Hon Andrew Powell MP
Minister for Environment and Heritage Protection

QUEENSLAND GOVERNMENT

Ref CTS 05521/13

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Mr Neil Laurie
The Clerk of the Parliament
Parliament House
George Street
BRISBANE QLD 4000

Dear Mr ~~Laurie~~ Neil

I refer to your letter of 6 March 2013 enclosing a copy of Petition No. 2036-12 lodged in the Queensland Legislative Assembly.

The Petition draws to the attention of the House concerns about reports of coal dust deposits emanating from coal wagons and the coal stockpile at the Port of Brisbane. The Petitioners request that the House take immediate action to reduce the amount of coal dust and other air pollution in the Wynnum Manly district and surrounding suburbs.

In response to the concerns of residents of the area, I can advise that the Department of Environment and Heritage Protection has required Queensland Bulk Handling to undertake dust monitoring in the area. Queensland Bulk Handling began its monitoring program on 7 March 2013 and the monitoring program will run for a year in order to gain an understanding of the coal dust impacts in the Wynnum community.

The Department of Science, Information Technology, Innovation and the Arts, in conjunction with the Department of Environment and Heritage Protection, carried out monitoring in the Tennyson area in September to October 2012 to assess the level of dust impact from coal train movement. This monitoring program revealed that the levels of coal dust in the Tennyson area were within guidelines. Impacts from coal trains at any point along the corridor, including Wynnum, can be expected to be similar. The Tennyson report also found that additional materials in ambient dust included soil/rock particles, black rubber particles from tyre wear and plant/insect material. It is likely that these materials will also be present in the ambient dust at Wynnum. I have enclosed a copy of the report for your information. The report can also be accessed on the Department of Environment and Heritage Protection's website at www.ehp.qld.gov.au/air/pdf/tennyson-dust-report.pdf.

I can also advise you that a cross-agency working group has been established in response to the community concerns associated with noise and coal dust resulting from train movements. The Coal Dust and Noise Policy Working Group consist of representatives of the Department of Transport and Main Roads, the Department of Environment and Heritage Protection, the Department of Science, Information Technology, Innovation and the Arts, the Department of Premier and Cabinet as well as Queensland Rail.

The working group has designed a comprehensive dust monitoring program for the West Moreton Rail System. This monitoring program is currently being implemented by independent air quality experts from the Environmental Monitoring and Assessments Sciences division of the Department of Science, Information Technology, Innovation and the Arts. The monitoring results will provide network wide air quality information and underpin the development of a Coal Dust Management Plan.

As a result of the strong position held by the Premier and Government in regard to this issue, the industry has recently committed to veneering all coal wagons travelling along the West Moreton Rail System by the end of 2013.

I hope this information has been of assistance to you. Should you have further enquiries, please contact my Chief of Staff, Mr Troy Collings on 3239 0844.

Yours sincerely

ANDREW POWELL MP
Minister for Environment and Heritage Protection

Enc

Tennyson Dust Monitoring Investigation

September to October 2012

Department of Science, Information Technology, Innovation and the Arts

Queensland Government

Prepared by:
Environmental Monitoring and Assessment Sciences, Science Delivery Division

Department of Science, Information Technology, Innovation and the Arts

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Summary

An investigation of air quality in the Tennyson community adjacent to the rail corridor used by trains hauling coal from West Moreton coal mines to the Port of Brisbane was conducted by the Department of Science, Information Technology, Innovation and the Arts (DSITIA) over the period from 5 September to 5 October 2012. The investigation was commissioned by the Department of Environment and Heritage Protection (DEHP) following concerns raised by residents about dust impacts from uncovered coal wagons.

The investigation focused on acquiring data to assess both health and nuisance impacts in the community, together with determination of the contribution of coal particles to overall dust levels. The monitoring program collected information on:

- PM_{10} (particles less than 10 micrometres in diameter) levels—for assessment against criteria based on health
- Deposited dust (dustfall)—for assessment against criteria based on nuisance
- Coal dust content in deposited dust—for assessment of the percentage contribution of coal particles to overall dust levels.

The monitoring by DSITIA found that ambient particle concentrations generally complied with ambient air quality objectives.

PM_{10} levels did not exceed the Queensland Environmental Protection (Air) Policy 2008 (EPP Air) 24-hour average air quality objective on any day at the Tennyson Railway Station monitoring site during the entire investigation period.

The lack of any observed relationship between 24-hour average PM_{10} concentrations and the proportion of winds coming from the direction of the rail line during the daily sampling period suggests that coal trains are not a significant contributor to PM_{10} levels in the Tennyson community when compared to other local and regional sources of PM_{10} such as motor vehicle emissions.

Average daily deposited dust (insoluble fraction) levels at the three Tennyson monitoring sites over the 30-day sampling period were less than the dust nuisance trigger level recommended by the New Zealand Ministry for the Environment, which was used in the absence of Australian dust nuisance criteria.

The major component of the dust samples from the Tennyson monitoring sites was soil/rock dust at 40 per cent or more of the total insoluble dust collected. Coal dust was found to comprise between 10 percent and 20 per cent of the insoluble deposited dust samples in the Tennyson community. Another black particle type, rubber dust generated from vehicle tyre wear, was present in all the deposited dust samples at a level of 10 per cent of total insoluble dust. Fragments of plant and insect materials were also found in the dust samples. The coal dust particles identified in the microscopic analysis were between 20 µm and 200 µm in size.

The proportion of coal dust in the deposited dust samples was higher than that found during a previous coal dust study conducted at Tennyson between July 1998 and August 1999. The coal dust levels found in the current investigation were roughly in line with the threefold increase in the amount of coal being transported to the Port of Brisbane (3 million tonnes in 1998-1999 versus 9 million tonnes in 2012).

During the passage of individual trains, the levels of particles less than 20 µm in size were found to increase on average by 5 $\mu g/m^3$ or less when compared to levels immediately before the train passed. Loaded coal trains appeared to cause the greatest increase in short-term levels of particles of this size, although when meteorological conditions favoured impacts from dust generated by passing trains, all train types except empty coal trains showed a similar average concentration change. It appears that for loaded coal trains, re-entrainment of surface dust by air movements associated with the passing train is a larger source of airborne particles of this size in the immediate vicinity of the rail line than losses from the coal wagons.

Table of contents

Glossary of terms

AMCP	University of Queensland Applied Materials Characterisation and Performance Laboratory.
Ash	The mass of the insoluble portion of particles deposited in a deposit gauge which remains after combustion of the sample.
AS/NZS	Australian Standard/New Zealand Standard
Combustible matter	The mass of the insoluble portion of particles deposited in a deposit gauge which is lost on combustion of the sample.
Deposited dust	Particles collected in a deposit gauge which passes through a 1 mm mesh sieve.
DSITIA	Department of Science, Information Technology, Innovation and the Arts
DEHP	Department of Environment and Heritage Protection
EPP Air	Queensland Environmental Protection (Air) Policy 2008.
$g/m^2/30days$	Grams per square metre per 30 day period. A measure of the average mass of particles settling on a unit area over a 30 day period.
Insoluble solids	The mass of the insoluble portion of particles deposited in a deposit gauge.
km	Kilometre
µg	Microgram (= one millionth of a gram)
$µg/m^3$	Micrograms per cubic metre. A measure of the mass of particles suspended in a unit volume of air.
µm	Micrometre (= one millionth of a metre)
mg	Milligram (= one thousandth of a gram)
$mg/m^2/day$	Milligrams per square metre per day. A measure of the average mass of particles settling on a unit area on a daily basis.
ml	Millilitre
PM_{10}	Atmospheric suspended particles having an aerodynamic diameter of less than 10 µm.
SEM/EDS	Scanning electron microscopy with energy dispersive X-ray spectroscopy.
SIMTARS	Queensland Government Safety In Mines Testing And Research Station.
Soluble solids	The mass of the soluble portion of particles deposited in a deposit gauge.
Total solids	Total mass of particles deposited in a deposit gauge (the sum of insoluble and soluble solids fractions.
Wind rose	A diagram representing the frequency distribution of wind speed and direction on a polar co-ordinate map. Wind direction is the direction the wind is blowing from.

