cleared to proceed at any one time

Data summary

Date and time	14 January 2011 at 0803 ¹
Location	Papakura, 647.02 kilometres, North Island Main Trunk
Person involved	Veolia Transport Auckland Limited (Veolia) signaller
Injuries	nil
Damage	nil

¹ Times in this report are New Zealand daylight saving times (universal co-ordinated time plus 13 hours) and are expressed in the 24-hour mode.

1. Executive summary

- 1.1. On Friday 14 January 2011, a train that was supposed to be stopped at Papakura was signalled to enter a section of track that another train had been authorised to enter from the opposite direction. A potential head-on collision was recognised by the person-in-charge of a nearby worksite and the situation was resolved before the second train entered the section.
- 1.2. KiwiRail was upgrading the rail track between Papakura and Wiri stations in Auckland. The train programme had been reduced to allow this upgrade work to be undertaken, so only a small number of trains were scheduled to pass alongside the worksite. The worksite was in double-track territory and one of those tracks was open to trains.
- 1.3. The train controller had planned to stop an Auckland-bound freight train at Papakura while a southbound passenger train crossed over to the northbound line for the journey from Wiri to Papakura, where it was to cross back over to its own southbound line. The procedure for the southbound train to travel on the wrong line required the issue of a Mis.60 authority.
- 1.4. Both Wiri and Papakura stations had signal boxes that could be put under the control of signallers. This had been done for the duration of the upgrade work. The signallers worked the signals and points within their stations in accordance with the train controllers' plan.
- 1.5. Safety for the worksite between Papakura and Wiri was under the control of a person-in-charge, and the worksite was protected at each end by compulsory stop boards. Every train had to stop at these boards and request permission from the person-in-charge to pass. This was to ensure that the track workers and machinery were clear of the track.
- 1.6. The last signal controlling entry to the worksite at Papakura was Signal 3A. This was controlled by the Papakura signaller. The compulsory stop board was placed adjacent to Signal 3A. A blocking collar was required to be placed over the lever used to change Signal 3A in the signal box whenever the signaller was instructed to hold it at stop (red).
- 1.7. On the day of the incident Signal 3A was supposed to be held at red for 2 reasons – one, to protect the worksite and 2, because a Mis.60 had been issued to a train coming from the opposite direction. The blocking system was not designed to cater for more than one reason.
- 1.8. Neither the driver of the northbound train nor the person-in-charge was told that the northbound train was to be held at Signal 3A for the southbound train. The person-in-charge gave the driver of the northbound train permission to pass the compulsory stop board and asked the signaller to change Signal 3A to proceed (green). The signaller forgot about the other train coming down the line on a Mis.60 and removed the blocking collar and changed the signal to green.
- 1.9. The Transport Accident Investigation Commission (Commission) has made **findings** about poor communication leading to the incident, about the design of the blocking system, and about the management and resourcing of signal boxes on the Auckland metro network.
- 1.10. A number of **safety actions** were taken by KiwiRail and the train operator, Veolia, to address what would otherwise have been **recommendations** about the design of the blocking system, the management of and monitoring of signaller performance and standards, and communications with all parties involved in executing an agreed plan.
- 1.11. The **key lessons** for the industry arising from this incident are:
 - good communication of a plan is critical to its successful outcome.
 - standards for measuring the performance and compliance of a workforce will only be effective if they are followed.
 - audits will not be effective if the breaches they disclose are not acknowledged and remedied.

2. Conduct of the inquiry

- 2.1. The NZ Transport Agency notified the Commission on the day of the incident under section 13(4) of the Railways Act 2005. The Commission opened an inquiry under section 13(1) of the Transport Accident Investigation Commission Act 1990 to determine the circumstances and causes of the incident and appointed an investigator-in-charge.
- 2.2. The investigator-in-charge travelled to Auckland to conduct an on-site investigation on Monday 17 January 2011.
- 2.3. The Veolia signaller and management staff were interviewed. The investigator held interviews with KiwiRail staff, including the signaller at Wiri, the person-in-charge protecting the closed line between Wiri and Papakura, and the drivers of Trains 210 and 201. The investigator visited the signal box facilities at Wiri, Papakura and Pukekohe.
- 2.4. The signaller's training records, rosters and hours worked were obtained together with Veolia fatigue management and roster procedures. The status of the safety observations of all signallers employed by Veolia and KiwiRail at the time of the incident was also obtained.
- 2.5. The Commission considered a draft final report at the Commission meeting on 23 November 2011 and it was approved that same day for circulation to interested persons for comment.
- 2.6. Written submissions were received from the NZ Transport Agency, KiwiRail and Veolia. Veolia accepted an invitation to present its submission in person and this occurred during the Commission meeting on 23 February 2012.
- 2.7. The Commission approved the final report for publication on 29 March 2012.

3. Factual information

3.1. Narrative

Historical background

- 3.1.1. In August 2004 Veolia (formerly Connex) was awarded a contract (titled Passenger Services Agreement) by the Auckland Regional Council to continue the provision of rail passenger services on the Auckland metro network. The contract included the transfer to Veolia of the Toll New Zealand Consolidated Limited (predecessor to KiwiRail) signal box operations at Papakura and Pukekohe together with the certified signalling staff. These staff members were known as travel services officers and they continued with the signalling responsibilities under Veolia.
- 3.1.2. In February 2006 the Auckland Regional Transport Authority approved a variation to the agreement to recognise formally the transfer to Veolia of the signal box operations at the 2 stations. The contract stated that it was expected that “significant efficiencies” would accrue as a result of this transfer.
- 3.1.3. Veolia required the signallers at the Papakura signal box to undertake the following general duties in addition to signalling trains:
- dispense daily information and special bulletins to local Veolia staff
 - liaise with the Veolia control room centre at Britomart for rolling stock allocation changes
 - liaise with KiwiRail for vehicle maintenance
 - undertake supervisory duties of local Veolia staff
 - make public address announcements of train arrivals and departures
 - monitor overall train timekeeping performance
 - initiate and answer calls on the local radio.
- 3.1.4. KiwiRail co-ordinated the movement of all trains running on the controlled network from its national train control centre in Wellington. KiwiRail was also responsible for train signalling (in support of train control) at most of the principal signal boxes on the network.
- 3.1.5. Papakura station was located on an island platform arrangement with main lines on either side of the platform. The signal box was located within the station building and was equipped with a Westinghouse power-operated signal panel. The panel had been commissioned in November 1939 and was one of the largest of this type remaining in use (see Figure 1).

