ENVIRONMENT REPORT

AIR MONITORING REPORT 2010 -COMPLIANCE WITH THE NATIONAL ENVIRONMENT PROTECTION (AMBIENT AIR QUALITY) MEASURE

TASMANIAN AIR MONITORING REPORT 2010

COMPLIANCE WITH THE NATIONAL ENVIRONMENT PROTECTION MEASURE (AMBIENT AIR QUALITY) FOR 2010 BY TASMANIA – JULY 2011

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EPA DIVISION, TASMANIA,
JUNE 2011

Executive overview

This report presents the results of air quality monitoring in Tasmania and assesses them against the requirements of the Ambient Air Quality Environment Protection Measure (Air NEPM).[1] An electronic copy of this report, together with those for previous years, and general air quality data tables are available on the Tasmania EPA Divisions website.[2]

The Air NEPM establishes:

- requirements for monitoring air quality,
- air quality standards that are levels of specified pollutants against which air quality can be assessed,
- a goal that the air quality standard are met by 2008 to the extent specified in the NEPM. Recognising that certain events can impact on air quality, the NEPM specifies a maximum number of days on which it is permissible to exceed the standard.

Monitoring was performed in Hobart and Launceston, in accordance with the Tasmanian monitoring plan,[3] Air NEPM Technical Papers and the EPA Division's NATA accreditation. Data capture rates in excess of 75% were achieved at all stations except for $PM_{2.5}$ particulates in Q3 at Launceston, due to equipment breakdown.

As an island with a cool climate and a relatively dispersed population, Tasmania experiences very low ambient levels of industrial and vehicle generated airborne pollutants, such as ozone (O_3), sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and carbon monoxide (CO).

The major contribution to urban air pollution in Tasmania is smoke from domestic wood heaters, agricultural and forestry burning, during the autumn and winter, with a contribution from bushfires in the summer months.

The overall particle pollution levels in Tasmania during 2010 were marginally lower than in 2009. The PM_{10} goal was met at both stations with only a single exceedence of the PM_{10} standard in Hobart in late May, which is partly attributed to a build-up of wood smoke over several days of cold and relatively calm weather.

The 24-hour advisory standard for particles (as $PM_{2.5}$) was exceeded on 2 days in Hobart, and 11 days in Launceston. Except for a single event in Launceston during March, caused by planned burn smoke (from Victoria) , these events occurred during cold weather, with smoke from domestic heaters identified as the most likely cause. The annual reporting standard for $PM_{2.5}$ (8 µg/m^3) was met in Hobart (7.1 µg/m^3) but not in Launceston (8.3 µg/m^3).

[1] National Environment Protection Measure for Ambient Air Quality, National Environment Protection Council publication, available from www.ewphc.gov.au

[2] Air Monitoring Report 2009, Compliance with the National Environment Protection Measure (Ambient Air Quality) by Tasmania July 2010, available from www.environment.tas.gov.au

[3] National Environment Protection Measure For Ambient Air Quality, Monitoring Plan for Tasmania, May 2001, available from www.environment.tas.gov.au.

TASMANIAN AIR MONITORING REPORT 2010

COMPLIANCE WITH THE NATIONAL ENVIRONMENT PROTECTION MEASURE (AMBIENT AIR QUALITY) FOR 2010 BY TASMANIA – JULY 2011

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Section A – Air NEPM Monitoring Summary 2010.

Under Clause 18 of the National Environmental Protection (Ambient Air Quality) Measure (Air NEPM), jurisdictions are required to submit an annual report on their compliance with the measure in an approved form. Content and format requirements for the annual report are detailed in the Air NEPM Technical Paper No. 8 which is available at www.ephc.gov.au .

Tasmania's Air NEPM air monitoring plan was approved by the National Environment Protection Council Ministers in 2001. Three regions with sufficient population to warrant the establishment of NEPM monitoring stations are defined in the monitoring plan. The details of the regional topography, climate, air pollution potential and population exposures are listed in Appendix A.

- The Hobart and Launceston regions have permanent performance monitoring stations, as listed in Table 1. A location map is given in Figure 1.
- Installation of the Macquarie Street CO monitoring station, within the Hobart CBD, was completed in December 2010. The station will be commissioned in 2011.

Description of the exposed population

A qualitative description of the exposed population represented by each monitoring station is in the location category column in Tables 1 and 2. A more detailed description of the exposed populations is given in Appendix B of this report.

Table 1: Tasmanian NEPM performance measuring stations

Region Performance monitoring station	**Location category**	**Site type**					
		CO	NO_2	O_3	SO_2	$PM_{2.5}$	PM_{10}
Hobart New Town	Residential					G & T	G & T
Launceston Ti Tree Bend	Light Industry					G & T	G & T

G = Generally Representative Upper Bound **T** = Trend station

Table 2: Summary of station's siting compliance with AS 3580.1.1-2007

Region Station	Location category	Height above ground	Min. distance to support structure	Clear sky angle of 120°	Unrestricted airflow of 170°/360°	20m from trees	No nearby boilers or incinerators	Distance from roads or traffic
Hobart New Town	Residential	√	√	√	√	√	√	√
Launceston Ti Tree Bend	Light industry	√	√	√	√	√	√	√

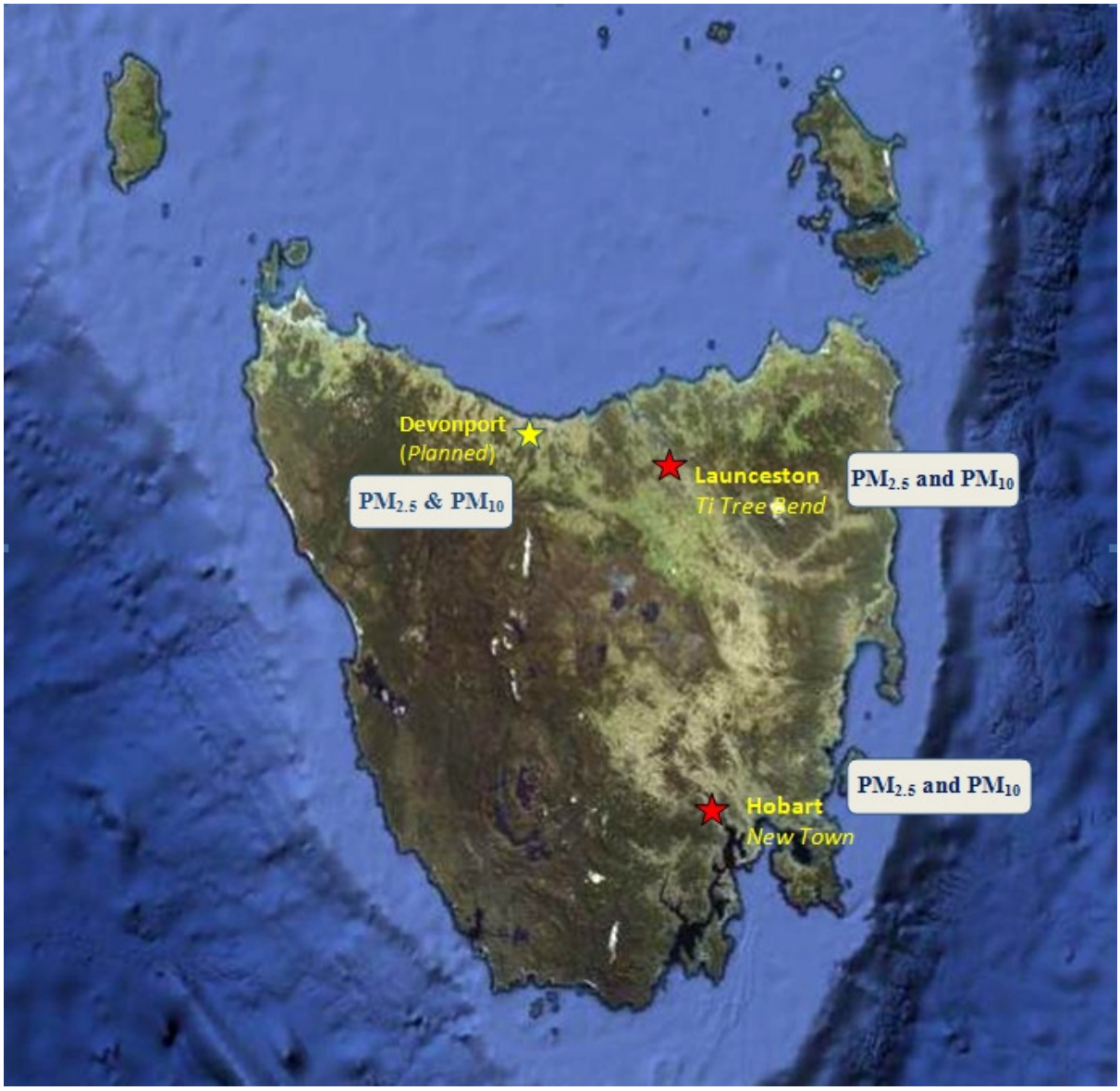

Figure 1: Existing and planned Air NEPM regions and gravimetric $PM_{2.5}$ and PM_{10} air monitoring stations in Tasmania

Implementation of the monitoring plan

The Hobart Performance and Trend monitoring station was moved approximately 2.5 km from the Prince of Wales Bay to New Town in May 2006. The background and rationale for this move are detailed in Appendix B.

The Launceston Performance and Trend monitoring station at Ti Tree Bend Waste Water plant was moved approximately 200 metres in December 2008 to avoid local dust contamination, as detailed in Appendix B.

The planned installation of the Devonport ambient air monitoring station has been delayed by outstanding logistical and resource issues associated with negotiating access to a suitable site.

Monitoring methods

NEPM compliance air monitoring in Tasmania is conducted in accordance with the relevant Australian standards shown in Table 3. Data not meeting the requirements of these standards and the EPA Division's quality assurance procedures is identified as invalid and not included in this report.

Particle concentrations in $\mu g/m^3$ have been corrected for the ambient air density and refer to a volume of air at 0°C (273.15°K) and a pressure of one standard atmosphere (101.325 kPa).

PM_{10} particle data measured by the Tapered Element Oscillating Microbalance (TEOM) included in this report incorporates an empirical ambient temperature adjustment as described in Appendix C. This adjustment is identical to the approved procedure described in NEPM Technical Paper 10,[4] except that low temperature cut-off for the application of the linear temperature correction has been extended from 5°C to 0°C, to reflect the lower ambient temperatures experienced in Tasmania. The resulting adjustments vary from no change on days with an average temperature at, or above 15°C, to a 60% increase at a daily average temperature of 0°C.

Table 3: Methods for monitoring NEPM pollutants in Tasmania

Pollutant		Standard	Title	Method used
Particles	PM_{10}	AS3580.9.8:2006	Ambient air – PM_{10} continuous direct mass method using a tapered element oscillating microbalance analyser	TEOM (tapered element oscillating microbalance)
Particles	PM_{10}	AS3580.9.9:2006	Ambient air – Determination of suspended particulate matter – PM_{10} low volume sampler – Gravimetric method	Low volume air sampler. Gravimetric reference method.
Particles	$PM_{2.5}$	AS3580.9.10:2006	Ambient air – Determination of suspended particulate matter – $PM_{2.5}$ low volume sampler – Gravimetric method	Low volume air sampler. Gravimetric reference method.

NATA status

The Tasmanian ambient air monitoring programme holds NATA Accreditation (NATA Certificate No. 16646, issued 7/4/2009) for the determination of $PM_{2.5}$ and PM_{10} using the Andersen RAAS samplers according to the methods described in AS3580.9.9:2008 and 3580.9.10:2008.

Following an external NATA audit of the PM_{10} TEOM methodology in August 2010, this accreditation has been extended to cover the continuous gravimetric determination of PM_{10} using the TEOM method according to AS3580.9.8:2008.

The quality assurance system is currently being expanded with the intention to apply in 2011 for accreditation for the determination of $PM_{2.5}$ and PM_{10} using the R&P Partisol Plus™ samplers according to the methods described in AS3580.9.9:2006 and 3580.9.10:2006.

[4] National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 10, Collection and Reporting of TEOM PM_{10} Data, available from www.ephc.gov.au

Screening for other pollutants

Monitoring for other listed Air NEPM pollutants is not performed at the Tasmanian NEPM stations of Launceston and Hobart because work carried out previously in Tasmania[3], and non-NEPM monitoring of SO_2 and NO_2 at George Town, have all indicated that the probable levels of Nitrogen dioxide (NO_2), Sulphur dioxide (SO_2) and ozone (O_3) would be well below the corresponding NEPM standards.

Details of past screening studies conducted in Tasmania are presented in the Air NEPM Monitoring Plan for Tasmania[3], and are summarised in Table 4. Details of other non-NEPM monitoring activities are available in Appendix A.

Table 4: Screening Results for other Air NEPM pollutants

Pollutant (Air NEPM standard)	**Hobart**	**Launceston**
Ozone (0.1 ppm, 1 hour)	Sampled 1994-1995, Max. 1 hr average 0.03 ppm	Sampled 1992-1993, max 1-hr level was 0.04 ppm
Nitrogen Dioxide (0.12 ppm, 1hour); (0.03 ppm, 1-year)	No data available. No significant sources	CSIRO - Ti Tree Bend (2007 – 2008) Maximum 1-hr average 0.04 ppm, Average (11 months) 0.004 ppm,
Carbon Monoxide (9.0 ppm, 8 hours)	Prince of Wales Bay (2000-2004) Max. 8 hour average 2.3 ppm 95th percentile (8-hr) 0.4 ppm	CSIRO - Ti Tree Bend (2008) Max. 8 hour average 2.7 ppm Average (4 months) 1.0 ppm
Sulphur Dioxide (0.2 ppm, 1 hour); (0.08 ppm, 1 day); (0.02 ppm, 1 year)	Technology Park (2001 - 2003) Max. 1 hour average 0.136 ppm Max. daily average 0.025 ppm Annual average 0.002 ppm	George Town (2007 – 2010) Max. 1 hour average 0.018 ppm Max. daily average 0.007 ppm Annual average 0.001 ppm
Lead (0.50 µg/m^3)	Sampled 1989-1996 (intermittent) Annual average (1996) 0.2 µg/m^3	Sampled 1993-1998 (intermittent) Annual average (1996) 0.02 µg/m^3

$PM_{2.5}$ monitoring

In 2003, the NEPM was varied to include advisory reporting standards for $PM_{2.5}$ particles. Tasmania monitors daily $PM_{2.5}$ concentrations at both the Hobart and Launceston reference stations using Anderson Reference Ambient Air Samplers (RAAS), fitted with $PM_{2.5}$ very sharp cut cyclones (VSCC), according to AS/NZS 3580.9.10.

TEOM monitors fitted with $PM_{2.5}$ VSCC were installed at the Hobart and Launceston NEPM stations in 2010, and have been collecting real-time gravimetric $PM_{2.5}$ data since 1/1/2011.

