REPORT AGAINST THE

NATIONAL ENVIRONMENT PROTECTION MEASURE

FOR AMBIENT AIR QUALITY FOR 2008

BY TASMANIA

June 2009

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SECTION A – MONITORING SUMMARY

INTRODUCTION

The Environment Division of the Tasmanian Department of Environment, Parks, Heritage, and the Arts (DEPHA) continues to monitor air quality at its NEPM measuring stations in Launceston (Ti Tree Bend) and Hobart (Newtown), using Low Volume Air Samplers (LVAS) and Tapered Element Oscillating Microbalance (TEOM) instrumentation for PM_{10} and LVAS for $PM_{2.5}$.

A 12-month equivalence study for the PM_{10} low volume samplers against High Volume Air Samplers, noted in the amended Tasmanian Air Monitoring Plan (2005), was not able to be carried out for reasons noted below.

The planned installation of the Devonport ambient air monitoring station did not take place in 2008 due to logistical and resource issues. However air dispersion modelling studies and sampling surveys in Devonport were carried out in mid 2008. The results of the modelling and surveys identified a potentially suitable site in the south of the urban area. (See Appendix 2 for more details of this work.) Negotiations with the owners of the proposed site commenced soon afterwards, but were complicated by a change in the owner's corporate governance structure. However, in-principle agreement to establish a station on this site has now been reached. It is expected the station will be commissioned in Devonport during in late 2009.

Other air monitoring programmes, not for NEPM reporting, are also being conducted in Tasmania.

(i) 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}, $PM_{2.5}$ using Low Volume Air Samplers and levels of SO_2 and NO_x using gas analysers. Continuous particle monitoring is also provided by means of 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.

(ii) In late 2007 the Environment Division took over the operation of the lower Tamar air monitoring stations established in 2006 by the Tasmanian Regional Planning and Development Council (RPDC), as part of the baseline environmental studies required prior to the construction and operation of the proposed pulp mill at Longreach. Initially this network consisted of a primary Level 2 station at Rowella and 10 Level 1 stations located in the surrounding region, including one which was collocated with the Level 2 station at Rowella. In late 2007 some of the continuous monitoring equipment at the Level 2 station was decommissioned. Five of the Level 1 stations were also decommissioned. Since then the Level 2 station at Rowella has continued to monitor $PM_{2.5}$ and PM_{10} particles using TEOM instrument and the levels of sulphur dioxide, oxides of nitrogen and Total Reduced Sulphur (TRS) using gas analysers. The remaing five Level 1 stations located at Beauty Point, Deviot, Riverside, Tippogorrie Hills and Rowella, continue to monitor PM_{10} and hydrogen sulphide levels using Microvol^{TM} air samplers and passive adsorption samplers respectively.

(iii) In the Autumn of 2008 large areas of Tasmania were affected on several occasions by smoke from planned burns, conducted largely by the forestry industry, but also from agricultural, fuel reduction and environmental management burns. These smoke events have also occurred in previous years. As a response to the autumn smoke, in late 2008 the Environment Division of the Department of Environment, Parks, Heritage and the Arts (DEPHA) proposed to establish a regional network of air monitoring stations to determine the effects of forestry, agricultural burning and other smoke generating activities on air pollution levels in country centres. This network – the *Base-Line Air Network of EPA Tasmania* (BLANkET) will consist of up to 15 stations, equipped with nephelometric instruments, located near communities that are likely to be affected by smoke from planned burn operations. Appendix 3 discusses the specific autumn 2008 smoke events and general issues related to planned burn smoke in Tasmania.

Plans to monitor CO concentrations at a peak site within the Hobart CBD have been delayed due to difficulties in negotiating access to suitable locations.

OVERVIEW OF REGIONS

A-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. These factors include topography, meteorology and the chemical and physical properties of 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.

In the past the availability of meteorological data for Hobart has been limited. Moreover, development of complex atmospheric dispersion models for the region has only recently commenced, so the extent of the Hobart airshed is not yet fully characterised.

For the purpose of the Measure, the Hobart Region boundaries are defined as presented in Figure 1. 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 1. 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 1).

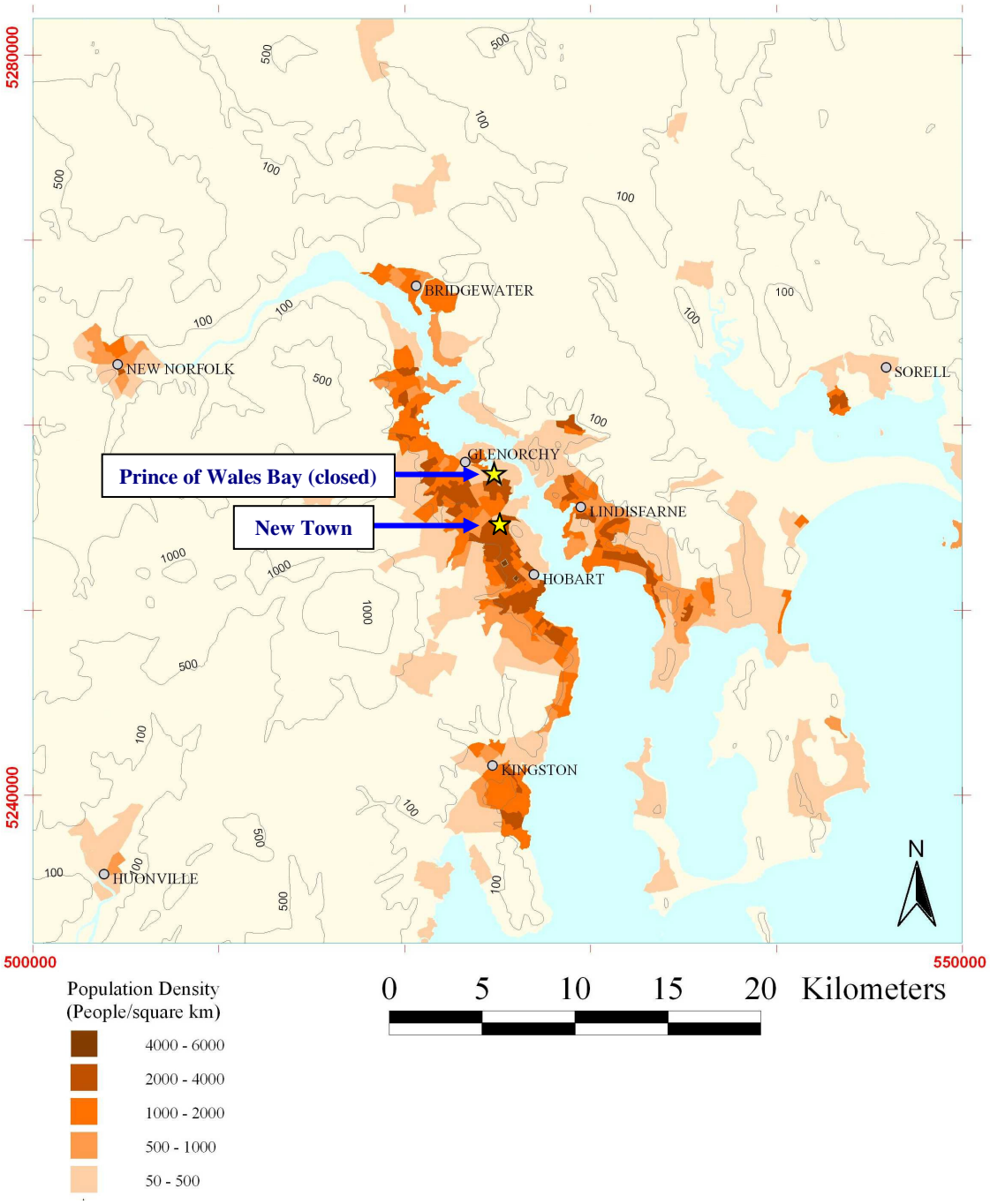

Figure 1. Map of the Hobart Region, showing the Population Density, Topography and the location of the NEPM Air Monitoring Stations. The Prince of Wales Bay Air Station was closed in mid 2006 when the New Town station commenced operation.

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 the PM_{10} TEOM from the decommissioned Prince of Wales Station, plus an Andersen RAAS low volume sampler for each of PM_{10} and $PM_{2.5}$, as well as a *DustTrak*™ particle counter for continuous indicative monitoring of fine 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 2.

The following indicators were measured at the New Town station in 2008:

- $PM_{2.5}$ 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.
- A collocated TEOM direct-reading instrument with a PM_{10} head.

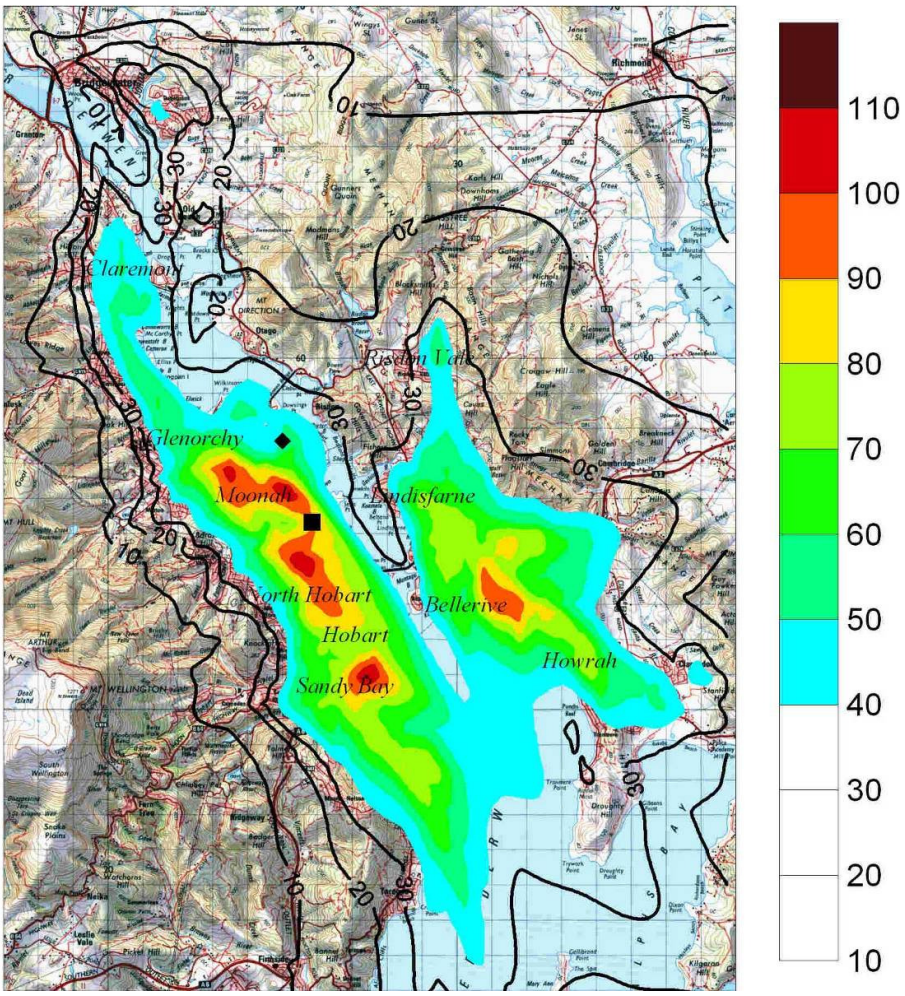

Figure 2. Results of preliminary modelling of maximum 24 hr average PM10 concentrations in the Hobart region, showing indicative "hot-spots" (in red) for particles. The black square and diamond symbols respectively represent the locations of the current Newtown and former Prince of Wales Bay air monitoring stations.

A-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 3.

The total population of the Launceston Region as defined in the *Air Monitoring Plan for Tasmania*, and illustrated in Figure 3, 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 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. An additional five Level 1 stations equipped with PM_{10} *microvol*™ air samplers are located at Rowella, Beauty Point, Deviot, Tippogorree Hills and Riverside-Trevallyn, as shown in Figure 3. The data from these non-NEPM stations are not included in this report, but some results are noted where relevant.

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.

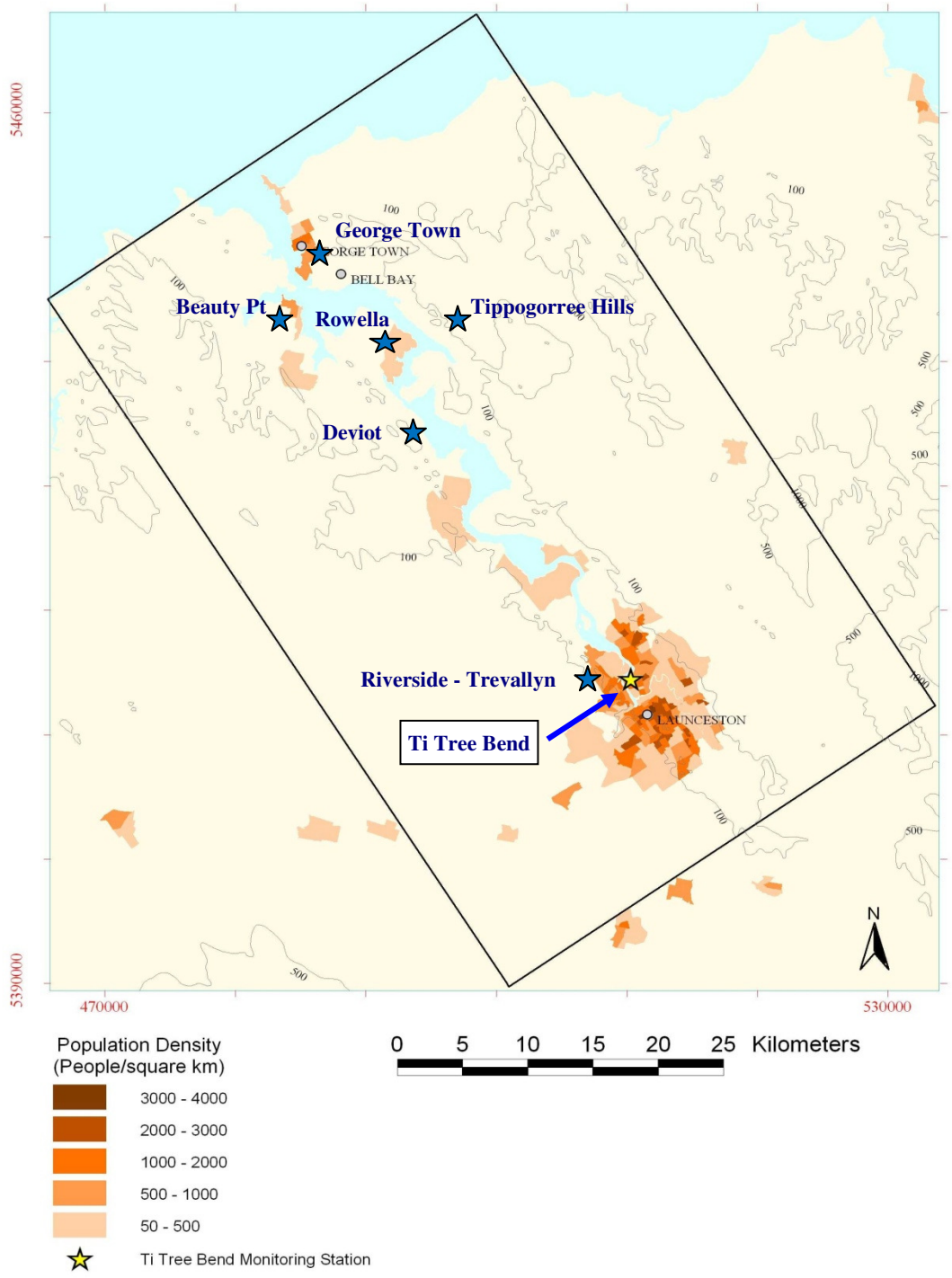

Figure 3. Map of Launceston Region showing the Population Density, Topography and the location of Air Monitoring Stations.