Introduction

Approximately 9 million tonnes of export coal is transported each year to the Port of Brisbane via the Western and Metropolitan Rail Systems. These railway networks are owned and managed by Queensland Rail, while the coal haulage (train) services are undertaken by Aurizon. The coal haulage route starts just east of Miles, travels through Dalby, Toowoomba, Ipswich and the western and southern suburbs of Brisbane through to the Port of Brisbane. At present the coal is transported in uncovered rail wagons.

The Department of Environment and Heritage Protection (DEHP) has received a number of complaints from residents of Brisbane suburbs along the Metropolitan Rail Line to the Port of Brisbane concerning dust nuisance from the transport of coal. A high proportion of these complaints have come from residents of the suburb of Tennyson. At Tennyson there is a bend in the rail line, which could lead to greater shaking of rail wagons as trains slow down and then speed up, increasing the potential for generation of dust.

In response to local community concerns about dust impacts from coal trains, the DEHP arranged for the Science Delivery Division of the Department of Science, Information Technology, Innovation and the Arts (DSITIA) to undertake a one-month dust monitoring investigation at Tennyson to assess the validity of the complaints and to obtain information which could be used as a basis for determining what future action may need to be taken. Tennyson was chosen as the site of this initial investigation due to the concentration of complaints received by the DEHP from Tennyson residents.

This report summarises the monitoring results obtained by DSITIA from the dust monitoring investigation at Tennyson for the four-week period from 5 September to 5 October 2012.

Monitoring program design

The potential health effects of dust are closely related to particle size. The size range of airborne particles varies from less than 0.1 µm up to about 500 µm or half a millimetre in diameter (1 µm = one millionth of a metre). Human health effects of airborne dust are mainly associated with particles less than 10 µm in size (commonly termed PM_{10}), which are small enough to pass through the filtration mechanisms in the upper respiratory tract and penetrate beyond the larynx to the lower airways. PM_{10} particles are invisible to the naked eye. By way of comparison, a human hair is approximately 60 µm in diameter. PM_{10} particles can arise from combustion processes (e.g. motor vehicle engines) and mechanical processes (e.g. windblown dust).

Particles can also cause considerable nuisance problems through soiling of property and materials. Nuisance effects can be caused by particles of any size, but are most commonly associated with those larger than 20µm which rapidly settle out of the air in the vicinity of the point of emission.

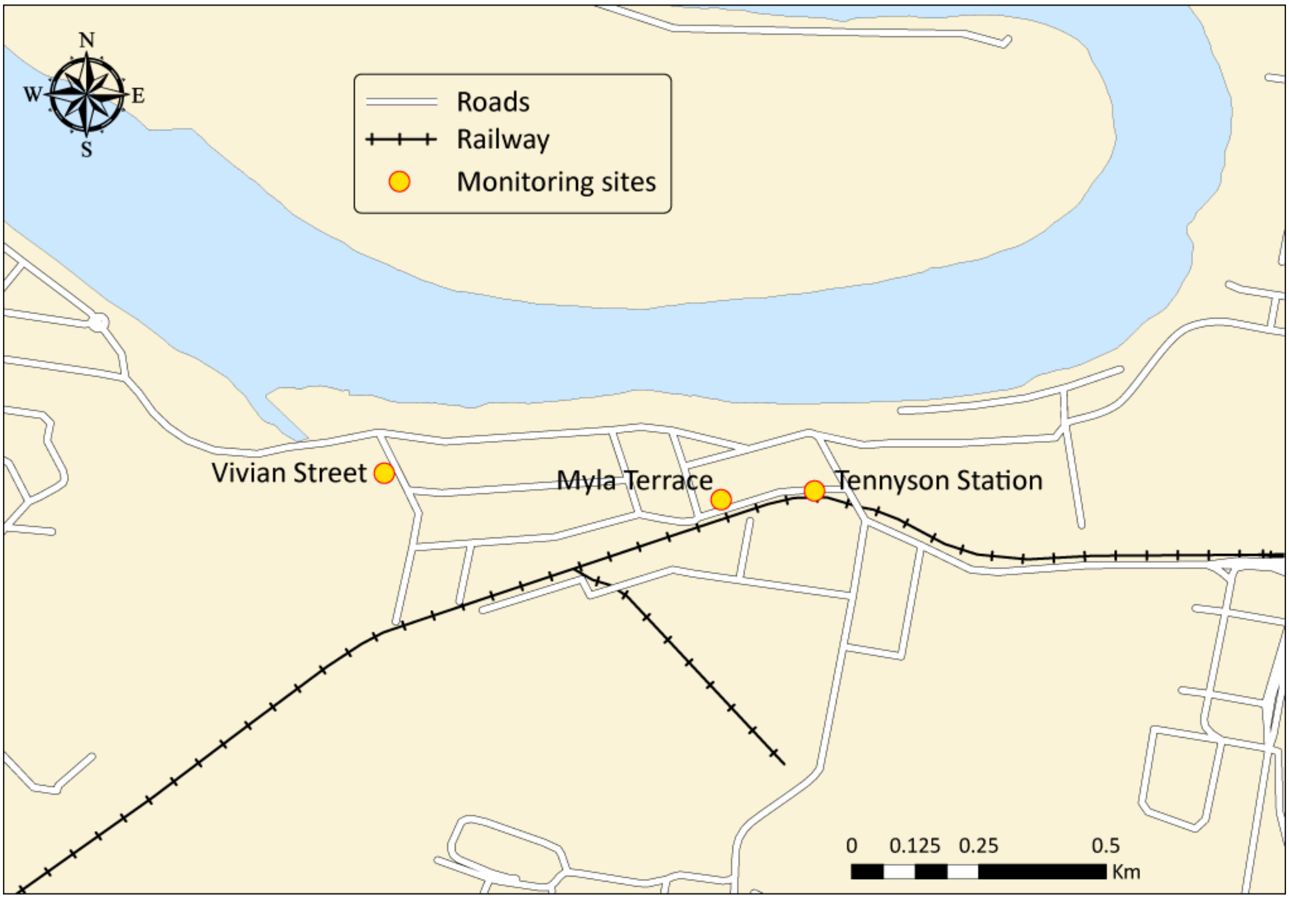
The DSITIA's dust monitoring investigation at Tennyson between September and October 2012 focused on acquiring data to assess both health and nuisance impacts in the community, together with determination of the contribution of coal particles to overall dust levels. The monitoring program collected information on:

- PM_{10} levels—for assessment against criteria based on health
- Deposited dust (dustfall)—for assessment against criteria based on nuisance
- Coal dust content in deposited matter—for assessment of the percentage contribution of coal particles to overall dust levels.

PM_{10} results were compared with the Queensland Environmental Protection (Air) Policy 2008 (EPP Air) 24-hour air quality objective of 50 µg/m^3. In the absence of an EPP Air objective for deposited matter, measured deposited dust levels were compared against the trigger level of 4 g/m^2/30 days, or 130 mg/m^2/day expressed on a daily basis, recommended by the New Zealand Ministry of the Environment[1].

