

Air monitoring results: Broadmeadows Tyre Crumb Australia fire



Environment
Protection
Authority Victoria

Publication 1617
Published March 2016

Air quality report

This publication was created in consultation with EPA Victoria, the Department of Health and Human Services, Metropolitan Fire Brigade and Emergency Management Victoria. For a brief summary see factsheet [Broadmeadows tyre fire – Air quality](#) (Publication 1618 March 2016).

Summary of air impacts

Environment Protection Authority Victoria (EPA) monitored air quality impacts during a tyre fire that began on Monday 11 January 2016 at the Tyre Crumb Australia facility in Broadmeadows.

EPA monitored levels of PM_{2.5}, which are fine particles found in smoke. PM_{2.5} levels were determined to be the best indicator for potential community health impacts from the smoke. The highest estimated levels of PM_{2.5} were recorded north of the fire between 10.00 pm on Monday 11 January and 3.00 am on Tuesday 12 January. During this time, the Metropolitan Fire Brigade (MFB) was using heavy equipment to move the burning material and gain better access to extinguish the fire.

EPA also sampled the air for volatile organic compounds (VOCs) that were considered likely to be present in smoke from the burning tyres. Two types of VOCs – benzene and toluene – were detected in one air sample, but the levels were below relevant air quality criteria. No other VOCs were found in the air.

During the incident, community information and warnings were issued by MFB in line with the principle of 'shelter in place', advising people to stay indoors and close windows and doors. Following this action will have helped limit exposure to smoke and protect the health of those living close to the fire.

This report provides a summary of the air monitoring data recorded during the incident.

Details of the incident and response

The fire broke out at approximately 9.00 am on 11 January 2016 in a large outdoor stockpile of tyres at the Tyre Crumb Australia site, at the corner of Centre Road and Maygar Boulevard in Broadmeadows. The site stores and recycles used car tyres. The MFB estimated the stock pile of tyres to be 100 metres long, 30 metres high and four metres high. The fire was sparked by an electrical fault in a nearby tractor.

The MFB was the control agency attending the incident, and was supported by other agencies including, Ambulance Victoria, Aviation Rescue Fire Fighting, Country Fire Authority (CFA), Victoria Police, State Emergency Services (SES) and other emergency management team members. EPA acted as a support agency to monitor air quality and environmental impacts.

EPA began forecasting smoke impacts at 9.30 am and **monitoring air quality** at 4.00 pm using a vehicle-mounted monitor to track the spread of smoke. A stationary monitor was then set up at 7.30 pm to monitor PM_{2.5} levels and inform community warnings.

EPA also collected two air samples over a 24-hour period beginning at 7.30 pm to test for VOCs in the air.

The MFB issued initial community information and warnings at approximately 9.15 am. Further information and warnings were issued throughout the event.

A Watch and Act advice remained in place until the fire was under control to ensure people were taking the appropriate action to protect their health from the impacts of the smoke. Additional messages about smoke and health from the Department of Health and Human Services (DHHS) were included in the MFB's community information and warnings throughout the incident.

MFB brought the fire under control by 08.00 am on Tuesday 12 January. EPA ceased air monitoring on Thursday 14 January. Due to a high fire rating on the Wednesday, MFB remained on site and used thermal imaging cameras to ensure the fire was totally extinguished.

Public meetings were held at the City of Hume Offices at 2.00 pm on both 11 and 12 January to provide updates to the community.

EPA's air monitoring response

EPA monitors air quality during large-scale emergencies that are likely to result in significant or persistent air quality impacts on a community. This is usually done using portable monitoring equipment that can be quickly deployed to the incident to gather data. The data is used to inform the actions of other emergency response agencies including delivering precautionary advice for the protection of community health.

The data from portable EPA equipment is considered to be an estimate, as these monitors do not have the same level of accuracy as other air monitors in EPA's network. More-advanced monitors take longer to setup and can take many hours to 'warm up' and begin recording data. The incident did not last long enough for this to occur. [Further information about monitoring equipment is available on EPA's website.](#)

Air monitoring results: Broadmeadows tyre fire

Vehicle-mounted smoke tracking

At 4.00 pm on 11 January 2016, EPA began using a vehicle-mounted SmokeTrak device to track the movement of the smoke and where it was most heavily impacting air quality.