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 300 metres from the Launceston Weather Station operated by the Bureau of Meteorology, as illustrated in Figure 4. 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 4. Satellite image of the Ti Tree Bend Waste Water plant showing the old and new positions of the DEPHA air monitoring station. (Image from Google Earth.)

As was noted in the 2007 NEPM Annual Report on Ambient Air Quality for Tasmania, the Ti Tree Bend station experienced a loss of representative PM_{10} data in hot dry weather on 3 reported days in 2007. This was a result of contamination by wind-blown dust generated by the movement of vehicles on the nearby unsealed service road and from dirt piles that were temporarily, but repeatedly, deposited and removed from the vicinity of the station (see Figure 5).

In order to prevent such data signal contamination in the future, on the 16th of December 2008, the station was moved approximately 200m NNE to a more suitable site in the NE corner of the waste water treatment plant, as shown in Figure 4. Several existing trees near the station 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*). This part of the treatment plant experiences greatly reduced road traffic and is not subject to

locally produced dust from settling pond operations. The relocation resulted in the station not collecting data on the 16th and 17th of December 2008.

Figure 5. Ti Tree Bend air station (container at right) at its original location (pre-16 December 2008), showing the proximity of (temporary) dirt piles, removed from the nearby settling ponds. In dry windy weather, or when plant vehicles were working here, the air station could experience significant local dust contamination.

The following indicators were measured at the Ti Tree Bend station in 2008.

- $PM_{2.5}$ 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.
- A collocated TEOM direct-reading instrument with a PM_{10} head.
- In addition, comparative studies have been undertaken of DustTrak particle counters against the above methods, as part of the Launceston wood heater Program.
- It is planned to install a second TEOM with a $PM_{2.5}$ head, during the second half of 2009.

A-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 6. 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 Devonport in 2003, to assess the need for a permanent station. 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. In response to these findings, planning was undertaken to install a monitoring station in the grounds of the Devonport High School in 2007 as part *The Tasmanian Air Quality Monitoring System Development Project, 2004-2008*, but this plan could not proceed due to limited resources, together with engineering and administrative difficulties relating to student safety and site access.

Following modelling studies and surveys with a portable particle counter (see Appendix 2), an alternative site, meeting the requirements of AS2923 and AS3580, has been identified in an open space to the south west of the Devonport CBD, as shown in Figure 6. Negotiations with the land owners at are at an advanced stage, and at this stage, it is expected that this station will be commissioned in the second half of 2009.

Equipment has been acquired to measure the following air quality indicators 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.
- A collocated dichotomous TEOM direct-reading instrument for $PM_{2.5}$ and PM_{10}. (PM_{10} according to AS3580.9.8:2008.)

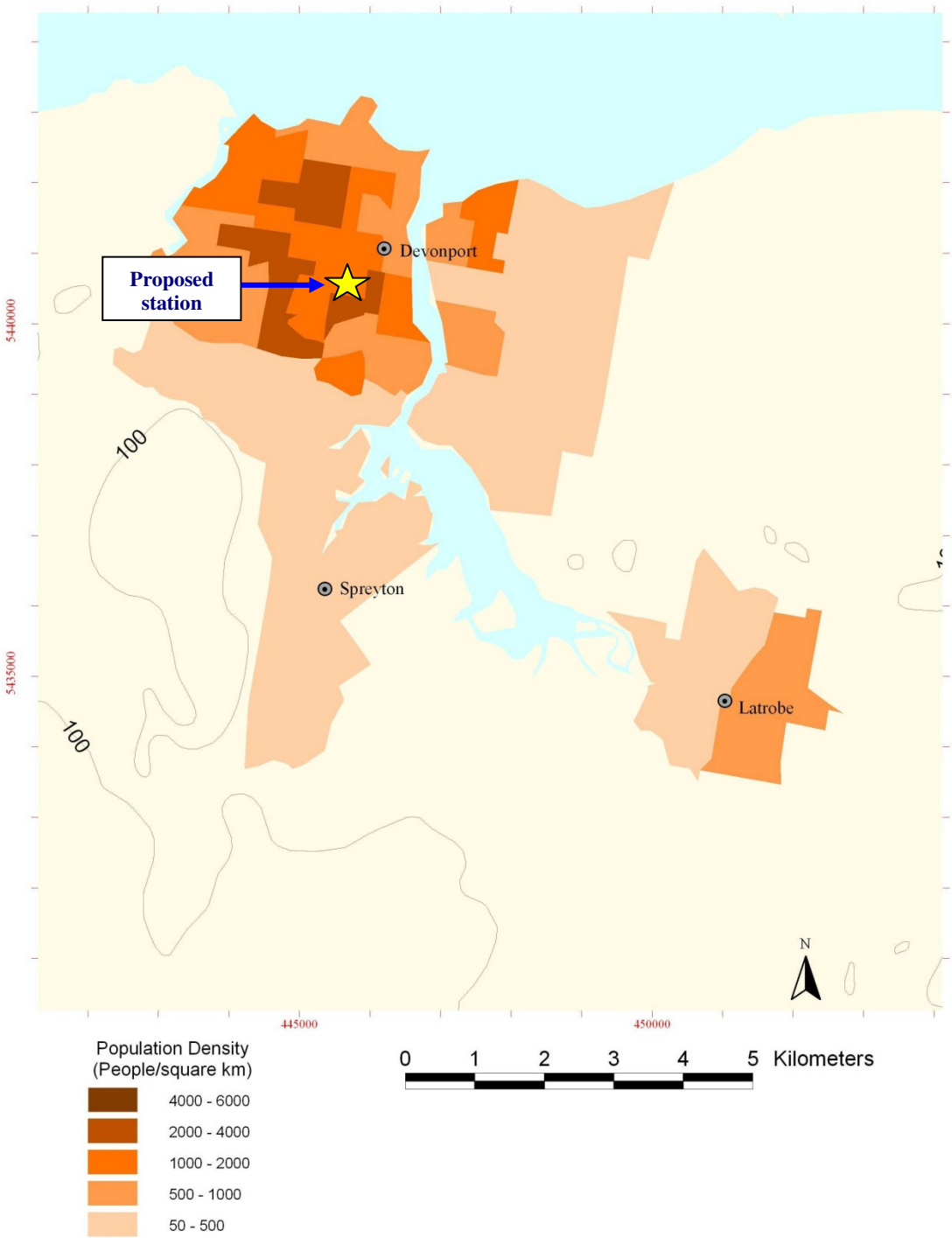

Figure 6. Map of Devonport Region Including Population Density and Topography. The location identified as a suitable site for the proposed Devonport air station is indicated.

A-4. REFERENCE 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 - PM_{10} low volume sampler - Gravimetric Method.
AS3580.9.10:2006	Methods for sampling and analysis of ambient air - Determination of suspended particulate matter - $PM_{2.5}$ 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 the following Manual 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):

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. In the absence of validated air sampler data, 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}] >/= 15°C
			1.00 + (15 - T_{24}) / 25	0°C < T_{24} < 15°C
			1.60	When T_{24} =< 0°C

Note: this reflects a change from 2007 and earlier years where TCF was previously equal to:

TCF =1.00	for 24 hr average temperature [T_{24}] >/= 15°C
TCF =1.00 +(15 - T_{24}) / 15	for 0°C < T_{24} < 15°C and

TCF = 2.00 for T_{24} =<0.

The previous TCF values came from the regression of TEOM and high-volume PM_{10} data. The new TCF was able to be determined from comparison of TEOM data with three years of low-volume air sampler data (2006-2008) from Hobart and Launceston air stations. The change in the corrected TEOM values from applying the new TCF compared to the previous TCF is of order 20% for T_{24} = 5 C. The overall effect of this change in TCF on the final data is relatively small, as there are few days with T_{24} of 5 C or below. The new TCF has not been retrospectively applied to the historical TEOM data in the Tasmanian Air Quality Database for measurements prior to 1st January 2006, but is applied to TEOM data collected after and including that date. The 1st January 2006 is chosen as it demarcates the interval where the primary PM_{10} data sources at Hobart and Launceston air stations were high-volume air samplers (pre 1st January 2006) from the interval when the primary data sources are low-volume air samplers (from 1st January 2006 onwards). The historical number of recorded exceedences of the Air NEPM PM_{10} standard has not affected by the application of the new TCF to the post 1st January 2006 data.

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.

A-5. PROGRESS TOWARDS NATA ACCREDITATION

Progress towards NATA Accreditation for the Environment Division of the Tasmanian Department of Environment, Parks, Heritage and the Arts (DEPHA) Ambient Air Monitoring Programme continued to be made in 2008. Following a successful advisory desk audit by a NATA assessor in November, a full external audit of the Air Monitoring Programme by an accredited NATA inspector is scheduled for February 2009.[1]

[1] Following the external audit by two NATA assessors on 16th and 17th February 2009, and subsequent corrective actions to address minor non-compliance issues identified in the audit, the Tasmanian ambient air monitoring programme received accreditation (NATA Certificate No. 16646) 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.

The quality assurance system is being expanded with the intention to apply 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, and PM_{10} monitoring using the TEOM according to AS3580.9.8:2008.

A-6 SITING CRITERIA FOR AIR QUALITY MONITORING STATIONS

The following Australian Standards were used to select appropriate locations for Tasmania's air quality monitoring stations in Hobart and Launceston.

6.1 APPLICABLE AUSTRALIAN STANDARDS

1. AS2922 (Guide for siting of sampling)

   Critical criteria for location of sampling site:

   (i) Hg = Height of sampling inlet above ground. (2 to 5 m)

   (ii) Ho = Height of nearby obstacle above sampling inlet

   (iii) D = Horizontal Distance to nearby obstruction - typically >20 m.

   (iv) 120^0 = Minimum clear sky angle above sampling inlet

2. AS2923 (Ambient Air- Guide for the Measurement of Wind).

   Critical criteria for placement of 10 m meteorological tower

   Recommended minimum distance from obstruction = 10 x H

   Where H = Height of obstruction

6.2 COMPLIANCE WITH APPLICABLE STANDARDS

(i) New Town Air Quality Monitoring Site, Hobart

The Air Monitoring Station is located in a corner of an old jam factory site at 0 Bell St, New Town, which is currently used as a hockey complex. This air monitoring site has several obstructions within critical distances.

AS2922 (*Guide for siting of sampling*)

No.	Obstruction Description	Distance D (m)	H_o (m)	$2 H_o \leq D$	120^0 Sky Angle
1	Power Pole [1]	**3**	**7.6**	Does not comply	Does not comply
2	Met Mast [1]	**6**	**6.6**	Does not comply	Does not comply
3	Brick Wall	**15**	**-1**	Complies	Complies
4	Chimney	**50**	**22.6**	Complies	Complies

AS2923 (Ambient Air - Guide for the Measurement of Wind).

No.	Obstruction Description	Distance (m)	Height (m)	D > 20m	D > 10H
1	Power Pole [1]	**5**	**11**	Does not comply	Does not comply
2	Brick Wall	**13**	**2.4**	Does not comply	Does not comply
3	Chimney	**47**	**26**	Complies	Does not comply

Note 1. The power pole and meteorological masts are integral parts of the air monitoring station, and do not have a significant effect on air flow to the samplers and meteorological instruments.

6.2 COMPLIANCE WITH APPLICABLE STANDARDS (continued)

(ii) Ti-Tree Bend Air Quality Monitoring Site, Launceston.

The Launceston Ambient Air Quality Monitoring Station is located within the grounds of the Launceston City Council Waste Water Treatment Plant at Ti-Tree Bend. Until 15th December 2008, the station building and instruments were located besides the 4 settling lagoons away from the built-up area of the sewage treatment plant as described in section 2.4.

AS2922 (*Guide for siting of sampling*) – Old station location (1992-Dec 2008)

No.	Obstruction Description	Distance D (m)	H_o (m)	$2 H_o \leq D$	120^0 Sky Angle
1	Met Mast [1]	**8**	**6.6**	Did not comply	Did not comply
2	Tree 1	**27**	**6.6**	Complied	Complied
3	Shed 1	**30**	**1.6**	Complied	Complied
4	Shed 2	**50**	**1.6**	Complied	Complied

AS2923 (Ambient Air - Guide for the Measurement of Wind). Old station location (1992-Dec 2008)

No.	Obstruction Description	Distance (m)	Height (m)	D > 20m	D > 10H
1	Tree 1	**38**	**10**	Complied	Did not comply
2	Shed 1	**22**	**5**	Complied	Did not comply
3	Shed 2	**55**	**5**	Complied	Complied

Note 1. The meteorological mast is an integral part of the air monitoring station, and did not have a significant effect on air flow to the samplers and meteorological instruments.

AS2922 (*Guide for siting of sampling*) – New station location (18 Dec 2008 onwards)

No.	Obstruction Description	Distance D (m)	H_o (m)	$2 H_o \leq D$	120^0 Sky Angle
1	Met Mast [1]	**9**	**6.2**	Does not comply	Does not comply

AS2923 (Ambient Air - Guide for the Measurement of Wind). New station location (18 Dec 2008 onwards)

No.	Obstruction Description	Distance (m)	Height (m)	D > 20m	D > 10H
1	Equipment shelter[2]	**9**	**3.8**	Does not comply	Does not comply

Note 1. The meteorological mast is an integral part of the air monitoring station, and does not have a significant effect on air flow to the samplers and meteorological instruments.

Note 2. The equipment shelter houses the Air Quality instruments.

SECTION B – ASSESSMENT OF COMPLIANCE WITH STANDARDS AND GOALS

B-1 PARTICULATE MATTER

The monitoring results from 1st January 2008 to 31st December 2008, at Tasmanian Performance Monitoring stations are presented in Table 1.

Table 1: Summary of Performance against Standards for PM_{10} and $PM_{2.5}$ at Tasmanian Monitoring stations for the 2008 calendar year.

Region/Performance Monitoring Station	Data Availability Rates (% of days for sampling regime 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***	***Period***	***No.***	
PM_{10} (All instruments)	100	100	100	100	100	24 hour	0	***MET***
- LVAS (every day)	93	80	62	99	84	24 hour		
- TEOM [1,2]	98	100	100	99	99	24 hour		
$PM_{2.5}$ *Reporting Standard*	95	76	97	99	92	24 hour	9	
- LVAS (every day)	Average annual $PM_{2.5}$ conc. = 7.3 µg m^{-3}					Annual		
Launceston: Ti Tree bend	***Q1***	***Q2***	***Q3***	***Q4***	***Annual***	***Period***	***No.***	
PM_{10} (All instruments)	92	100	100	98	98	24 hour	1	
- LVAS (every day)	84	50	98	96	82	24 hour		***MET***
- TEOM[1,2]	92	98	98	98	96	24 hour		
$PM_{2.5}$ *Reporting Standard* - LVAS (every day)	81	78	95	90	86	24 hour	17	
	Average annual $PM_{2.5}$ conc. = 8.8 µg m^{-3}					Annual		
Devonport: (Site: TBD) PM_{10} and $PM_{2.5}$	Station scheduled to begin operation in late 2009 No data					24 hour	N/A	

Notes: 1. Temperature adjusted using local model according to Technical Guidance Paper 10

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

Where TCF = 1.00 for 24 hr average temperature [T_{24}] >/= 15°C
1.00 + (15 - T_{24}) / 25 0°C < T_{24} < 15°C
1.60 When T_{24} =< 0°C

2. Day-averaged TEOM data are used only when LVAS PM10 data are not available.

Note: National air quality standards:
PM_{10}: 24-hour standard is 50 µg m^{-3}, goal is for no more than 5 exceedences per year.
$PM_{2.5}$: 24-hour advisory reporting standard is 25 µg m^{-3}, annual average advisory reporting standard is 8 µg m^{-3}.