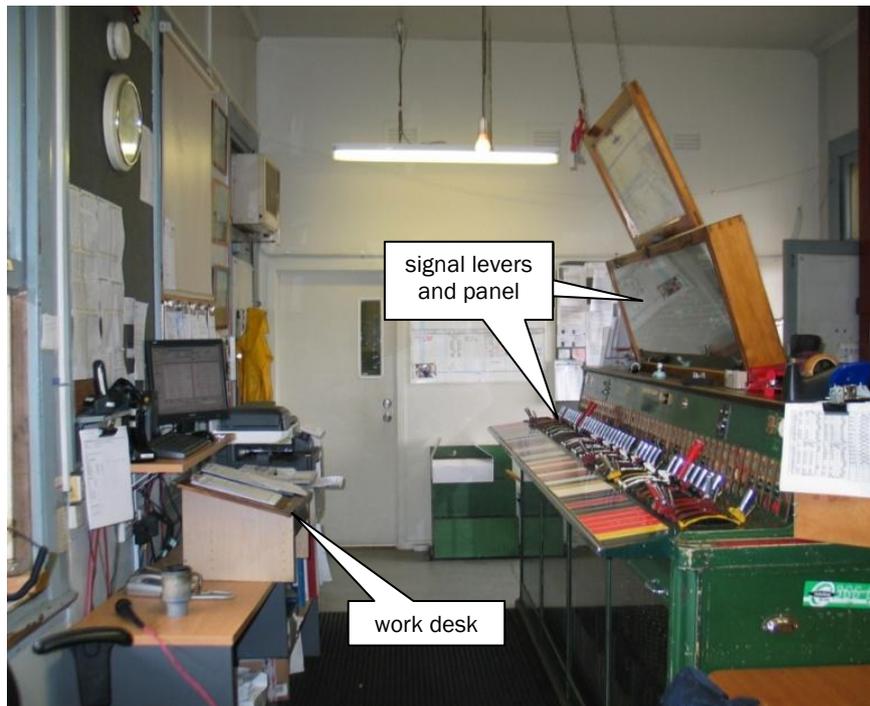


Figure 1
Inside the Papakura signal box

- 3.1.6. Between 9 and 16 January 2011, major infrastructure upgrade work was underway on the Down Main line (Down line) between Wiri and Papakura in preparation for the electrification of the Auckland metro network. A KiwiRail person-in-charge was responsible for protecting the worksite.
- 3.1.7. The work required the suspension of all Veolia passenger services and a reduced KiwiRail operation, with only some Up and Down freight and long-distance passenger trains timetabled to run. These trains were routed around the work area by using the adjacent Up Main line (Up line). The process for achieving this was called “wrong line running”, an authorised deviation from normal double-line train running arrangements.
- 3.1.8. The wrong line running and protection arrangements were detailed in a special bulletin that had been issued on 7 January 2011. Although the Up line was not being upgraded, compulsory stop boards were erected at Papakura and Wiri because machines and workers involved with the Down line upgrade work were close to the Up line.
- 3.1.9. The signal box at Wiri station was not used often, but while the upgrade work was in progress it had to be operated so that Down trains at Wiri could be signalled from the Down line to the Up line. KiwiRail provided signallers at Wiri because Veolia could not. The Papakura signal box was usually operated for 19 hours on weekdays, but during the period of the upgrade work it was operated for 24 hours each day.
- 3.1.10. Train controllers issued the signallers at Papakura and Wiri and the drivers of Down trains at Wiri with a Mis.60 wrong line running authority. The Mis.60 was required because there were no signals provided for the Down trains (they all faced the other way by design) for the journey from Signal 3ABC at Wiri to Signal 43 at Papakura, a distance of about 10 kilometres (refer Figure 2). The trains were then re-routed to the Down line at Papakura by the signaller there.
- 3.1.11. KiwiRail’s general operating rules required the Papakura signallers to obtain specific train control authority at all times (verbally given as instructions) before Up freight trains could depart Papakura and continue running on the Up line in accordance with signals.

- 3.1.12. KiwiRail's track safety rules also contained instructions regarding the liaison needed (in this case) between the signaller and person-in-charge of the worksite when it came time for an Up train to pass the compulsory stop board that was erected adjacent to Signal 3A at Papakura. All Up trains had to stop there and ask for the person-in-charge's permission to pass the board. The person-in-charge could give verbal permission to do so once the worksite was clear, but the train could still not proceed until the signaller had changed the signal aspect to green.
- 3.1.13. The signaller could not change the signal aspect to green without first receiving permission from the train controller. While this arrangement was in place the signaller was supposed to place a red collar over the Signal 3 lever as a reminder not to change the signal aspect without receiving permission to do so. This meant that for the entire period of the upgrade work, the Signal 3 lever was supposed to have been collared except for when a train had been authorised to pass the compulsory stop board. The signaller only applied the collar when the Mis.60 was issued.
- 3.1.14. The collar was an elongated cap that was placed over the operating lever. The collar did not physically prevent the lever being moved, and was available in one colour and one size.

The incident

- 3.1.15. At 0630 on Friday 14 January 2011, a KiwiRail train controller, based in Wellington, told the Veolia signaller at the Papakura signal box that freight Train 210 should arrive at about 0745. The train controller instructed the signaller to hold the train at Papakura to allow southbound passenger Train 201 to pass. The signaller wrote the instruction on a sheet of notepaper and placed it on a clipboard located on top of a work desk (refer Figure 1).
- 3.1.16. The train controller at the time intended to give passenger Train 201 priority to proceed along the wrong line from Wiri to Papakura ahead of freight Train 210 (see Figure 2).

