

BLANkET¹ Brief Report 22

Smoke measurements during a fire training
exercise at Spreyton, northern Tasmania,
14 October 2015

‘Burning down the house’

Air Section, EPA Division, October 2015



Figure 1: The Tasmania Fire Service training exercise underway at Spreyton, on the evening of 14th October 2015. The camera time-stamp in is AEST. (Add one hour for summer time.)

¹Base-Line Air Network of EPA Tasmania

1 Summary

On the evening of the 14th of October 2015 the Tasmania Fire Service conducted a training exercise in Spreyton, northwest Tasmania. The exercise involved igniting several fires in different rooms of a specially prepared residence for extinguishing, then the ignition and subsequent consumption by fire of the entire residence. The EPA Division undertook smoke measurements in the nearby streets surrounding the exercise area using the car-based Travel BLANkET system. Measured smoke levels were generally very low, with some brief intervals with peak values up to $50 \mu\text{g m}^{-3}$. Hence the impact from smoke on the neighbouring area appeared minimal. The burn was conducted on a mild and calm night. The hot burn produced a buoyant smoke column that appeared to rise above local ground-level and disperse.

2 Introduction

On the evening of the 14th of October 2015 the Tasmania Fire Service (TFS) conducted a training exercise in Spreyton, just south of Devonport, Tasmania. The exercise involved ignition and extinguishment of several fires inside a residence scheduled for demolition, with the final exercise being a complete burning of the house while adjoining properties were protected. The TFS liaised with the Devonport City Council (DCC), who in turn contacted the EPA Division well in advance of the exercise planned for the 14th of October 2015. For the purposes of this report it is noted that the EPA Division decided to undertake air quality measurements during the exercise. The EPA Division informed the DCC on the afternoon of the 14th of October that a smoke survey would be conducted.

The house used in the exercise was in Mersey Main Road, but was set back approximately 60 metres from the road. Spreyton is located in the broad, and flat, lower reaches of the Mersey River. The locality of the exercise is generally level at low altitude, although there is steeply rising ground about 1 km to the west. The residential density is generally low, although there are houses along much of Mersey Main Road, and a higher-density residential area² is located approximately 100 metres east of the exercise area.

The burn was registered and listed on the TFS web pages on the evening of the 14th of October 2015.

3 Air quality data

The EPA Division's car-based smoke measurement system ('Travel BLANkET') was used to measure smoke levels in the public streets around the exercise area. Travel BLANkET records a geo-located $\text{PM}_{2.5}$ measurement each 5 seconds, along with ambient temperature, and wind speed and direction relative to the

²Leila Avenue and the nearby streets.

vehicle. Measurements were made on public roads and in the car parks of two retail establishments³. In general the survey consisted of a number of circuits from part way along Bay Drive to Mersey Main Road, past the burn location, into the areas of Leila Avenue and Fleetwood Drive, and short transits up and down Sheffield Road back to Mersey Main Road. Measurements were also made along Kelcey Tier Road on one occasion.

3.1 Survey visualisation images

A visual representation of the Spreyton $\text{PM}_{2.5}$ survey data is given in plan view in Figure 2. The burn location is indicated by the red cross near image centre. $\text{PM}_{2.5}$ values are colour coded as follows: Red symbols: $50 \mu\text{g m}^{-3}$ or greater; mid green $\sim 25 \mu\text{g m}^{-3}$; dark blue: $\sim 10 \mu\text{g m}^{-3}$. There were very few instances of $\text{PM}_{2.5}$ near $50 \mu\text{g m}^{-3}$. The majority of these were recorded in Mersey Main road directly adjacent to the burn location. There was a brief interval near 19:00 AEST where a number of measurements in the range of 20 to $40 \mu\text{g m}^{-3}$ were recorded in the streets to the south-east of the burn⁴. An oblique view of these survey data is given in Figure 3. The $\text{PM}_{2.5}$ value is also represented as height above local ground-level.

³These were the IGA Supermarket and ‘The Big Apple’, both on Mersey Main Road.