B-2 SCREENING FOR OTHER POLLUTANTS

Monitoring for other listed Air NEPM pollutants is not performed at the Tasmanian NEPM stations of Launceston and Hobart because screening studies carried out previously in Tasmania indicated the likely levels of these pollutants would be well below the corresponding NEPM standards. The details of these screening studies were presented in the Air NEPM Monitoring Plan for Tasmania (available online at http://www.environment.tas.gov.au/index.aspx?base=83), and are summarised in the Table 2 below.

Table 2: Screening Results for other Air NEPM pollutants:

Pollutant (Air NEPM standard)	Hobart	Launceston
Ozone (0.1 ppm, 1 hour)	Sampled 1994-1995, maximum 1-hr level was 0.03 ppm	Sampled 1992-1993, maximum 1-hr level was 0.04 ppm
Nitrogen Dioxide (0.12 ppm, 1hour; 0.03 ppm, 1-year)	See note below	Sampled 2007 May - 2008 February Peak 0.04 ppm, 1-hour Mean 0.004 ppm, 1-hour
Carbon Monoxide (9.0 ppm, 8 hours)	Sampled 2000-2004 (Prince of Wales Bay) Peak level was 2.3 ppm (8-hr), 95th percentile was 0.4 ppm (8-hr)	Sampled 2007 May-September Peak level was 2.7 ppm. Mean level was 1.0 ppm (1-hr)
Sulphur Dioxide (0.2 ppm, 1 hour; 0.08 ppm, 1 day; 0.02 ppm, 1 year)	See note below	See note below
Lead (50 µg m^{-3}, 5 days/year)	Sampled 1989-1996 (intermittently). Annual average for 1996 was 0.2 µg m^{-3}	Sampled 1993-1998. Annual average for 1998 was 0.02 µg m^{-3}

Nitrogen Dioxide. NO_2 monitoring is conducted at George Town, some 50 km north-east of Launceston, near the industrial facilities of Bell Bay. Measurements here from mid 2007 to the current date showed a maximum hourly NO_2 concentration of just under 0.080 ppm. The 90th percentile of the hourly values was 0.009 ppm. The maximum daily concentration was 0.020 ppm, and the mean daily concentration was 0.003 ppm. Under certain conditions Launceston may receive polluted air from Bell Bay, however the concentrations of NO_2 at Launceston under these circumstances is expected to be well under the NEPM standard. Based on the likely sources on NO_2 in Tasmania, it is considered likely that Hobart would experience similar or lower levels of NO_2 to Launceston.

Sulphur Dioxide. Continuous monitoring of SO_2 has been undertaken at George Town from mid 2007 ongoing to current date. The maximum daily SO_2 concentration seen in the George Town dataset was 0.007 ppm, well under the daily NEPM standard of 0.080 ppm. From the available data and consideration of the magnitude and location of SO_2 sources, under existing and most likely future emission scenarios, it is concluded that ambient concentrations of SO_2 in Tasmanian urban areas will likely be below 10% of the NEPM Standard.

SECTION C – ANALYSIS OF AIR QUALITY MONITORING

C-1. HOBART

The results of the 2008 monitoring at New Town demonstrate compliance with the Air NEPM goals for PM_{10}, as data were collected for more than 272 days (75%) of the year in total and for more than 75% of each quarter. No exceedences of the PM_{10} Standard were recorded at New Town station during the year (Table 3).

The 24 hour $PM_{2.5}$ concentration was observed to exceed the 25 µg m^{-3} advisory reporting standard on nine days during 2008. (See Table 4 and section D1 below for more discussion.)

The annual average $PM_{2.5}$ concentration for 2008 was 7.3 µg m^{-3} (Table 1). Compliance with the Air NEPM $PM_{2.5}$ annual advisory reporting standard of 8 µg m^{-3} is therefore demonstrated as data were collected for more than 272 days (75%) of the year and for more than 75% of each quarter. The 2008 annual average value of 7.3 µg m^{-3} is slightly lower than the 7.6 µg m^{-3} for 2007, which was the first full year for which $PM_{2.5}$ data were collected at New Town.

Table 3: Exceedences of PM_{10} NEPM Standard during 2008 at New Town, Hobart, with Attribution of Cause.

Date	LVAS (µg/m^3)	24 Hour TEOM (µg/m^3)	Mean Temp (^oC)	Comment
NO EXCEEDENCES RECORDED				

Table 4: Exceedences of $PM_{2.5}$ 24-Hour Advisory Reporting Standard in 2008 at New Town, Hobart, with attribution of causes (in descending order of concentration).

National Environment Protection Advisory Reporting Standards: 25 µg/m^3 24 hour average
8 µg/m^3 annual average

	Date	LVAS $PM_{2.5}$ (µg m^{-3})	LVAS PM_{10} (µg m^{-3})	Corr. TEOM PM_{10} (µg m^{-3})	Mean Temp. (^oC)	Comment
1.	08/07/2008	42.0	No data	38.4	8.6	Cold with light rain and smoke.
2.	18/06/2008	34.2	48.7	47.3	6.5	Fine & cold with smoke
3.	10/08/2008	33.8	41.2	36.0	5.0	Fine with frost and smoke
4.	26/07/2008	32.5	No data	39.0	4.3	Fine with frost and smoke
5.	24/05/2008	31.2	37.3	34.2	7.6	Fine with some fog and smoke
6.	24/04/2008	29.5	37.1	32.6	14.3	Fine with planned burn smoke
7.	25/04/2008	28.3	34.8	31.6	14.6	Light rain with planned burn smoke
8.	25/05/2008	27.7	31.6	27.3	10.1	Fine with smoke
9.	17/07/2008	26.6	No data	33.7	8.0	Fine with smoke

C-2. LAUNCESTON

Results for Ti Tree Bend show that the air quality in Launceston complied with the Air NEPM goal for PM_{10} during 2008 (see Table 1), as there was only 1 reported exceedence (Table 5), which occurred on a hot dry day with strong winds and with several bushfires burning in the Launceston area. Satellite images suggest a significant amount of smoke from a large bushfire burning in the Tarkine region (NW Tasmania) may also have impacted on Launceston on this day. It was noted the particle levels at George Town (40 km north of Launceston) were also significantly raised at this time. (This is further discussed in Appendix 2).

While the annual average $PM_{2.5}$ concentration of 8.8 µg m^{-3} (Table 1) for 2008 exceeds the annual advisory reporting standard of 8 µg m^{-3}, it represents a continuing slow improvement in yearly-averaged air quality when compared to the annual average $PM_{2.5}$ concentrations of 9.5 µg m^{-3} in of 2007 and 10.4 µg m^{-3} in 2006.

The 24 hour average $PM_{2.5}$ concentration exceeded the Advisory Reporting Standard of 25 µg m^{-3} on 17 days in 2008 (see Table 6), which also indicates an improvement in air quality when compared with 20 days exceeding 25 µg m^{-3} during 2007 and 36 days in 2006.

Table 5: Exceedences of PM_{10} standard at Ti Tree Bend, Launceston in 2008, with attribution of causes (in descending order of concentration).

National Environment Protection Standard: 50 µg m^{-3} (24 hour average)

Date	LVAS PM_{10} (µg m^{-3})	Corr. TEOM PM_{10} (µg m^{-3})	Mean Temp (^{o} C)	LVAS $PM_{2.5}$ (µg m^{-3})	Reason
1. 18/03/2008	75.7	71.7	20.8	41.7	Hot with strong winds and smoke from local and distant bushfires

Note. The 24-hour average PM_{10} concentration from the TEOM was adjusted for the loss of volatiles from the heated TEOM filter using an empirical local temperature correction model developed according to Technical Guidance Paper 10

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

Where TCF = 1.00 for 24 hr average temperature [T_{24}] >/= 15°C

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

= 1.60 When T_{24} =< 0°C

Table 6: Exceedences of $PM_{2.5}$ 24-Hour Reporting Standard at Ti Tree Bend, Launceston, 2008, with attribution of causes (in descending order of concentration).

National Environment Protection Advisory Reporting Standards: 25 µg/m^3 for 24 hours
8 µg/m^3 annual average

Date	LVAS $PM_{2.5}$ µg m^{-3}	LVAS PM_{10} µg m^{-3}	Corr. TEOM PM_{10} µg m^{-3}	Mean Temp [^{o}C]	Reason
1. 18/03/2008	41.7	75.7	71.7	20.8	Hot with strong winds & bushfire smoke
2. 14/05/2008	35.6	No data	36.2	11.8	Fine, calm morning. Possible planned burn
3. 05/07/2008	34.5	44.3	39.5	5.3	Temperature inversion with smoke
4. 07/07/2008	33.7	42.4	36.6	10.5	Smoke signature. No BoM smoke reports
5. 23/07/2008	33.0	49.5	56.9	4.4	Temperature inversion with smoke
6. 06/06/2008	31.2	39.5	36.4	5.6	Temperature inversion with smoke
7. 25/04/2008	29.8	No data	37.8	13.3	Smoke signature. Likely from planned burn
8. 04/07/2008	29.2	40.5	47.8	3.2	Frost with temperature inversion and smoke
9. 19/06/2008	29.1	39.6	32.8	10.9	Light winds. No BoM smoke reports
10 03/06/2008	28.1	38.2	38.0	9.6	Temperature inversion with smoke
11. 11/04/2008	26.3	No data	34.8	16.1	Smoke signature. Likely from planned burn
12. 06/07/2008	26.0	32.6	34.2	6.2	Temperature inversion with smoke
13. 15/06/2008	26.0	29.9	28.5	5.1	Frost with temperature inversion & smoke
14. 30/07/2008	25.4	35.1	30.6	4.9	Frost with temperature inversion & smoke
15. 02/06/2008	25.4	30.3	29.3	10.0	Temperature inversion with smoke
16. 14/06/2008	25.3	31.0	32.1	5.1	Frost with temperature inversion & smoke
17. 04/06/2008	25.1	41.9	35.7	12.1	Temperature inversion with smoke

C-3. DEVONPORT

No data are available. A new $PM_{2.5}$ and PM_{10} Air NEPM monitoring station is due to be established at Devonport by the end of 2009 in response to the results of monitoring undertaken there in 2003.

SECTION D – DATA ANALYSIS

D-1. HOBART:

Andersen Reference Ambient Air Samplers (RAAS), sequential Low Volume air samplers (LVAS), for $PM_{2.5}$ and PM_{10} measurements were in operation at the New Town station for the whole of 2008. Exceedences of the Air NEPM PM_{10} air quality standard were determined using the data from these instruments as they are a recognised method for gravimetric PM_{10} and $PM_{2.5}$ measurements under AS 3580.9.9:2006 and AS 3580.9.10:2006. For days when LVAS data were not available observations made with the TEOM were used to determine if a PM_{10} exceedence occurred.

No daily average PM_{10} concentrations exceeding 50 µg m^{-3} were recorded at the New Town station in 2008. The overall data availability for 2008 was sufficient to demonstrate that Hobart's air quality complied with the Air NEPM goal for PM_{10}.

The daily average $PM_{2.5}$ concentration measured at New Town exceeded the 25 µg m^{-3} advisory reporting standard on nine days in 2008. Five of these exceedences occurred on cool days in June, July, or August, when smoke from domestic wood heaters can become trapped in temperature inversions, or becomes concentrated in the station area via cold air drainage from the Lenah or Derwent valleys. However, the other four exceedences (24/4/2008, 25/4/2008, 24/5/2008 and 25/05/2008) occurred on relatively warm days with visible haze reported by the Hobart Bureau of Meteorology. The two April exceedences were very likely due to smoke from planned burns moving into the Hobart area. A planned burn contribution to the May exceedences cannot be excluded, but this cannot be confirmed either. This is discussed more fully in Appendix 3 below.

D-2. LAUNCESTON

Two RAAS LVAS instruments for PM_{10} and $PM_{2.5}$ and a TEOM with a PM_{10} size selective inlet were collocated at the Launceston station for the whole year. Exceedences of the Air NEPM PM_{10} air quality standard were primarily determined using the data from the RAAS. For days when LVAS data were not available observations made with the TEOM were used to determine if a PM_{10} exceedence occurred.

Figure 7 shows that the annual number of recorded 24-hour PM_{10} exceedences measured at Ti Tree Bend has significantly decreased, from 50 in 1997 (when daily PM_{10} measurements were started at Ti Tree Bend) to only a single exceedence in 2008. This was only the second year since monitoring began in 1992 (the first being 2007) when Launceston's ambient air quality met the Air NEPM goal of no more than 5 exceedences of the 24-hour PM_{10} standard of 50 µg m^{-3}. The single 2008 exceedence of the 50 µg m^{-3} PM_{10} Air NEPM standard occurred on the 18th of March (when the 24-hour PM_{10} was measured to be 75.7 µg m^{-3}). Several bushfires were reported to have been burning around Launceston at this time. Additionally smoke from the more distant but large bushfire in the Tarkine region (NE Tasmania) also appeared to reach Launceston for a few days around the 18th of March. Hence this exceedence was not from domestic wood smoke. The highest daily PM_{10} concentration attributable to wood heater emissions was 49.5 µg m^{-3} on 23 July 2008 (Figure 8).

The daily average $PM_{2.5}$ concentration measured at Ti Tree Bend exceeded the 25 µg m^{-3} advisory reporting standard on 17 days during the year. Eight of these exceedences occurred on cold days (mean temperature near or below 5 degrees) in June and July, with overnight temperature inversions, and would be expected to be attributable to trapped urban wood

smoke. The highest daily $PM_{2.5}$ concentration of 41.7 µg m^{-3} occurred on the 18th of March, when smoke from several major bushfires resulted in the PM_{10} concentration at Ti Tree Bend reaching 76 µg m^{-3}.

Of the remaining eight exceedences not discussed above, three (two in April, one in May) are likely to have arisen due to smoke from planned burning operations reaching Launceston, while the other five (in June and July) appear to be in the main to be due to domestic woodsmoke, although a contribution from other sources can not be ruled out. The analysis that leads to these conclusions is discussed in Appendix 3.