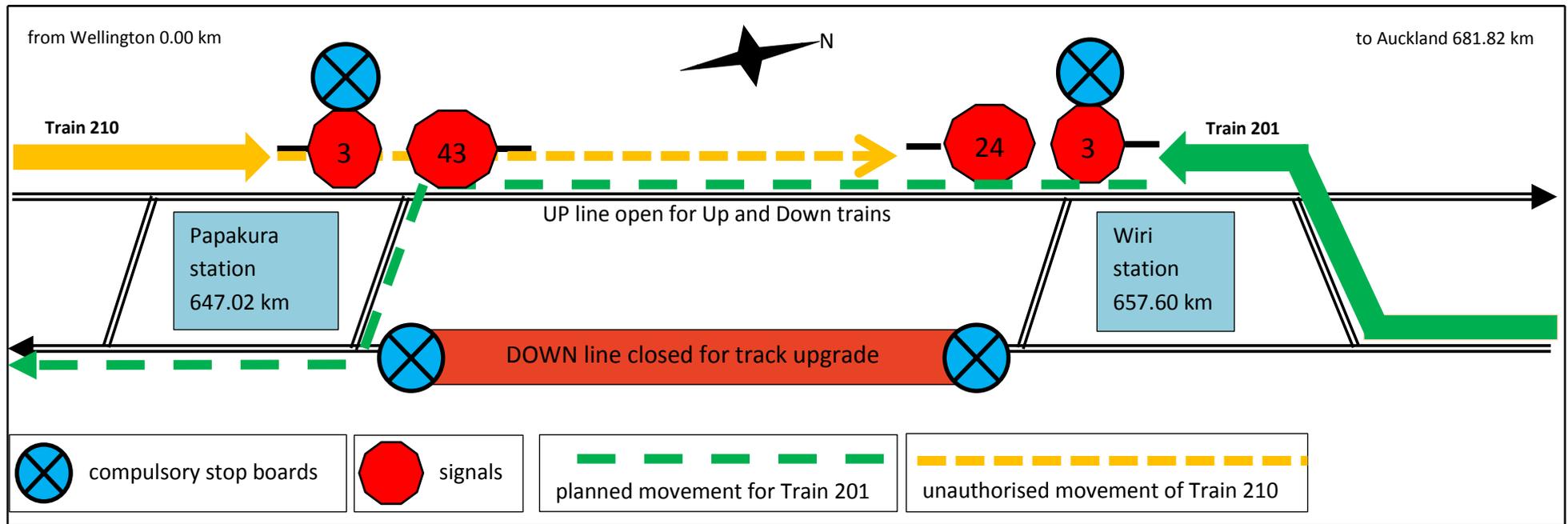


Figure 2
Track layout, protection details and train running arrangements
between Wiri and Papakura (not to scale)

- 3.1.17. The train controllers changed shift at 0630. The new train controller telephoned the signaller at 0650 to remind her to hold Train 210 at Papakura. The signaller radioed the person-in-charge and told her of Train 210's arrival time but did not inform her that the train was to be held at Papakura for Train 201. During the period of compulsory stop protection, the person-in-charge was required to obtain specific permission from train control before the protected line (the Up line in this instance) could be obstructed. This procedure was designed to minimise disruption to train movements.
- 3.1.18. The train controller issued the Mis.60 to the signaller at Wiri 58 minutes later at 0748, authorising the wrong line movement of Train 201, then to the signaller at Papakura at 0755. KiwiRail's double-line automatic signalling rule 1 (c) required the train controller to ensure that the signaller had collared the Signal 3 lever, but this was not done. The signaller at Papakura placed the Mis.60 on a clipboard at the work desk, but beneath other documents, and placed a red collar over the Signal 3 lever as required, even though she had not been instructed to do so by the train controller (see Figure 3).

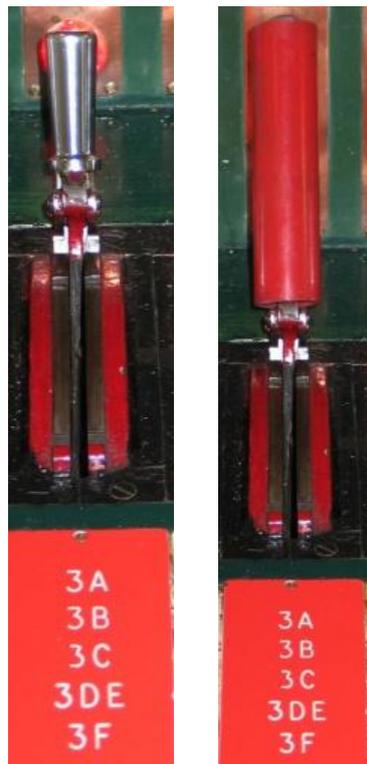


Figure 3
Signal 3 lever un-collared (left) and collared (right)

- 3.1.19. The collar provided a visual reminder to the signaller to not operate the lever without first getting the train controller's permission. Track safety rule 907 in KiwiRail's rail operating rules for compulsory stop board protection, and sections one and 10 in KiwiRail's rail operating procedures for wrong line running arrangements, both contained instructions for the use of collars.
- 3.1.20. In this instance the red collar was supposed to remind the signaller to not change the signal to green without the train controller's permission **because of the Mis.60 procedure** (emphasis added). Since this incident, procedures have changed; they now require the train controller to obtain confirmation that a signal(s) (Signal 3A at Papakura in this instance) is at stop and the signal lever(s) is collared. This confirmation must be endorsed by the train controller on their copy of the Mis.60 before the authority is issued to the applicable train driver.
- 3.1.21. Meanwhile, Train 210 arrived at Papakura and stopped at Signal 3A at 0754. The driver of Train 210 had not been told that his train would be held at Papakura for Train 201. No-one was required to tell the drivers of the trains that this would be the case. The procedure has since been changed to include this requirement.

- 3.1.22. Four minutes later, the signaller overheard the driver of Train 210 radio the person-in-charge seeking permission to pass the compulsory stop board erected adjacent to Signal 3A. The person-in-charge granted permission subject to Signal 3A being cleared to proceed by the signaller.
- 3.1.23. At 0801, the person-in-charge radioed the signaller at Papakura and said that Train 210 had permission to pass the compulsory stop board. The signaller took this to mean that the machines and workers were not obstructing the Up line. She therefore removed the collar and moved the Signal 3 lever to the “proceed” position. At around this time the signaller was having to deal with the following signalling and peripheral tasks:
- routing/signalling a berthing Veolia passenger train from Pukekohe into Papakura station
 - acting on a request to ensure a connecting bus service waited for the berthing Veolia passenger train
 - routing/signalling 2 track maintenance machines through another part of the station
 - conversing with a fitter regarding the fuelling of the berthing Veolia service.
- 3.1.24. At 0801, Train 201 stopped at Signal 3ABC at Wiri at about the time the signaller was removing the collar from the Signal 3A lever at Papakura. The train controller issued the driver with the Mis.60 for Train 201 to travel to Papakura, which was acknowledged by the driver at 0803.
- 3.1.25. At 0804, Train 210 departed Papakura after the aspect on Signal 3A changed to green. At about the same time, the driver of Train 201 radioed the person-in-charge seeking permission to pass the compulsory stop board at Wiri. This request was denied because the person-in-charge was aware that Train 210 had left Papakura and was travelling on the Up line towards Train 201.
- 3.1.26. Meanwhile, the signaller returned to the work desk to record the arrival time of the Veolia service from Pukekohe and saw the Mis.60. The signaller saw that Train 210 had already left, realised her error and notified the train controller.
- 3.1.27. The train controller radioed the driver of Train 201, ascertained that he had not left Wiri and cancelled the Mis.60, requiring him to remain where he was.
- 3.1.28. At about 0820, Train 210 arrived and stopped at Signal 24ABC (at red) on the Up line at Wiri, 365 metres from Signal 3ABC where Train 201 was standing (see Figure 4).