Section B. - Assessment of compliance with Standards and Goal

Air quality is assessed against the Air NEPM standards and goal as shown in Table 5.

Table 5: Air NEPM air quality standards and goal

Pollutant	**Averaging Period**	**Standard** (Note 1)	**2008 goal.** (Note 2) **Maximum allowable exceedences**
Carbon monoxide	8 hours	9.0 ppm	1 day a year
Nitrogen dioxide	1 hour	0.12 ppm	1 day a year
	1 year	0.03 ppm	None
Ozone	1 hour	0.10 ppm	1 day a year
	4 hours	0.08 ppm	1 day a year
Sulphur dioxide	1 hour	0.20 ppm	1 day a year
	1 day	0.08 ppm	1 day a year
	1 year	0.02 ppm	None
Particles as PM_{10}	1 day	50 $\mu g/m^3$	5 days a year
Lead	1 day	0.50 $\mu g/m^3$	None
Particles as $PM_{2.5}$	1 day	25 $\mu g/m^3$	Not applicable
	1 year	8 $\mu g/m^3$	Not applicable

Notes 1 Standards are concentrations, in parts per million (ppm), or micrograms per cubic metre ($\mu g/m^3$), against which air quality can be assessed.

2 The goal of the Air NEPM is to achieve the National Environment Protection Standards within 10 years of commencement (1998) as assessed in accordance with the monitoring protocol to the extent specified in Schedule 2 of the Air NEPM[1]. The extent is the maximum allowable number of exceedences for each standard (shown in column 4)

The number of allowable exceedences associated with the standards has been set to account for unusual meteorological conditions and, in the case of particles, for natural events such as bushfires and dust storms that cannot be controlled through normal air quality management strategies.

Air quality data from each monitoring site is assessed against these standards and the associated goal. No performance goal has been set for $PM_{2.5}$ at this time, but this will be reviewed when sufficient data becomes available.

The following tables summarise compliance with the standards and goal of the Air NEPM

Air quality is assessed as complying with the Air NEPM if:

- The number of exceedences does not exceed the relevant allowanceas set for the appropriate goal, and,
- Availability of valid data was at least 75% in each quarter of the year.

Regions also meet the standard if they do not require monitoring on the basis that screening shows pollutant levels are expected to be consistently below the relevant standards.

Compliance with the Air NEPM is assessed as 'not demonstrated' if insufficient data have been collected to demonstrate that the standards have or have not been met, or screening has not been completed.

Carbon monoxide

Not monitored in Tasmania in 2010. Peak monitoring in Hobart will commence in 2011.

Nitrogen dioxide

Not monitored by NEPM performance stations in Tasmania. Screening and industry monitoring at George Town indicate ambient nitrogen dioxide levels are expected to be well below the relevant Air NEPM standard in both Hobart and Launceston.

Ozone

Not monitored in Tasmania. Screening studies and the relatively low concentration of motor vehicles, together with climatic conditions generally unfavourable to the formation of petrochemical smogs in Tasmania, indicate ambient ozone levels are expected to be well below the relevant Air NEPM standard in both Hobart and Launceston.

Sulphur dioxide

Not monitored by NEPM performance stations in Tasmania. Screening and industry monitoring at George Town, and Hobart indicate ambient sulphur dioxide levels are expected to be well below the relevant Air NEPM standard in both Hobart and Launceston.

Particles as PM_{10}

Table 6 provides summary information demonstrating compliance with the Air NEPM goal for Tasmania for PM_{10} in 2010.

Table 6: Compliance summary for PM_{10} in Tasmania for the 2010 calendar year
Air NEPM Standard: 50 µg/m^3 (24 hour average)
Air NEPM 2008 Goal: Standard exceeded on no more than 5 days per year

Region/Performance Monitoring Station	**Data Availability Rates (% of days with 75% or more hourly samples per 24 hours for TEOMs)**					**No. of Exceedences**	**Performance against Standard and Goal**
Hobart: New Town	***Q1***	***Q2***	***Q3***	***Q4***	***Annual***	***Days***	
PM_{10} (All instruments)	100	99	98	100	99	1	
- LVAS (every day)	98	99	87	99	96		***MET***
- TEOM [1,2]	87	98	87	99	93		
Launceston: Ti Tree bend	***Q1***	***Q2***	***Q3***	***Q4***	***Annual***	***Days***	
PM_{10} (All instruments)	100	100	100	100	100	0	
- LVAS (every day)	90	91	99	99	95		***MET***
- TEOM[1, 2]	97	98	100	99	98		
Devonport:	Scheduled to begin operation in late 2011						***Not demonstrated***

Notes 1. Temperature adjusted using local model according to Technical Guidance Paper 10[4]

Adjusted PM_{10} = Measured PM_{10} x Temperature Correction Factor [TCF]

Where TCF = 1.00 for 24 hr average temperature $[T_{24}] \geq 15°C$

= $1.00 + (15 - T_{24}) / 25$ $0°C < T_{24} < 15°C$

= 1.60 When $T_{24} \leq 0°C$

2. Day-averaged TEOM data are used only when LVAS PM_{10} data are not available.

Particles as $PM_{2.5}$

The Air NEPM was varied in 2003 to include advisory reporting standards for particles as $PM_{2.5}$. There is no time frame for compliance, but monitoring by the reference method and other acceptable methods is required to be reported.

Table 7 summarises Tasmania's monitoring of $PM_{2.5}$ by the reference method, which is the only approved method to be used for comparisons with the advisory reporting standards. The goal is to gather sufficient data nationally to facilitate a review of the reporting standards as part of the review of the NEPM that commenced in 2005.

Table 7: Compliance summary for $PM_{2.5}$ in Tasmania for the 2010 calendar year

Air NEPM advisory reporting standard: 25 µg/m^3 (24 hour average)
8 µg/m^3 (annual average)

Region/Performance Monitoring Station	**Data Availability Rates**					**Number of exceedences**	**Annual mean**
Hobart: New Town	***Q1***	***Q2***	***Q3***	***Q4***	***Annual***	***Days***	
LVAS (every day)	98	92	97	98	96	2	7.1 µg/m^3
Launceston: Ti Tree bend	***Q1***	***Q2***	***Q3***	***Q4***	***Annual***	***Days***	
LVAS (every day)	77	89	70	98	83	11	8.3 µg/m^3
Devonport	Scheduled to begin operation in late 2011					N/A	

Apart from one exceedence in Launceston on 17th March 2010 due to planned burn smoke from Victoria moving across Bass Strait to northern Tasmania, all remaining exceedence events were attributed to accumulated smoke from wood heaters, as detailed in Section C.

Lead

With the phasing out of leaded petrol, the concentrations of airborne lead measured in Hobart and Launceston fell well below the Air NEPM standard, and the monitoring of airborne lead was discontinued in 1998.

SECTION C – ANALYSIS OF AIR QUALITY MONITORING

The annual summary statistics for Tasmania are presented in this section in Tables 8 to 12. The Air NEPM states that short term standards should not be exceeded on more than one day each year for carbon monoxide, nitrogen dioxide, ozone and sulphur dioxide, or on more than five days per annum for PM_{10}.

All occasions when a standard was exceeded are listed in the following tables, together with the circumstances leading to the exceedence. Concentrations exceeding the standard are highlighted in bold.

Tables of monitoring statistics presented in this section have been prepared according to Air NEPM guidelines.

Carbon monoxide

Not monitored in Tasmania during 2010.

Nitrogen dioxide

Not monitored at the NEPM reference stations in Hobart and Launceston.

Ozone

Not monitored in Tasmania

Sulphur dioxide

Not monitored at the NEPM reference stations in Hobart and Launceston.

Particles as PM_{10}

PM_{10} was monitored each day at the Hobart and Launceston stations by both LV air samplers and TEOM. The reported PM_{10} concentrations are preferentially from the LVAS reference method. On days when these data were not available, when the 24-hour average PM_{10} has been estimated from the temperature adjusted PM_{10} TEOM measurements, using the Tasmanian empirical correction factor derived according to the methods presented in Technical Guidance Paper 10.[4]

The 2010 summary statistics for Tasmania for PM_{10} are given in Table 8.

Table 8: 2010 summary statistics for 24-hour PM_{10} in Tasmania

Air NEPM Standard: 50 µg/m^3 (24 hour average)

Air NEPM 2008 Goal: Standard exceeded on no more than 5 days per year

Region Performance monitoring station	No. of valid days	Highest concentration		6th highest concentration	
		µg/m^3	Date	µg/m^3	Date
Hobart New Town	362	**50.5**	25/5/2010	29.4	20/6/2010
Launceston Ti Tree Bend	365	49.5	26/7/2010	37.7	27/7/2010

There was only a single recorded exceedence of the 50 µg/m^3 PM_{10} standard in 2010, which was at New Town (Hobart) in May. This can be compared with recent years where there were

none in 2009, 1 in 2008 (Launceston), 5 in 2007 (all in Launceston) and 6 in 2006 (also all in Launceston).

Table 9 gives further details of the recorded PM_{10} exceedence for Tasmania for 2010.

Table 9: PM_{10} exceedences in 2010 for Tasmania

Air NEPM Standard: 50 µg/m^3 (24 hour average)

Air NEPM 2008 Goal: Standard exceeded on no more than 5 days per year

Region	**Hobart**	
Station	**New Town**	**Inferred cause**
25 May 2010	**50.4**	Smoke from domestic wood heaters, with larger (coarse) aerosol (unidentified) in late morning

The PM_{10} exceedence at Hobart (New Town) is unusual as it is the first measured exceedence at this station since monitoring commenced in mid 2006. As noted below, the $PM_{2.5}$ measurement for this day was 35.6 µg/m^3, and is ascribed to urban woodsmoke. Figure 2 shows in the top panel the (temperature corrected) 10-minute TEOM PM_{10} and optical proxy $PM_{2.5}$ from an 8520 dust-trak located at New Town station. The lower panel shows meteorological data from New Town. The data in the top panel show that an interval of elevated PM_{10} levels occurred between approximately 8 a.m. and midday, with a much smaller corresponding increase in proxy $PM_{2.5}$. The increase in PM_{10} appeared to coincide with a wind direction change (measured at 10 m elevation) from westerly to northerly.

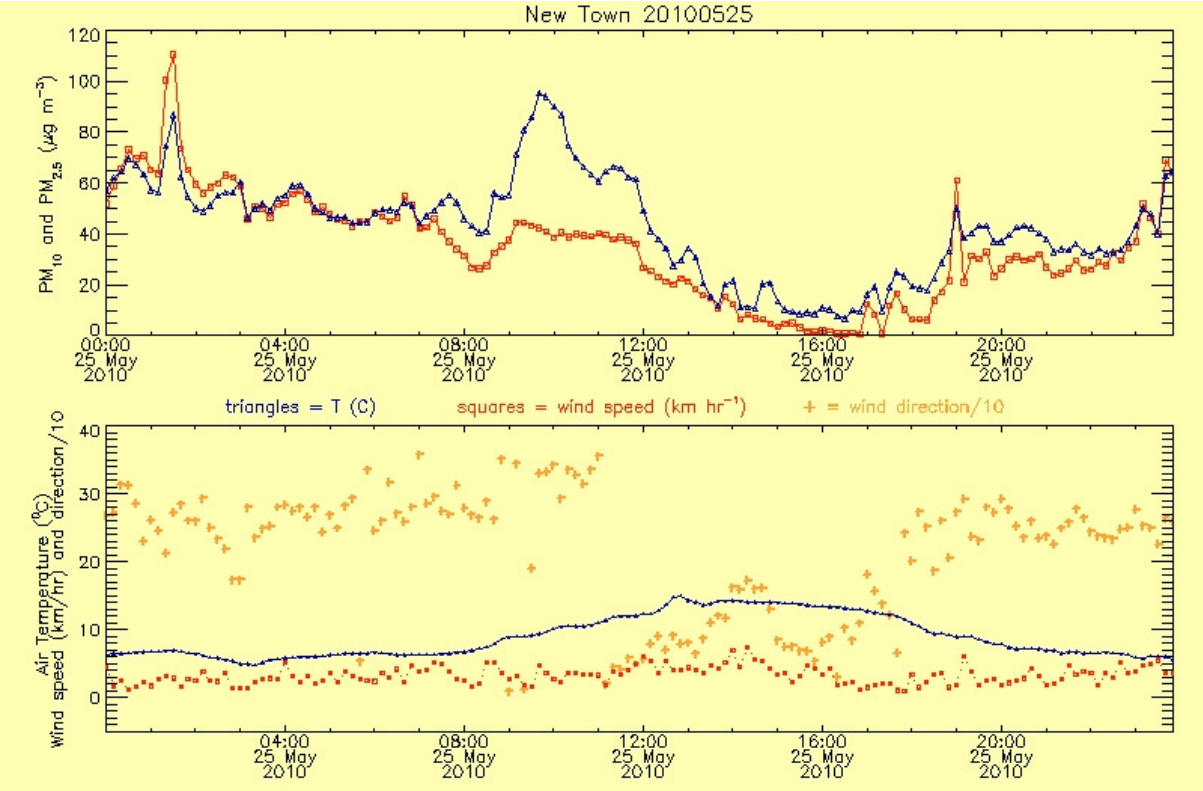

Figure 2. New Town (Hobart) data for 25 May 2010. Top: 10-minute temperature corrected TEOM PM_{10} (blue) and optical proxy $PM_{2.5}$ (red) data. Lower: Meteorological data.

A DRX dustrak was also in operation at New Town station on this day. This optical scattering instrument also provides estimated (proxy) mass fractions of both PM_{10} and $PM_{2.5}$. Figure 3 shows these DRX data. The day-averaged DRX PM_{10} and $PM_{2.5}$ values, of 53 and 37 µg/m^3 respectively, agree well with the gravimetric low-volume measurements of 50.4 and 35.6 µg/m^3. Although the peak DRX PM_{10} value is slightly greater than the peak TEOM PM_{10} data, the overall variation is very similar.

Taken together, the data shown in Figures 2 and 3 indicate that a mostly coarse (> 2.5 µm diameter) aerosol impacted at the station in the late morning of this day, and contributed to the measured PM_{10} exceedence. The wind speed was moderate at this time, indicating it was probably unlikely to be wind-raised dust. The relatively smooth PM_{10} time-series trace may also argue against a very local (and hence variable) mechanical source, such as local traffic or mechanical plant operations. Sea-salt is known to contribute to the PM_{10} aerosol fraction in Tasmania. Pollen can be present in some areas at certain times of the year. However, as no further data concerning this event are available the origin of the mid-morning increase in PM_{10} cannot be determined.