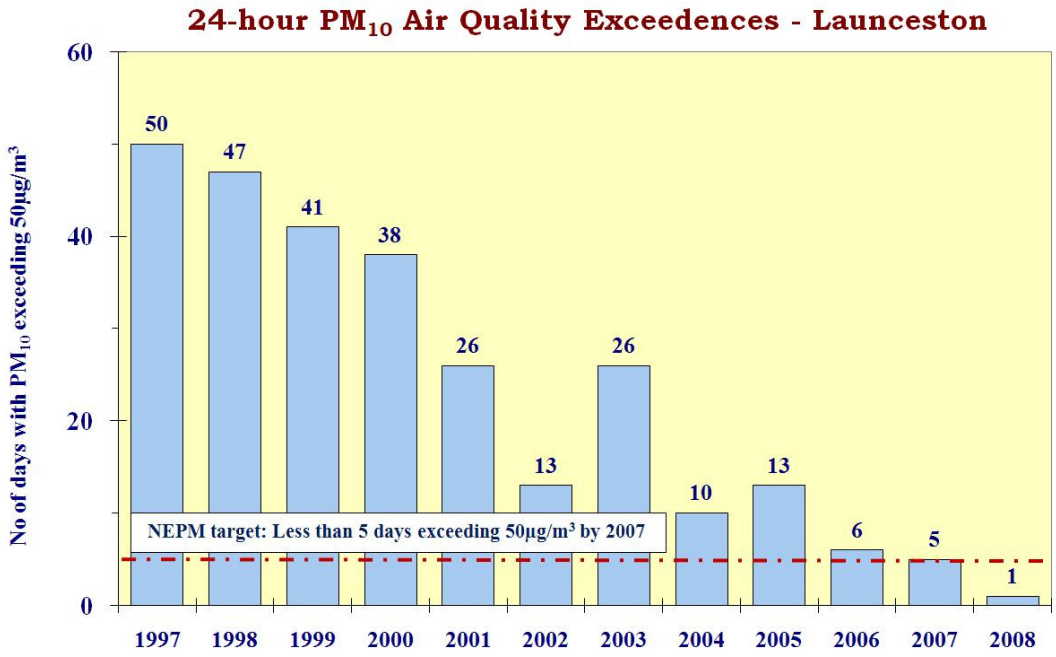

Figure 7. The number of days each year where the 24-hour average PM10 concentration exceeded the Air NEPM standard of 50 µg m^{-3}, since daily winter monitoring began in 1997.

NOTE: The development of the Tasmanian Air Quality Database has allowed the air density corrections for the historical high volume air sampler data to be recalculated using the observed meteorological data for the measurement period. This recalculation, performed in 2005, resulted in some revision of the historical PM_{10} concentrations and the number of exceedences for past years.

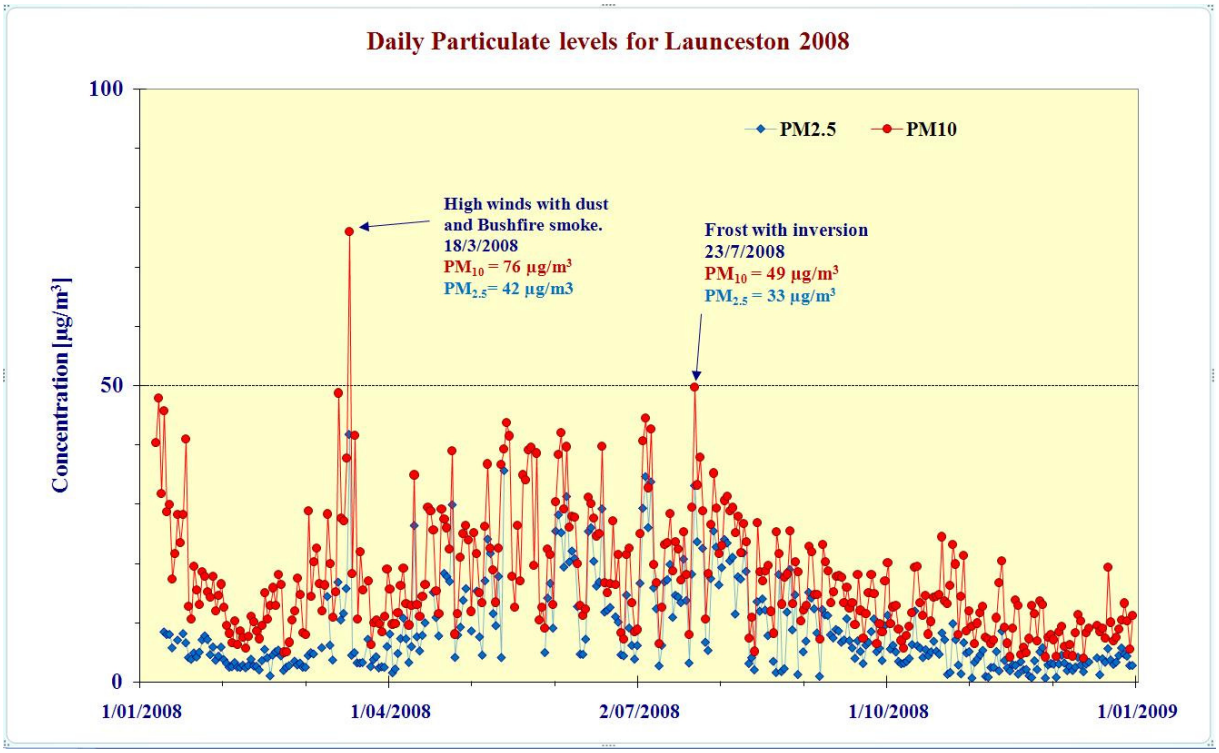

Figure 8. The daily average $PM_{2.5}$ and PM_{10} concentrations measured at Ti Tree Bend in 2008.

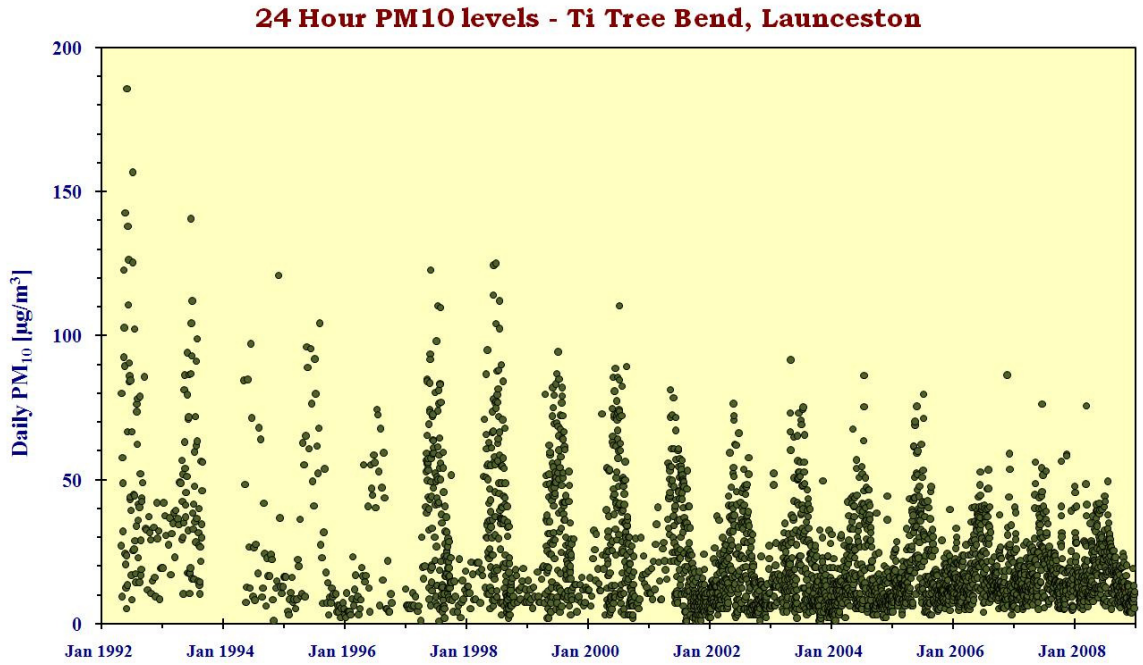

Figure 9. The daily average PM_{10} concentrations measured at Ti Tree Bend 1992 - 2008.

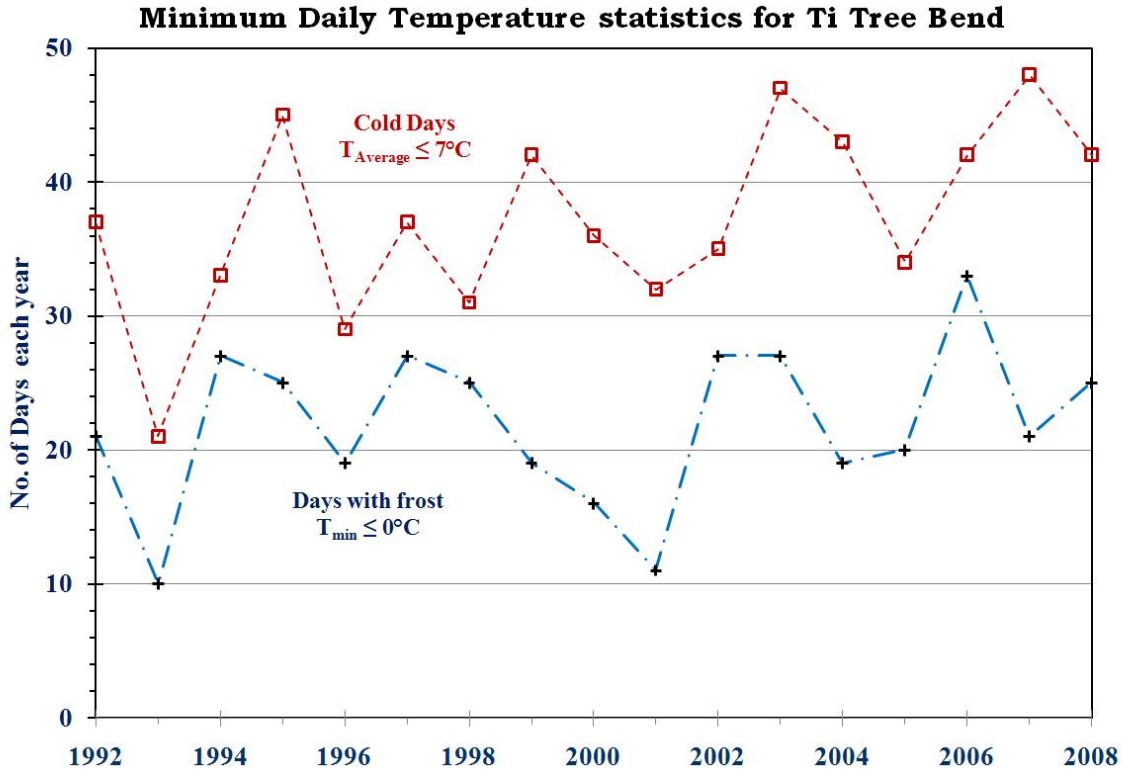

Figure 10. The annual frequency of frosts (minimum temperature ≤ 0°C) and cold days (Average Temperature ≤ 7°C) measured at Ti Tree Bend 1992 - 2008.

From Figure 9 it can be observed that winter PM_{10} levels in Launceston have significantly decreased from the 1992-1993 levels. While there is some anecdotal evidence from Launceston residents that the winters are not as severe as they were in the 1990s, this is not supported by a preliminary analysis of the meteorological records (Figure 10), where a small increase in the frequency of frosts and cold days over the last 16 years may be present. There

is a clear cause and effect relationship between the frequency of cold days, wood heater use and smoke dispersion. The fact that the number of cold days has not decreased over the interval of the data record strongly suggests that it is unlikely that the steady decline in PM_{10} in Launceston over the past 16 years can be adequately explained by meteorological factors alone.

It is considered more likely that the primary cause for 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, including a reduction in wood heater numbers through buy-back schemes, and lower individual wood heater emissions through better design and community education programmes leading to better operating habits. Other factors that may have contributed to the improvement in air quality are the reticulation of natural gas, conversion of commercial wood-fired boilers to other energy sources, and improved thermal efficiency of houses (insulation, double-glazing etc.).

However, an inspection of the $PM_{2.5}$ and PM_{10} data for 2008 (Figure 8) indicates that Launceston still experiences relatively high levels of fine particulate pollution in the winter, when PM_{10} concentrations regularly exceed 40 $\mu g\ m^{-3}$. There is clearly a need for further improvements in Launceston's air quality.

D-3. DEVONPORT

The winter monitoring campaign in Devonport during winter 2003 showed that the local air quality is adversely affected by particulate pollution and may not comply with the NEPM goal. It is planned to establish a PM_{10} and $PM_{2.5}$ monitoring station at Devonport by the end of 2009. Details of the work of site selection for Devonport are given in Appendix 2.

D-4. STATISTICAL SUMMARY

The statistical summary of the PM_{10} and $PM_{2.5}$ data collected in Tasmania during 2008 against the National Environment Protection Measure for Air Quality are listed in Tables 7 and 8 below.

Table 7: 2008 Summary Statistics for PM_{10}

National Environment Protection (Ambient Air Quality) Measure: PM_{10} Standard: 50 µg m^{-3} (24 hour average)

Pollutant	Number of Valid days	Highest		6th Highest		Percentiles [µg m^{-3}]				
		µg m^{-3}	Date	µg m^{-3}	Date	98th	95th	90th	75th	50th
New Town, Hobart										
LV Air Sampler	306	48.7	18/6/2008	34.8	25/4/2008	34.8	29.0	23.3	16.6	12.3
TEOM - Measured	363	47.4	14/3/2008	31.3	24/4/2008	30.9	26.3	21.4	16.4	12.7
- Corrected	363	47.4	18/6/2008	36.0	11/1/2008	35.2	29.3	25.4	19.0	13.8
Ti Tree Bend, Launceston										
LV Air Sampler	299	75.7	18/3/2008	44.3	5/7/2008	44.3	39.5	30.5	22.4	15.0
TEOM - Measured	353	71.7	18/3/2008	41.5	7/1/2008	40.3	31.6	26.8	18.8	13.4
- Corrected	353	71.7	18/3/2008	46.0	9/1/2008	44.8	37.2	32.4	21.7	15.1
Devonport			Monitoring scheduled to commence by end of 2009							

Table 8: 2008 Summary Statistics for $PM_{2.5}$

National Environment Protection (Ambient Air Quality) Measure: Advisory Reporting Standards: 25 µg m^{-3} (24 Hour Average); 8 µg m^{-3} (Annual Average)

Pollutant	Number of Valid days	Highest		6th Highest		Percentiles [µg m^{-3}]				
		µg m^{-3}	Date	µg m^{-3}	Date	98th	95th	90th	75th	50th
New Town, Hobart LV Air Sampler	335	42.0	8/7/2008	29.5	24/4/2008	28.3	21.2	16.9	9.0	4.8
Ti Tree Bend, Launceston LV Air Sampler	315	41.7	18/3/2008	31.2	6/6/2008	31.2	25.3	20.3	12.0	5.8

References:

DELM, 1995, 'The Tamar Valley Airshed Study', report by SEMF Consultants to the Tasmanian Department of Environment and Land Management.

Power, M., 2000, 'Air pollution dispersion within the Tamar valley', PhD thesis, University of Tasmania.

APPENDIX 1 - SUMMARY OF ACHIEVEMENTS AND FUTURE DIRECTIONS

The Tasmanian Government has several programmes in place to assess compliance with the Air NEPM and to achieve progressive improvement in air quality throughout the state. These are outlined below, along with brief descriptions of related programmes and information on other developments.