Figure 4
Looking south from Wiri

Events during the preceding 2 days

- 3.1.29. On Wednesday 12 January 2011, 2 days before the incident, the Veolia signaller who was based at Pukekohe received a telephone call from her manager requesting that she relieve at the Papakura signal box. The signaller replied that she “would rather not” because she was shifting her family into a new house, she was currently working 12-hour shifts at Pukekohe and she had heard that “it was full-on” at Papakura with the wrong line running and other arrangements.
- 3.1.30. The manager tried making other arrangements but without success. About 30 minutes later he telephoned the signaller again. The signaller repeated that she “would rather not” and also because of her lack of currency working the Papakura signal box and her limited experience working with the wrong line running procedures. The signaller was certified to work the Papakura signal box but had last worked there 6 months earlier.
- 3.1.31. The signaller had been involved with the wrong line running process on 3 previous occasions – during her theory training, during a training visit to KiwiRail’s Otahuhu signal box, and about one month earlier at Pukekohe. The signaller reminded her manager that she was in the process of shifting house and together with the long hours currently being worked, she was not comfortable relieving at Papakura. Eventually, however, she agreed to do this.
- 3.1.32. After finishing her shift that day at Pukekohe, the signaller travelled to the Papakura signal box to observe its operation. She was not able to ask questions of the signaller on duty because of the high level of activity, but she stayed for a while to familiarise herself with the arrangements. She also took a copy of the special bulletin that detailed the wrong line running arrangements to read at home.
- 3.1.33. The signaller started duty at Papakura on Thursday 13 January 2011. Throughout the day she successfully dealt with 6 Mis.60s for trains running wrong line from Wiri. She said that she collared the Signal 3A lever each time she received a Mis.60. Signal 3A was the last manually operated signal on the Up line at Papakura.

3.2. Personnel

The signaller

- 3.2.1. The signaller had begun practical training for the Papakura signal box on 14 December 2009. Her training and certification records (certification was achieved on 26 May 2010) were endorsed with a comment that the signaller “needs practical observation as she has no practical experience” of wrong line running operations, but that she had orally met requirements on the subject. No formal level A safety observations were conducted by Veolia as required by procedures for new rail personnel.
- 3.2.2. The signaller’s practical training and certification records (certification was achieved on 23 July 2010) for the Pukekohe signal box were identical in that endorsements showed she lacked practical experience with wrong line running. No formal level A safety observations had been conducted by Veolia.
- 3.2.3. During 2009 and 2010 KiwiRail rolled out a project to formally train its staff, including the Veolia signallers, on recent changes to the operating rules and procedures (Project Reset). Train controllers and signallers were retrained in blocking/collaring/tagging for track work protection and in crew resource management practices. The signaller did not need to take part in Project Reset because she had only recently completed her theory training, which included all of the latest procedural training.
- 3.2.4. The national rail system standard and rail operating procedures required Veolia to conduct a series of formal safety observations/theory assessments of the signaller at the following frequency:

Time in role	1 - 3 months	4 - 9 months	After 9 months
Safety observations	monthly	bi-monthly	8-monthly
Theory assessments	at end of 3 months	at end of 6 and 9 months	bi-annually

- 3.2.5. The formal safety observation process was used to assess the competence of rail personnel. The formal safety assessment process was graded into either level A or level B. Level A assessments were applied by any suitably qualified manager/supervisor who held certification for the tasks being evaluated. Level B assessments were applied by a suitably qualified manager/supervisor who had access to safety system documentation and could make informed judgements on the tasks being observed.
- 3.2.6. Veolia had a total of 7 signallers/signaller assessors. At the time of the incident 3 were current, but 4 had not had formal level A safety assessments for periods ranging from 2 to 5½ years.
- 3.2.7. In contrast, KiwiRail had 26 signallers and only one was overdue for a formal level A safety assessment at the time of the incident.
- 3.2.8. The following table shows the rostered hours worked by the signaller for the 6-week period leading up to the incident. The pink boxes refer to work at the Pukekohe signal box and the green box refers to work at the Papakura signal box.

2010	0000 to 0200	0200 to 0400	0400 to 0600	0600 to 0800	0800 to 1000	1000 to 1200	1200 to 1400	1400 to 1600	1600 to 1800	1800 to 2000	2000 to 2200	2200 to 2400
Sun 5 Dec												
Mon 6 Dec												
Tue 7 Dec								1245 to 2100 each day				
Wed 8 Dec								1245 to 2100 each day				
Thu 9 Dec								1245 to 2100 each day				
Fri 10 Dec								1245 to 2100 each day				
Sat 11 Dec												
Sun 12 Dec												
Mon 13 Dec			0515 to 1300 each day (0400 start on Monday)									
Tue 14 Dec			0515 to 1300 each day (0400 start on Monday)									
Wed 15 Dec			0515 to 1300 each day (0400 start on Monday)									
Thu 16 Dec			0515 to 1300 each day (0400 start on Monday)									
Fri 17 Dec			0515 to 1300 each day (0400 start on Monday)									
Sat 18 Dec												
Sun 19 Dec												
Mon 20 Dec								1245 to 2100 each day				
Tue 21 Dec								1245 to 2100 each day				
Wed 22 Dec								1245 to 2100 each day				
Thu 23 Dec								1245 to 2100 each day				
Fri 24 Dec								1245 to 2100 each day				
Sat 25 Dec												
Sun 26 Dec												
Mon 27 Dec			0550 to 1400 each day									
Tue 28 Dec			0550 to 1400 each day									
Wed 29 Dec			0550 to 1400 each day									
Thu 30 Dec												
Fri 31 Dec												
2011												
Sat 1 Jan								1350 to 2200 each day				
Sun 2 Jan								1350 to 2200 each day				
Mon 3 Jan								1350 to 2200 each day				
Tue 4 Jan								1350 to 2200 each day				
Wed 5 Jan								1350 to 2200 each day				
Thu 6 Jan								1350 to 2200 each day				
Fri 7 Jan				0550 to 1400 Fri								
Sat 8 Jan				0550 to 1800 Sat, Sun, Mon								
Sun 9 Jan				0550 to 1800 Sat, Sun, Mon								
Mon 10 Jan				0550 to 1800 Sat, Sun, Mon								
Tue 11 Jan				0550 to 1630 Tue								
Wed 12 Jan				0550 to 1300 Wed								
Thu 13 Jan				0550 to 1300 Wed								
Fri 14 Jan				0550 to 1430 Thu and Fri								

incident occurred at 0803 on Friday 14 January 2011

3.2.9. The signaller had been rostered to work between 1400 and 2200 at Papakura on Saturday 15 January, followed by a return to her normal hours and shift rotations at Pukekohe on Monday 17 January 2011.