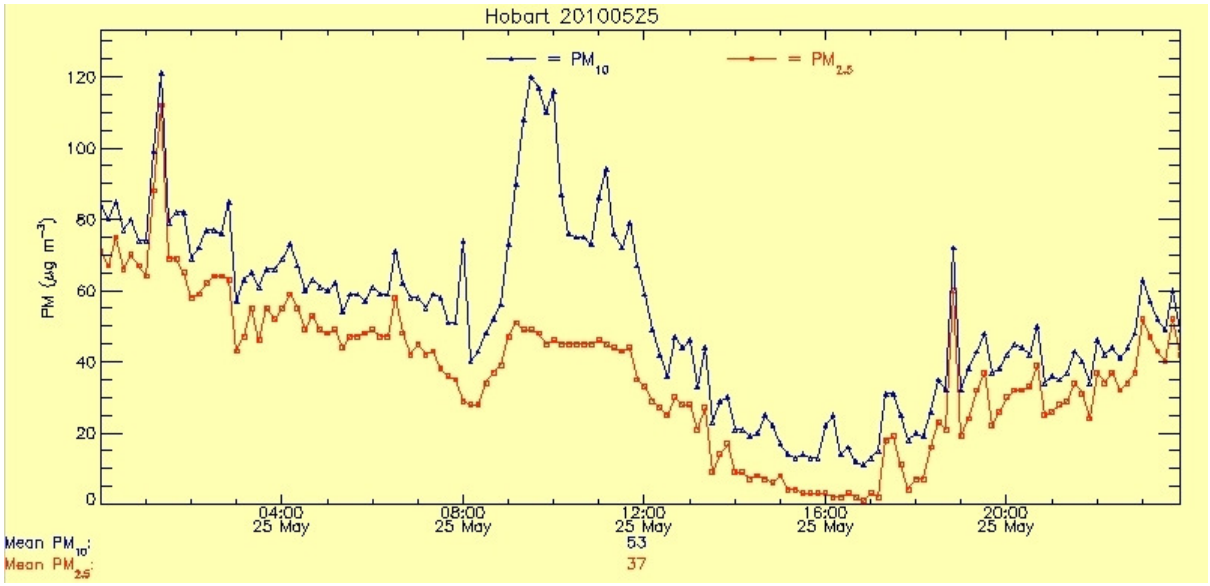

Figure 3. DRX dustrak (optical proxy) PM_{10} (blue) and $PM_{2.5}$ (red) 10-minute data from New Town, 25th May 2010

Particles as $PM_{2.5}$

$PM_{2.5}$ was monitored each day at the Hobart and Launceston stations by LV air samplers. The 2010 summary statistics for Tasmania for $PM_{2.5}$ are given in Table 10.

Table 10: 2010 summary statistics for 24-hour $PM_{2.5}$ in Tasmania
Air NEPM advisory reporting standard: 25 µg/m^3 (24 hour average)

Region & Station	No. of valid days	Highest concentration		6th highest concentration	
		µg/m^3	Date	µg/m^3	Date
Hobart, New Town	351	**35.6**	25/5/2010	21.7	9/8/2010
Launceston, Ti Tree Bend	304	**40.9**	26/7/2010	**27.2**	27/6/2010

In 2010, the 24-hour $PM_{2.5}$ reporting standard was exceeded on two days in Hobart and 11 days in Launceston, as listed in Tables 11 and 12.

Table 11: Exceedences of $PM_{2.5}$ 24-Hour Advisory Reporting Standard in 2010 at New Town, Hobart, with inferred causes (in descending order of concentration).

Air NEPM advisory reporting standard: 25 µg/m^3 (24 hour average)

Date	$PM_{2.5}$ (µg/m^3)	PM_{10} (µg/m^3)	Mean Temp.	Inferred cause
25/5/2010	**35.6**	**50.4**	9.0 °C	Urban wood smoke
28/5/2010	**30.7**	43.6	8.0 °C	Urban wood smoke

Table 12: Exceedences of $PM_{2.5}$ 24-Hour Reporting Standard in 2010, at Ti Tree Bend, Launceston, with inferred causes (in descending order of concentration).

Air NEPM advisory reporting standard: 25 µg/m^3 (24 hour average)

Date	PM2.5 (µg/m^3)	PM10 (µg/m^3)	Mean Temp	Inferred cause
1. 26/07/2010	**40.9**	49.5	7.0 °C	Urban wood smoke
2. 04/07/2010	**31.3**	36.8	3.0 °C	Urban wood smoke
3. 21/06/2010	**28.5**	37.8	4.6 °C	Urban wood smoke
4. 17/03/2010	**28.3**	37.8	19.7 °C	Victorian smoke
5. 02/07/2010	**27.3**	35.4	3.1 °C	Urban wood smoke
6. 27/06/2010	**27.2**	34.5	2.2 °C	Urban wood smoke
7. 22/07/2010	**27.1**	33.6	8.3 °C	Urban wood smoke
8. 05/07/2010	**26.4**	33.1	4.1 °C	Urban wood smoke
9. 27/07/2010	**26.4**	37.7	6.8 °C	Urban wood smoke
10. 13/06/2010	**26.2**	31.9	3.3 °C	Urban wood smoke
11. 17/07/2010	**25.4**	32.6	7.3 °C	Urban wood smoke

Summary of progress towards achieving the Air NEPM goal in 2010

Compliance in 2010

Sufficient data was captured at both the New Town and Ti Tree Bend monitoring stations during 2010 to demonstrate compliance of the air quality in Hobart and Launceston with the Air NEPM standards and goal for PM_{10}. The single exceedence of the 50 µg/m^3 PM_{10} standard occurred at New Town. At this station the two exceedences the 24-hour advisory reporting standard for $PM_{2.5}$ occurred during a 4-day period of cold, relatively calm weather, conducive to the formation of temperature inversions trapping smoke from domestic wood heaters. The 2010 annual average $PM_{2.5}$ concentration for Hobart of 7.1 µg/m^3 also complied with the Air NEPM annual advisory reporting standard for $PM_{2.5}$ of 25 µg/m^3.

The 24-hour PM_{10} concentration measured at Ti Tree Bend in 2010 did not exceed the Air NEPM PM_{10} 24-hour standard of 50 µg/m^3. However Launceston still experiences a significant level of winter smoke pollution. The maximum daily PM_{10} concentration was 49.5 µg/m^3, and 11 days above the 24-hour advisory reporting standard for $PM_{2.5}$ were

recorded. One $PM_{2.5}$ exceedence was due to the impact of Victorian smoke in March[5]. The remaining ten $PM_{2.5}$ exceedences all occurred on cold and relatively calm winter days, where a combination of high levels of wood heater use, and poor smoke dispersion led to high levels of accumulated smoke in the local airshed. The 2010 annual average $PM_{2.5}$ concentration of 8.3 µg/m^3 did not comply with the Air NEPM annual reporting standard for $PM_{2.5}$ of 8 µg/m^3.

Trends in compliance

Hobart

PM_{10} data measured at the Prince of Wales Bay station (July 2000 - July 2006) and New Town (May 2006 to present), have demonstrated that Hobart's air quality has complied with NEPM PM_{10} standard and goal since 2001 (see Tables 13 and 14, section D following).

Launceston

The ambient air quality in Launceston met the Air NEPM PM_{10} standard in 2010. This was the second successive year with no observed exceedences of the 50 µg/m^3 24-hour PM_{10} limit at the Ti Tree Bend air monitoring station, and the fourth successive year that the air quality in Launceston has met the Air NEPM goal for PM_{10} (see Tables 13 and 15, section D following).

D. TRENDS AND POLLUTION DISTRIBUTIONS

Results of further analysis are presented in this section. The following tables present:

- Percentiles of 2010 daily peak concentrations are presented for each station and standard.
- Daily values are only reported for days with more than 75% of hourly data
- Exceedences are shown in bold type
- Data for stations with less than 75% annual data are shown in italics
- Data for years with less than 25% valid data (91 days) have not been reported.

Carbon monoxide

No data collected in Tasmania in 2010.

Nitrogen dioxide

No data collected at NEPM stations in Tasmania.

Ozone

Not measured in Tasmania

Sulphur dioxide

No data collected at NEPM stations in Tasmania.

[5] See BLANkET Technical report 9 for a full analysis of this event from the 17th of March 2010, available on the EPA Division web pages at http://www.environment.tas.gov.au/index.aspx?base=7529

Particles as PM_{10}

Table 13 provides summary statistics for the PM_{10} monitoring conducted at Hobart and Launceston for 2010. Historical summaries are also provided for Hobart in Table 14 and Launceston in Table 15.

Table 13: 2010 Summary Statistics for PM_{10}

Air NEPM standard: 50 µg/m^3 (24 hour average)

Air NEPM goal: Standard not exceeded more than 5 days per year

Region and Performance Monitoring Station	**Data Availability (% of days)**	**Max.** µg/m^3	**Percentiles (µg/m^3)**						
			99th	98th	95th	90th	75th	50th	25th
Hobart									
New Town	99.2	**50.5**	30.6	29.3	25.5	22.3	17.2	12.0	7.9
Launceston									
Ti Tree Bend	100	49.5	37.8	36.8	31.5	26.6	19.8	13.2	9.2

Exceedences shown in **bold**.

Table 14: Percentiles of 24-hour PM_{10} at New Town, Hobart (2006 – 2010)

Air NEPM Standard: 50 µg/m^3 (24 hour average)

Air NEPM 2008 goal: Standard exceeded on no more than 5 days per year

Year	Data Availability (% of days)	No. of exceedences (days)	Max. µg/m^3	Percentiles (µg/m^3)						
				99th	98th	95th	90th	75th	50th	25th
2006	*69.3*	*0*	*46.7*	*39.2*	*36.3*	*31.9*	*27.8*	*20.5*	*13.9*	*9.0*
2007	99.7	0	43.8	39.3	36.1	30.3	25.9	18.5	13.7	9.5
2008	100	0	48.7	38.7	37.1	29.6	25.3	18.7	12.9	8.6
2009	99.5	0	43.2	36.1	33.4	26.4	23.3	17.3	11.4	8.5
2010	99.2	1	**50.5**	30.6	29.3	25.5	22.3	17.2	12.0	7.9

Years with data availability less than 75% are shown in *italics*. Exceedences are shown in **bold**

Table 15: Percentiles of 24-hour PM_{10} at Ti Tree Bend, Launceston (1997 – 2010)

Air NEPM Standard: 50 µg/m^3 (24 hour average)

Air NEPM 2008 goal: Standard exceeded on no more than 5 days per year

Year	Data Availability (% of days)	No. of exceedences (days)	Max. µg/m^3	Percentiles (µg/m^3)						
				99th	98th	95th	90th	75th	50th	25th
1997	*46.8*	***50***	***122.8***	***110.4***	***109.7***	***83.5***	***73.9***	***54.0***	*23.5*	*12.0*
1998	*51.0*	***47***	***125.0***	***124.4***	***112.0***	***88.0***	***74.8***	***51.2***	*24.1*	*11.6*
1999	*51.8*	***43***	***94.4***	***86.8***	***83.2***	***79.0***	***66.6***	*48.5*	*24.9*	*11.7*
2000	*53.0*	***38***	***110.4***	***89.2***	***85.6***	***74.8***	***71.5***	*42.3*	*23.6*	*10.3*
2001	*65.5*	***27***	***81.2***	***78.4***	***71.7***	***57.0***	***51.6***	*34.9*	*15.5*	*7.4*
2002	91.0	**13**	**76.4**	**70.6**	**59.4**	47.4	39.0	24.3	13.6	7.4
2003	85.5	**26**	**91.5**	**74.3**	**70.7**	**56.0**	43.4	26.5	15	8.3
2004	92.3	**10**	**86.1**	**67.6**	**54.0**	44.3	37.5	21.8	12.4	7.4
2005	99.2	**13**	**79.6**	**70.2**	**62.3**	47.6	39.6	23.4	13.9	9.5
2006	97.3	5	**86.3**	**53.5**	47.0	40.0	35.4	23.7	15.3	10.9
2007	96.4	5	**76.3**	**56.4**	**51.9**	40.0	31.1	21.6	15.0	11.1
2008	97.5	1	**75.7**	47.7	42.4	39.0	30.5	22.4	15.0	10.0
2009	100	0	44.1	42.3	38.1	29.8	22.1	16.4	12.2	8.4
2010	100	0	49.5	37.8	36.8	31.5	26.6	19.8	13.2	9.2

Years with data availability less than 75% are shown in italics. Exceedences are shown in bold

Particles as $PM_{2.5}$

Table 16 provides summary statistics for the $PM_{2.5}$ monitoring conducted at Hobart and Launceston for 2010. Historical summaries are also provided for Hobart in Table 17 and Launceston in Table 18.

Table 16: 2010 Summary Statistics for $PM_{2.5}$

Air NEPM Reporting Standard: 25 µg/m^3 (24 hour average)
8 µg/m^3 (annual average)

Region and Performance Monitoring Station	Data Availability (% of days)	Max. µg/m^3	Percentiles (µg/m^3)						
			99th	98th	95th	90th	75th	50th	25th
Hobart									
New Town	96.1	**35.6**	23.0	21.7	18.2	15.2	8.9	5.2	3.4
Launceston									
Ti Tree Bend	83.3	**40.9**	**28.5**	**27.2**	23.7	19.0	9.9	6.0	4.0

Exceedences shown in **bold**.

Table 17: Percentiles of 24-hour $PM_{2.5}$ at New Town, Hobart (2006 – 2010)

Air NEPM Reporting Standard: 25 µg/m^3 (24 hour average)
8 µg/m^3 (annual average)

Year	Data Availability (% of days)	No. of exceedences (days)	Max. µg/m^3	Percentiles (µg/m^3)						
				99th	98th	95th	90th	75th	50th	25th
2006	*54.8*	*2*	***29.4***	***27.6***	*23.0*	*21.4*	*16.0*	*9.6*	*4.8*	*3.1*
2007	86.6	7	**31.5**	**28.0**	**25.4**	21.1	16.6	9.3	5.4	3.5
2008	91.5	9	**41.9**	**33.8**	**28.3**	21.2	16.9	9.0	4.8	3.2
2009	87.4	4	**28.4**	**26.1**	24.1	19.1	15.2	8.5	5.6	3.7
2010	96.1	2	**35.6**	23.0	21.7	18.2	15.2	8.9	5.2	3.4

Years with data availability less than 75% are shown in *italics*. Exceedences are shown in **bold**

Table 18: Percentiles of 24-hour PM2.5 at Ti Tree Bend, Launceston (2006 – 2010)

Air NEPM Reporting Standard: 25 µg/m^3 (24 hour average)
8 µg/m^3 (annual average)

Year	Data Availability (% of days)	No. of exceedences (days)	Max. µg/m^3	Percentiles (µg/m^3)						
				99th	98th	95th	90th	75th	50th	25th
2006	92.1	35	**43.6**	**39.9**	**34.6**	**30.5**	**26.3**	13.6	6.3	4.2
2007	86.6	20	**53.6**	**39.7**	**37.3**	**26.5**	20.6	11.4	6.4	4.4
2008	86.1	17	**41.6**	**34.6**	**31.2**	**25.3**	20.3	12.0	5.8	3.4
2009	83.8	12	**36.3**	**32.9**	**29.8**	22.0	14.8	8.9	5.4	3.6
2010	83.3	11	**40.9**	**28.5**	**27.2**	23.7	19.0	9.9	6.1	4.0

Years with data availability less than 75% are shown in italics. Exceedences are shown in bold

Pollution distribution and trends

The particulate pollution levels in Tasmania exhibit a strong seasonal behaviour, with the highest pollution levels experienced during the autumn and winter. Plots of the monthly average $PM_{2.5}$ and PM_{10} concentrations from both Hobart and Launceston since $PM_{2.5}$ monitoring started in 2006 (Figures 4 and 5) demonstrates the dominant role of $PM_{2.5}$ particulates in winter air pollution. Over the past 5 years (since daily $PM_{2.5}$ measurements started), the $PM_{2.5}$ fraction represented 70% of the PM_{10} particulates in Launceston for the high pollution months of May to August, compared to 38% between September and April. The slight rise in the (PM_{10}-$PM_{2.5}$) fraction in summer may be due to wind-blown dust in dry weather, and a possible increase in sea-salt aerosol loading from a tendency to increased occurrence of sea breezes on warm days.