- In May 2004 the Australian Government-funded *Launceston Woodheater Replacement Program* ceased. This joint project between local, state and national governments, was managed through the Launceston City Council (LCC) and directly resulted in removal of about 2200 woodheaters from the airshed. However, many more were also replaced during the three-year program and it is likely that some of these were an indirect result of the education component of the program. LCC is currently operating a similar, although smaller scale, woodheater buy-back programme.
- On 1 June 2005 the Environment Protection Policy (Air Quality) 2004 came into force. The Policy includes specific reference to meeting the requirements of the Air NEPM through regulation of industry and management of diffuse sources and planned burning activities.
- On 5 June 2006 the *Tasmanian Air Quality Strategy* was released by the Minister for Tourism, the Arts and Environment, Hon Paula Wriedt. The five-year Strategy aims to further reduce domestic, transport and industrial emissions of fine particles in critical regions of the state, while maintaining a balance with economic growth and social equity issues, particularly relating to home energy use and conservation. In November 2008 a Implementation Steering Committee (ISC) for the Air Strategy was established to review progress made to date on the implementation of the objectives of the strategy and to guide and facilitate the achievement of the outstanding objectives identified. As a result of this review the ISC is currently in the process of forming a Home Heating Working Group (HHWG) to further investigate approaches to achieving the objectives of the strategy related to reducing particle levels associated with emissions from domestic wood heaters.
- The *Environmental Management and Pollution Control (Distributed Atmospheric Emissions) Regulations 2007* commenced in 2007. The regulations require solid fuel heaters manufactured or sold in Tasmania or imported into Tasmania to comply with AS/ZNS 4013. They also prescribe requirements in relation to visible smoke emissions and heater modification. The regulations prohibit backyard burning on smaller blocks, although there is provision for councils to opt out through by-laws. Permissible fuels for heaters and backyard burning are also prescribed. The regulations are currently being evaluated in the light of implementation experience to date.
- In July 2007 the George Town air monitoring station (GAMS) was established in partnership with the local councils and heavy industries operating in the near vicinity. Since then it has been monitoring PM_{10}, $PM_{2.5}$ using Low Volume Air Samplers and levels of SO_2 and NO_x using gas analysers. Continuous particle monitoring is also provided by means of 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. The station is also equipped with a Vaisala MAWS-300 automatic weather station.
- In late 2007 the Environment Division took over the operation of the lower Tamar air monitoring stations established in 2006 by the Tasmanian Regional Planning and Development Council (RPDC), as part of the baseline environmental studies required

prior to the construction and operation of the proposed pulp mill at Longreach. Initially this network consisted of a primary Level 2 station at Rowella and 10 Level 1 stations located in the surrounding region, including one which was collocated with the Level 2 station at Rowella. In late 2007 some of the continuous monitoring equipment at the Level 2 station was decommissioned. Five of the Level 1 stations were also decommissioned. Since then the Level 2 station at Rowella has continued to monitor $PM_{2.5}$ and PM_{10} particles using TEOM instruments and the levels of sulphur dioxide, oxides of nitrogen and Total Reduced Sulphur (TRS) using gas analysers. The remaining five Level 1 stations located at Beauty Point, Deviot, Riverside, Tippogorrie Hills and Rowella, continue to monitor PM_{10} and hydrogen sulphide levels using Microvol^{TM} air samplers and passive adsorption samplers respectively. The Level 2 station at Rowella together with the five Level 1 stations now comprise the ongoing Tamar Air Quality Monitoring Program. This program has been and continues to be a significant commitment of the air monitoring resources of the Division.

- Over the period 2004 to 2008 the Tasmanian Government provided funding to develop a monitoring capability for $PM_{2.5}$ particles as required in the amendment to the Air NEPM (May 2003), and upgrade existing PM_{10} monitoring. The new system is in operation at Hobart and Launceston and will be extended to Devonport in late 2009, in line with the *Amended Tasmanian Air Monitoring Plan 2005*.
- In recent years the Department has published several advertisements on air quality issues. During the winter of 2006 a radio campaign was conducted around the state to encourage woodheater users to improve the operation of their heaters. Further newspaper advertisements to run in all three regional newspapers informing the public on the restrictions the regulations impose on the sale of second hand woodheaters are planned for 2009.
- In keeping with the objectives of the Air Strategy relating to community education, the Department is working with external experts and a group of high school science teachers to develop high quality educational materials designed to increase student's awareness of air quality issues, particularly in the Tasmanian context. The groundwork for a program which involves students designing air quality experiments and carrying out their own research using portable particle monitors, on loan from the Department, is expected to be completed in early 2009. This program will be trialled at two high schools in Hobart. Another educational program under development aims to construct a website to provide a bank of air quality related educational resource materials for teachers and students. The focus in the early stages of this ongoing program will be on designing the site to be attractive and interesting to students while enabling easy integration of the materials into the school curriculum.
- A Partnership Agreement has been signed between the State Government and the Launceston City Council. This agreement is designed to reflect the desire of both parties for continued cooperation between the State and Local Governments. The parties aim to work together to identify new opportunities to promote and implement environmental policies and practices including those relating to air quality and monitoring.
- Attempts in recent years to tighten the solid fuel heater emission standard, introduce an efficiency standard and introduce an effective heater certification scheme, involving collaboration between government, the heater industry and Standards Australia, have failed. A working group has now been formed by the EPHC Standing Committee to investigate the development of a national regulatory framework for heaters. Options under consideration are a NEPM, Commonwealth legislation and uniform State/Territory

legislation. A regulatory impact statement in relation to these options is currently being prepared.

- The Division is working towards ensuring that smoke from all types of planned burns is managed in accordance with best practice and that smoke is reduced to the lowest practical level consistent with the need to conduct burns through its participation in a smoke management working group formed by the Forestry Practices Authority (FPA). The group includes representatives from the FAP, the Environment Protection Authority, the Parks and Wildlife Service, the Department of health and Human Services and the forestry industry. A major specific objective of the Division's participation is to ensure the principles of the Air Policy are reflected in an amendment to the *Forestry Practices Code* which will enable the enforcement of best practice smoke management through the forest practices regulatory system. Division is also contributing partial funding and other support to a research project on the health effects of planned burning.
- The Division has commenced the initial phases of work on a major project to more accurately model the dispersion of wood smoke from domestic heaters in each of Tasmania's major population centres. This work will be underpinned by detailed spatial estimates of wood heater numbers. Similar work is also underway on the development of an inventory of industrial atmospheric emissions. Information from regular stack tests is being collated and analysed to facilitate an understanding of spatial and temporal variations in industrial emissions. Airshed models will be developed on the basis of this data to enable a better understanding of air pollution and facilitate regulation on a regional basis. Results from these and other related studies will ultimately feed into an *Air Pollution Potential Atlas* for use by local councils, planning agencies and policy makers throughout the state.
- In mid 2008 an automated procedure was developed and implemented to enable unvalidated TEOM data from Hobart, Launceston and the Rowella air stations to be made available on the Environment Division web site the day after collection. Also available (automatically) are summary plots of the previous week and previous month of unvalidated data.
- Also in mid 2008 a project commenced to develop software for the purposes of automatically validating continuous data. The software is written in the Interactive Data Language (IDL) environment. Programs to automatically validate TEOM data were completed. The programs are able to process eighteen months of 1-minute cadence TEOM data (both PM_{10} and $PM_{2.5}$) from the Rowella station in around one hour of processing time. The software is being extended to work with TEOM data from other Tasmanian stations, and also to validate continuous gas analyser data. Work is now being carried out on a comparison between manually-validated and automatically-validated data, and on system integration.
- In late 2008 the initial planning and programming was undertaken to allow a real-time (updated hourly) display of unvalidated TEOM data on the Environment Division's public web pages. It is intended that this will be fully implemented in 2009.
- In late 2008 an Environment Division proposal for a new Tasmanian air network to specifically monitor smoke from planned burning operations was presented to the board of the newly formed Environmental Protection Authority. The EPA board recommended to the Minister that the proposal be funded. This new network, known as the *Base-Line Air Network of EPA Tasmania* (BLANkET), will consist of up to 15 small stations, sited near communities that have been or are likely to be affected by smoke from planned

burns, and will report in real-time indicative particle and meteorological data to a central data-logging computer. These data will be made available on the Environment Division web pages almost immediately. The data will assist in the management of smoke from planned burns, will contribute to the understanding of smoke movement and dispersal in the greater Tasmanian airshed, and will provide data on population exposure to smoke. It is planned that this network will be fully operational for the 2010 autumn burning season.

APPENDIX 2 - AN OUTLINE OF THE DEVONPORT SITE SELECTION

A brief outline of the work carried out in 2008 to select a site for a performance and trend station in Devonport is presented here. A more detailed report is available on request.

TAPM (The Air Pollution Model) was run for Devonport in the standard manner using data on household locations from the Australian Bureau of Statistics. A fixed proportion of houses in any given area were assumed to have wood heaters. The model was fed with a year of climatological meteorology. The resulting contour plot of mean PM_{10} concentration for May to September is shown in Figure 11. The high school, Adult Education centre, and the Valley Road TAFE (now part of the Tasmania Polytechnic institutes) are shown by labelled upright crosses. As will be discussed in this section, the TAFE (lower centre of Figure 11) has been selected as the site for an Air Monitoring station. At the back of the TAFE is an open area, of several hectares in size, that forms part of a flood control basin. Such open areas are rare in urban Devonport – this site was the only site identified that would easily meet the Australian standard for siting an air monitoring station by being removed from local sources of pollution.

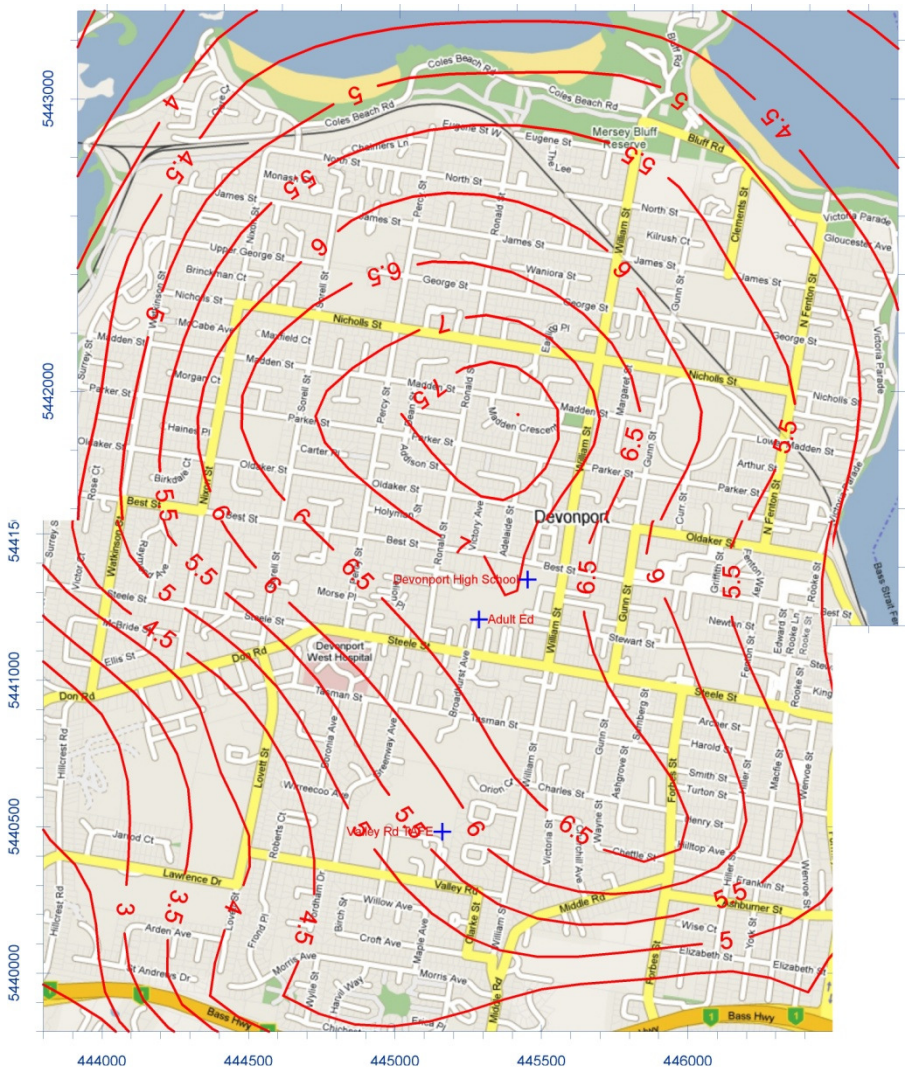

Figure 11. TAPM results for Devonport for May to September, showing contours of modelled mean PM_{10} in µg m-3.

The modelled maximum concentration is shown as slightly north of the centre of the urban area. The high school is close to the maximum. The TAFE site (lower centre) is at a contour about 15% below the peak, but is located on a relatively steep gradient of decreasing concentration.

In order to gain an appreciation for how representative the TAFE site is for Devonport as a whole, two smoke surveys were carried out in July 2008 using a small Dustrak 8520 particle counter. The sites where samples were taken are shown as numbered crosses and are draped on a topographical relief map of Devonport in Figure 12. Sample site s11 is the TAFE site.

Figure 12. Sample sites (numbered crosses) draped on a topographical relief of Devonport.

Sampling was carried out on the nights of 2nd and 23rd of July 2008. Both nights were calm and cold, with mostly clear skies. The sites were visited sequentially on each night by car. The car engine was stopped while measurements were conducted. Brief notes were made at each site of relevant information (such as the presence of a nearby visible smoke plume).

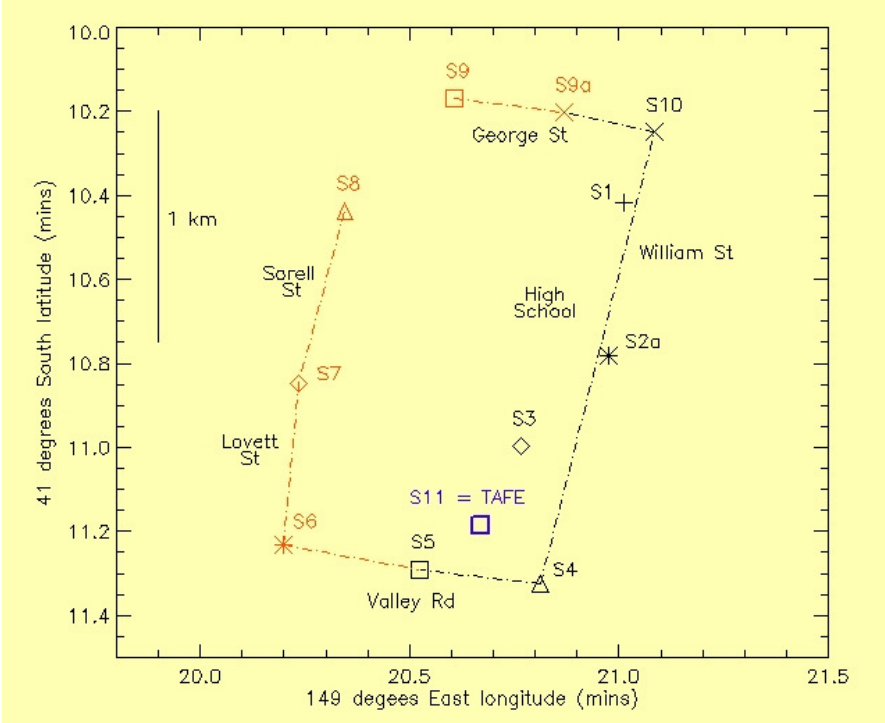

Figure 13. Schematic map of the sampling sites at Devonport, 2nd and 23rd of July 2008.