The signallers' manager

3.2.10. The signallers' manager had previous passenger train operations/train control experience. He had started with Veolia in 2007 as a service delivery manager in the corporate office in central Auckland. The 6 signallers based at Papakura and Pukekohe had been placed under his management because of his experience.

3.2.11. In late 2009 the manager had been promoted to a more senior role for an interim term, but retained responsibility for the signallers and the signal boxes. He had not seen a Veolia management plan for signal box operation and was aware that the Pukekohe signaller had not been observed since her initial certification for the Papakura signal box.

Infrastructure/Operating personnel

3.2.12. At the time of the incident, the KiwiRail person-in-charge, train controller and signaller at Wiri all held current certification for their roles, as did the KiwiRail drivers on Trains 210 and 201.

3.3. Audit

The NZ Transport Agency

- 3.3.1. Between 23 and 27 February 2009, the NZ Transport Agency had performed an ordinary safety assessment [audit] on Veolia. The assessment raised one “condition” relating to Veolia’s requirement to undertake internal audits in order to verify that its activities complied with its own documented intentions to meet management system objectives and standards. The assessment found there was no evidence of a system audit that assessed its safety case and safety system or an interface audit of any key suppliers to its business. Veolia had advertised for an internal auditor in response to this matter and at the time the assessment report was produced the position remained unfilled.

KiwiRail

- 3.3.2. On 18 February 2010 KiwiRail had performed operational safety audits at the Papakura and Pukekohe signal boxes. The 2 audits reported the following summary of corrective actions required from Veolia:

The process of ensuring on-going competency of signallers is not functioning. This matter needs urgent action to address. During debrief it was agreed KiwiRail Network deliver Project Reset for signallers either directly or by train [sic] the trainer to enable Veolia to deliver. Going forward a system needs to be developed to ensure that safety observations occur every 8 months in accordance with rail operating procedures. Other action points are noted in the Audit form in the report. A closure verification meeting in relation to these items will be held before 1 July 2010.

- 3.3.3. The closure verification meeting referred to above did not take place before this incident happened. When questioned by the Commission about the KiwiRail audit, Veolia responded:

We are confident we took corrective actions to become fully compliant with the 8-month frequency of safety observations required by Signal Box audit.

The debrief for the Papakura and Pukekohe signal box audit on 10 February 2010 was held between Veolia’s service delivery manager and KiwiRail Network with subsequent follow up documented in e-mails.

The service delivery manager undertook to take corrective action on items in the audit which included the arranging of signallers reset course which was completed by KiwiRail Network train control trainer in July 2010 at Veolia’s offices.

We arranged for 4 of the 6 signallers to have Project Reset signalling refresher course and all were certified by KiwiRail upon completion of the training. The remaining 2 signallers had recently attended a signaller training course (KiwiRail theory course) provided by KiwiRail, as part of their initial certification to operate a signal box. During final sign off after [on-job training], Veolia certified both signallers with a theory examination and safety observations.

Once Project Reset was completed, safety observations were reset to 8 months from the date of the course. As from 8 July 2010, all Veolia signallers had up-to-date bi-annual theory assessments.

Prior to the audit, safety observations and re-certifications were undertaken by Veolia trainers on a 12-month safety observation cycle and were tracked and recorded using a paper based system.

There was a misunderstanding of the requirement of section 10.3 of the rail operating rules and procedures. Once we were made aware, via the station audit of this misunderstanding regarding the 8-monthly cycle of safety observations, we adjusted our observations timetable appropriately.

As an outcome of a system review we have implemented a more robust system for tracking all safety observations and certifications. They are now arranged with KiwiRail and recorded in spread-sheets held by KiwiRail and Veolia.

Veolia

- 3.3.4. Veolia's safety case stated that it had a system of internal audits in order to verify that its activities were undertaken in compliance with the stated documented intentions in order to meet management system objectives and standards. Veolia added that 11 internal audits had been conducted in 2010 and that one of the audits had been a comprehensive risk review undertaken in May with assistance from an external consultant. Aspects of this audit continue to be implemented within the organisation.
- 3.3.5. On 24 June 2011 Veolia said that it considered the audit undertaken by KiwiRail during February 2010 to be an internal audit and that post-incident corrective actions had been taken.

4. Analysis

4.1. Wrong line running

- 4.1.1. The need to run a significantly different train operation between Papakura and Wiri provided a number of challenges for the rail system; however, these challenges could have been properly managed with robust established procedures. Wrong-line running with Mis.60 authorities was a recognised procedure that should not have caused any problems had there been good communication.
- 4.1.2. The incident in this case occurred when the Papakura signaller removed a collar that was supposed to remind her to seek authorisation from train control before changing the aspect on Signal 3A to green. She did not seek that approval and inadvertently created a potential head-on collision between 2 trains. The collar formed part of the train signalling “blocking” procedure, which should have provided the desired defence against the potential head-on collision.
- 4.1.3. The potential for a head-on collision was eventually averted by the person-in-charge of the worksite who became aware of the conflict, followed shortly afterwards by the signaller after she saw the Mis.60 and realised her mistake.
- 4.1.4. This report discusses 3 key matters:
- a design flaw in the “blocking” procedure, and the external influences that could have contributed to the signaller forgetting the Mis.60
 - how poor communication (including communicating in “silos”) can create confusion and erode defences
 - the commitment of Veolia to manage a signal box control operation that was outside its core function as a train operator.