Monitoring was conducted at three locations within the Tennyson community, as shown in Figure 1. Equipment monitoring PM_{10} and deposited dust was located at the Tennyson Railway Station, approximately six metres from the edge of the platform and the nearest railway track. It was anticipated that measurements at this site would provide an indication of maximum levels of coal dust due to the proximity of the monitoring equipment to passing coal trains. At the time of the monitoring study the station was not in use and the platform was fenced off to prevent public access.

Figure 1: Map showing the location of the monitoring sites at Tennyson in relation to the rail corridor.



Measurement of deposited dust was also carried out at residential properties in Myla Terrace and Vivian Street in the Tennyson community. Myla Terrace runs adjacent to the rail line and residential properties in this street are likely to experience the highest exposure to any dust coming from passing coal trains. At the Myla Terrace monitoring site, the deposited dust monitoring equipment was located in the front yard of a residential property approximately 20 metres from the nearest rail track. The third monitoring site in Vivian Street was located in a residential property approximately 300 metres from the rail corridor. Monitoring of deposited dust at the Vivian Street site was intended to provide an indication of any reduction in dust levels with distance from the rail line.

Deposited dust was monitored by determining the amount of dust collected over an exposed surface in a fixed period of time. Measurement was by means of a funnel and collection bottle, which simply caught the dust settling over a fixed surface area over a period of one month. The dust was washed from the bottle, filtered and weighed, and the results reported in terms of the weight of dust collected per unit of surface area over the sampling period. Collection and analysis were carried out in accordance with Australian/New Zealand Standard AS/NZS 3580.10.1:2003 Method 10.1 Determination of particulates – Deposited Matter – Gravimetric method. The sample collection was carried out by DSITIA staff and the analysis was carried out by Queensland Government Safety in Mines, Testing and Research Station (SIMTARS). Prior to analysis, the solution contained in the collection bottle was homogenised and a 100 ml sub-sample was extracted for the coal dust identification analysis.

Daily 24-hour average PM_{10} samples were collected using a Partisol® Model 2025 sequential low-volume air sampler at the Tennyson Station monitoring site for assessment of compliance with the EPP Air 24-hour objective. The sampler was operated in accordance with Australian/New Zealand Standard AS/NZS 3580.9.10:2006 Method 9.9: Determination of suspended particulate matter – PM_{10} low-volume sampler – Gravimetric method. The sequential air sampler operated by drawing air through a PM_{10} size-selective inlet (to remove particles larger than 10 µm) and depositing the PM_{10} particles on a pre-weighed 47mm diameter Teflon® filter over a 24-hour period from midnight to midnight. After sampling, the filter was again weighed, with the difference in weight being the mass of PM_{10} particles collected. The PM_{10} mass concentration was calculated by dividing the mass of PM_{10} particles collected by the volume of air drawn through the sampler over the 24-hour sampling period. The sample collection was carried out by departmental staff and the gravimetric analysis was carried out by SIMTARS.

At the Tennyson Station monitoring site, continuous 5-minute averaged particle measurements were also collected using a Model 8533 Dusttrak™ DRX Aerosol Monitor to determine if the passage of coal trains coincided with short-term increases in particle levels. The Dusttrak™ analyser drew air into a sensing chamber where the air stream was illuminated by light from a laser diode. Particles present in the air stream caused the light beam to be scattered, with the amount of scattering being measured by a photodetector mounted at 90^{o} to the air stream. The aerosol concentration was determined by the overall photodetector response, while individual pulses from the photodetector provided a measure of the size of the particle causing the light scattering. The Dusttrak™ instrument was chosen due to its fast response time to particle concentration changes. However, as the Dusttrak™ instrument does not directly measure particle mass, the recorded particle concentrations could not be used to determine compliance with the EPP Air objectives for particles.

Determination of the coal particle content was performed by microscope examination of the sub-sample extracted from the deposited dust samples before the deposited dust analysis was carried out. The deposited dust sub-sample solution was filtered onto a membrane filter and examined by stereomicroscopy for particle distribution (surface coverage) and general appearance. This was followed by the use of scanning electron microscopy with energy dispersive X-ray spectroscopy (SEM/EDS) of selected individual particles to confirm that the particles assessed by stereomicroscopy as coal particles were actually coal particles. The coal dust identification work was performed by the Applied Materials Characterisation and Performance Laboratory (AMCP) at the University of Queensland. AMCP are considered nationally as experts in coal dust determination and the techniques used in the Tennyson investigation have been previously applied to other coal dust studies in Queensland.

Wind speed and direction measurements averaged over 30-minute periods were recorded at the Tennyson Railway Station monitoring site to assist with determination of the contribution of coal trains to overall particle levels. A Gill Windsonic ultrasonic wind sensor was connected to the inbuilt wind sensor input on the Partisol® sequential low-volume air sampler, which recorded 30-minute averaged wind speed and direction measurements. The wind sensor operated by measuring the speed at which sound waves travelled through the air between two sets of transducers. The wind sensor was located at a height of six metres above ground level.

Results and discussion

Meteorology

Wind direction was a critical factor in the measurement of dust impacts at the Tennyson monitoring sites. For dust generated by the passage of coal trains to impact the Tennyson Station and Myla Terrace monitoring sites, the wind direction had to be between east through south to west. For impacts at the Vivian Street monitoring site, wind direction had to be between east-southeast and southwest (see Figure 1). A summary of the wind characteristics during the monitoring period is provided in Table 1. The distribution of winds over the dust deposition monitoring period from 5 September to 5 October 2012 is also shown in the wind rose in Figure 2.

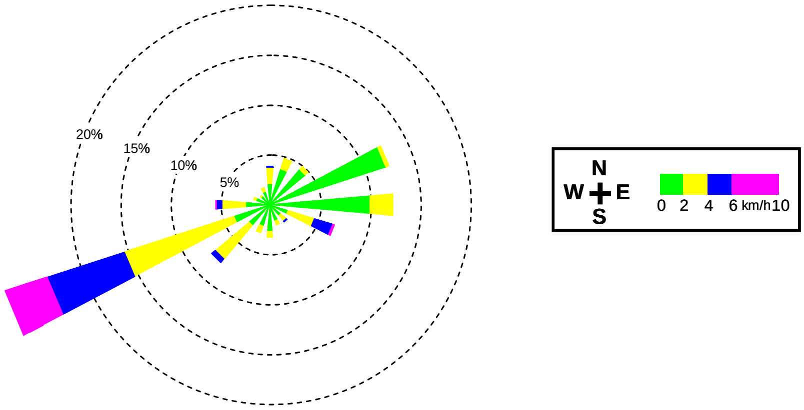
During the deposited dust sampling period from 5 September to 5 October, winds were favourable for transport of dust from coal trains towards the Tennyson Railway Station and Myla Terrace monitoring sites for over half of the sampling period. At the Vivian Street monitoring site, winds blew from the direction of the rail line for only 20 per cent of the sampling period.

Winds from the direction of the rail line during daily sampling periods ranged from two per cent to 100 per cent of all winds at the Tennyson Station monitoring site. On 16 of the 29 sampling days, more than 50 per cent of all winds blew from the direction of the rail line towards the monitoring equipment at the Tennyson Station monitoring site.

Table 1: Wind and rainfall conditions during the Tennyson dust monitoring investigation from 5 September to 5 October 2012.