Figure 13 shows a schematic map of the sample sites with each site identified by a unique symbol. These symbols are used on the following data plots. The raw Dustrak numbers have been approximately calibrated to $PM_{2.5}$ values from an intercomparison with a Dustrak

running at Launceston which has been shown over several years to give an output well correlated with the co-located low volume $PM_{2.5}$ sampler

The corrected or proxy $PM_{2.5}$ Dustrak measurements for the 2nd of July are shown in Figure 14. The sites are coded by symbols as given in Figure 13. There was a clear dichotomy between the north-east and south-east stations, which generally recorded higher values, compared to those in the south-west and north-west. The highest readings were for site 1 which recorded proxy $PM_{2.5}$ values near 100 µg m^{-3} on the first two circuits. Site 10 also recorded high values near 50 to 60 µg m^{-3} on the first measurement (which was repeated) at this site. It was noted at the time of these observations that several smoke plumes were clearly visible locally, and it is likely that the Dustrak was nearly directly in the path of such a plume.

Omitting these four high values (two at site 1, two at site 10) as they were likely to be due to local effects, the mean of the remaining measurements is 14 µg m^{-3} (median: 10 µg m^{-3}). The south-west and north-west sites (sites 6 to 9a inclusive) were generally low, with a mean over the evening of 7 µg m^{-3} (median: 6 µg m^{-3}). For the south-east sites of 2a, 3, 4, and 5, the mean was 19 µg m^{-3} (median: 20 µg m^{-3}). The TAFE site is located fairly centrally with respect to sites 3, 4, and 5. The mean of the two TAFE site measurements was 29 µg m^{-3}. A third measurement could not be obtained as the TAFE gates were locked sometime after 22:00. There was good agreement between measurements made at the TAFE site and sites 4 and 5, and to a lesser extent with site 3, on the first two circuits.

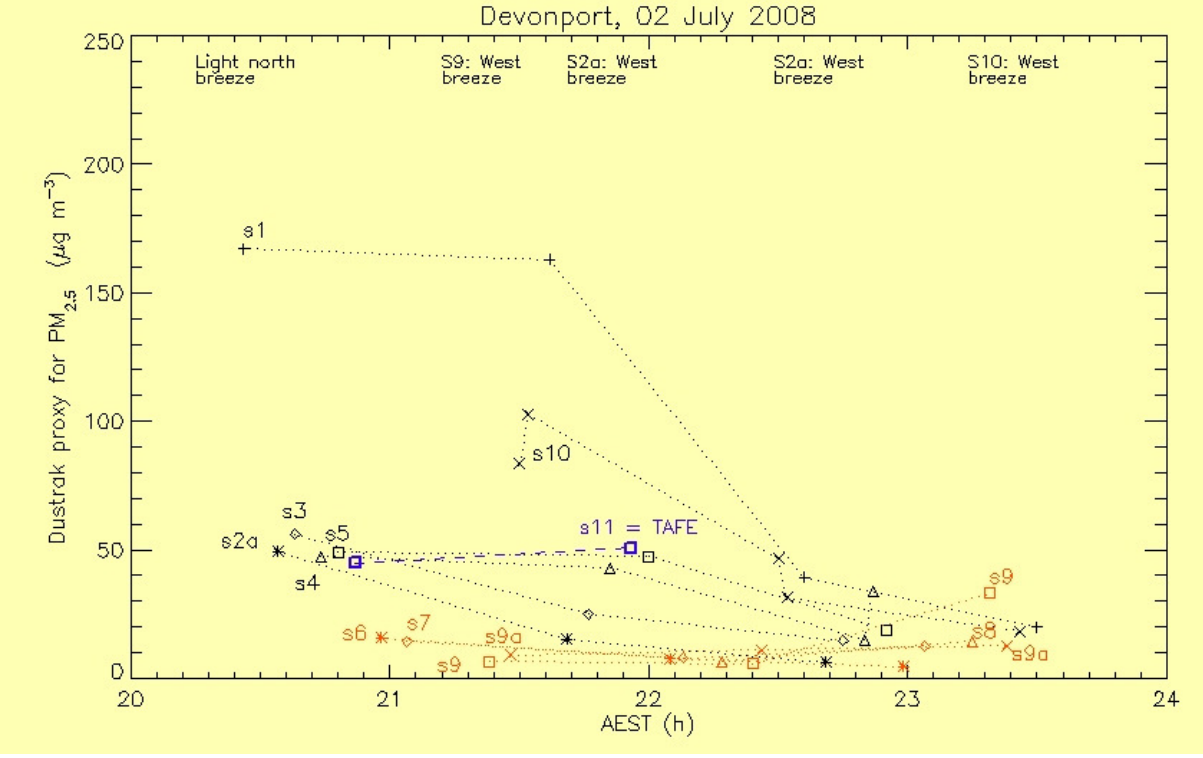

Figure 14. Devonport sample results for the night of 2nd of July 2008

The corrected Dustrak measurements obtained on the 23rd of July are shown in Figure 15. While doing the circuit on this night it was noted that there were large amounts of smoke present. Site 9a (in George St, at the foot of the ridge below site 9) recorded the highest readings, on two separate circuits, with values over 100 µg m^{-3}. In these cases it was noted at

the time that the high readings were not due to local plumes, but there was generally a high level of smoke visible for at least 100 metres down the street. A very light southerly wind was blowing at the time. An explanation may be that the southerly wind was pushing smoke from the main urban area of Devonport northwards towards the coast. Smoke may have been entrained in a flow that moved parallel to the base of the ridge (where site 9 is located). The point is worth further study.

The other high readings on this evening were the initial measurements at site 1, with three consecutive readings near 80 µg m^{-3}. Several smoke plumes from dwellings were noted at the time of these readings, so that possibly local effects may have been the cause.

These six high values (three at site 1, three at site 9a) are omitted from the following discussion assuming that they were influenced by local some plumes, rather than being representative of the area, leaving 44 data points to be considered.

The mean of the four measurements at site 11 (the TAFE site) is 23 µg m^{-3} (median: 21 µg m^{-3} with a standard error in the mean (standard deviation divided by the square root of the number of points minus one) of 4 µg m^{-3}. The mean of the other 40 measurements (i.e. all remaining sites excluding site 11) is 25 µg m^{-3} (median: 23 µg m^{-3}).

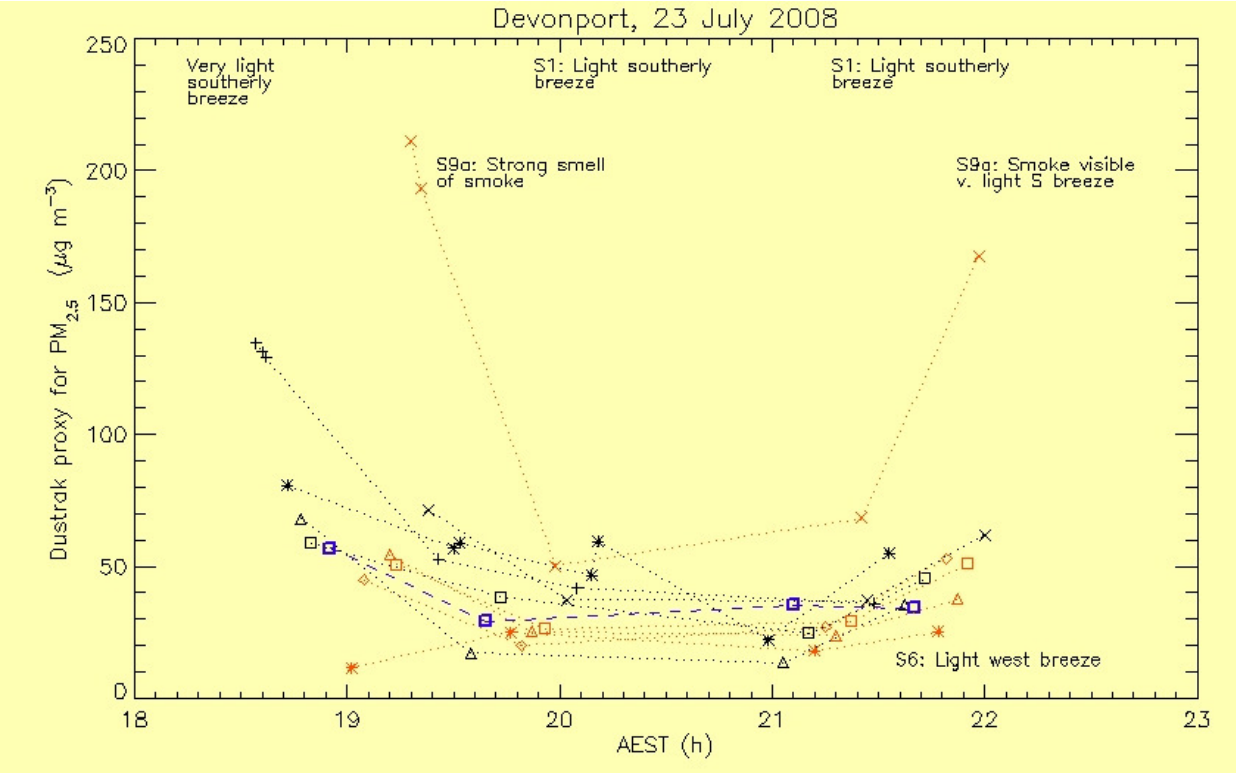

Figure 15. Devonport sample results for the night of 23rd of July 2008

The measurements from the two nights of sampling runs, although different in character, are consistent in the sense that they provide evidence the TAFE site is reasonably representative of the Devonport urban area. Data from the first night indicated a clear dichotomy between particulate levels in the north-east to south-east sites compared to those on the south-west and north-west. This may have been a consequence of the light westerly wind that appeared to be present for most of the sampling run. Data from the second night, taken under a very light

southerly wind, showed generally more uniform particulate levels at all sites. It is perhaps noteworthy that site 6, on the south--west corner of the sampling area, showed low levels on both nights.

A point of interest from the second night are the high levels measured on two occasions at site 9a. As noted, this site is to the north of the urban area, near the foot of a ridge that runs to the north-east. It is possible that smoke from the main urban area of Devonport was channelled along the base of the ridge by the southerly wind, concentrating it near site 9a. This is an aspect that appears worthy of follow up studies, especially if the air station is established at the TAFE site, which is at the southerly end of the urban area.

Apart from the possibility of smoke concentration at site 9a, the two sampling runs indicate that the TAFE site is generally representative of smoke levels in the Devonport urban area, and that the study results support selecting this location as a site for the proposed GRUB station.

Tasmanian TAFE colleges were amalgamated into the new Polytechnic Institute in January 2009. Negotiations with the new land owner have commenced. It is intended that the Devonport station will be commissioned in late 2009.

APPENDIX 3 - PLANNED BURNS AND TASMANIAN AIR QUALITY

OVERVIEW

Earlier in this report it was stated that several exceedences of the $PM_{2.5}$ advisory reporting standard at both Hobart and Launceston in 2008 were ascribed to planned burns, viz. Hobart on the 24th and 25th of April, and possibly on the 24th and 25th of May, and in Launceston on the 11th and 25th of April, and on the 14th of May. (for comparison, in 2007 at Launceston four of the 20 reported exceedences of the $PM_{2.5}$ advisory reporting standard were ascribed to smoke from planned burning.)

Between the March and June 2008 there were 579 forest or forest industry planned burns in Tasmania, covering a total area of around 31,000 ha[2]. The Environment Division received around 35 complaints and enquiries about planned burn related smoke during this time. Here the issue of smoke impacts from planned burns is considered in more detail.

A SMOKE EVENT OF LARGE SPATIAL EXTENT – 24TH/25TH APRIL 2008

The 24th/25th April 2008 events in Hobart and Launceston are well illustrated by the MODIS satellite image (obtained courtesy of the CSIRO Marine and Atmospheric Research) of south-east Australia on the 24th of April, shown in Figure 16. Widespread smoke is seen from large fires burning in both Victoria and Tasmania. A generally northerly wind pattern was present, as indicated by Bureau of Meteorology synoptic weather charts (not shown) and indicated by the well-defined wake in the cloud pattern around the Ben Lomond plateau in north-east Tasmania. Smoke from these large fires can be followed for significant distances from the source. It appears that smoke from Victoria moved across Bass Strait, although it is not known whether this smoke impacted at ground level in Tasmania.

On the 24th and 25th of April the Air NEPM station at Hobart recorded exceedences of the 24-hour $PM_{2.5}$ advisory reporting standard. The Air NEPM station at Launceston recorded high $PM_{2.5}$ levels on the 24th of April, and an exceedence on the 25th of April. On the 25th of April the George Town air station also recorded a 24-hour $PM_{2.5}$ value near 35 $\mu g\ m^{-3}$ from a low volume air sampler. At George Town, 24-hour $PM_{2.5}$ values above 20 $\mu g\ m^{-3}$ are very rare, even in winter. The satellite image by itself cannot be used to determine the height of the smoke plumes at any given location, however it appears reasonable to assume that at least some of the smoke visible in this image impacted at ground level in George Town, Launceston, and Hobart.

While such widespread, near synoptic-scale, smoke events of the type in Figure 16 appear relatively rare based on an inspection of the satellite image archive, during the autumn burning season it is possible to see extended smoke plumes covering a significant spatial extent in Tasmania. This is demonstrated by both satellite images and ground-based data. For example, Figure 17 shows the low-volume $PM_{2.5}$ measurements for George Town (top panel) and Launceston (lower panel) for January-June 2008. A clear commonality is present, indicating a broad spatial extent for a number of smoke events. The mid-March bushfire smoke (discussed in the main body of the report in Section D-2) is clearly apparent, as is a

[2] R. Chuter, 'Air curtain burners', available online at the FPA web page at: http://www.fpa.tas.gov.au/fileadmin/user_upload/PDFs/Smoke_Managment/Air_Curtain_Burner_leaflet_24_March_2009.doc

series of high values starting around the 11th of April leading through to mid May. (The fire permit period in Tasmania in 2008 ended on the 9th of April.)