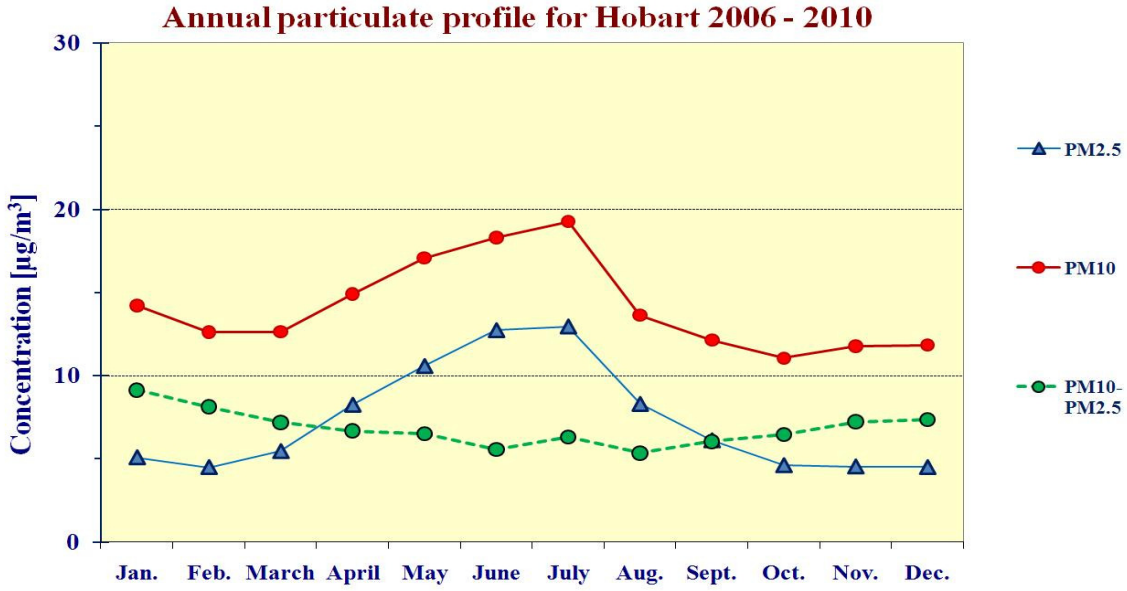

Figure 4. Annual particulate profile, by monthly average, for Hobart for 2006 to 2010

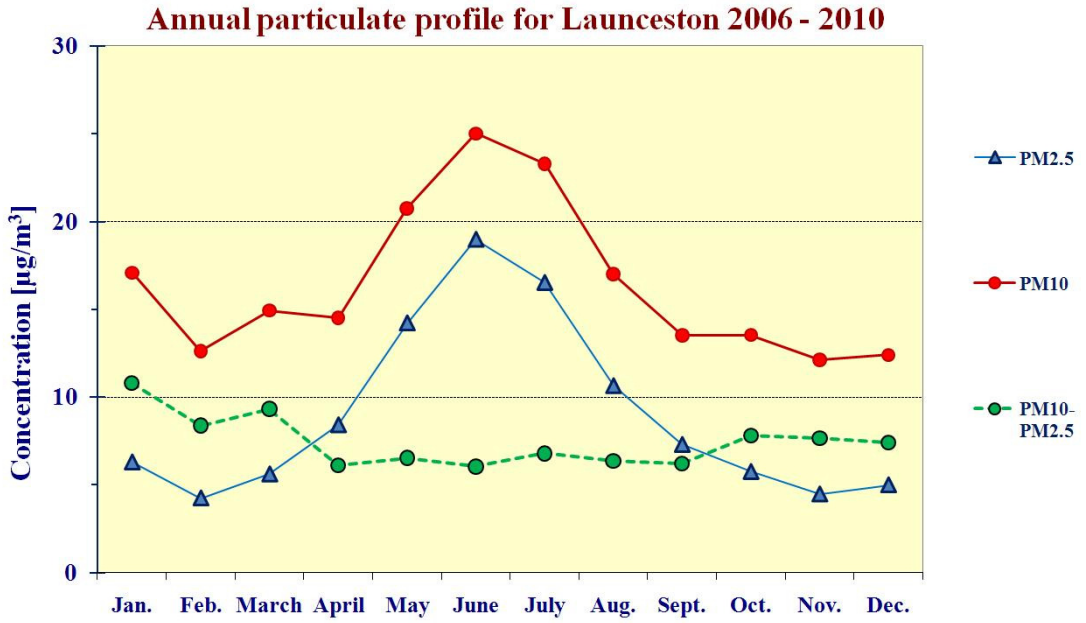

Figure 5. Annual particulate profile, by monthly average, for Launceston for 2006 to 2010

It can be seen that both population centres have very similar annual pollution profiles for coarse particles (represented by the $PM_{10} – PM_{2.5}$ plot), but Launceston has experienced significantly higher levels of winter $PM_{2.5}$ pollution than Hobart in the past. However, this differential has become smaller, as the winter air quality in Launceston has improved over the last decade. The reduction in the winter particle pollution in Launceston over the past 2 decades is illustrated in Figures 6 and 7. The frequency of 24-hour PM_{10} exceedences has declined from 50 days per annum in 1997, when daily winter PM_{10} measurements began, to only a single exceedence in 2008 (caused by bushfire smoke), and none in 2009 and 2010.

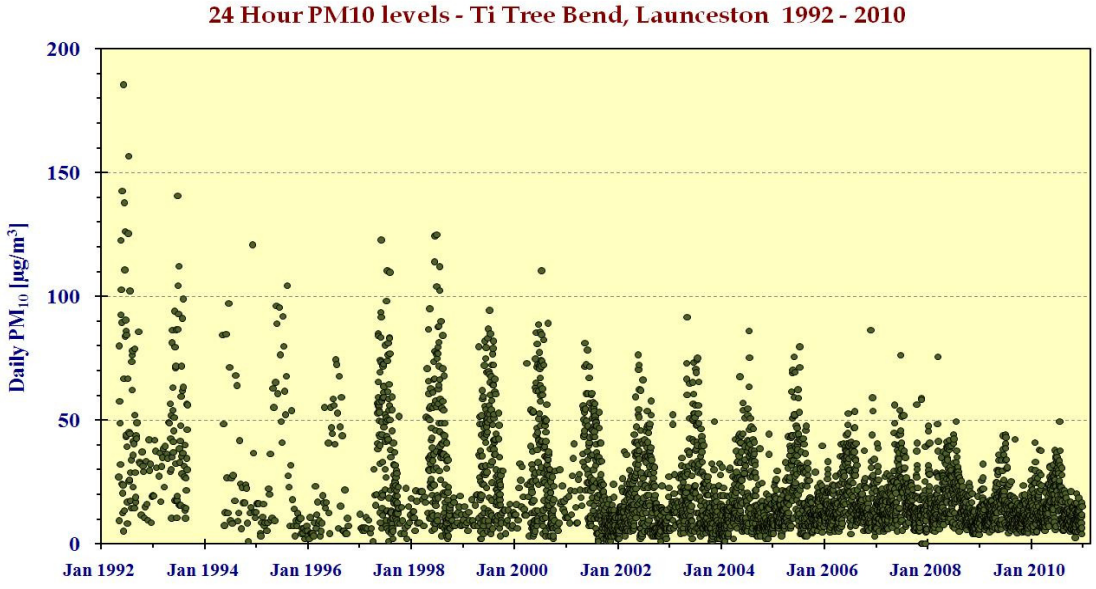

Figure 6. The daily average PM_{10} concentrations measured at Ti Tree Bend 1992 - 2010.

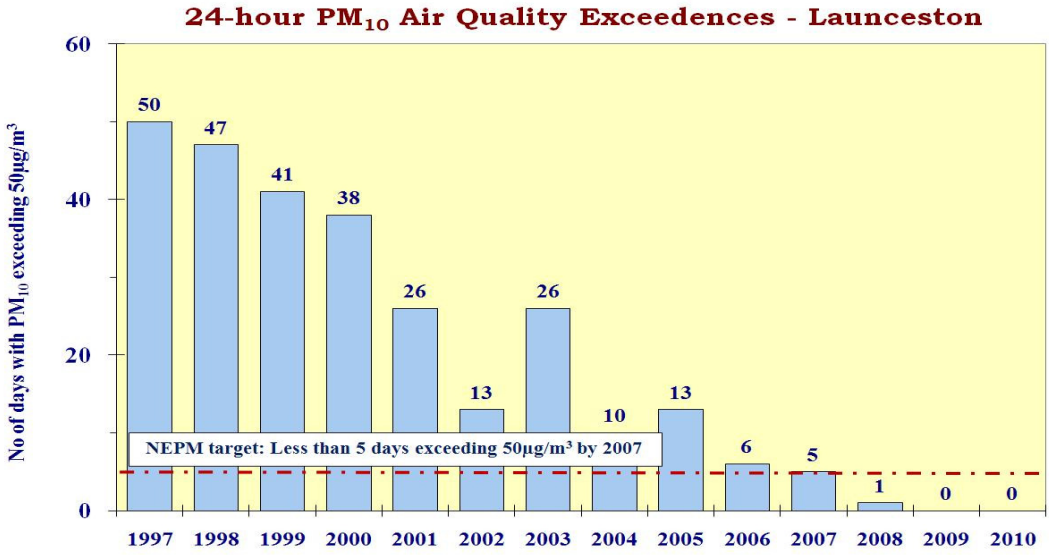

Figure 7. The number of days each year where the 24-hour average PM_{10} concentration at Ti Tree Bend exceeded the Air NEPM standard of 50 µg/m^3, since daily winter monitoring began in 1997.

This improvement in Launceston's air quality has been largely due to a reduction in winter smoke pollution, illustrated by a steady long-term decline in the mean winter (May – August) PM_{10} concentrations from 45 µg/m^3 in 1998 to 20 µg/m^3 in 2010 (Figure 8). However, a similar trend is not observed in Hobart, where there has been a very small increase in the average winter PM_{10} since 2002 (Figure 9). The summer (October – February) PM_{10} levels have remained relatively constant between 10 µg/m^3 and 15 µg/m^3 for both regions over this period.

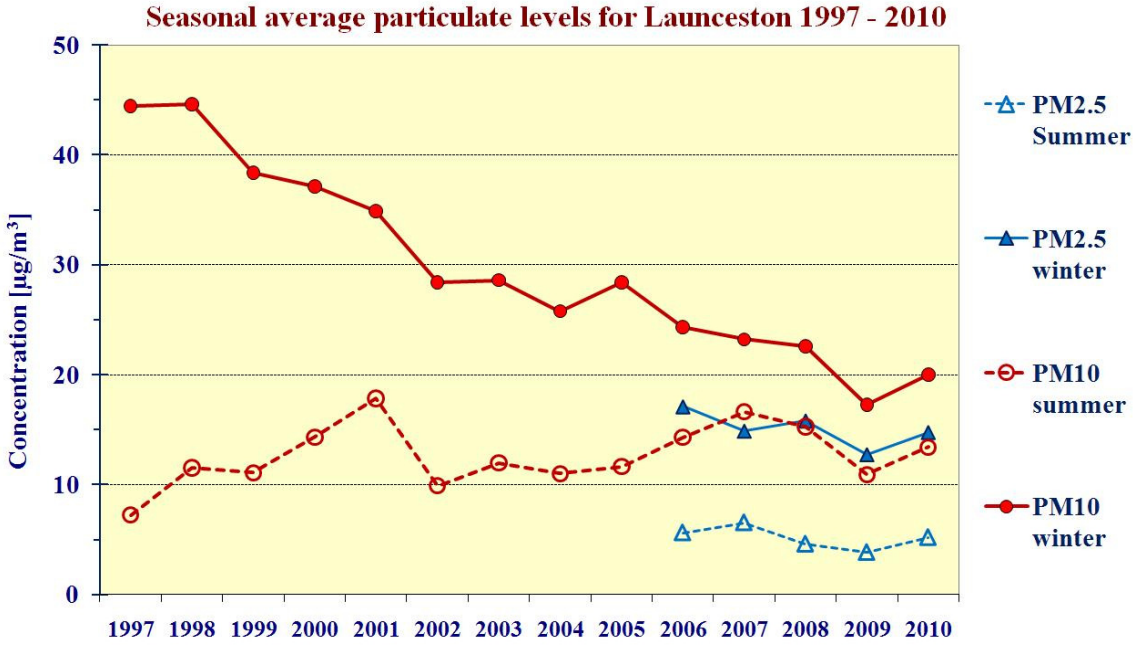

Figure 8. The seasonal average $PM_{2.5}$ and PM_{10} concentrations measured at Ti Tree Bend since regular year-round monitoring of PM_{10} began in 1997

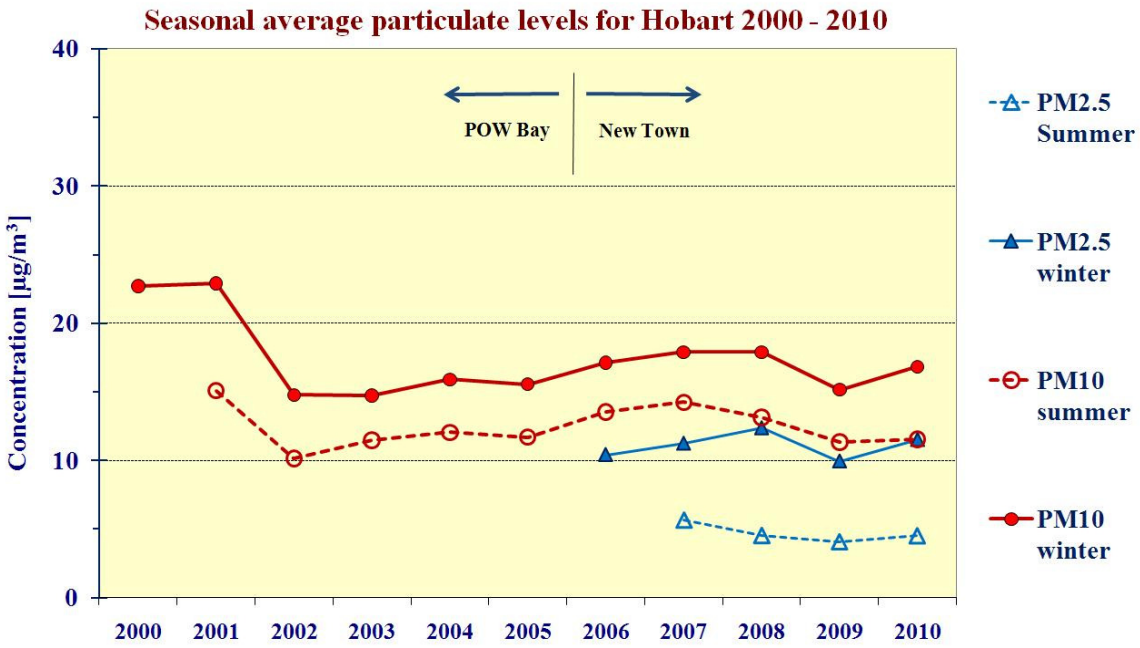

Figure 9. Seasonal $PM_{2.5}$ and PM_{10} concentrations in Hobart since monitoring began in 2000

While there are anecdotal reports from Launceston residents that the recent winters are not as severe as they were in the 1990s, this is not supported by the meteorological records from Ti Tree Bend which do not show any apparent trends in the number of cold days each winter over the last 20 years (Figure 10). Woodheater use is greater and smoke dispersion is usually poorer on cold days in Launceston. However, the observed steady decline in winter smoke pollution in Launceston over the past 19 years cannot be adequately explained by meteorological factors alone.