Sampling period	Winds from direction of railway line					Rainfall (mm)
	Proportion of winds (%)			Average wind speed (km/h)	Maximum wind speed (km/h)	
	Tennyson Station	Myla Terrace	Vivian Street			
Deposited dust monitoring						
5 September to 5 October	56	57	20	2.4	12.8	7.8
PM_{10} monitoring						
6 September	2	4	0	1.8	4.7	0.0
7 September	25	25	4	1.8	7.3	0.0
8 September	85	71	2	5.5	11.2	0.1
9 September	71	88	31	2.9	8.8	0.0
10 September	56	63	17	2.3	5.6	0.0
11 September	46	48	2	1.9	6.0	0.0
12 September	42	42	10	1.5	3.3	0.0
13 September	44	42	0	2.3	6.2	0.0
14 September	77	77	13	4.9	12.8	0.0
15 September	75	85	25	2.5	7.1	0.0
16 September	56	56	8	1.8	4.8	0.0
17 September	48	52	8	1.6	4.3	0.0
18 September	54	56	25	2.0	4.4	0.1
19 September	40	40	2	2.1	7.1	0.3
20 September	38	35	6	1.7	5.1	0.0
21 September	54	56	23	1.4	4.2	1.4
22 September	65	75	23	2.1	4.9	0.0
23 September	65	65	15	2.5	7.2	0.0
24 September	46	42	2	2.1	5.8	4.8
25 September	81	85	54	2.8	5.4	0.0
26 September	63	81	29	2.0	4.3	0.0
27 September	35	35	8	1.5	4.5	0.0
28 September	38	35	6	1.8	3.8	0.0
29 September	44	40	0	3.7	10.4	0.4
30 September	69	77	17	2.0	5.6	0.7
1 October	96	98	52	2.9	5.2	0.0
2 October	100	100	69	3.4	7.4	0.0
3 October	67	67	38	2.1	6.9	0.0
4 October	44	44	6	2.1	5.2	0.0

Figure 2: Tennyson Railway Station monitoring site wind rose, 5 September to 5 October 2012.



Rainfall was another factor influencing the outcome of the investigation through possible dust suppression. Daily rainfall information was available from the DSITIA's Rocklea air quality monitoring station (located approximately 1.5 km south west of Tennyson) and has been summarised in Table 1. Minimal rainfall was experienced during the study period, and little dust suppression due to wet conditions would have occurred during the period of monitoring.

It can be concluded that particle measurements obtained during the monitoring period would have included conditions likely to be representative of worst-case conditions for dust impacts from the dust sources existing in the Tennyson area, particularly for the two monitoring sites closest to the rail corridor.

PM_{10}

The 24-hour average PM_{10} monitoring results obtained from the Partisol® instrument at the Tennyson Railway Station monitoring site are displayed graphically in Figure 3, and summarised in Table 2. The highest 24-hour average PM_{10} concentration was 39.8 µg/m³ on 11 September. The average PM_{10} concentration over the entire 29-day period the Partisol® instrument was in operation was 26.6 µg/m³.

Figure 3: 24-hour average PM_{10} concentrations at the Tennyson Railway Station monitoring site, September to October 2012.

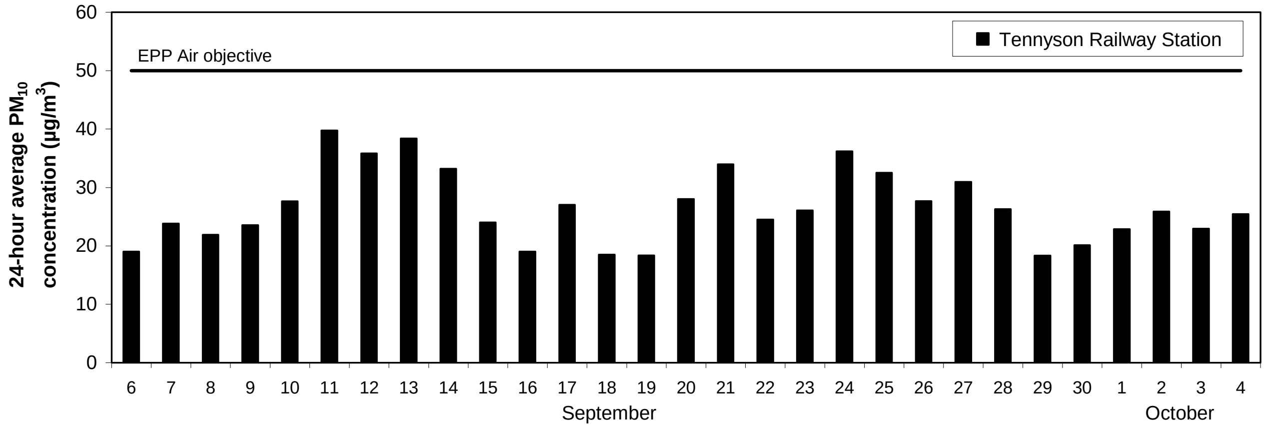


Table 2: 24-hour average PM_{10} concentration statistics at the Tennyson Railway Station monitoring site, 6 September to 4 October 2012.

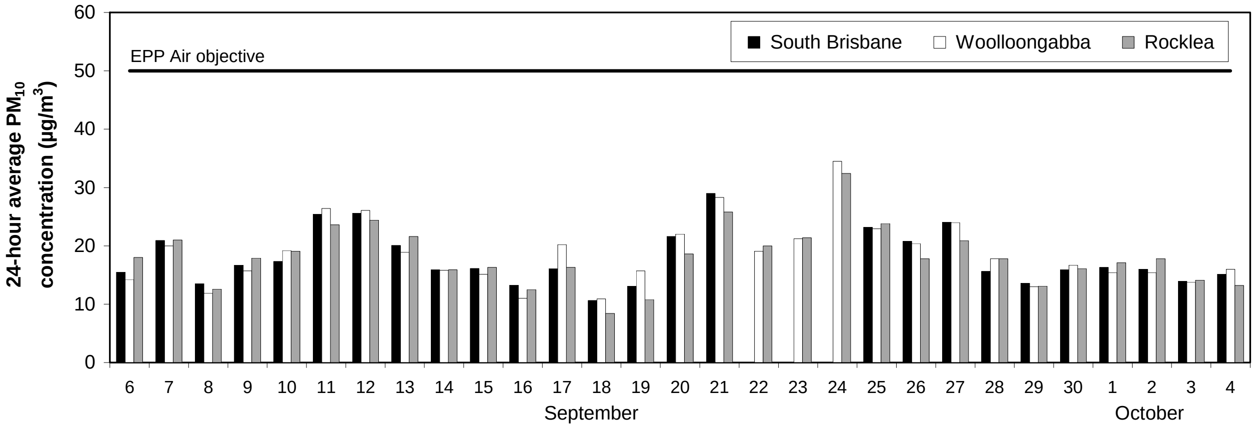
Monitoring site	Maximum concentration (µg/m³)	Average concentration (µg/m³)	Median concentration (µg/m³)	Minimum concentration (µg/m³)	Number of 24-hour values
Tennyson Railway Station	39.8	26.6	25.9	18.3	29

The EPP Air 24-hour average air quality objective for PM_{10} particles is 50 µg/m^3. During the investigation period the EPP Air objective was not exceeded at the Tennyson Railway Station monitoring site.

On Sunday 16 September, no coal trains and only four freight train services ran on the rail line past Tennyson Railway Station over the whole day. The PM_{10} concentration measured on this day was 19.0 µg/m^3. This provides an indication of typical background PM_{10} concentrations in the Tennyson area in the absence of train and significant motor vehicle emission sources.