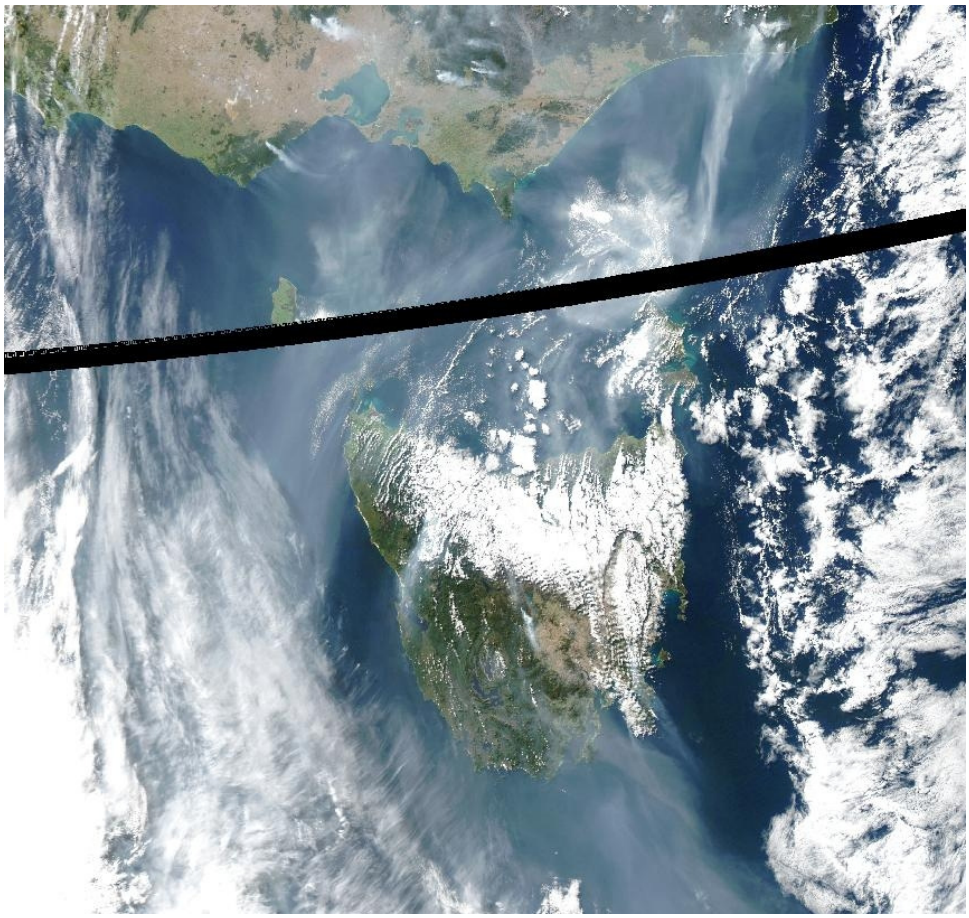

Figure 16. MODIS true colour image of south-eastern Australia, 24th April 2008. (Image from the CSIRO MAR web site.)

PLANNED BURN SMOKE IN LAUNCESTON IN 2008

For Launceston, it was noted that three of the recorded exceedences of the $PM_{2.5}$ advisory standard were ascribed to planned burn smoke. Of these, two occurred on mild days in April when domestic wood heaters are generally not operating, and Tasmania's weather was dominated by high pressure anti-cyclonic conditions. It is very likely that these April events arose due to smoke from planned burns. This was determined from satellite imagery (such as shown in Figure 16), inspection of the diurnal pattern of the hourly TEOM data at Launceston, and from comparison with data from George Town (see Figure 17) and Rowella stations (respectively 40 km and 35 km north of Launceston). The third exceedence on the 14th of May also occurred during mild weather. At this time data from the George Town station also showed several days of high particle levels, as did TEOM data from the Rowella station which is located in a rural setting and is not subject to domestic wood smoke influences. These data indicate a widespread smoke event from planned burn operations. Hence the 14th of May exceedence at Launceston is also ascribed to planned burn smoke.

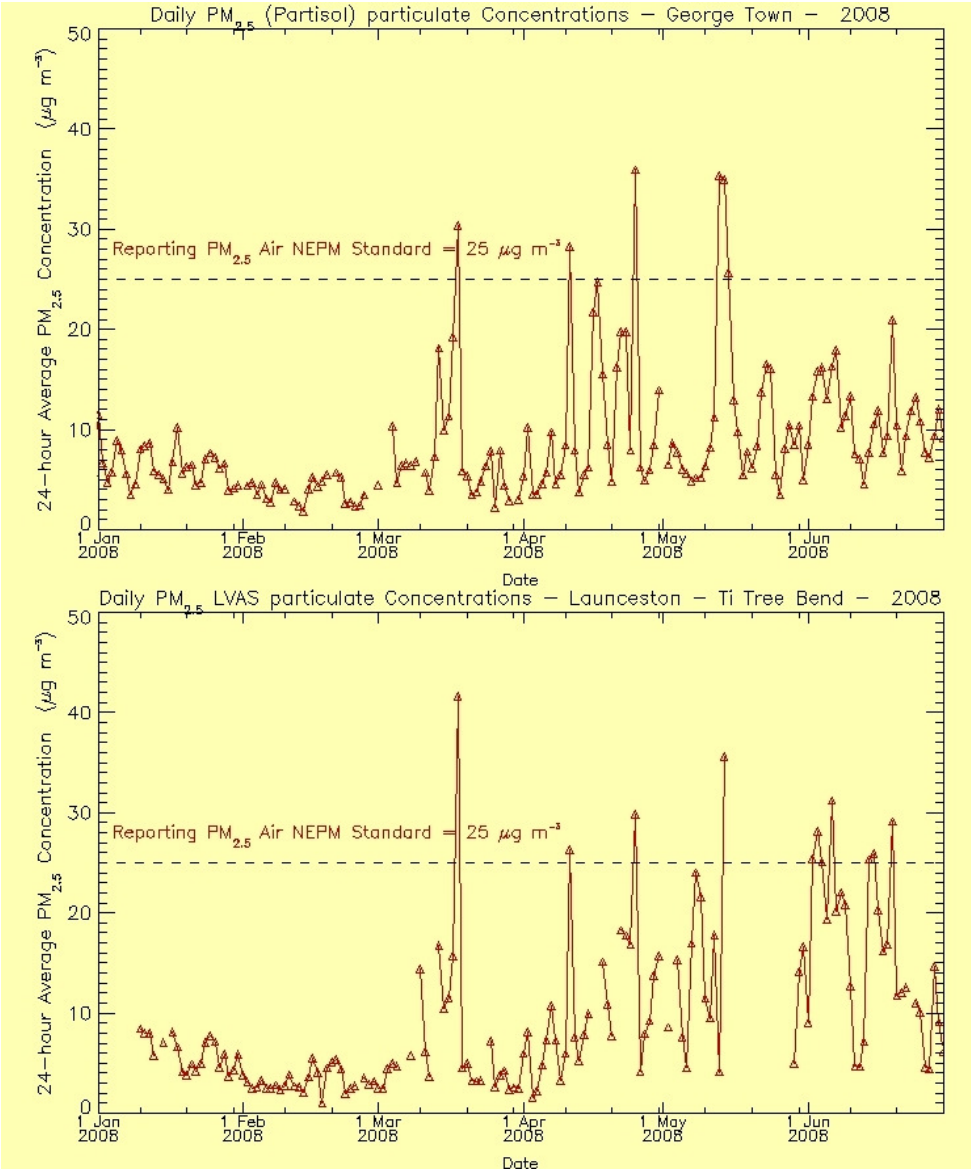

Figure 17. Daily-averaged $PM_{2.5}$ data for 2008 January-June for George Town (top panel) and Launceston (lower panel).

The Launceston $PM_{2.5}$ low-volume air sampler was out of commission from the 15th to the 28th of May inclusive. It seems probable that had the sampler been operating over this time at least one further $PM_{2.5}$ exceedence would have been recorded, judging from the PM_{10} and Dustrak results from Ti Tree Bend, the high values recorded contemporaneously at Rowella and George Town, and from the complaints and enquiries received from the Launceston public over this interval.

As well as the specific events noted above a general increase in background $PM_{2.5}$ levels is also seen after the first week of April (as compared with, for example the February levels), particularly at Launceston (see Figure 17 above and Figure 18 below). The diurnal signature of domestic wood-heater smoke becomes apparent in the Launceston data particularly in the latter part of May, but before this occurred with the onset of colder weather, it appeared that planned burning smoke contributed to raising the average $PM_{2.5}$ levels. Monthly mean $PM_{2.5}$ data for Launceston (from the low volume air sampler) are shown Figure 18. The April mean

$PM_{2.5}$ level is clearly elevated compared to March and February. Almost all of the April elevation is likely to be due to planned burn smoke. Planned burn smoke impacts at Launceston were episodic in April 2008, with significant impacts occurring on the 16th-18th and 21st-25th of April inclusive. Mean $PM_{2.5}$ levels over these episodes were near 15 µg m^{-3}, which is close to the June and July monthly average. That is, the planned burning in 2008 contributed to an effective extension of the duration that the Launceston population was exposed to near winter-time air quality levels.

The mean May $PM_{2.5}$ level is slightly below the June and July mean values. Note that the low volume sampler at Launceston was out of commission in the last two weeks of May (see Figure 17), so that the May average shown in Figure 18 is for the first half of May only, when domestic wood heater use was reduced compared to June and July. The full contribution of planned burn smoke to the degradation of air quality in May at Launceston cannot be determined from the current single-site data due to the confounding signal from domestic woodsmoke. Monitoring near Launceston (but away from local residential wood smoke sources) would address this issue. Note too, given very few planned burns were reported to have taken place after the end of May, domestic woodheater smoke appears to be the dominant source of winter-time particle pollution in Launceston.

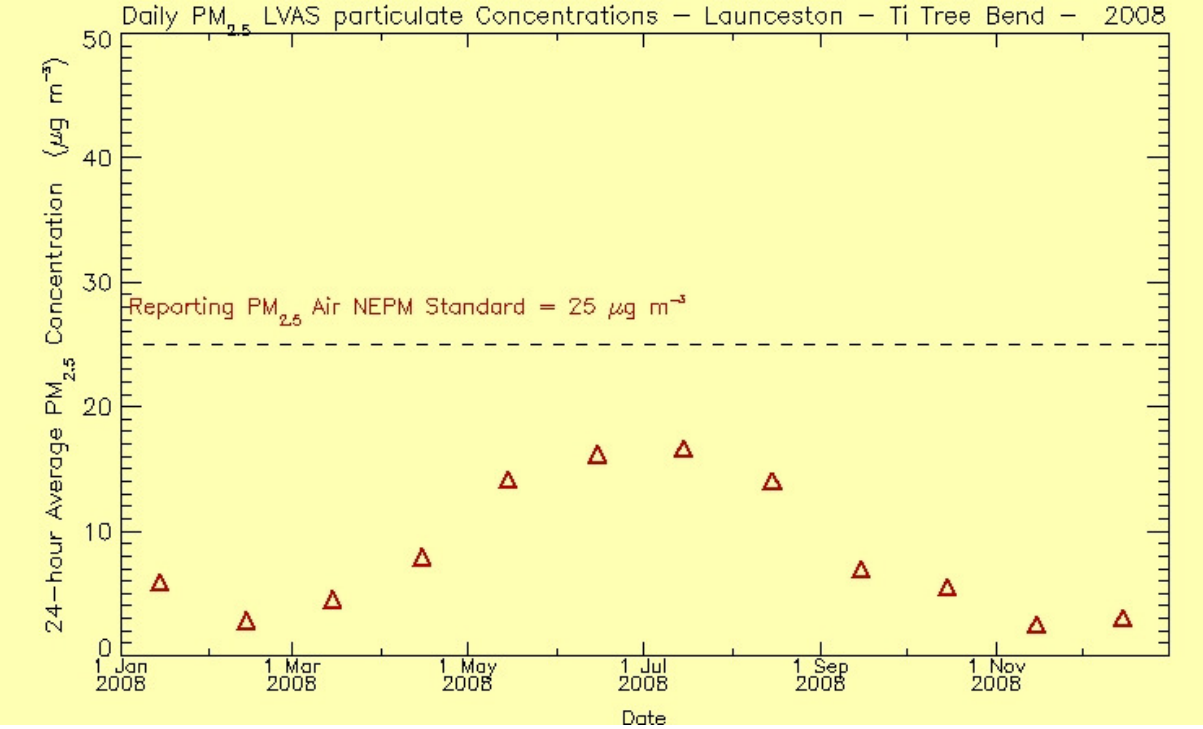

Figure 18 - Monthly mean $PM_{2.5}$ data (low volume air sampler) for Launceston, 2008. Note: The $PM_{2.5}$ low volume air sampler was out of commission from the 15th to the 28th of May inclusive, hence the May mean level is biased strongly to data from the first half of May.

PLANNED BURN SMOKE IN HOBART IN 2008

For Hobart, the 24th and 25th of April exceedences of the $PM_{2.5}$ reporting limit are clearly ascribable to planned burn smoke (as discussed above). The exceedences measured at Hobart of the 24th and 25th of May are due to the one smoke event that straddled these dates. The May PM_{10} and $PM_{2.5}$ data for Hobart shown in Figure 19 illustrate that particle levels on the 15th and 16th, and 24th and 25th, were significantly raised compared to the remainder of the month.

Satellite imagery shows that a number of large burns took place in southern Tasmania on the afternoon of the 15th of May (see Figure 20). The 15th and 16th of May were relatively mild days for May in Tasmania, with daily maximum temperatures near 20 C and minima near 6 or 7 C. Given the mild conditions, the elevated PM_{10} and $PM_{2.5}$ levels for the 15th and 16th appear unusually high. The hourly PM10 TEOM and ambient temperature data for Hobart for the 15th to the 17th of May are shown in Figure 21. On the 15th of May PM_{10} values started increasing around 16:00 AEST, when the air temperature was near 19 C. This is not consistent with a domestic wood smoke signature from solid fuel heating. PM_{10} levels remained above 20 µg m^{-3} during the following day (the 16th) despite a daytime maximum near 20 C, until a decrease during the evening. The PM_{10} levels then increased once more during the day of the 17th of May. This is not consistent with the signature of domestic wood smoke. A contributory effect from planned burn smoke would account for the increased particle levels at this time. Satellite images for the 16th and 17th of May show generally heavy cloud cover over Southern Tasmania. However an image for the afternoon of the 16th shows smoke moving down the east coast of Tasmania towards the Hobart area. Hence, while a planned burn smoke contribution to the Hobart airshed for this interval cannot be conclusively confirmed, it appears a likely explanation for the elevated PM_{10} and $PM_{2.5}$ levels seen at this time.

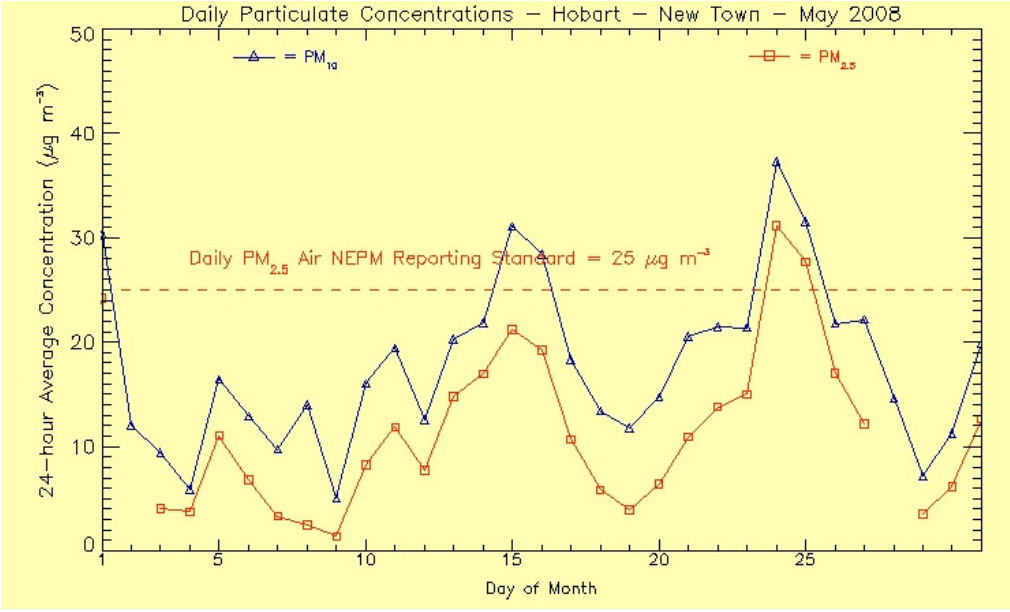

Figure 19. Hobart (New Town) LVAS PM_{10} and $PM_{2.5}$ data for May 2008.