⁴e.g. Mersey Main Road, Leila Avenue and Fleetwood Drive

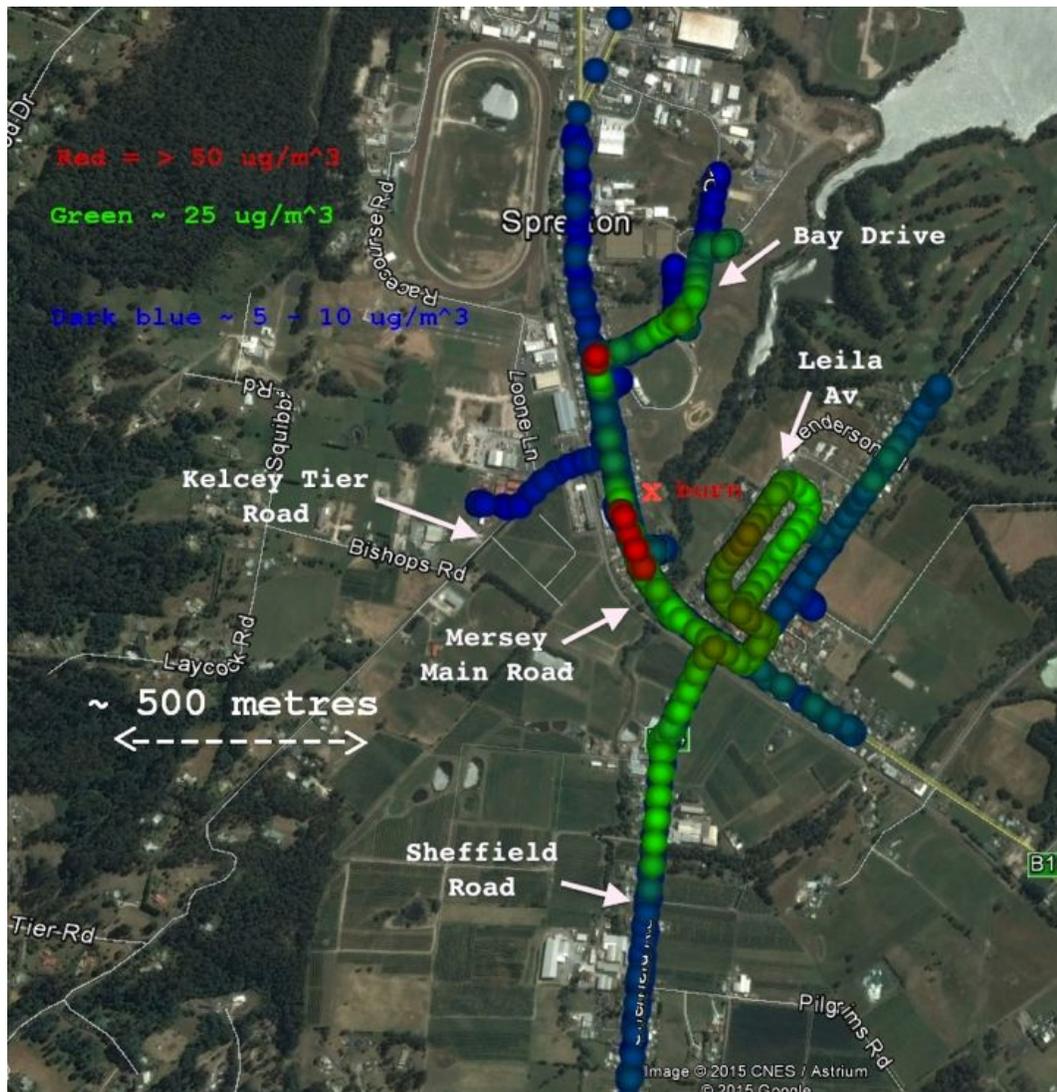


Figure 2: Plan view of Travel BLANKET data from Spreyton, evening of 14 October 2015. PM_{2.5} values are colour coded as follows: Red symbols: 50 $\mu\text{g m}^{-3}$ or greater; mid green $\sim 25 \mu\text{g m}^{-3}$; dark blue: $\sim 10 \mu\text{g m}^{-3}$. The burn exercise location is marked by the red cross.