The signal box collar “blocking” procedure

- 4.1.5. The blocking process for the Papakura signal box involved putting a red collar over a control lever to remind the signaller that the lever could not be moved until another mandatory function had been performed. The collar did not physically prevent the lever being moved so it was not, in the purest sense of the word, a “lockout”. The collar was available in one colour and one size, therefore it could only be used for one purpose at any given time. Blocking technology differed in some other signal boxes and in train control, but the function remained the same.
- 4.1.6. On the day in question the Signal 3A lever needed to be collared for 2 reasons:
- to remind the signaller that permission had to be obtained from the train controller because a Mis.60 had been issued to allow a train to travel on the same line in the opposite direction
 - to remind the signaller that permission had to be obtained from the person-in-charge before changing the signal aspect to green and thereby allowing a train to travel past the worksite.
- 4.1.7. The Signal 3 lever should have been collared permanently while the worksite was active. During the upgrade work this should have been 24 hours each day. Two KiwiRail train controllers on the day of the incident had failed to ensure that this had been done. Further, the collar should only have been removed with the person-in-charge’s permission. This defence was necessary to protect the staff and machinery at the worksite. The signaller, however, did not apply the red collar for this reason but instead applied it to remind her that a Mis.60 had been issued. The train controller should have reminded the signaller to collar the signal lever to protect the Mis.60 operation but did not do that either.

- 4.1.8. Using a single blocking system where dual blocking is required is problematic. Two different people can authorise its removal for 2 different reasons. Once the collar is removed for one reason there is no longer a defence in place for the other reason, thereby increasing the risk of a signaller moving the control lever without proper authorisation. This appears to have happened in this case. The signaller momentarily forgot about the train coming the other way under a Mis.60 and in response to a request from the person-in-charge to clear Signal 3A, the signaller removed the collar and changed it to green, thereby allowing Train 210 to proceed along a line about to be occupied by an opposing train.
- 4.1.9. If the KiwiRail train controllers and Veolia signallers had been following all the relevant rules, the train controller would have asked the signaller to collar the signal lever that had already been collared. This should have led to the realisation that a double blocking system was required before the incident occurred.
- 4.1.10. Veolia and KiwiRail have since introduced a double lockout system at Papakura to prevent this type of occurrence in the future. The Commission, therefore, is satisfied that it does not need to issue a recommendation to address this safety issue.
- 4.1.11. The signaller completed the Mis.60 paperwork and placed it on a clipboard under other paperwork. The act of writing the instructions was a good method for helping the signaller to remember them; however, the signaller should also have kept the instructions displayed in a prominent place.
- 4.1.12. Train drivers operating in track warrant territory receive instructions from train controllers in the form of track warrants, which give them authority to travel between set points. Accidents and incidents caused by drivers forgetting the limits of their track warrants prompted the fitting of illuminated clipboards in locomotive cabs so that the warrants were in full view of the drivers at all times. Signallers would benefit from the same process to complement the blocking procedure provided by the dual collar system. Veolia has altered the work desk arrangement at Papakura and provided a dedicated clipboard for Mis.60 forms to be displayed.

Findings

The potential for a head-on collision was created when the signaller momentarily forgot about a train authorised to travel on the wrong line under a Mis.60 procedure, and cleared a signal that allowed an opposing train on to the same section of track.

The lever in the signal box that was used to change the aspect of Signal 3A at Papakura should have had a double “blocking” ability to remind the signaller that 2 authorisations from 2 different people were required before she should change the signal aspect, but the system had not been designed to enable that.

Other influences

- 4.1.13. Forgetfulness is a normal human trait, but there are many different influences that can cause someone to forget a task. Some of these influences relate to individuals and others relate to the robustness of the systems designed to make people remember. The collar blocking system described above is one such system.
- 4.1.14. The Commission considered some factors that could have influenced the signaller’s performance on the day, including her work roster and fatigue from extended working hours.
- 4.1.15. Her work records showed that she had been working longer hours than normal in the week leading up to the incident and had completed extra shifts at Pukekohe because some freight train traffic was being transferred to road transport there. She said that she had had ample off-duty time to rest and sleep, and that she had felt well rested before each shift. Nevertheless, she had worked 12 of the previous 13 days before the incident, including transitioning from 5 late shifts to the start of early shifts with only one day off between.

- 4.1.16. Best practice in roster design optimises human performance by moving shift workers forward in the shift rotation instead of back; in other words, moving them from late to night shifts and then to early shifts, rather than finishing late only to start again early in the morning (Driscoll, Grunstein, & Rogers, 2007). This is not possible to achieve when alternating between late and early shifts only, with no intervening night shift.
- 4.1.17. In Veolia's case, signallers were normally given 2 days off before changing shifts, but in this case the signaller had only had one day off. For this reason she may have been operating at reduced performance at the start of her early shifts 8 days before the incident, but was unlikely to have been suffering from fatigue at the time of the incident due to her roster alone. Reasons for this are that she was only about 2 hours into her shift, at a time when the human body is naturally awake (0800) (Driscoll, Grunstein, & Rogers, 2007), and in the previous 2 days had been working normal-length shifts of 8 hours on average.
- 4.1.18. The signaller's shift pattern in the 8 days before the incident would have had the potential to result in her becoming fatigued if it had been followed week in and week out, but the signaller's roster had been normal for the preceding 5 weeks and was to return to normal one day after the incident. The circumstances show that the signallers were not routinely subjected to such a roster, but in this case the need arose due to unexpected staff sickness at a time when more hours were required from Veolia signallers because of the infrastructure upgrade work.
- 4.1.19. Although the signaller would have preferred to be at home dealing with personal matters rather than relieving at Papakura, she said this had not been a major concern for her when she was asked to relieve at Papakura. Instead, she had been more concerned about her currency with the Papakura signal box.
- 4.1.20. The signaller was nervous about managing the complexity of the work at the Papakura signal box as she felt unfamiliar with it after not having worked there for 6 months. The signaller compensated for this by visiting the signal box the day before to observe operations and she took a copy of the work bulletin home that night to study. Despite her nervousness and lack of familiarity with the Papakura signal box, her first day there went without incident, and she successfully managed 6 cases of wrong line running under Mis.60s.
- 4.1.21. The start of her second day had been more challenging, as she had to deal with several tasks concurrently when Trains 210 and 201 were about to cross. It is highly likely that these additional tasks that had been given to signallers at Papakura contributed to this incident. A more experienced signaller who was used to the Mis.60 procedure and more familiar with the signal box operation may have been able to deal simultaneously with these distractions and the crossing of Trains 201 and 210. However, in this case, the signaller had only been certified for 8 months and was not overly familiar with the Papakura signal box operation.
- 4.1.22. The amount of activity and the complexity of the operations at the Papakura signal box during the upgrade work should have warranted more resources being provided to the signal box function by splitting the signalling duties from the other duties or, at least, should have required that only experienced signallers be rostered to work at the signal box during those times. By comparison, signallers at other similar-sized signal boxes were not required to undertake these extra duties, which allowed them to focus solely on the task of signalling trains.
- 4.1.23. Veolia submitted that the age of the signal box and the lack of currently available technology for signalling trains was one cause of the incident. The Commission does not agree. The development of new technology does not automatically render the old technology obsolete or not fit for purpose. The Papakura signal box was performing essentially the same function that it had been when designed about 70 years earlier. It was not the equipment that failed, but the way it was being operated. This report has already discussed some improvements in the ergonomics of the room that housed the equipment, but the Commission has not been able to find fault in the equipment itself. If Veolia had had those concerns, it had the opportunity and responsibility to raise those issues with the owner of the equipment.