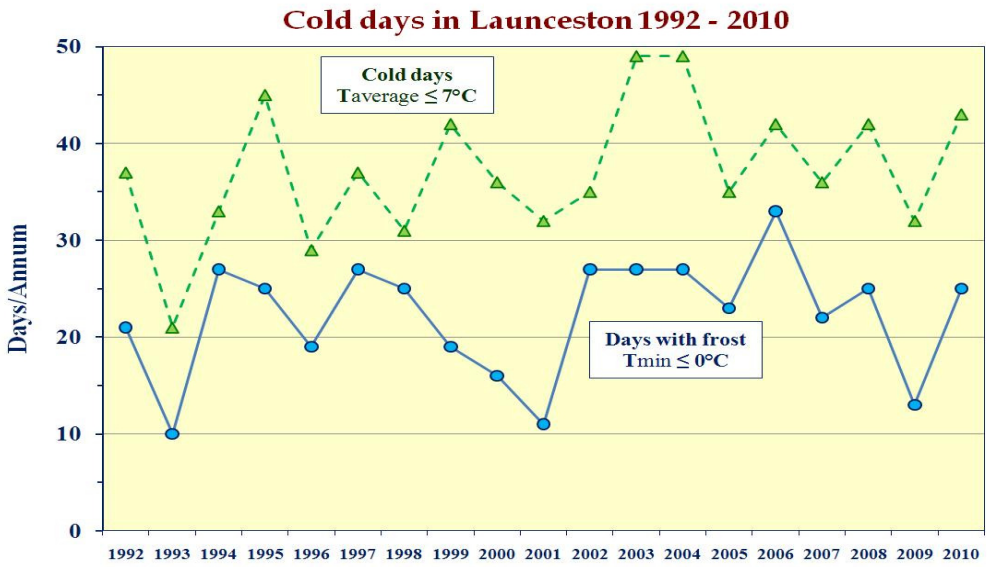

Figure 10. The annual frequency of frosts (minimum temperature ≤ 0°C) and cold days (average temperature ≤ 7°C) measured at Ti Tree Bend 1992 - 2010.

It is considered more likely that the causes of the reduction in Launceston's winter particulate levels over the past decade has been a reduction in the overall emission of wood smoke through a combination of emission reduction programs and initiatives. These programs have included reducing wood heater numbers through buy-back schemes, reducing individual wood heater emissions through better design, and community education programmes leading to better wood heater operating habits. Other factors that may have contributed to reduced smoke emissions are the reticulation of natural gas, the conversion of commercial wood-fired boilers to other energy sources, and improved thermal efficiency of houses (insulation, double-glazing etc.) reducing heating needs.

While Launceston's winter air quality has shown a dramatic improvement over the past 15 years, and now complies with the NEPM PM_{10} goal, the relatively unchanging mean winter $PM_{2.5}$ levels from the last five years, illustrated in Figure 8, would indicate that continued progress in improving the city's air quality will become more challenging in the future.

Appendix A: Non-NEPM air monitoring

A-1 Non-NEPM monitoring in Tasmania

The following air quality monitoring programmes, not for NEPM reporting, are also being conducted in Tasmania.

George Town Air Monitoring Station

The George Town Air Monitoring Station (GAMS), which was established in July 2007 in partnership with the local heavy industries, has been monitoring PM_{10}, $PM_{2.5}$ and levels of SO_2 and NO_x using Low Volume Air Samplers and gas analysers respectively. Continuous particle monitoring is undertaken using an optical Dust Monitor (*GRIMM Aerosol Technik*), which uses the optical scattering properties of the particles to estimate concentrations in the PM_{10}, $PM_{2.5}$ and PM_1 size fractions.

Tamar Valley network

The EPA Division has continued to operate the Level 2 monitoring station at Rowella in the central Tamar Valley, established in 2006 by the Tasmanian Regional Planning and Development Council (RPDC), as part of the baseline environmental studies required prior to the construction of the proposed pulp mill at Longreach. During 2010, this station has continued to monitor $PM_{2.5}$ and PM_{10} particles using TEOM instruments and the levels of sulphur dioxide, and oxides of nitrogen using gas analysers. The remaining Microvol™ air samplers and passive hydrogen sulphide monitoring stations in the Tamar Valley (Beauty Point, Deviot, Riverside, Rowella and Tippogorrie Hills) were decommissioned during 2010, although meteorological data continue to be collected at these sites.

BLANkET network

In 2009 the Environment Division of the Department of Environment, Parks, Heritage and the Arts (DEPHA), now the EPA Division of DPIPWE, commenced the establishment of a regional network of air monitoring stations to determine the effects of forestry and agricultural burning, domestic wood-heating, and other smoke-generating activities on air pollution levels over a representative sample of the state.

This network – *Base-Line Air Network of EPA Tasmania* (BLANkET) - currently consists of 19 stations equipped with optical particle (DRX dustrak) and meteorological instruments. The locations of the Tasmanian air monitoring stations, including the BLANkET stations, are shown in Figure 11. Real-time indicative PM_{10}, $PM_{2.5}$, and meteorological data are available

on the EPA Division's website at http://www.environment.tas.gov.au/?base=7747 .

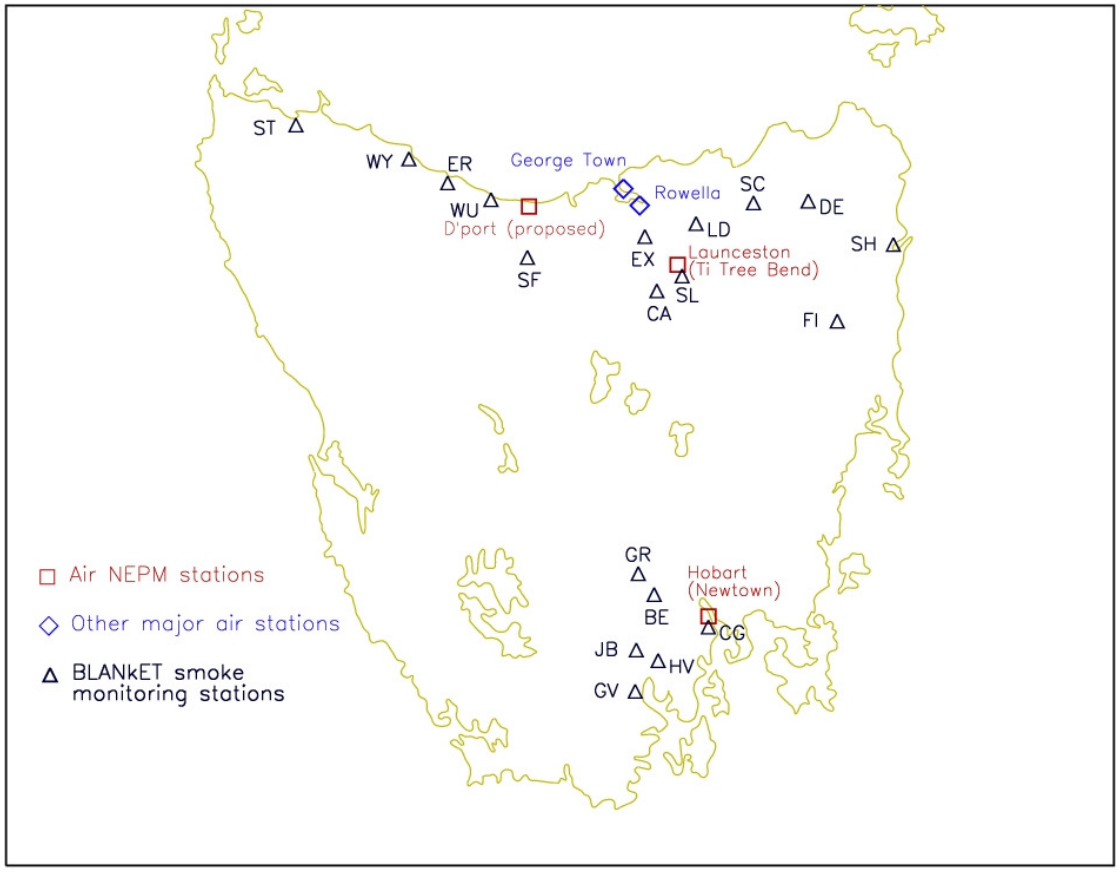

Figure 11 – Tasmania air quality monitoring stations 2010. The BLANkET stations are indicated by black triangular symbols.

The BLANkET stations are located near communities that are likely to be affected by smoke from planned burn operations, and provide air quality monitoring over a large proportion of Tasmania. These stations have significantly improved knowledge of smoke transport over Tasmania, and provided valuable insights into winter wood smoke levels (from domestic heating) in several of the smaller Tasmanian communities. Details of the instrumentation and results of analysis of the network data are presented in reports available at http://www.environment.tas.gov.au/index.aspx?base=7529 .

Two examples of planned burn smoke impacts will be briefly discussed here. The first example occurred on the night of the 21st/22nd April 2010 the Emu River station, 5 km south of Burnie, recorded very high $PM_{2.5}$ levels overnight, shown in Figure 12. Instantaneous (10-minute resolution) levels peaked at just under 1000 µg/m^3. For a number of hours $PM_{2.5}$ was over 300 µg/m^3. The full analysis of this event is still in progress, but there is evidence that the cause was, at least in part, smoke from a 10 ha forest industry burn inland from Burnie, carried out on the 21st of April. A well-defined katabatic flow down the Emu River valley was likely to have entrained the smoke plume, limiting smoke dispersal.

The second example occurred in mid April 2010 in the Huon region of southern Tasmania. In this case there was significant smoke build-up over several days due to numerous forest-industry burns in the region. The three BLANkET stations in the Huon recorded the increase

in particle concentrations. Day-averaged $PM_{2.5}$ data from these stations for April 2010 are shown in Figure 13, along with estimated daily burn totals (in kilotonnes) in the Huon airshed. Smoke dispersal in mid April was limited due to calm atmospheric conditions. There is a marked similarity in mid April between burn loads on a given day and the measured day-averaged $PM_{2.5}$ values on the following day. Many of the burns were ignited in the afternoon, and the full smoke impacts at the air stations were often seen after midnight.

Anecdotal evidence suggests that such events have occurred in the Huon and elsewhere in Tasmania in the past. These 2010 data were the first quantitative measurements of the smoke impacts resulting from several days of intensive forest burning during conditions of limited smoke dispersion. Feedback from the forest-industry indicates that the monitoring data have been very informative. The data and knowledge gained from the BLANkET network is being used to improve the management of smoke from planned burns through the Smoke Management Working Group of the Forest Practices Authority.

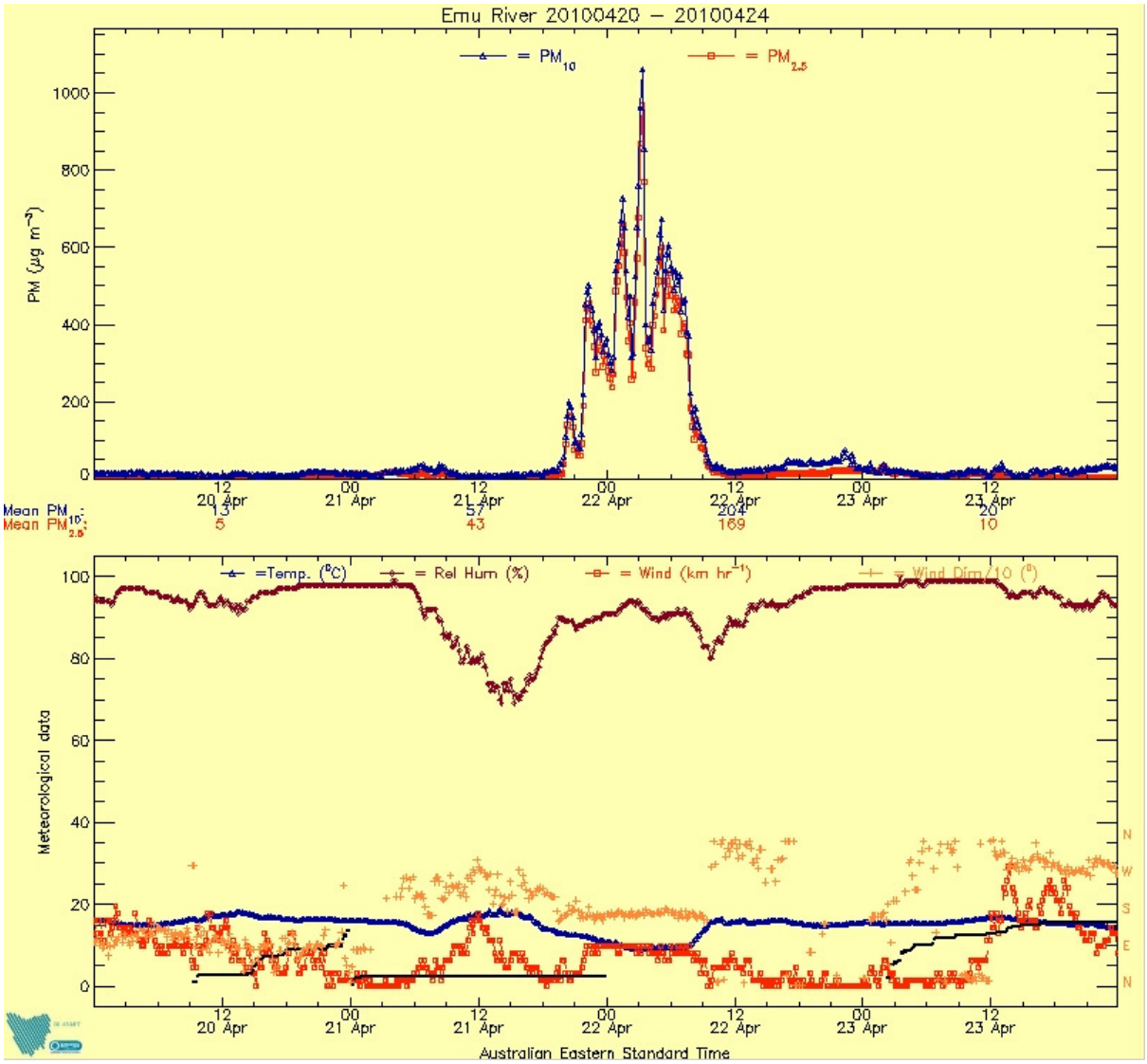

Figure 12 – Data from the BLANkET station at Emu River (near Burnie), 20-23 April 2010. Very high smoke concentrations were recorded on the night of the 21st - 22nd of April during an interval of katabatic wind.