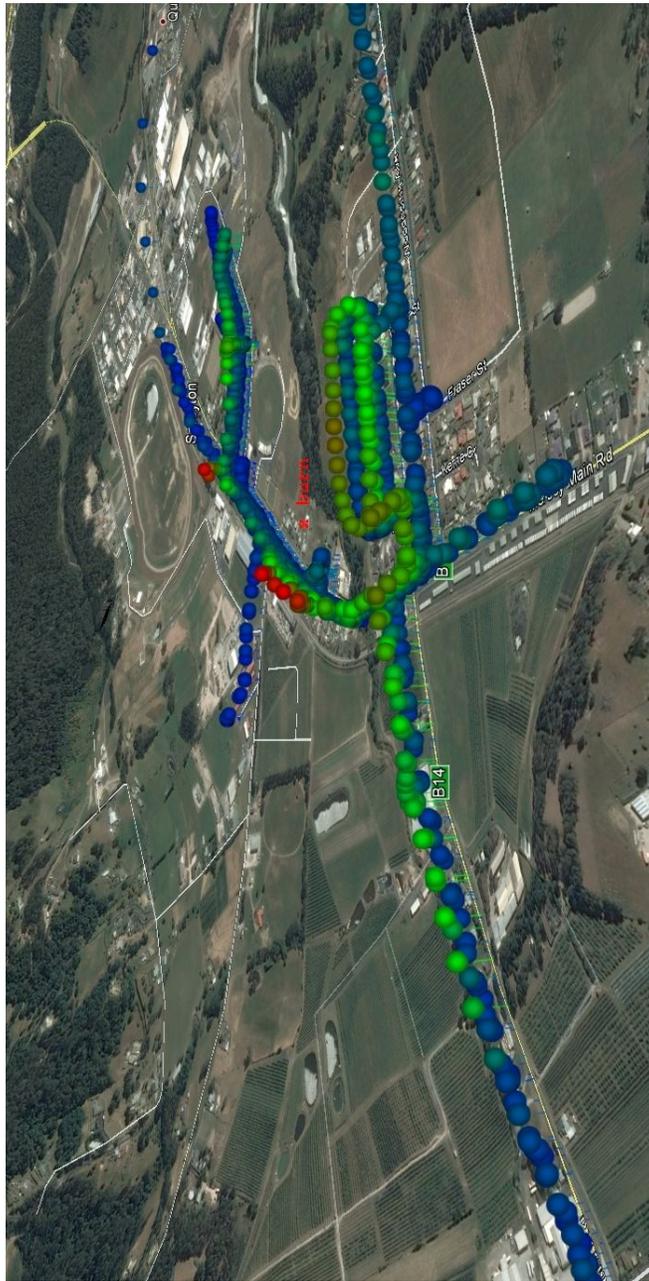


Figure 3: Oblique view of Travel BLANKET data from Spreyton, evening of 14 October 2015. $PM_{2.5}$ values are colour coded as follows: Red symbols: $50 \mu\text{g m}^{-3}$ or greater; mid green $\sim 25 \mu\text{g m}^{-3}$; dark blue: $\sim 10 \mu\text{g m}^{-3}$, and are also represented by height above local ground level.

3.2 Comparison of Spreyton survey and Devonport station $\text{PM}_{2.5}$

Figure 4 shows the time series of the Travel BLANKET $\text{PM}_{2.5}$ (as blue circles) along with 10-minute resolution $\text{PM}_{2.5}$ recorded at Devonport air station (as red squares), approximately 3.7 km due north of the exercise location. $\text{PM}_{2.5}$ levels at Devonport were very low, below $10 \mu\text{g m}^{-3}$. The Spreyton survey data show short-term elevations representing brief instances of the detection of the smoke from the exercise. The smallest sample values from the survey up to approximately 19:30 AEST are close to the levels seen at Devonport, and may represent a general background level for this area. After approximately 20:30 AEST until near 21:50 there is a small overall increase in the Spreyton survey data that is not reflected in the Devonport record. This could represent a general elevation in the area due to the exercise, or it could have another, independent cause.