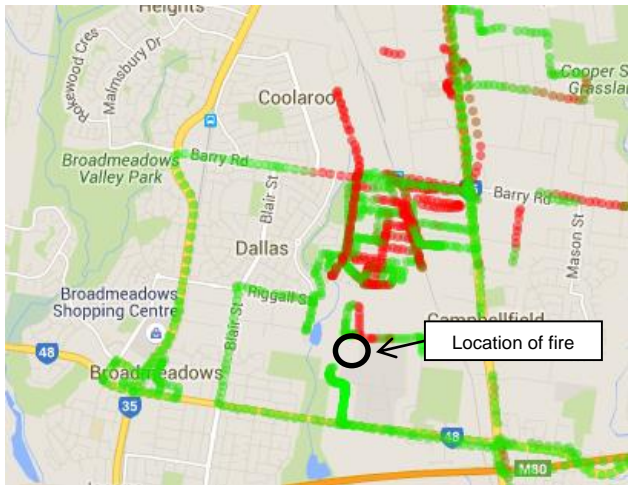


Figure 1: An example of data collected from the vehicle-mounted smoke tracking. Red dots indicate higher estimated levels of smoke particles in the air.

Initial results and observations showed the smoke plume was heading towards the north with the prevailing winds at the time.

Data from the SmokeTrack was not used to compare with air quality standards in this instance. For that purpose, we used a stationary ADR-1500 monitor, which is described below.

EPA ceased vehicle-mounted smoke tracking at 1.30 pm on Tuesday 12 January.

Stationary air monitoring devices

At 7.30 pm on 11 January 2016, EPA began monitoring air quality using an ADR-1500 monitor, which is used to estimate levels of PM_{2.5}. This data was compared with [relevant air quality criteria](#). The ADR-1500 monitor was set up at Wharton Avenue in Broadmeadows. This was the closest residential street to the fire, located approximately 500 m away and immediately north. This location was also downwind of the fire for considerable lengths of time.

EPA also took samples of the air to detect any VOCs that may have been present in the smoke, due to the chemical makeup of the tyres. Two air samples were collected – one in Wharton Avenue and another in Tempy Court, Dallas. The canisters draw in air over a 24-hour period. The air is then analysed in a laboratory.

Figure 2 shows the sampling locations of the both the ADR-1500 and the two canisters.

EPA continued monitoring with the ADR-1500 in Wharton Avenue until 1.00 pm on Thursday 14 January. By this time the smoke had completely cleared.

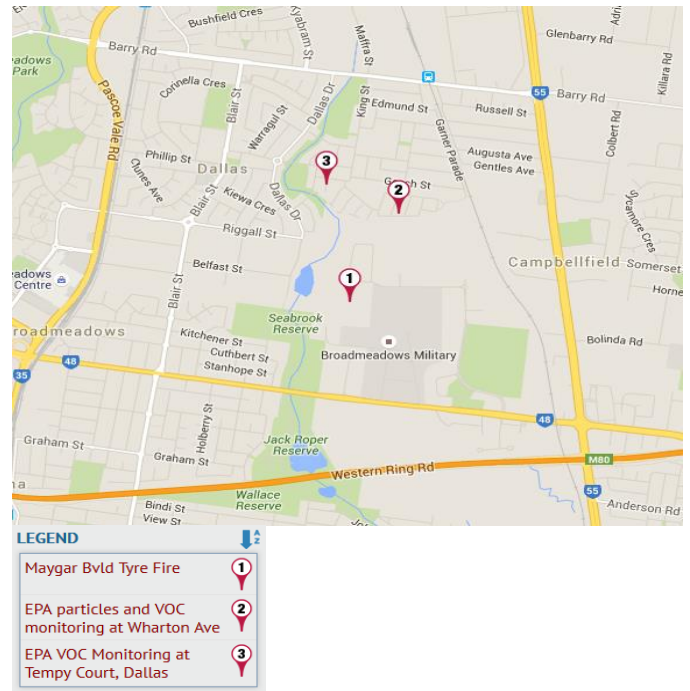


Figure 2: Locations of: (1) the tyre fire; (2) ADR-1500 monitoring and canister sampling at Wharton Avenue, Broadmeadows; (3) canister sampling at Tempy Court, Dallas.

Air monitoring results: Broadmeadows tyre fire

Results of monitoring

Fine particles – PM_{2.5} levels

Hourly average

The highest hourly smoke concentrations, measured as PM_{2.5}, were recorded for four hours between 10.00 pm on Monday 11 January and 3.00 am on Tuesday 12 January. Levels ranged from 329 to 511 µg/m³. These peaks occurred when MFB was using heavy equipment to move and access the burning material to extinguish the fire.

By 5.00 am on Tuesday 12 January, the fire was mostly extinguished and PM_{2.5} levels had returned to similar levels as the rest of Melbourne.