Findings

The signaller was likely to have been distracted by other tasks that had been assigned to her, which is likely to have contributed to her momentarily losing sight of the train controller's plan to cross trains at Papakura.

The signaller was certified and therefore qualified to operate the Papakura signal box, but she had had only 8 months' total experience as a signal box controller and had not worked there in the previous 6 months, which may not have been enough total and recent experience to deal with the complexity of operations at the time of the incident.

The signaller had worked longer-than-normal hours in the 8 days prior to the incident, but this was not likely to have contributed to her momentarily losing sight of the train controller's plan for crossing trains 201 and 210.

Communication/Crew resource management

- 4.1.24. The Commission has discussed in previous reports the importance of good communication and how this can help to reduce accidents and incidents within the rail industry, particularly the importance of good communication across the different sectors of the workforce performing connected roles in different organisations. Communication skills and practices form a significant component of what has become known as crew resource management in other transport modes.
- 4.1.25. In a paper presented at the American Transportation Research Board annual meeting in 2004 about the extent to which crew resource management had been introduced across the North American rail industry, the authors (Morgan, Kyte, Olsen, & Roop, 2004) identified that most applications of crew resource management up to 2004 had still strictly followed the crews within a train. They also identified several other groups and individuals who communicated with the crews outside the train, examples being train controllers, signallers and infrastructure staff members. The researchers described the potential benefits of introducing crew resource management as:
- By creating a safe working environment, encouraging teamwork, improving situational awareness, understanding technical proficiency, and practising error management, a work force will be created that communicates better, is more aware of its true situation, uses all of its available resources, and works better with one another.
- 4.1.26. The Commission believes that all rail participants should have a goal to create a culture in which crew resource management is not only understood, but is also practised and supported by management at the highest level. The challenge is to have all participants take part – train crews, train controllers, signallers and others who are taking part in the operation.
- 4.1.27. In spite of the Commission making, and subsequently closing off, 2 previous recommendations (Recommendation 026/08 in Report 07-110 and Recommendation 033/08 in Report 07-113) for improving standards of communication and crew resource management within the rail industry, this incident demonstrates that the standard has not reached an acceptable level.
- 4.1.28. There were 5 parties involved in this incident – the train controller, the signaller, the person-in-charge, the driver of Train 210 and the driver of Train 201. Some of them, however, were not fully informed about the plan for crossing the 2 trains. The signaller at the Wiri signal box was a potential sixth party but was not really involved and had little opportunity to intervene.

- 4.1.29. The train controller's plan was to hold freight Train 210 at Papakura and to give priority to Train 201. The train controller informed the signaller of this plan but neither he nor the signaller told the driver of Train 210 because the rules did not require either person to do this. As far as the driver of Train 210 was concerned, the only thing between his train and its destination was the worksite. The driver, therefore, stopped at the compulsory stop board, asked for permission to proceed, received that permission verbally and by way of the proceed aspect on Signal 3A began driving his train through the worksite, unaware that another train had been given authority to travel towards him from the opposite direction.
- 4.1.30. The driver of Train 210 should have been told that he was to stay at Signal 3A until another train had travelled down the line from the opposite direction under a Mis.60. The person-in-charge should also have been told this. Instead she was simply told what time to expect Train 210 at her worksite as a courtesy. If the person-in-charge had been given this information, she would not have verbally authorised Train 210 to pass the compulsory stop board and she would not have requested the signaller to change Signal 3A to green. The potential head-on collision would have been averted at that point.
- 4.1.31. As it turned out, it was the person-in-charge who initially detected the error and withheld approval for Train 201 to pass the compulsory stop board at the Wiri end of her worksite. This was a good outcome.

Finding

The KiwiRail train controller's plan to cross Trains 210 and 201 at Papakura was not disseminated to all the parties who needed to know. Consequently at least 2 early opportunities to avert the potential head-on collision were missed.

In spite of the Commission making, and subsequently closing off, 2 previous recommendations for improving standards of communication and crew resource management within the rail industry, this incident demonstrates that the standard has not reached an acceptable level.

Management of signal boxes

- 4.1.32. Veolia had updated its safety case to reflect the 2006 contract variation that saw it take responsibility for 3 signal boxes, but it had not developed a plan within its safety system to show how it intended to manage the operation. Rather it relied on the train control/signaller experience within its management team to provide oversight of the function. Train signalling is a critical function on a railway system and any company tasked with such a responsibility should resource itself and provide adequate processes to deal with it. Veolia had not.
- 4.1.33. Records show that the signaller had successfully passed her theory training for signalling operations, but gaps were noted relating to her practical training using the Mis.60 procedure. This gap in her training had never been resolved. This resulted in the signaller being less prepared for that task when she was required to perform it, from the moment she gained initial certification at Papakura, and subsequently at Pukekohe.
- 4.1.34. The signaller had not undergone the required formal level A safety observations after gaining certifications at both the Papakura and Pukekohe signal boxes. The observations would have provided opportunities to address the training requirement already identified and any other matters. During her time working solo in the 2 signal boxes the signaller should have been formally observed 5 times, but there were no records of this ever having been done.
- 4.1.35. Safety observations are a documented process used extensively within the rail industry. The reason for performing them is to correct unsafe and non-compliant practices, to confirm competency levels and to mentor employees in facets of their role with which they may be unfamiliar.

- 4.1.36. The Papakura signaller was not alone in having not received the required safety observations. Veolia had not performed safety observations for some of its other signallers either. Four out of 7 signallers had not been current for a number of years. This fact had been identified by KiwiRail in an audit of Veolia's signal box management processes, and even though the audit finding had been given a set date for closure of 1 July 2010, the issue had not been resolved before this incident happened, more than 6 months later. The follow-up of audit findings is an important part of the system.
- 4.1.37. Veolia did not effectively manage the new function of providing signallers for part of the Auckland train network because it did not have an effective system to ensure that the training and assessment of those signallers met industry standards, and it did not have a good system for corrective action once this breach had been identified.
- 4.1.38. The recent appointment of a national signaller assessor by KiwiRail meant that all KiwiRail and the remaining Veolia signallers have a single point of contact for operational issues. This action and the fact that several of the signal boxes operated by Veolia have been, and continue to be, absorbed into train control should improve performance in the area of assessments.