The 24-hour (calendar day) National Environmental Protection (Ambient Air Quality) Measure (the ‘Air NEPM’) reporting standard for $\text{PM}_{2.5}$ is $25 \mu\text{g m}^{-3}$. There is no shorter-term limit. From the data collected during the survey it is considered highly unlikely that the reporting standard would have been exceeded anywhere on the ground in the vicinity of the exercise due to the burn, with the obvious note that $\text{PM}_{2.5}$ concentrations in the plume itself would have been very high.

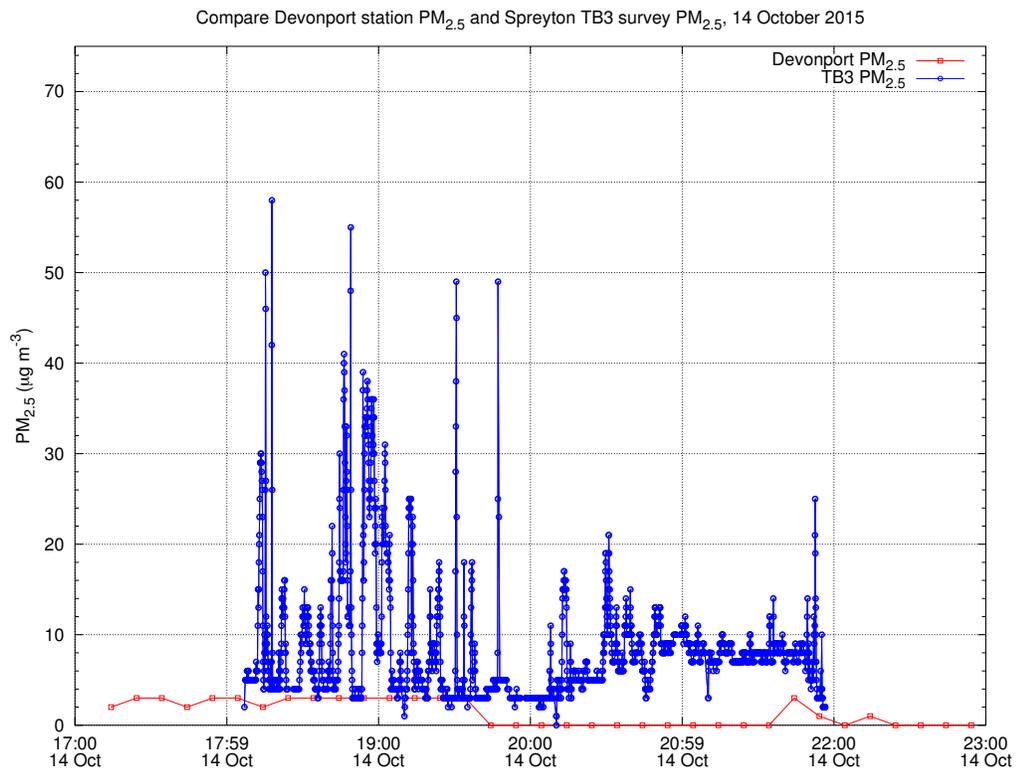


Figure 4: Comparison of PM_{2.5} data from the Devonport BLANkET station (red squares) and the car-based travel BLANkET data (blue circles) from Spreyton. The survey data were taken at a rate of one every 5 seconds. The Devonport station data are 10-minute resolution.

3.3 Digital images

A series of digital images were obtained during the survey. A selection is given here. Two different cameras were used. The camera time-stamps are in AEST. One camera had a time-exposure function which was used after the onset of darkness. The camera batteries failed near 20:30 AEST. (These batteries were freshly installed earlier on the 14th of October.) The other camera had a limited night-time capability. Some images were obtained. One such image is shown below after contrast enhancement.

All images where the plume is visible show smoke rising vertically, often in a well-defined column.



Figure 5: Images taken from the ‘Big Apple’ car park. Top pane: The house used in the exercise, as seen on the afternoon of the 14th of October 2015. Lower pane: A similar view from the morning of the 15th of October 2015, after the exercise.



Figure 6: Near the commencement of the exercises. Image taken at 18:43 AEST on Mersey Main Road looking southward.



Figure 7: Image taken at 18:46 AEST, a few minutes after Figure 6, on Mersey Main Road looking northward.



Figure 8: Time-exposure image (2.5 seconds duration) taken at 19:21 AEST, from Leila Avenue.