The elevated PM_{10} levels observed at the Tennyson Railway Station monitoring site on 11 to 13 September, 21 September and 24 September were replicated at the Department's ambient air quality monitoring network stations at South Brisbane, Woolloongabba and Rocklea on these days (Figure 4), indicating the added contribution of a regional source of PM_{10} particles. The Queensland Fire and Rescue Service website[2] reported that a number of annual hazard reduction/conservation management program burns for parks and forests were undertaken in the South-East Queensland region during September. There was also a grass fire at Upper Brookfield which burned for a number of days from 23 September. Smoke from these burns will have increased the background levels of PM_{10} particles in the atmosphere at these times.

Figure 4: 24-hour average PM_{10} concentrations at DSITIA's South Brisbane, Woolloongabba and Rocklea air quality monitoring sites, 6 September to 4 October 2012.



The relationship between 24-hour PM_{10} concentrations and the proportion of winds blowing from the direction of the rail line towards the Tennyson Railway Station monitoring site is plotted in Figures 5 and 6. No relationship was found between 24-hour average PM_{10} concentrations and the proportion of winds coming from the direction of the rail line during the daily sampling period (trend shown by the heavy line in Figure 5). This finding suggests that coal trains are not a significant contributor to PM_{10} levels in the Tennyson community, compared to other local and regional sources of PM_{10} such as motor vehicle emissions. The main roads running through Tennyson (King Arthur Terrance and Softstone Street) carry around 10 000 vehicles per day on average[3].

Figure 5: Relationship between 24-hour average PM_{10} concentrations and proportion of winds from the direction of the rail line at the Tennyson Railway Station monitoring site, September to October 2012.

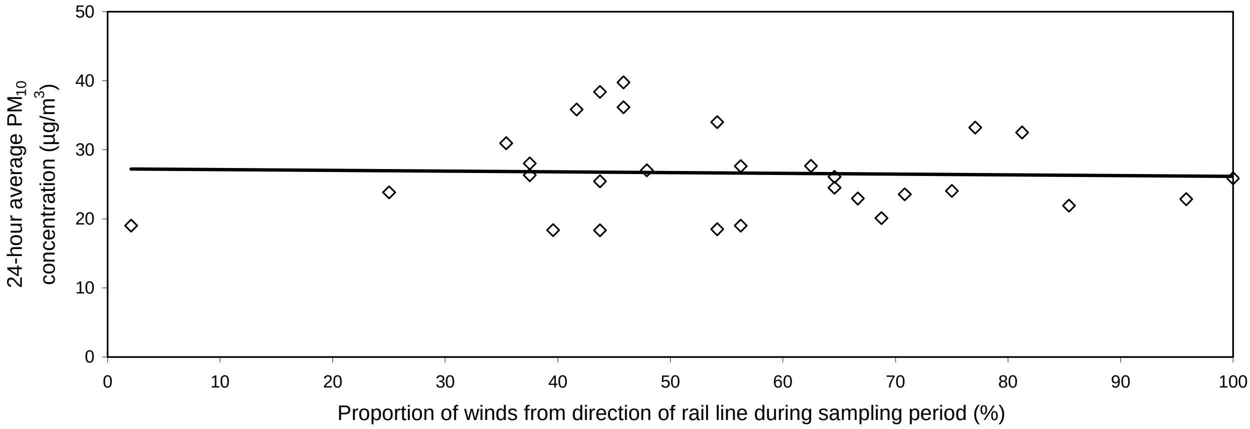
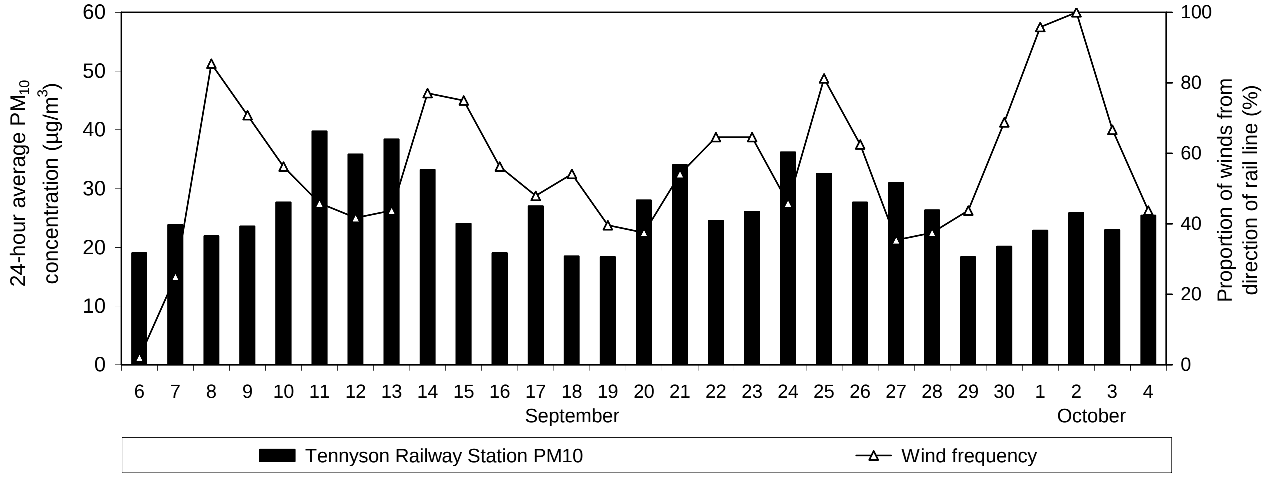


Figure 6: Comparison between the average PM_{10} concentration and the proportion of winds from the direction of the rail line for each sampling day at the Tennyson Railway Station monitoring site, September to October 2012.



Deposited dust

Monthly dust deposition monitoring was conducted at the three Tennyson monitoring sites to assess dust fallout levels against criteria for nuisance annoyance (as no health-based criteria exist for deposited matter) and for determination of the amount of coal particles present in the deposited dust.

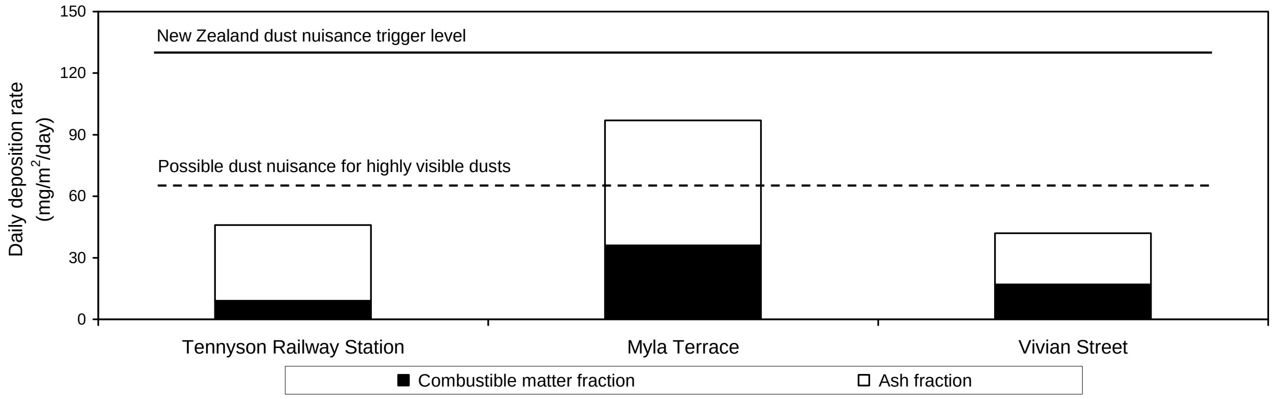
The dust deposition analysis method allows for the determination of total, dissolved and insoluble deposited matter, with a further breakdown of the insoluble fraction into combustible matter and ash content. Insoluble matter is the solid material collected by filtering the sample, while the dissolved matter is determined by evaporating some or all of the liquid filtrate. As a general rule, the dissolved material is of little interest in assessing nuisance effects. In a coastal environment a large proportion of the dissolved matter would be marine salt. Combustible matter is that portion of the insoluble matter lost during combustion and is an indication of the amount of organic matter in the dust. Any coal particles present in the insoluble deposited dust will be part of the combustible matter fraction, along with other organic matter such as plant fragments, insect material, plastic fragments, wood dust, soot and rubber dust. The ash content is an indication of the mineral content of the dust. The ash is often primarily soil or rock particles, but can include particles such as fly ash and cement dust.