Findings

Veolia had not properly managed the new function of providing signallers for 3 signal boxes in the Auckland metro train network because 5 of its 8 signallers, including the one involved in this incident, had not undergone the required safety observations that were designed to check knowledge, compliance with procedures and performance.

The audit system (internal and external) had detected the weakness in Veolia's safety system for monitoring signaller performance, but the matter had not been satisfactorily addressed at the time of this incident.

5. Findings

- 5.1. The potential for a head-on collision was created when the signaller momentarily forgot about a train authorised to travel on the wrong line under a Mis.60 procedure, and cleared a signal that allowed an opposing train on to the same section of track.
- 5.2. The lever in the signal box that was used to change the status of Signal 3A at Papakura should have had a double “blocking” ability to remind the signaller that 2 authorisations from 2 different people were required before she should change the signal aspect, but the system had not been designed to enable that.
- 5.3. The signaller was likely to have been distracted by other tasks that had been assigned to her, which is likely to have contributed to her momentarily losing sight of the train controller’s plan to cross trains at Papakura.
- 5.4. The signaller was certified and therefore qualified to operate the Papakura signal box, but she had had only 8 months’ total experience as a signal box controller and had not worked there in the previous 6 months, which may not have been enough total and recent experience to deal with the complexity of operations at the time of the incident.
- 5.5. The signaller had worked longer-than-normal hours in the 8 days prior to the incident, but this was not likely to have contributed to her momentarily losing sight of the train controller’s plan for crossing Trains 201 and 210.
- 5.6. The KiwiRail train controller’s plan to cross Trains 210 and 201 at Papakura was not disseminated to all the parties who needed to know. Consequently at least 2 early opportunities to avert the potential head-on collision were missed.
- 5.7. In spite of the Commission making, and subsequently closing off, 2 previous recommendations for improving standards of communication and crew resource management within the rail industry, this incident demonstrates that the standard has not reached an acceptable level.
- 5.8. Veolia had not properly managed the new function of providing signallers for 3 signal boxes in the Auckland metro train network because 5 of its 8 signallers, including the one involved in this incident, had not undergone the required safety observations that were designed to check knowledge, compliance with procedures and performance.
- 5.9. The audit system (internal and external) had detected the weakness in Veolia’s safety system for monitoring signaller performance, but the matter had not been satisfactorily addressed at the time of this incident.

6. Key lessons

- 6.1. Good communication of a plan is critical to its successful outcome.
- 6.2. Standards for measuring the performance and compliance of a workforce will only be effective if they are followed.
- 6.3. Audits will not be effective if the breaches they disclose are not acknowledged and remedied.

7. Safety actions

General

7.1. The Commission classifies safety actions by 2 types:

Type 1. Safety actions taken by the regulator or an operator to address safety issues identified by the Commission during an inquiry that would otherwise result in the Commission issuing a recommendation.

Type 2. Safety actions taken by the regulator or an operator to address other safety issues that would not normally result in the Commission issuing a recommendation.

Type 1 safety actions addressing safety issues identified during an inquiry

7.2. On 14 January 2011 KiwiRail reissued the bulletin after the incident with added instructions relating to the wrong line running procedures:

When an opposing train is to be crossed at Papakura the locomotive engineer of this train must be advised about the Mis.60 being issued to the down train before it is issued.

Train control must receive confirmation that the signals governing entry into the Papakura-Wiri section are at stop and the signal levers are collared. This information must be endorsed by train control on the bottom of the office copy of the Mis.60 prior to being issued to the locomotive engineer.

7.3. On 28 March 2011 Veolia advised that the following safety actions had been taken:

- The red collars were redesigned.
- An additional yellow collar to indicate that a second blocking requirement when multiple activities are in place.
- Work desk enlarged to allow space for a clipboard dedicated to the holding of Mis.60s.

7.4. On 27 May 2011 KiwiRail advised the following:

Papakura signal box is scheduled to close in January 2012. There is a small possibility it may continue operating for longer to enable construction of new track work at Papakura, but centralization into the national train control centre in Wellington will occur as part of the Papakura re-constructing and re-signalling project. KiwiRail Network is currently in the confidential stages of discussing transferring the management and employment of Pukekohe signallers to KiwiRail Network. No timeframe has been defined at this point but it is our decision in principle that this will occur.

7.5. On 27 July 2011 KiwiRail advised the following:

In the period following the incident, the KiwiRail national signaller assessor has conducted safety assessments on Veolia's signallers as follows:

- Between 2 and 4 March 2011, 3 signallers were assessed.
- 15 June 2011, 2 signallers assessed following absences for annual leave and leave following an accident.

On 4 March 2011, the signaller from the incident was given a more intense observation which focused practically on Rule 905 and wrong line running procedures. The incident was also discussed and advice was given about avoiding distractions and applying double protection that used points as well. The signaller was again assessed on 15 June 2011 and is scheduled again for assessment on 15 September 2011. Veolia has since employed two additional relief staff who were certified for Pukekohe on 14 and 15 June 2011.

8. Recommendations

General

- 8.1. The Commission may issue, or give notice of, recommendations to any person or organisation that it considers the most appropriate to address the identified safety issues, depending on whether these safety issues are applicable to a single operator only or to the wider transport sector. In this case, a recommendation has been made to the NZ Transport Agency.
- 8.2. In the interests of transport safety it is important that these recommendations are implemented without delay to help prevent similar accidents or incidents occurring in the future.

Recommendation

- 8.3. On 28 March 2012 the following recommendation was made:
The Commission recommends to the Chief Executive of the NZ Transport Agency that he requires the Executive of the National Rail System Standard to develop standards to ensure that all rail participants meet a consistently high level of crew resource management, and communication that includes the use of standard rail phraseology (002/12).
- 8.4. On 16 April 2012, the Chief Executive of the NZ Transport Agency replied in part as follows:
We intend to work closely with the National Rail System Standard (NRSS) Executive with an aim to implementing and closing out this recommendation as soon as practicable. The NZ Transport Agency sits of the NRSS Executive as an observer. We will also consider a strategy for rail operators outside the NRSS coverage.

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- 08-108 Express freight Train 845, track warrant overrun, Reefton - Cronadun, 13 August 2008

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