Figure 3 shows average hourly PM_{2.5} levels. The peaks in PM_{2.5} resulted in the average concentration over a 24-hour period reaching the 'unhealthy all' category. [Read more about air quality categories and cautionary advice on EPA's website.](#)

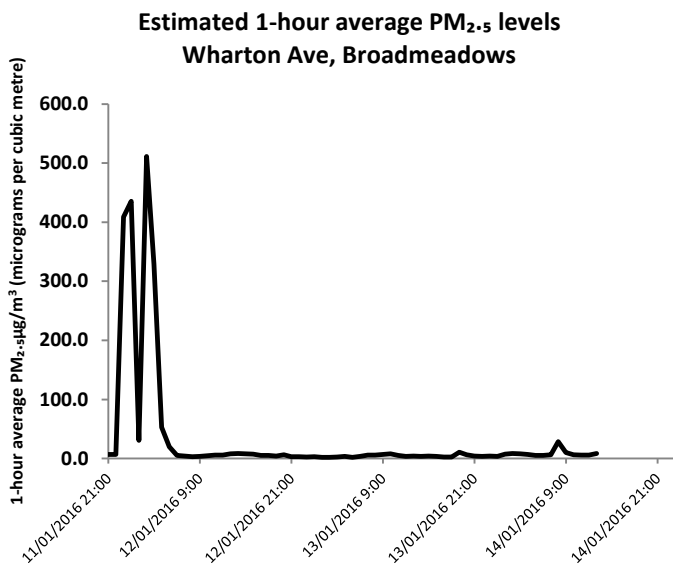


Figure 3: The black line shows the estimated PM_{2.5} one-hour average levels, recorded at Wharton Ave, Broadmeadows. The data for the hourly average is also provided in Table 1, Appendix 1.

24-hour average

The highest estimated PM_{2.5} 24-hour rolling average value was 79 µg/m³. This value was the average level between 8.00 pm on Monday evening and 8.00 pm on Tuesday evening. This period represents the first full 24-hour rolling average PM_{2.5} concentration after monitoring began at Wharton Avenue. This value falls into the 'unhealthy all' [air quality category listed on EPA's website](#). This peak is a result of high 1-hour average concentrations that occurred at the same time that MFB was using equipment to access the burning material and extinguish the fire. This action was necessary to bring the fire under control in a relatively short time frame.

From 3.00 am Wednesday the estimated PM_{2.5} 24-hour rolling average remained below 8 µg/m³ until monitoring ceased at 1.00 pm on Thursday 14 January.

Note: A rolling 24-hour average is the average level recorded over the previous 24-hour period. The value is recalculated each hour, rolling over from hour to hour. It is used to compare against health standards.

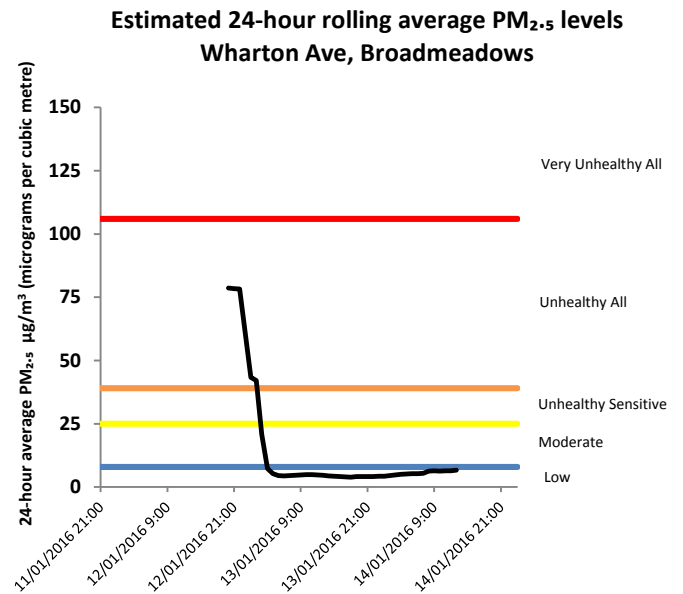


Figure 4: The black line shows the estimated PM_{2.5} 24-hour rolling average recorded at Wharton Ave, Broadmeadows. The first 24-hour rolling average was calculated 24 hours after the monitoring equipment first began recording. Categories to the right of the graph relate to [cautionary advice about the effects of smoke](#) provided on EPA's website.

A graph of the 24-hour PM_{2.5} levels is shown in Figure 4. The data for both the hourly average and 24-hour rolling average is also provided in Table 1, Appendix 1.

Volatile organic compounds

Two 24-hour air samples were collected in specially-treated steel canisters and analysed for 78 different VOCs using [USEPA Method TO-15](#). The detection limit for the sampling is 1 part per billion (ppb).

Two VOCs were detected in the Wharton Avenue sample. Benzene was found at 2.5 ppb and toluene was 1.1 ppb. Both of these levels are below the 24-hour air quality assessment criteria of 9 ppb for benzene in the [US Agency for Toxic Substances and Disease Registry Minimum Risk Level](#) and 1000 ppb for toluene in the [National Environment Protection \(Air Toxics\) Measure](#).