The results of dust deposition sampling at the Tennyson monitoring sites over the 30-day period from 5 September to 5 October 2012 are summarised in Table 3 and displayed graphically in Figure 7. In Figure 7 the contributions from combustible matter particle types and ash particle types to the overall insoluble dust deposition rate are shown by the divisions on each column.

Table 3: Deposited dust monitoring results at the Tennyson monitoring sites, 5 September to 5 October 2012.

Monitoring site	Dust deposition			Winds from direction of rail line (%)	Rainfall (mm)
	Insoluble solids ($mg/m^2/day$)	Ash ($mg/m^2/day$)	Combustible matter ($mg/m^2/day$)		
Tennyson Railway Station	46	37	9	56	7.8
Myla Terrace	97	61	36	57	
Vivian Street	42	25	17	20	
Note: Ash deposition rate plus Combustible matter deposition rate equals Insoluble solids deposition rate.					

Figure 7: Monthly insoluble dust deposition rates at the Tennyson monitoring sites, 5 September to 5 October 2012.



There are currently no Australian ambient air quality guidelines for deposited dust. The New Zealand Ministry for the Environment's recommended dust nuisance trigger level for deposited dust is a maximum insoluble solids dust deposition rate of 4 g/m^2/30days (above background concentrations), or 130 mg/m^2/day averaged over a 30-day period[1]. Previous routine dust deposition monitoring conducted by the former Department of Environment in South-East Queensland (this monitoring ceased in 1994)[4-6] showed that background daily dust deposition rates were between 20 mg/m^2/day and 30 mg/m^2/day averaged over a 30-day period at a location in Toowong, a residential suburb. There are no dust deposition guidelines expressed in terms of ash deposition or combustible matter deposition.

The maximum insoluble dust deposition rate measured at Tennyson was 97 mg/m^2/day at the Myla Terrace monitoring site, which is below the New Zealand recommended trigger level for nuisance impacts from deposited dust. Insoluble dust deposition rates at the Tennyson Railway Station and Vivian Street monitoring sites were less than 50 mg/m^2/day. While dust deposition rates were below the recommended trigger level, the New Zealand Ministry for the Environment guidance document[1] notes that in highly sensitive residential areas, deposition rates in the order of 2 g/m^2/30days (or 65 mg/m^2/day averaged over a 30-day period) above background concentrations may cause nuisance, especially for highly visible dust such as black coal dust. While the overall insoluble dust deposition rate measured at the Myla Terrace monitoring site would be equal to or sightly above this level after typical residential background levels have been deducted, the combustible matter fraction, which would contain any black coal dust present, was well below the level at which highly visible dusts might lead to nuisance impacts (see Table 3).

The insoluble dust deposition rates measured at the Tennyson Railway Station and Vivian Street monitoring sites during the current investigation period did not differ greatly from the deposition rates reported for Tennyson in a previous coal dust investigation program conducted by SIMTARS for Queensland Rail between July 1998 and August 1999[7], despite an increase in the quantity of coal hauled by rail to the Port of Brisbane from approximately three million tonnes per annum to approximately nine million tonnes in the intervening period.

In this earlier study the dust deposition sampling site was located on railway property at the end of Gerlee Street, Tennyson. Across the fourteen monthly samples collected at the Gerlee Street sampling site, the average insoluble dust deposition rate was 35 mg/m^2/day (range 16 to 60 mg/m^2/day) and the average ash deposition rate was 23 mg/m^2/day (range 13 to 34 mg/m^2/day). On average, combustible matter comprised 32 per cent by weight of the total insoluble dust fraction (range 7 to 50 per cent) at the Gerlee Street sampling site. In the current investigation, combustible matter content ranged between 20 per cent at the Tennyson Railway Station monitoring site and 40 per cent at the Vivian Street monitoring site.

It is not possible to determine how representative the dust deposition measurements obtained during this investigation are of dust deposition over a longer period at the three monitoring sites. Given the similarity in insoluble dust deposition rates at the Tennyson Railway Station and Vivian Street monitoring sites compared to the Myla Terrace monitoring site, it is possible that activities in the immediate vicinity of the collection bottle at Myla Terrace could have contributed to the higher deposition rate measured at this site.

Coal dust

One of the aims of the Tennyson monitoring was to obtain a measure of the contribution of coal dust to overall dust levels in the community. This was done by filtering the sub-sample taken from the deposited dust collection bottle from each monitoring site through a membrane filter, followed by microscopic examination of the insoluble particles retained on the surface of filter. The microscope techniques used by the University of Queensland's Applied Materials Characterisation and Performance Laboratory were capable of distinguishing a number of different types of particles in the deposited dust. The particle types able to be identified included a range of black-coloured particles (coal, soot and rubber dust), mineral dust (e.g. soil, rock, fly ash, cement, glass), biological particles (e.g. insect and plant fragments) and other general organic particles (e.g. wood, fibres, paint, plastics).

The relative proportions of the different particles present in the dust sample were based on the surface area coverage of each particle type on the membrane filter. The microscope techniques were capable of resolving the relative surface area proportions of the different particle types to an accuracy of approximately ±5 per cent. As the particle composition analysis is based on surface area coverage and the dust deposition rate analysis is based on particle mass, it is not possible to derive a quantitative deposition rate for individual particle types from the particle composition analysis results.

Table 4 provides a full listing of the types of particles able to be identified by the microscopic techniques used, and details the relative proportions (based on filter surface area coverage) of those particles found to be present in the deposited dust at the three Tennyson monitoring sites.

The major component of the deposited dust at each monitoring site was found to be mineral dust (soil or rock dust), comprising between 40 to 50 per cent of the total deposited dust fraction at each site. Coal dust made up 20 per cent of the deposited dust at the Myla Terrace and Vivian Street monitoring sites, and 10 per cent of the deposited dust at the Tennyson Railway Station monitoring site. Black rubber dust (generated from vehicle tyre wear) was found at levels of 10 per cent coverage for all three monitoring site samples. Other particles detected in the deposited dust samples were plant debris (e.g. bark, leaf fragments), insect debris (only at the Tennyson Railway Station site where there was overhead security lighting in close proximity to the collection bottle) and 'copper sludge'. The presence of copper sludge is due to the addition of copper sulfate to the dust deposition bottle prior to sampling to control the growth of algae in the collection bottle during the sampling period as specified by the requirements of the Australian Standard method. The presence of copper sludge is not the result of a source of airborne copper compounds in the Tennyson area.

The relative proportions of the different particle types present in the deposited dust samples at each monitoring site, excluding copper sludge which was a product of the copper sulfate solution added to the collection bottle and was not present in the atmosphere, are displayed graphically in Figure 8.