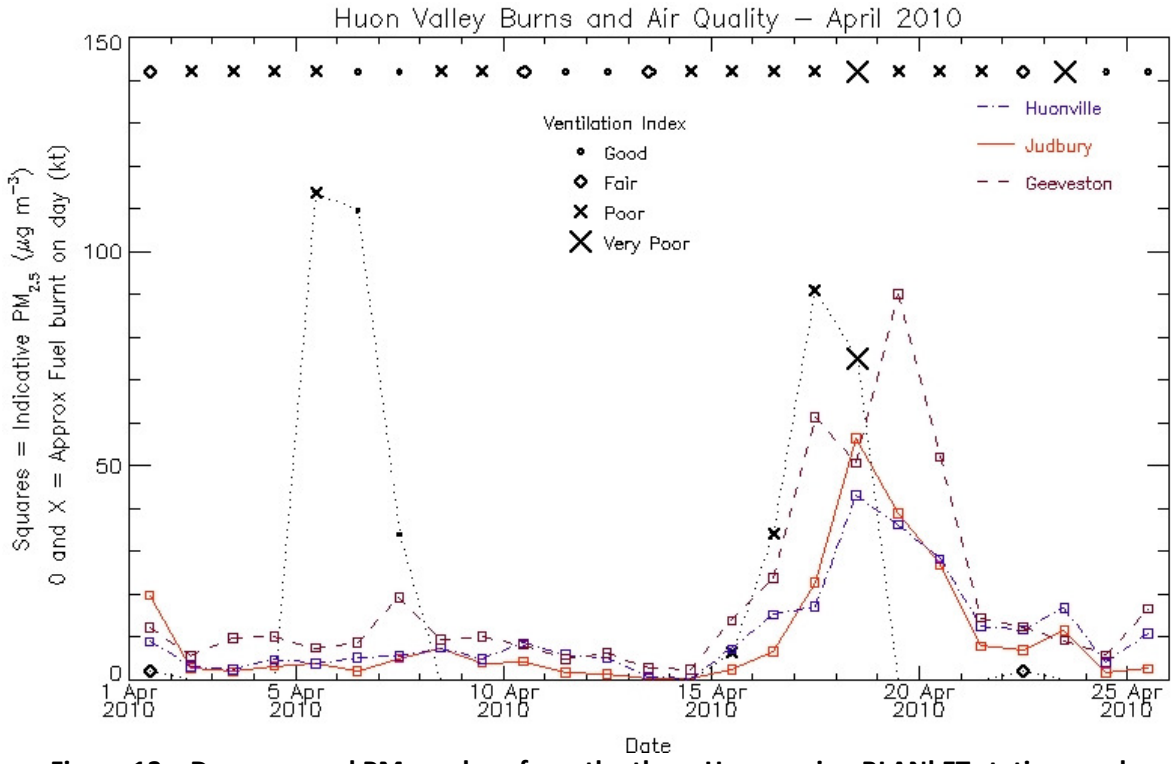

Figure 13 – Day averaged $PM_{2.5}$ values from the three Huon region BLANkET stations and estimated daily forest-industry burn-loads, April 2010. Daily burn loads are shown as the dotted line with symbols representing the calculated daily ventilation index, which is a measure of atmospheric mixing. Air quality data are shown for Huonville (dot-dashed-line), Judbury (solid line), and Geeveston (dashed line). The mid-April burns were conducted on days of poor to very poor ventilation index.

Other findings from the BLANkET network have highlighted that very poor air quality can be experienced in winter-time even in small Tasmanian communities, due to smoke from domestic wood-heaters. Figure 14 shows the day-averaged $PM_{2.5}$ data from Geeveston (population of approximately 800 in the town itself, and a similar number in the surrounding area) for April to September 2010. The mid-April increase is due to smoke from forest-industry planned burns, discussed above. The elevated levels seen from late May to early September arise from due to smoke from local domestic wood-heaters. Geeveston township is largely surrounded by low hills, and frequently experienced cold nights in winter 2010. It is likely that a temperature inversion layer often forms at night in cold weather, which together with the local topography acts to limit smoke dispersion.

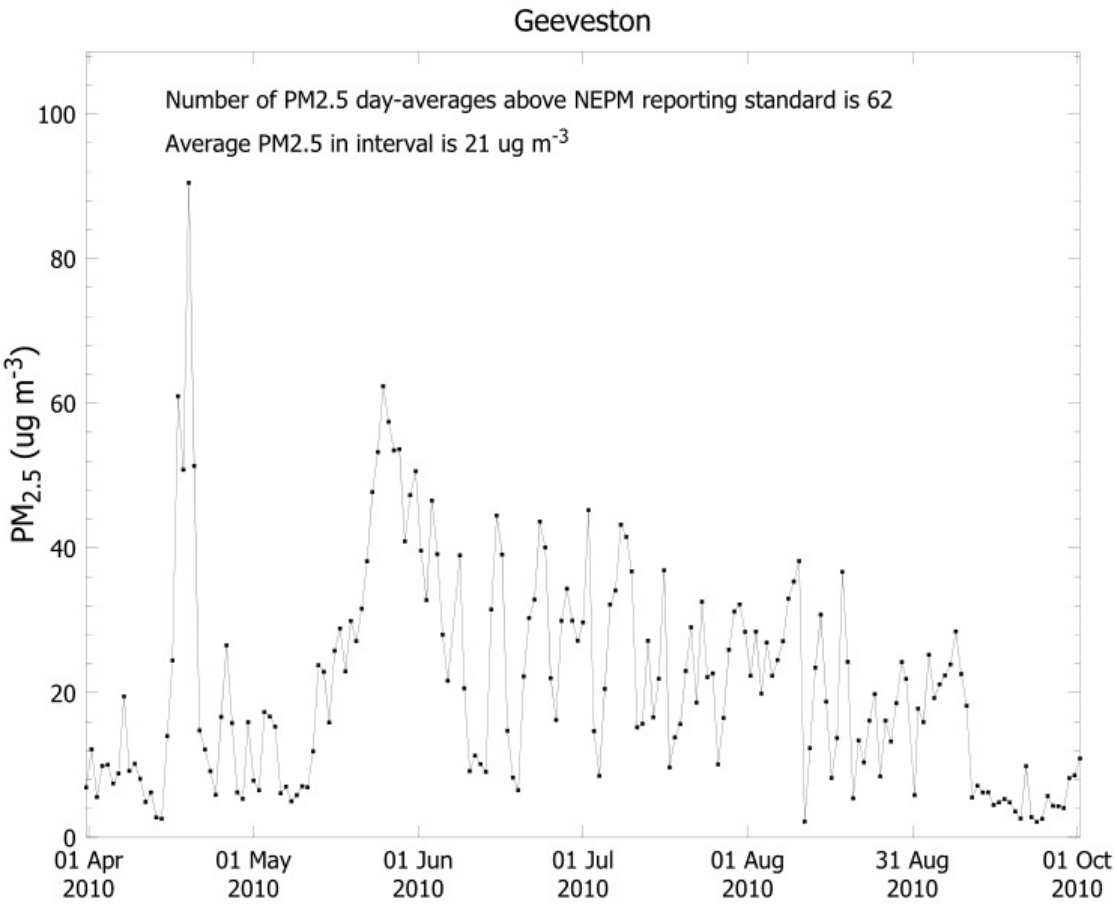

Figure 14 – Day-averaged $PM_{2.5}$ values from the Geeveston BLANkET station, April to September 2010.

An analysis of the winter 2010 BLANkET data showed that Geeveston regularly recorded the poorest air quality of all 15 stations. (Not all BLANkET stations are located in or near residential areas as at Geeveston.) There was also a clear need for a means of obtaining air quality data from towns and communities elsewhere in Tasmania to identify other localities of poor winter-time air quality.

In consequence, a car-based monitoring system was developed, called Travel BLANkET, consisting of a DRX dustrak and heated inlet, GPS, and PC datalogger. Smoke surveys were undertaken of several Tasmanian towns in late winter 2010, including Geeveston and Huonville where BLANkET stations are located. Figure 15 shows the result of one survey of New Norfolk, in the Derwent Valley, from September 2010, displayed via Google Earth. The colour of the circular symbol and its height above local ground represent the measured $PM_{2.5}$ value. The peak values were over 200 $\mu g/m^3$, and many readings were over 100 $\mu g/m^3$. The general spatial distribution of the smoke shown in this figure has been confirmed from subsequent surveys. It is clear that New Norfolk can experience very poor air quality, due to smoke from domestic heaters, in the colder months of the year. The survey work has proved

to be extremely informative. Further surveys are planned. The information will be provided to local government as part of work to reduce ambient smoke concentrations in Tasmania.

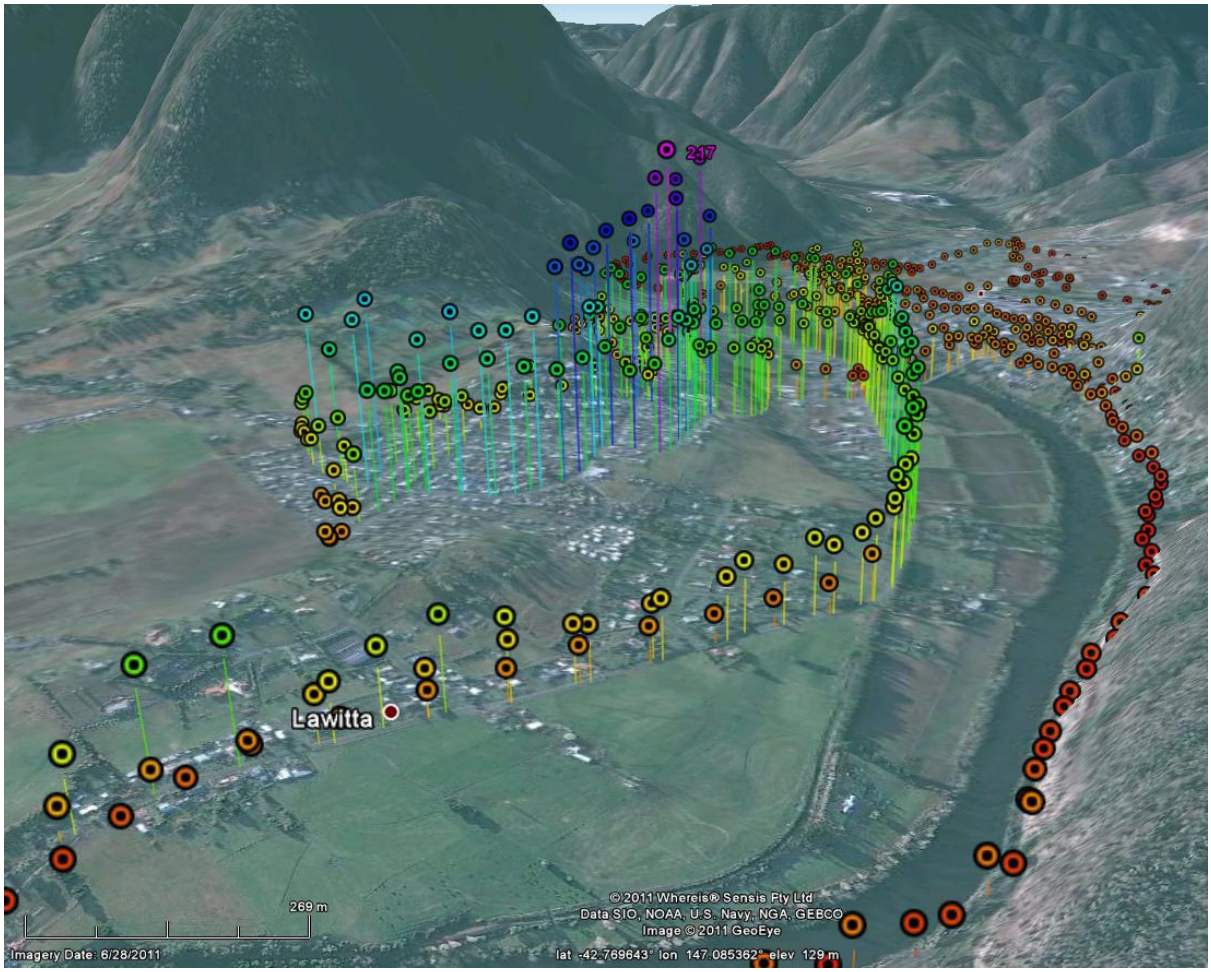

Figure 15 – Travel BLANkET $PM_{2.5}$ survey results for New Norfolk, from the evening of 8th September 2010, viewed in Google Earth. The colour of the circular symbols and their height above local ground level represent the $PM_{2.5}$ value. The peak values were over 200 µg/m^3.

Appendix B – Overview of NEPM monitoring regions

B-1 HOBART

1.1 Region Boundaries

The extent to which pollutants emitted in a given area can impact on air quality elsewhere depends on a number of factors, including topography, meteorology and the chemical and physical properties of the pollutants. The term airshed is commonly used to refer to an area that is defined by natural or topographic features affecting air quality.