No VOCs were detected in the Tempy Court sample.

Air monitoring results: Broadmeadows tyre fire

Why wasn't the smoke detected by other air monitoring equipment in our general network?

The smoke plume from the fire was clearly visible from various locations across Melbourne.

The hot smoke plume initially rose high in the air, and dispersed above a lower layer of colder air close to the ground. As the plume began to cool and spread out, it started to come back down towards the top of the colder air layer – the 'boundary layer'. This process can be seen in Figure 5 below.

This boundary layer prevented much of the smoke from reaching ground level and helps to explain why it wasn't

detected elsewhere in EPA's general air monitoring network as either PM_{2.5} particles or as 'visibility reduction'.

Continuous improvement

Each time EPA deploys this new air monitoring capability, we learn more about the best approach for different conditions, incident types and locations, as well as how to improve the way we work with other government agencies. EPA gained valuable insights from this incident that will help to continually improve how we respond in future. We are committed to using each deployment, together with regular interaction with the emergency management sector to build an approach that is as effective as possible for the protection of human health and the environment.



Figure 5: The smoke plume from the Broadmeadows fire visible from Melbourne. This image shows the smoke plume rising, then staying above the boundary layer. Photo: Herald Sun, 11 January 2016.

Air monitoring results: Broadmeadows tyre fire

Appendix 1: Data

PM_{2.5} data table

The data table below provides the raw data collected from the ADR-1500 monitor at Wharton Ave, Broadmeadows. Note that the one-hour average from midnight to 1.00 am on Monday was 31 µg/m³, yet the averages for the hours before and after this reading were much higher (435 µg/m³ and 511 µg/m³). This highlights the variable nature of smoke plumes and indicates the plume drifted back and forth across the monitoring site with changes in wind direction.

Table 1: Estimated PM_{2.5} results recorded by the ADR-1500 monitor located at Wharton Ave, Broadmeadows from Monday 11 January to Thursday 14 January 2016.

Day	Hour	1-hr average PM _{2.5} concentration (µg/m ³)	24-hr rolling average PM _{2.5} concentration (µg/m ³)	
Monday	8–9pm	7	Not yet enough data to calculate at this time.	
Monday	9–10pm	7		
Monday	10–11pm	409		
Monday	11pm – midnight	435		
Tuesday	midnight – 1am	31		
Tuesday	1–2am	511		
Tuesday	2–3am	329		
Tuesday	3–4am	53		
Tuesday	4–5am	20		
Tuesday	5–6am	5		
Tuesday	6–7am	4		
Tuesday	7–8am	3		
Tuesday	8–9am	4		
Tuesday	9–10am	5		
Tuesday	10–11am	6		
Tuesday	11am – midday	6		
Tuesday	midday – 1pm	8		
Tuesday	1–2pm	8		
Tuesday	2–3pm	8		
Tuesday	3–4pm	7		
Tuesday	4–5pm	5		
Tuesday	5–6pm	5		
Tuesday	6–7pm	4		
Tuesday	7–8pm	6		79
Tuesday	8–9pm	3		78
Tuesday	9–10pm	3		78
Tuesday	10–11pm	3	61	
Tuesday	11pm – midnight	3	43	
Wednesday	midnight – 1am	2	42	
Wednesday	1–2am	2	21	
Wednesday	2–3am	3	7	
Wednesday	3–4am	4	5	
Wednesday	4–5am	2	4	
Wednesday	5–6am	3	4	
Wednesday	6–7am	6	4	

Air monitoring results: Broadmeadows tyre fire

Wednesday	7–8am	6	5
Wednesday	8–9am	7	5
Wednesday	9–10am	8	5
Wednesday	10–11am	5	5
Wednesday	11am – midday	3	5
Wednesday	midday – 1pm	4	5
Wednesday	1–2pm	4	4
Wednesday	2–3pm	4	4
Wednesday	3–4pm	3	4
Wednesday	4–5pm	3	4
Wednesday	5–6pm	2	4
Wednesday	6–7pm	10	4
Wednesday	7–8pm	6	4
Wednesday	8–9pm	4	4
Wednesday	9–10pm	4	4
Wednesday	10–11pm	4	4
Wednesday	11pm – midnight	4	4
Thursday	midnight – 1am	7	5
Thursday	1–2am	8	5
Thursday	2–3am	8	5
Thursday	3–4am	7	5
Thursday	4–5am	5	5
Thursday	5–6am	5	5
Thursday	6–7am	6	5
Thursday	7–8am	28	6
Thursday	8–9am	10	6
Thursday	9–10am	6	6
Thursday	10–11am	5	6
Thursday	11am – midday	6	6
Thursday	midday – 1pm	8	7