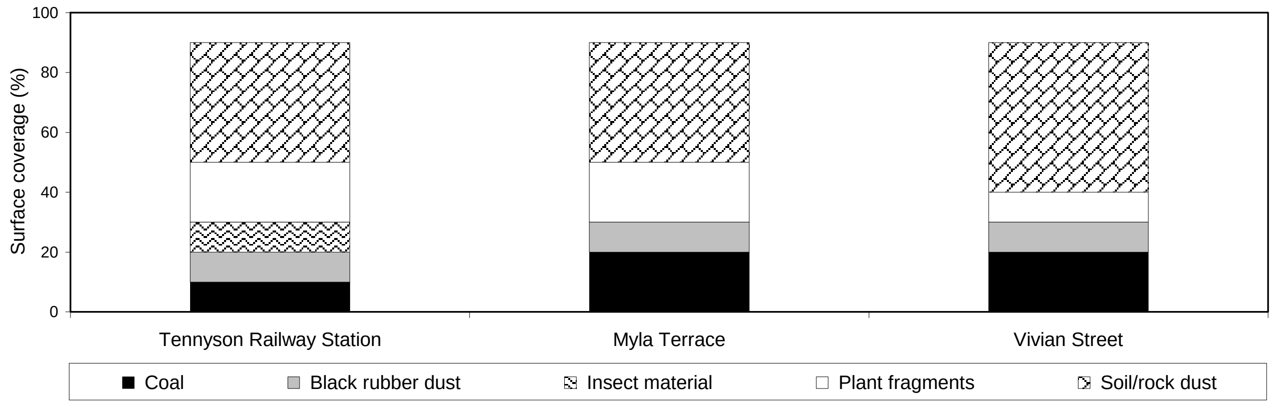
The proportions of coal dust found in the insoluble dust samples in this investigation (at between 10 and 20 per cent) were higher than those determined in the previous sampling carried out between July 1998 and August 1999[7]. In the earlier investigation, coal dust was found to comprise between 1 and 3 per cent of the deposited dust insoluble fraction. However, care needs to be exercised in directly comparing the two datasets as a different coal dust identification technique was used in the previous study to that used in the current investigation. Despite this, the increased proportion of coal dust in the 2012 samples was roughly in line with the threefold increase in coal haulage tonnages compared with those at the time of the earlier study.

Table 4: Composition of deposited dust insoluble solids fraction at Tennyson monitoring sites, September to October 2012.

Particle Identity		Percentage (projected area basis)[a]		
Category	Particle Type	Tennyson Railway Station	Myla Terrace	Vivian Street
Black	Coal	10	20	20
	Soot	not detected	not detected	not detected
	Black rubber dust	10	10	10
Inorganics and Minerals	Mineral dust (soil or rock dust)	40	40	50
	Mineral dust (fly ash)	Trace	trace	trace
	Mineral dust (cement dust)	not detected	not detected	not detected
	Mineral dust (glassy)	not detected	not detected	not detected
	Glass fragments	not detected	not detected	not detected
	Copper sludge	10	10	10
Biological	Photosynthetic slime and fungi	not detected	not detected	not detected
	Insect debris	10	not detected	trace
	Plant debris (general)	20	20	10
	Plant debris (plant char)	not detected	not detected	not detected
General organic types	Wood dust	Trace	not detected	not detected
	Fibres (miscellaneous)	Trace	not detected	not detected
	Starch	not detected	not detected	not detected
	Paint	Trace	not detected	trace
	Plastic fragments	not detected	not detected	not detected
	Red rubber dust	not detected	not detected	not detected

[a] The uncertainty in the measurement of projected area is ±5 per cent

Figure 8: Relative proportions of the different particle types present in deposited dust samples at the Tennyson monitoring sites.



Dust levels during train movements

Total particle measurements recorded by the Dusttrak™ instrument located at the Tennyson Railway Station monitoring site were used to determine the effect of the passage of different types of trains on short-term particle levels at Tennyson. (In this context, total particles refers to the concentration of all particles capable of being detected by the Dusttrak™ instrument, with an upper particle size limit of approximately 20 µm in diameter[8].) This assessment consisted of comparing the average total particles concentration measurement during the two five-minute monitoring periods immediately before the passage of an individual train against the corresponding average concentration for the five-minute periods during and immediately following the passage of the train. Train movement details for Tennyson during the investigation period were provided by Queensland Rail. To minimise the influence of multiple train movements, only train movements where there were no other trains within the 15 minute period before and the ten minute period following the passage of the train were considered in the analysis.

During the period from 6 September to 4 October 2012 there were 1591 train movements past the Tennyson Railway Station. Of these, 576 (36 per cent) fitted the individual train criteria described above, comprising 169 loaded coal trains, 194 empty coal trains, 168 other freight trains and 45 passenger trains. The results of the analysis of changes in total particle levels coinciding with train movements are summarised in Table 5 and shown graphically in Figure 9. The highest average change in total particle levels occurred for loaded coal trains (4.9 µg/m^3), followed by other freight trains (2.8 µg/m^3), empty coal trains (2.4 µg/m^3) and passenger trains (1.6 µg/m^3). Median particle level concentration change values showed a similar trend (the median value is the middle of all measurement values when sorted in order).

A second analysis was undertaken for train movements when meteorological conditions were favourable for dust impacts at the monitoring site, i.e. calm conditions (wind speeds less than 1.0 km/h), or when winds were blowing from the direction of the rail line (between east and west). With these added conditions only 417 train movements complied, comprising 127 loaded coal trains, 146 empty coal trains, 116 other freight trains and 28 passenger trains. The results of this analysis are summarised in Table 5 and shown graphically in Figure 10. The highest average change in total particle levels again occurred for loaded coal trains (5.0 µg/m^3), closely followed by other freight trains (4.8 µg/m^3) and passenger trains (4.6 µg/m^3), then empty coal trains (2.3 µg/m^3). For median particle level concentration change values the order was loaded coal trains, passenger trains, other freight trains and empty coal trains. The relatively low number of passenger trains may account for the higher median value for passenger trains.

Table 5: Summary of average and median changes in concentrations of total particles (less than 20 µm in size) during the passage of different train types at the Tennyson Railway Station monitoring site, 6 September to 4 October 2012.

Train type	All wind directions and speeds				All wind directions for wind speeds <1.0 km/h, or wind direction 90^o to 270^o for wind speeds >1.0 km/h			
	Number of trains	Concentration of total particles			Number of trains	Concentration of total particles		
		Initial concentration	Change in concentration			Initial concentration	Change in concentration	
		Average (µg/m^3)	Average (µg/m^3)	Median (µg/m^3)		Average (µg/m^3)	Average (µg/m^3)	Median (µg/m^3)
Coal (loaded)	169	24.2	4.9	2.5	127	26.4	5.0	3.5
Coal (empty)	194	24.3	2.4	1.0	146	25.5	2.3	1.0
Other freight	168	23.8	2.8	1.5	116	21.5	4.8	1.5
Passenger	45	35.0	1.6	0.0	28	35.8	4.6	2.0

Figure 9: Comparison of the change in total particle concentrations by train type during all wind conditions at the Tennyson Railway Station monitoring site, 6 September to 4 October 2012.