In the case of a secondary pollutant (i.e. one that is formed by chemical reactions in the atmosphere, rather than being directly emitted, e.g. O_3), the airshed may extend relatively large distances from the city centre. However, for a pollutant such as PM_{10} in winter, the extent of influence may be more localised and perhaps confined to areas sharing common nocturnal-drainage airflows.

For the purpose of the Measure, the Hobart Region boundaries are defined as presented in Figure 13. Although there is no functional purpose served in exactly defining the boundary MGA co-ordinates, these may be taken to be defined by the south-west corner (Easting 500,000; Northing 521,000) and the north-east corner (Easting 550,000; Northing 5290,000).

1.2 Population and Topography

The population density and topography for the Hobart Region is presented in Figure 13. The city of Hobart is located on the narrow coastal plain of the Derwent Estuary, which lies in a well-defined valley flanked by a complex terrain of hills and mountain ranges. The majority of the region's population of 205,500 (ABS, 2006), reside within a 10 kilometre radius of the Central Business District (CBD), as illustrated in Figure 1, with significant satellite urban centres at Kingston-Blackmans Bay to the south (pop 29,000), Bridgewater-Gagebrook (pop. 14,000) and New Norfolk (pop. 6,800) to the north.

1.3 Meteorology

The prevailing wind direction for Tasmania is northwest, which is strongly modified by the complex mountainous terrain surrounding the Derwent Estuary. While the city experiences periods of strong winds during winter storms and the equinox, the city also experiences relatively calm anti-cyclonic conditions for much of the year. During these periods, the wind flows are dominated by the katabatic drainage winds flowing down the Derwent Valley during the night and early mornings, and a south-easterly sea breeze on warm afternoons. In clear, calm autumn and winter weather, relatively high levels of locally generated air pollution can be trapped in hollows and basins.

1.4 Hobart, Performance and Trend Monitoring Station

The Performance and Trend air monitoring station for Hobart was established in June 2000 at the Prince of Wales Bay sports fields, approximately 6km WNW of the Hobart CBD in the northern suburb of Glenorchy. In May 2006, following the review of the Tasmanian Air Monitoring Plan in 2005, a new Performance and Trend air monitoring station was established 2.5 km closer to the CBD at a more representative site in New Town (Figure 16).

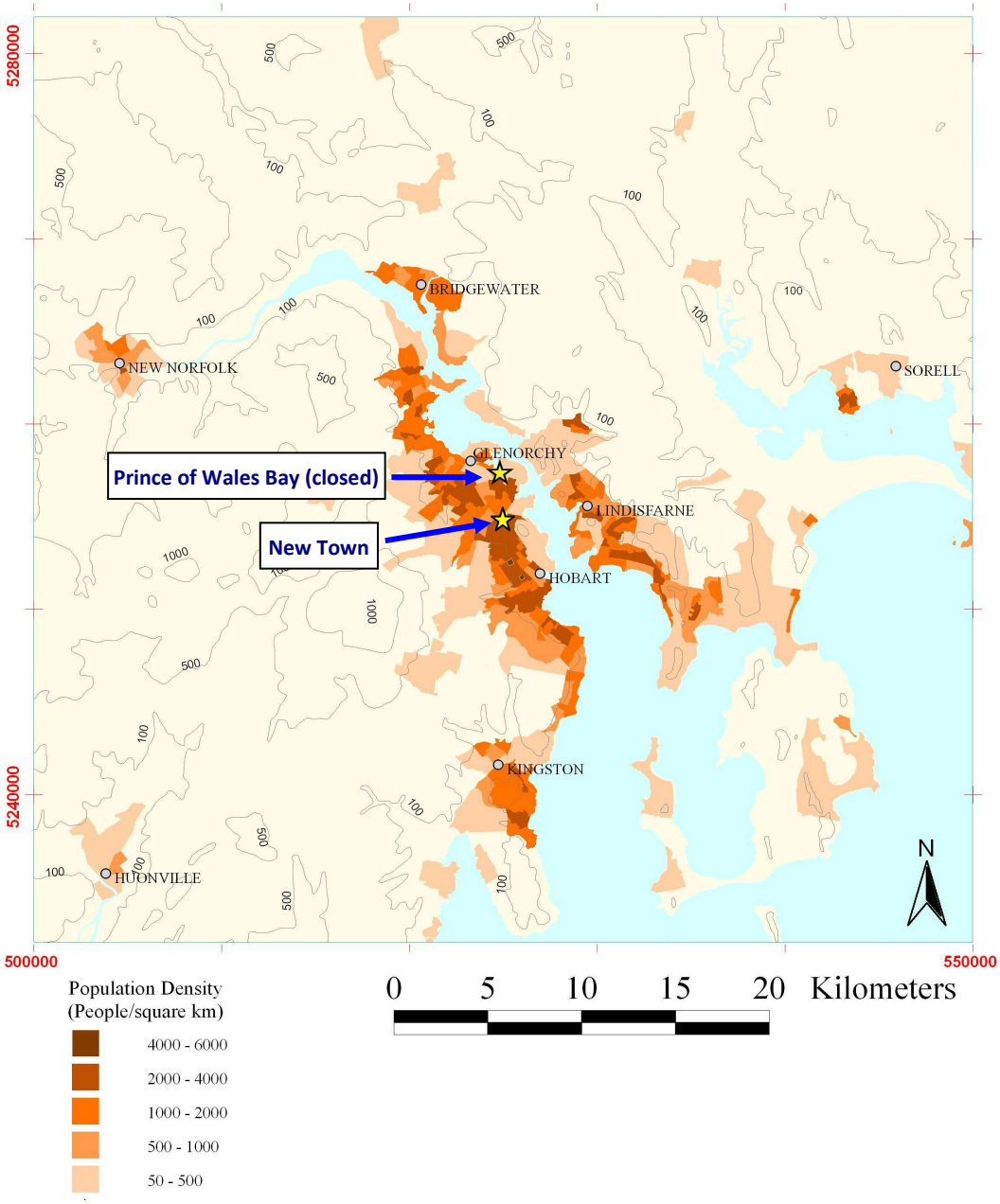

Figure 16 - Map of the Hobart Region, showing the Population Density, Topography and the location of the NEPM Air Monitoring Stations. The Prince of Wales Bay Air Station was closed in mid 2006 when the New Town station commenced operation.

1.4.1 New Town Station

In May 2006, the Environment Division moved the primary *Hobart Performance and Trend Monitoring Station* to a property in New Town leased by the Hockey Association of Tasmania, some 2.5 km SSE from the original station. The new station incorporates a PM_{10} TEOM, plus an Andersen RAAS low volume sampler for each of PM_{10} and $PM_{2.5}$, as well as one 8520 *DustTrak*™ and two 8533 DRX *DustTrak*™ particle counters for continuous indicative monitoring of particle concentrations. The choice of this site was supported by

TAPM modelling of the greater Hobart airshed, which predicts elevated smoke concentrations in the areas illustrated in Figure 17.

The following were measured at the New Town station in 2010:

- $PM_{2.5}$ measured by Andersen RAAS™ low volume air sampler (LVAS), according to AS 3580.9.10-2006, sampled every day.
- PM_{10} measured by Andersen RAAS™ low volume air sampler (LVAS), according to AS 3580.9.9-2006, sampled every day.
- PM_{10} by a TEOM direct-reading instrument.
- $PM_{2.5}$ via a second TEOM with a Size Selective Inlet and Very Sharp Cut Cyclone. This was installed and commissioned in late 2010. The TEOM $PM_{2.5}$ data came on-line from 1/1/2011.

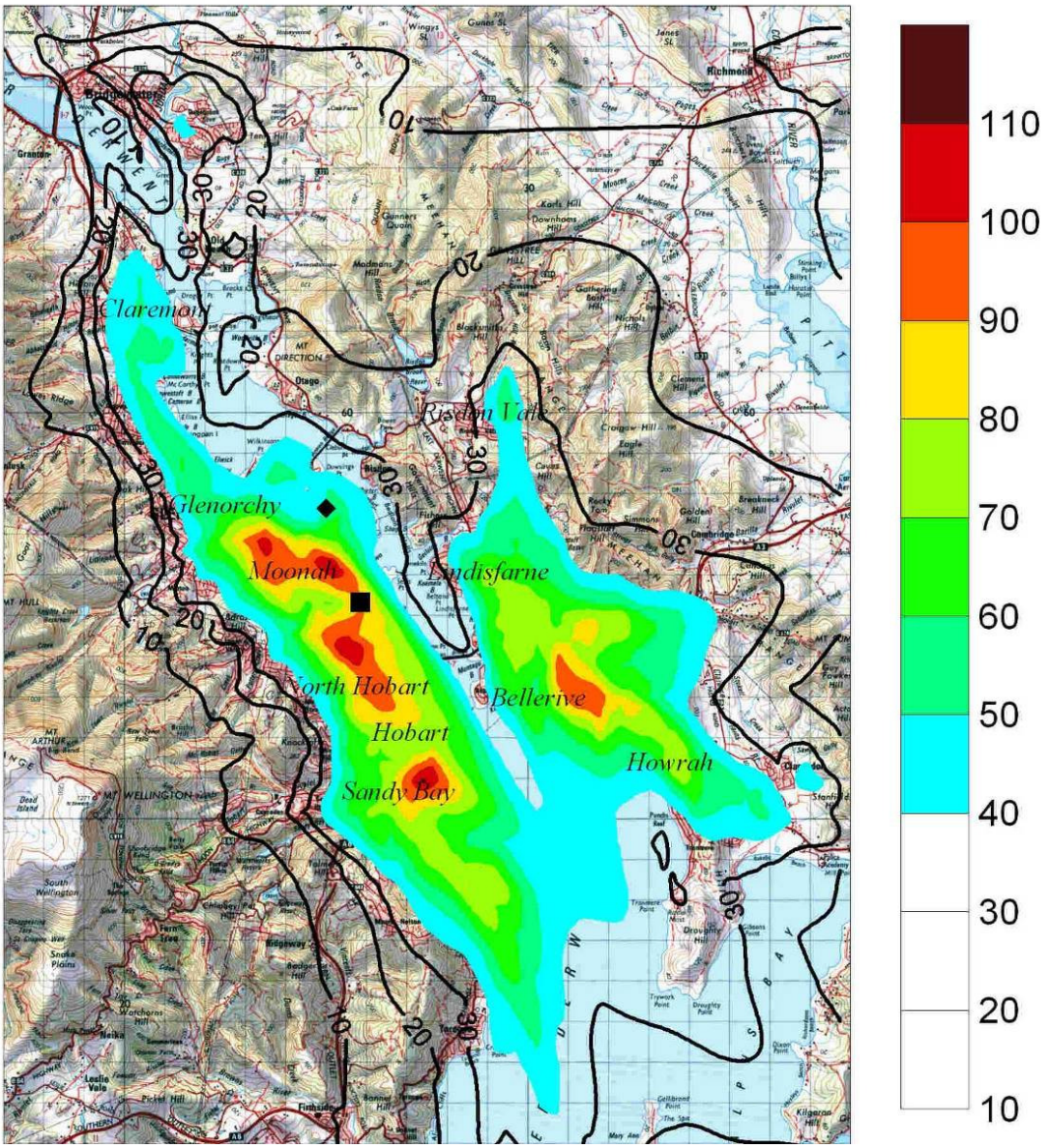

Figure 17. Results of preliminary modelling of maximum 24 hr average PM_{10} concentrations in the Hobart region, showing indicative "hot-spots" (in red) for particles. The black square and diamond symbols respectively represent the locations of the current Newtown and former Prince of Wales Bay air monitoring station.

B-2 LAUNCESTON

2.1 Region Boundaries

Launceston and the Tamar Valley as a whole have been well studied in terms of the meteorology and atmospheric dispersion of the region. Results of three-dimensional atmospheric dispersion modelling have indicated that emissions from heavy industry at Bell Bay, some 40 kilometres north-west of Launceston, may occasionally have a minor impact on air quality in Launceston under unfavourable weather conditions (DELM, 1995).

For the purpose of the Measure, the Launceston Region boundaries are defined as presented in Figure 3 and cover an area approximately 40 kilometres wide and 60 kilometres long. This area has been selected for consistency with the Tamar Valley Airshed Study (DELM, 1995). Although there is no functional purpose served in exactly defining the boundary MGA co-ordinates, these may be taken to be defined by the south-most corner (Easting 501,250; Northing 5,389,750) and the north-most corner (Easting 498,750; Northing 5,467,250).

2.2 Population and Topography

The population density and topography of the Launceston Region is presented in Figure 18.

The total population of the Launceston Region as defined in the *Air Monitoring Plan for Tasmania*, and illustrated in Figure 15, is approximately 108,000 (ABS, 2006). The city of Launceston is located on the upper reaches of the Tamar River, in a well defined valley that extends some 50 kilometres to Bass Strait. The valley axis is mostly aligned in a north-west to south-east orientation and is flanked by hills that reach heights of up to 400 m.

Most of Launceston's urban population of 64,000 is located within approximately 5 kilometres of the city centre, with the highest densities located south-east of the city centre and significant densities on the banks of the Tamar River to the north and north-west of the city.

George Town, near the mouth of the Tamar river, is the second largest urban centre in the region with a population of 6,700. While the population of George Town is below the threshold for the installation of an ambient air monitoring station under the *National Environment Protection (Ambient Air Quality) Measure (2003 – hereafter "Air NEPM")*, an industry-government funded air monitoring station has been operating on the southern edge of George Town since July 2007.

The $PM_{2.5}$ and PM_{10} levels in the Launceston region are also monitored by two TEOMs at the Rowella station in the central Tamar Estuary, as shown in Figure 18. The PM_{10} *microvol*™ air samplers at the Level 1 stations shown in Figure 18, (Beauty Point, Deviot, Riverside-Trevallyn, Rowella and Tippogorree Hills) were decommissioned during the year.

The data from these non-NEPM stations are not included in this report.

2.3 Meteorology

The prevailing winds tend to be northerly all year round in Launceston, with atmospheric calm conditions reported to be most frequent in the winter and autumn months (Power, 2000).

Available data for the Launceston region clearly indicate that high concentrations of particles are frequently associated with light winds and highly stable atmospheric conditions.

Moreover, because of night-time ground cooling and the formation of drainage flows, relatively high pollutant concentrations are likely to be found in topographic hollows and basins, and on low-lying land.