Figure 9: Time-exposure image (2.5 seconds duration) taken at 19:28 AEST, from Bay Drive.

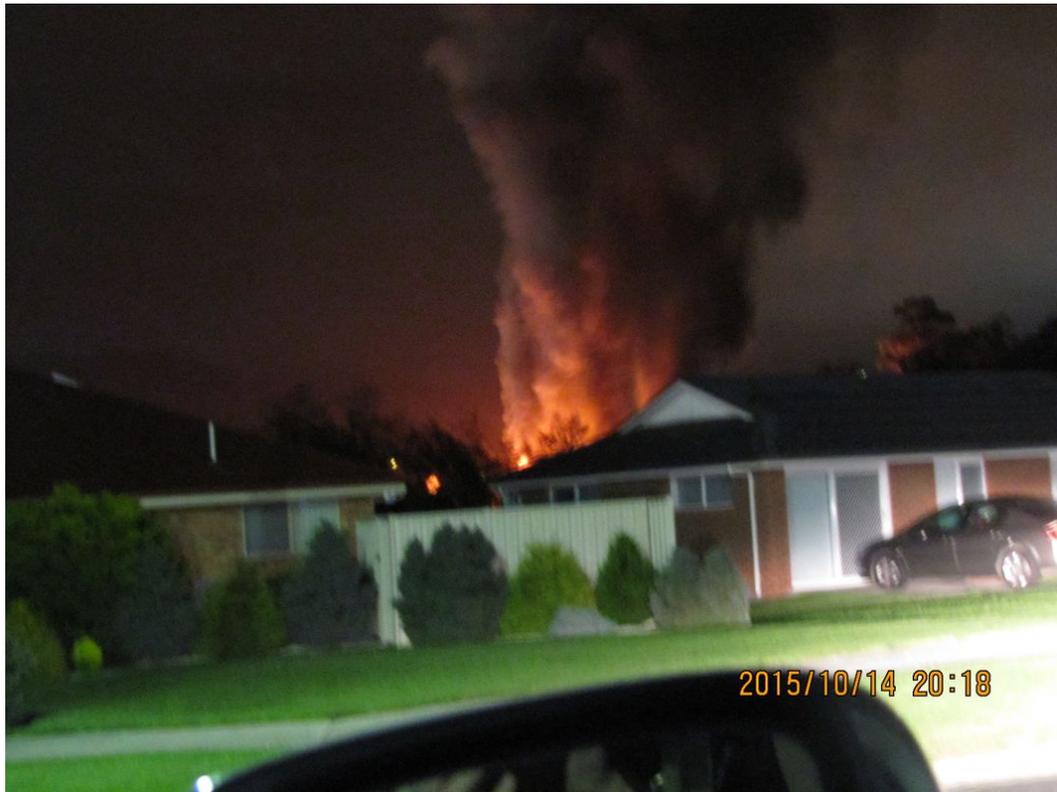


Figure 10: Time-exposure image (2.5 seconds duration) taken at 20:18 AEST, from Leila Avenue.



Figure 11: Time-exposure image (2.5 seconds duration) taken at 20:22 AEST, from the 'Big Apple' car park.



Figure 12: Contrast enhanced image obtained at 20:33 AEST from Bay Drive.

4 Comments

From information received via the Devonport City Council, the house used for the exercise was inspected for asbestos and other potentially problematic substances and made safe prior to the burn. However it is probable that some material, such as painted surfaces and electrical wiring insulation, were consumed in the burn. The toxicity of the smoke plume was consequently very likely to be greater than that of ‘pure’ woodsmoke.

Overall there appeared to be very little impact from smoke from the burn exercise as measured at ground-level in the streets surrounding the exercise location. The night chosen (several days in advance) for the exercise was very calm. The burn was hot, giving a buoyant smoke column. The night was mild, near 15 C, meaning there was unlikely to have been a significant temperature inversion that may have inhibited vertical movement of the smoke. The lack of high ground in the near vicinity also reduced the chance of smoke at altitude impacting on nearby residences before it had a chance to mix and disperse.

5 Acknowledgements

We thank the Devonport City Council for the information exchange and support for the work reported here.

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