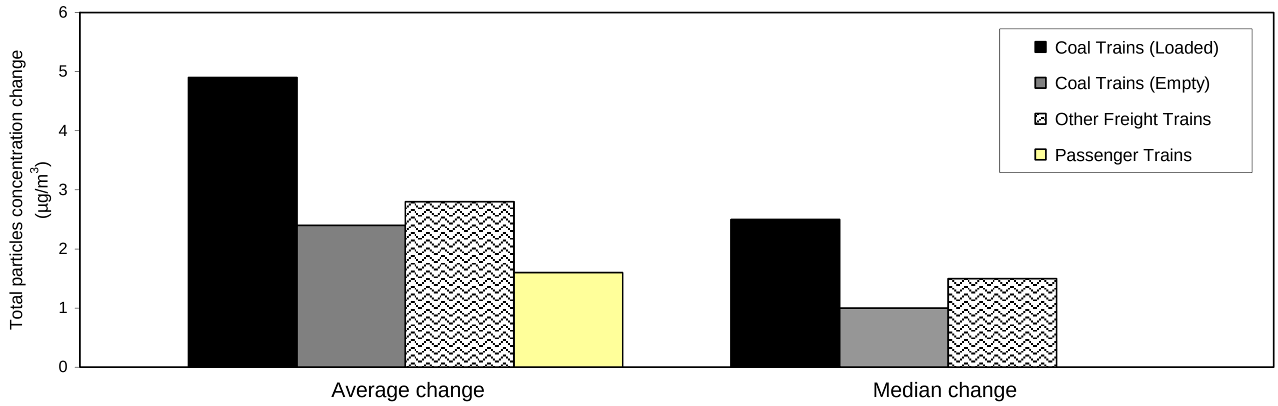
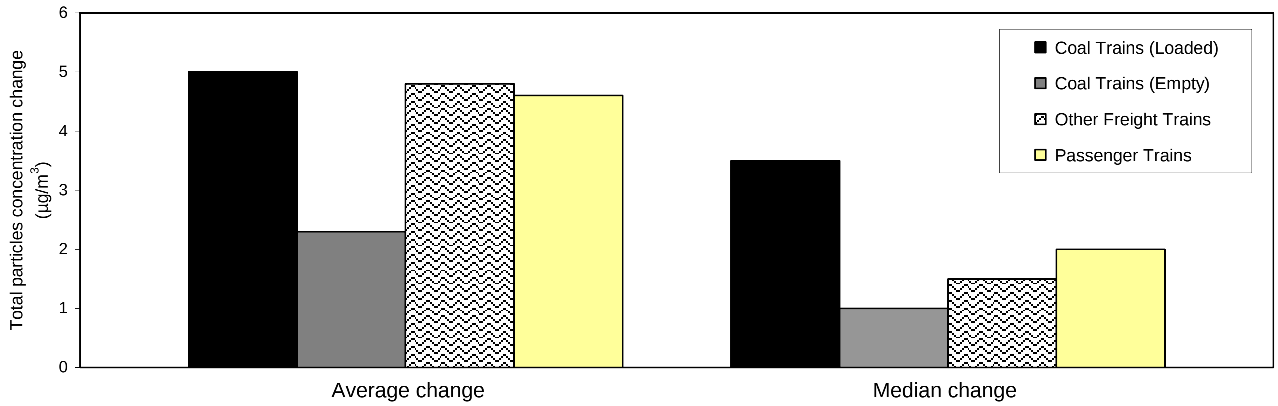


Figure 10: Comparison of the change in total particle concentrations by train type during conditions of low wind speed or winds blowing from the direction of the rail line at the Tennyson Railway Station monitoring site, 6 September to 4 October 2012.



These results suggest that the passage of trains of all types past the monitoring site were associated with an average increase of less than 5 µg/m^3 in the levels of particles less than 20 µm in size when compared to levels immediately before the train passed. This equates to an increase of approximately 10 to 20 per cent of the particle levels before the train passed. Loaded coal trains appeared to cause the greatest increase in particle levels. However, when meteorological conditions favoured impacts from dust generated by passing trains at the monitoring site, all train types except empty coal trains showed a similar average concentration change (Figure 10). This suggests that for loaded coal trains, re-entrainment of surface dust by air movements associated with the passing train is a larger source of airborne particles of this size in the immediate vicinity of the rail line than losses from the coal wagons. One possible factor leading to the lower result seen for empty coal trains may be that these trains predominantly travel on the set of rail tracks farthest from the monitoring site.

Due to the limitation in the upper size of particles able to be detected by the Dusttrak™ instrument, this analysis was unable to determine the contribution made by the different train types to atmospheric levels of larger particles which are more likely to result in dust nuisance impacts in the Tennyson community.

Conclusions

Monitoring in the community adjacent to rail line at Tennyson conducted by the DSITIA between September and October 2012 has found that ambient particle concentrations generally complied with ambient air quality objectives.

Particle measurements obtained during the monitoring period would have included conditions likely to result in worst-case conditions for dust impacts from coal trains passing Tennyson enroute to the Port of Brisbane. There was a high incidence of winds from the direction of the rail line during the sampling period. Rainfall totals during this period were generally low, making it unlikely that measured particle concentrations would have been suppressed to a significant degree by rainfall events during this period.

PM_{10} levels did not exceed the EPP Air 24-hour air quality objective of 50 µg/m^3 during the investigation period at the Tennyson Railway Station monitoring site. The highest 24-hour PM_{10} concentration measured was 39.8 µg/m^3, or 80 per cent of the EPP Air objective. No relationship was found between 24-hour average PM_{10} concentrations and the proportion of winds coming from the direction of the rail line during the daily sampling period. This suggests that coal trains are not a significant contributor to PM_{10} levels in the Tennyson community when compared to other local and regional sources of PM_{10} such as motor vehicle emissions.

Insoluble dust deposition rates did not exceed the trigger level for dust nuisance of 4 g/m^2/30days (or 130 mg/m^2/day averaged over a 30-day period) recommended by the New Zealand Ministry for the Environment. The maximum insoluble dust deposition rate measured was 97 mg/m^2/day at the Myla Terrace monitoring site. Deposition rates were less than 50 mg/m^2/day at the other two monitoring sites.

The insoluble dust deposition rate at the Myla Terrace monitoring site was above 65 mg/m^2/day, the level identified by the New Zealand Ministry for the Environment as possibly triggering dust nuisance in sensitive residential areas if the dust is highly visible. However, from the level of combustible matter measured in the dust, the maximum amount of coal dust that could have been deposited at Myla Terrace was 36 mg/m^2/day.

The insoluble solids dust deposition rates measured at the Tennyson Railway Station and Vivian Street monitoring sites during the current investigation period did not differ greatly from the deposition rates reported for Tennyson in a previous coal dust investigation program conducted between July 1998 and August 1999.

Mineral dust (soil or rock dust) was the major component of the deposited dust at each monitoring site. Coal dust made up between 10 and 20 per cent of the deposited dust. Another black-coloured particle, rubber dust, was found at levels of 10 per cent at all three monitoring sites. The proportions of coal dust found in the insoluble dust samples in this investigation (10 to 20 per cent) were higher than those found in the 1998-1999 sampling program (1 to 3 per cent). The increase in the proportion of coal dust in the 2012 samples is roughly in line with the threefold increase in coal haulage tonnages compared with those at the time of the earlier study. Improved precision in the coal dust identification technique may also be a contributing factor.

The passage of trains past the Tennyson Railway Station monitoring site was found to result in an average increase in the levels of particles less than 20 µm in diameter of 5 µg/m^3 or less when compared to levels immediately before the train passed. Loaded coal trains appeared to cause the greatest increase in short-term particle levels, although when meteorological conditions favoured impacts from dust generated by passing trains, all train types except empty coal trains showed a similar average concentration change. It appears that for loaded coal trains, re-entrainment of surface dust by air movements associated with the passing train is a larger source of airborne particles less than 20 µm in diameter in the immediate vicinity of the rail line than losses from the coal wagons.

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