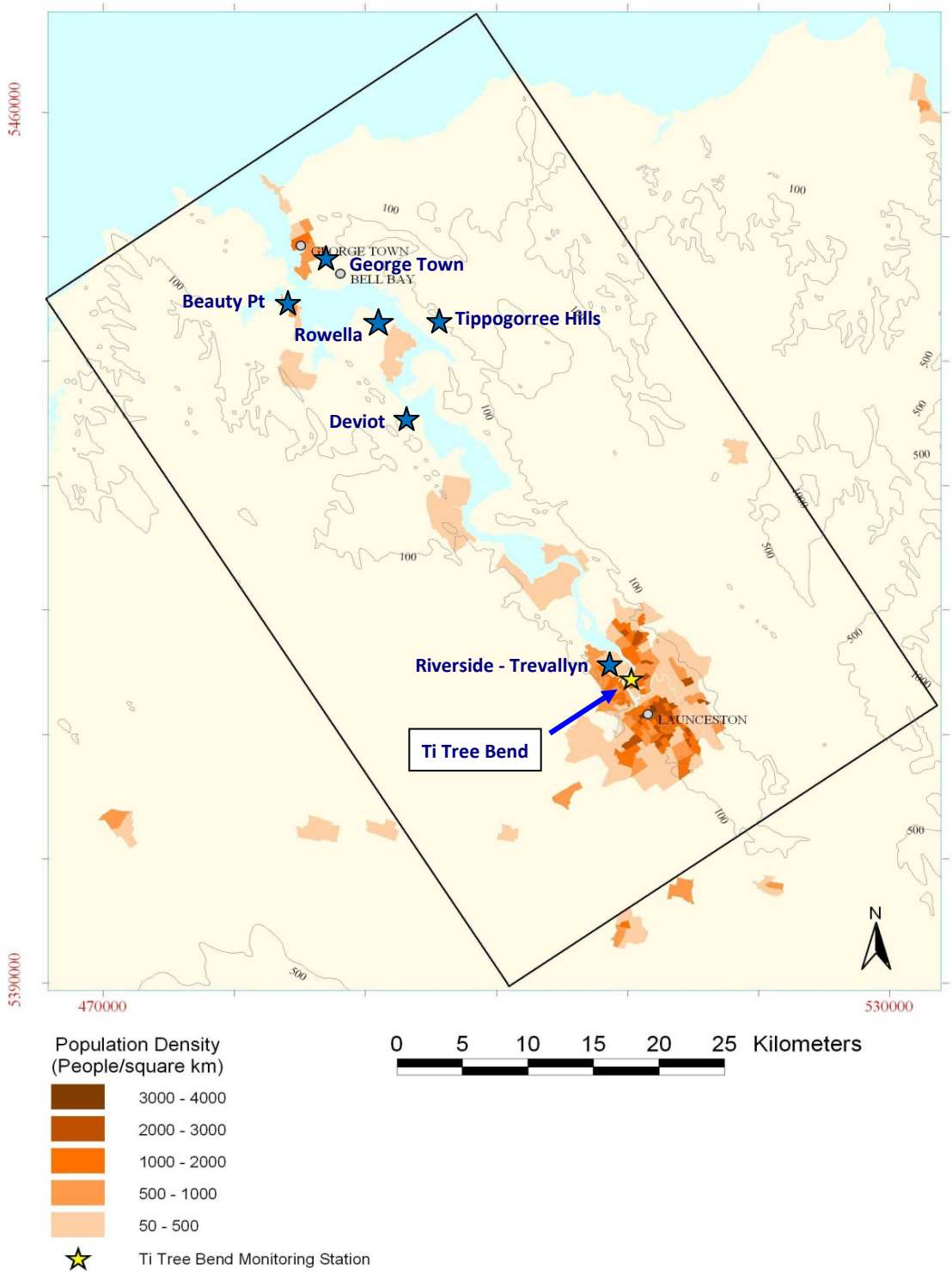

Figure 18 - Map of Launceston Region showing the Population Density, Topography and the location of Air Monitoring Stations, including the Air NEPM monitoring station at Ti Tree Bend.

2.4 Launceston, Ti Tree Bend Performance and Trend Monitoring Station.

Seasonal PM_{10} measurements using a High Volume Air Sampler have been collected at Ti Tree Bend since 1992, with year round sampling commencing in 1997. The station was established in the grounds of the Launceston Council Waste Water Treatment Plant, on the banks of the Tamar River, some 170 metres from the Launceston Weather Station operated by the Bureau of Meteorology, as illustrated in Figure 19. This station was upgraded in March 2002 with the installation of a PM_{10} TEOM, a permanent station building in 2004, and the installation of Andersen RAAS™ Low Volume Air Samplers (LVAS) for $PM_{2.5}$ and PM_{10} in August 2005, as part of the *Tasmanian Air Quality Monitoring System Development Project, 2004-2008*.

Figure 19 - Satellite image of the Ti Tree Bend Waste Water plant showing the old and new positions of the Ti Tree Bend Air NEPM monitoring station.
(Image from Google Earth.)

As noted in the 2008 NEPM Annual Report on Ambient Air Quality for Tasmania, the Ti Tree Bend air monitoring station was moved on the 16th of December 2008 to a more suitable site in the NE corner of the waste water treatment plant away from the very localised dust contamination problems associated with sludge transfer operations. Several existing trees at the new station site were removed to comply with the requirements of **AS2923** (*Ambient air - Guide for the measurement of horizontal wind for air quality applications*) and **AS3580** (*Methods for sampling and analysis of ambient air - Guide to siting air monitoring equipment*).

The following were measured at the Ti Tree Bend station in 2010.

- $PM_{2.5}$ measured by Andersen RAAS low volume air sampler (LVAS), according to AS 3580.9.10-2006, sampled every day.
- PM_{10} measured by Andersen RAAS low volume air sampler (LVAS), according to AS 3580.9.9-2006, sampled every day.
- PM_{10} via collocated TEOM direct-reading instrument.
- $PM_{2.5}$ via second TEOM with a Size Selective Inlet and Very Sharp Cut Cyclone. This was installed during the second half of 2010, with the data coming on line from 1st January 2011.

B-3 DEVONPORT

3.1 Region Boundaries

For Devonport, the availability of meteorological data tends to be relatively low. Moreover, comprehensive atmospheric dispersion models have not been developed for the Region. For these reasons, the extent of the Devonport airshed is unclear.

For the purpose of the Measure, the Devonport Region boundaries are defined as presented in Figure 6. Although there is no functional purpose served in exactly defining the boundary MGA co-ordinates, these may be taken to be defined by the south-west corner (Easting 441,000; Northing 5430,000) and the north-east corner (Easting 454,000; Northing 5444,000).

3.2 Population and Topography

The population density and topography for the Devonport Region is presented in Figure 20. The majority of the population resides within approximately a 5 km radius of the CBD. In total, the population of the Devonport Region as defined in the *Air Monitoring Plan for Tasmania* is approximately 33,500 (ABS 2006).

Devonport is located in a shallow coastal plain on the banks of the Mersey River. The Mersey connects the town of Latrobe with Devonport.

3.3 Meteorology

Westerly winds tend to prevail in the Devonport Region, with atmospheric calm conditions most frequent in winter and autumn.

Strongly stable atmospheric conditions in Devonport are normally associated with southerly, south-easterly or easterly winds draining out of the Valley. This is especially evident in winter.

3.4 Devonport Performance And Trend Monitoring Station

Campaign monitoring of particles was completed at the Devonport High School in 2003, to assess the need for a permanent station in Devonport. The results of this survey confirmed that central Devonport experienced elevated levels of PM_{10} air pollution during the winter months, which could exceed the 50 $\mu g/m^3$ NEPM 24-hr standard under calm atmospheric conditions. Initial plans to install a permanent monitoring station in the grounds of the Devonport High School in 2007 could not proceed due to limited resources, together with engineering and administrative difficulties relating to student safety and site access.

Negotiations are continuing with owners of alternative sites in the south west of the Devonport CBD, with the aim of commissioning a Devonport station in 2011.

A transportable station building and suitable monitoring instruments have been acquired to measure the following air quality parameters at the Devonport site:

- $PM_{2.5}$ measured by sequential Low Volume Air Sampler (LVAS), according to AS 3580.9.10:2006, sampled every day.
- PM_{10} measured by sequential Low Volume Air Sampler (LVAS), according to AS 3580.9.9 :2006, sampled every day.
- $PM_{2.5}$ and PM_{10} via collocated TEOM direct-reading instruments. (PM_{10} according to AS3580.9.8:2008.)

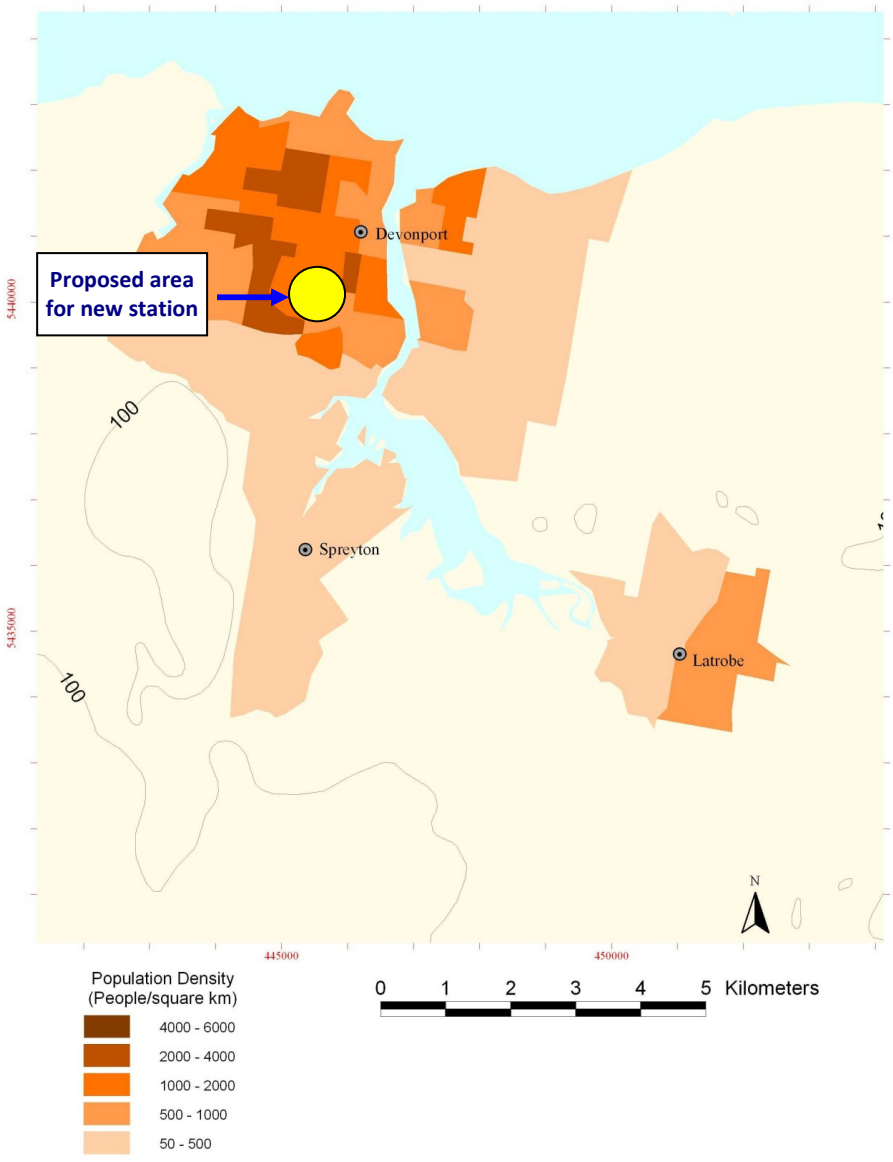

Figure 20- Map of Devonport Region Including Population Density and Topography. The region identified as suitable for the proposed Devonport air station is indicated.

APPENDIX C: REFERENCE METHODS

Australian standard methods

The reference methods specified in Schedule 3 of the *Air NEPM* for determining PM_{10} particulate concentration in ambient air are:

AS3580.9.6–1990	Determination of Suspended Particulate Matter – PM_{10} High Volume Sampler with Size Selective Inlet – Gravimetric Method.
AS3580.9.7-1990	Determination of Suspended Particulate Matter - PM_{10} Dichotomous Sampler – Gravimetric method

Advances in air sampler technology and the requirement to measure smaller particulate size fractions have seen the widespread adoption of US EPA compliant low volume air samplers as the preferred method for the measurement of PM_{10} and $PM_{2.5}$ in ambient air. These techniques are now recognised by the following Australia/New Zealand standards:

AS3580.9.9:2006	Methods for sampling and analysis of ambient air - Determination of suspended particulate matter - PM10 low volume sampler - Gravimetric Method.
AS3580.9.10:2006	Methods for sampling and analysis of ambient air - Determination of suspended particulate matter - PM2.5 low volume sampler - Gravimetric Method.

The Thermo-Electron/Andersen RAAS and Partisol sequential low volume air samplers used by the Environment Division are recognised as Reference Methods for $PM_{2.5}$ and PM_{10} monitoring in the US EPA *List of Designated Reference and Equivalent Methods* (www.epa.gov/ttn/amtic/criteria.html). Details are provided in the following table.

Air Sampler	Size	USEPA Approval No.
Andersen Model RAAS10-300	PM_{10}	Manual Reference Method RFPS-0699-132
R&P Partisol®-Plus Model 2025	PM_{10}	Manual Reference Method RFPS-1298-127
Thermo-Electron Model RAAS2.5-300	$PM_{2.5}$	Manual Reference Method RFPS-0699-132
R&P Partisol®-Plus Model 2025 FEM	$PM_{2.5}$	Manual Reference Method RFPS-1298-145

Continuous monitoring of the PM_{10} particle concentrations at both Launceston and Hobart have been performed using TEOMs fitted with a PM_{10} size selective inlet, in accordance with AS/NZS 3580.9.8:2008 (*Methods for sampling and analysis of ambient air – PM_{10} continuous direct mass method using a tapered element oscillating microbalance analyser*)

Where practicable, the daily average PM_{10} concentrations measured by an approved low volume air sampler were used for the purposes of determining compliance with the NEPM Standard. When LVAS data were not available, the daily average PM_{10} measurement from

the TEOM was used, with the following empirical temperature adjustment developed for Tasmanian conditions.

Adjusted PM_{10} = Measured PM_{10} x Temperature Correction Factor [TCF]

Where TCF = 1.00 for 24 hr average temperature $[T_{24}] \geq 15°C$

= $1.00 + (15 - T_{24}) / 25$ $0°C < T_{24} < 15°C$

= 1.60 When $T_{24} \leq 0°C$

Note: This reflects a change from 2007 and earlier years where TCF was previously:

TCF = 1.00 for 24 hr average temperature $[T_{24}] \geq 15°C$

= $1.00 + (15 - T_{24}) / 15$ for $0°C < T_{24} < 15°C$ and

= 2.00 $T_{24} \leq 0$.

(See the 2008 Tasmanian Monitoring Report for a discussion of this issue.)

The uncertainties associated with the low-volume measurements (U95) are estimated to be 1.4 µg/m^3 at 25 µg/m^3 and 2.6 µg/m^3 at 50 µg/m^3. For the day-averaged TEOM PM_{10}, 95% of the measurements are within 6 µg/m^3 of the low-volume air sampler value for simultaneous observations.