As was noted above, particle levels at Hobart (New Town) on the 24th and 25th of May were also high, but in this case daily averages were above the $PM_{2.5}$ advisory reporting standard. The hourly TEOM PM_{10} and temperature data for Hobart for the 24th-25th May event are shown in Figure 22. The TEOM data show that PM_{10} levels begin to rise during the mid afternoon of the 24th, reaching a peak over 60 µg m^{-3}, much higher than for the surrounding days, and remained high during much of the following morning. The 24th was a relatively mild day with a maximum near 15 C and a cool minimum near 5 C on the night of the 24th/25th. The 25th was a slightly warmer day. (The coldest overnight temperature for the month occurred in the early hours of the 22nd of May, but corresponded to only moderate particle levels.) Satellite images for the 24th show a heavy cloud cover, but for the 25th an image obtained at 15 h AEST (not shown) shows a smoke plume in the far south of the state,

demonstrating that planned burns were still occurring late in May 2008. These data are not conclusive, but given the higher than usual PM_{10} and $PM_{2.5}$ levels seen on the evening of the 24th a planned burn contribution may be possible.

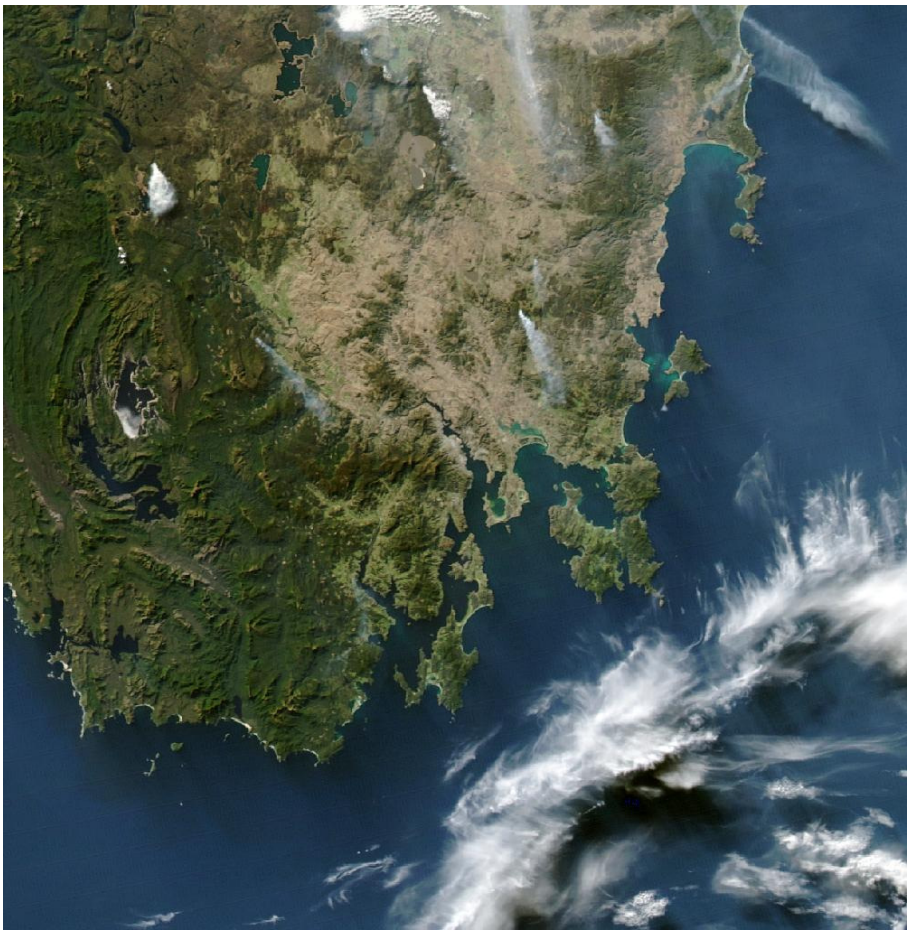

Figure 20 - MODIS image of southern Tasmania, 15 h AEST, 15th May 2008.

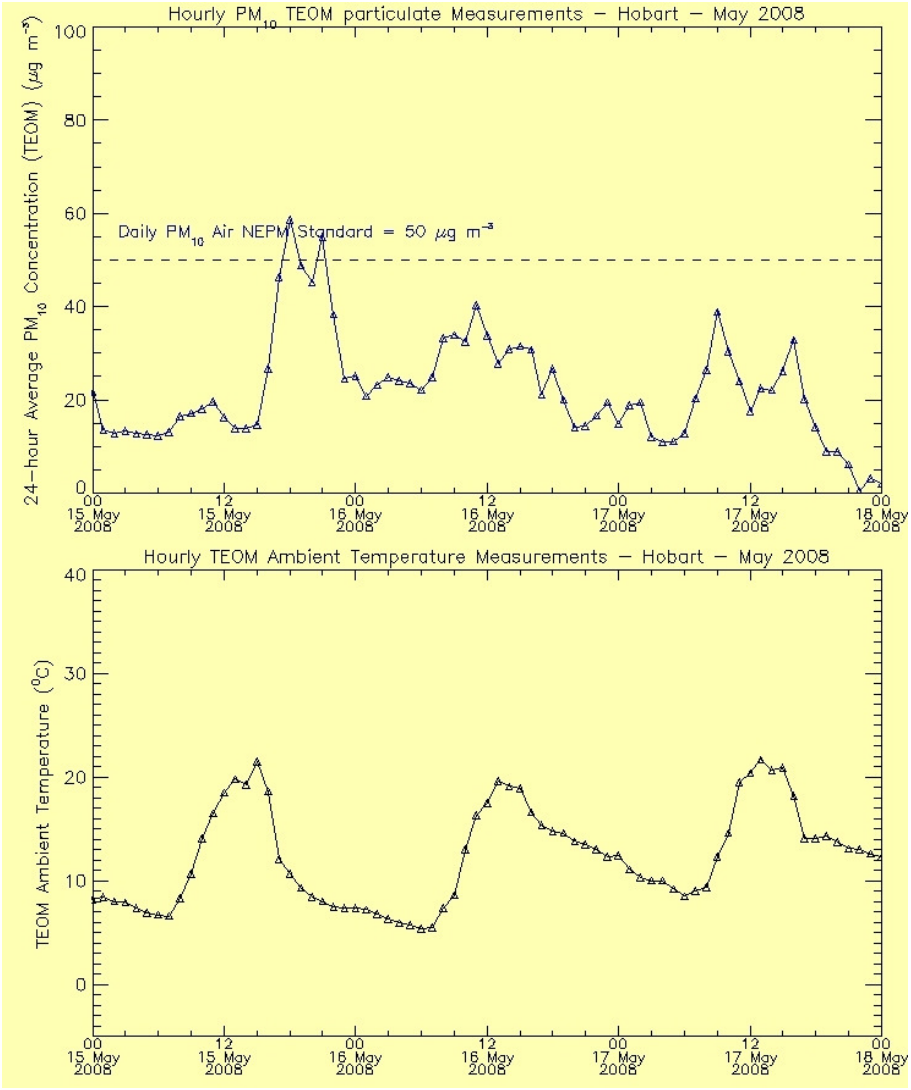

Figure 21 -Hourly PM_{10} TEOM and air temperature data for Hobart, for 15th to 17th of May 2008

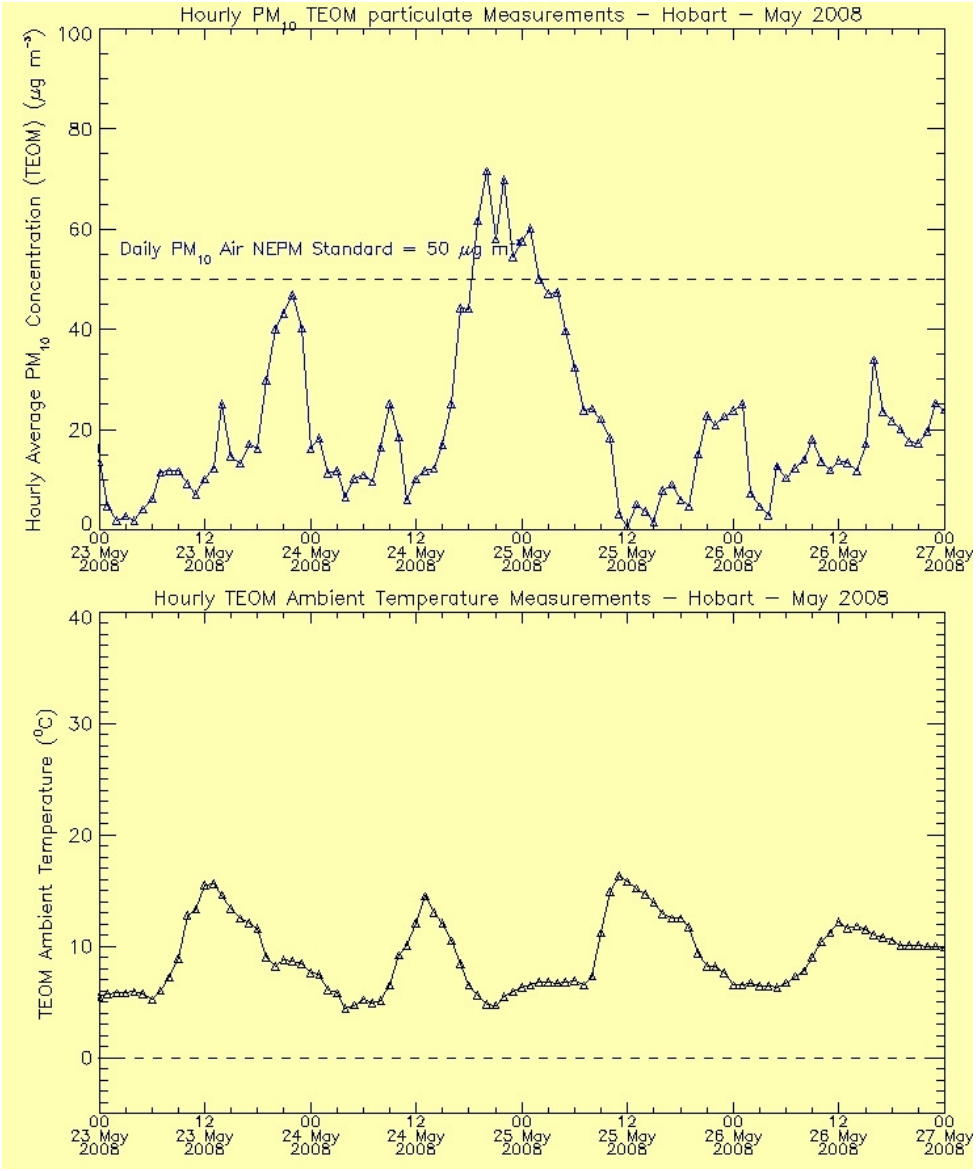

Figure 22 - Hobart (New Town) TEOM PM_{10} data (top) and temperature data (lower) for 23rd to 26th May 2008.

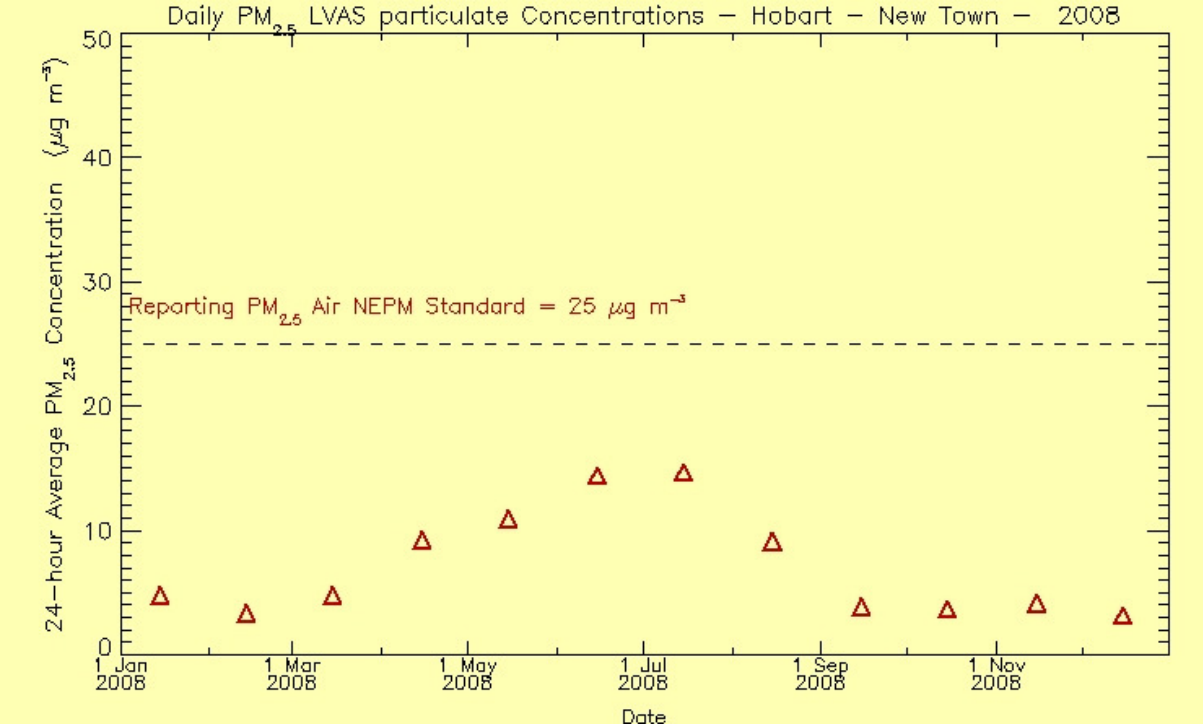

Figure 23 - Monthly mean $PM_{2.5}$ (low volume air sampler) data for Hobart, 2008.

Figure 23 shows monthly mean $PM_{2.5}$ levels for Hobart (New Town station) for 2008. April and May mean levels are significantly elevated compared to February and March. The raised April and May levels are, at least in part and particularly for April, likely to be due to the effects of planned burn smoke reaching Hobart. Although not as large as the effect seen in Launceston in 2008, there is clearly a degradation of air quality in Hobart due to the planned burns. Domestic wood smoke is likely to be the main contributor to the high $PM_{2.5}$ levels shown in the elevated June and July monthly means, and remains the dominant source of particle pollution for Hobart.

PLANNED BURN PARTICLE EMISSION TO THE TASMANIAN AIRSHED

The relative contribution to the Tasmanian airshed for 2008 of particle pollution from smoke from forestry planned burns and smoke from domestic wood heaters can be estimated. A review of the 2008 planned burn season for the Tasmanian Forest Practices Authority[3], estimated that of the 31,000 hectares of 579 forest or forest industry planned burns in Tasmania, nearly 18,000 ha was of heavy fuel burns, with a fuel loading near 400 tonnes per hectare. This leads to an estimate of about 7.2 million tonnes of wood consumed in these heavy-fuel burns alone.

Assuming a particle production rate of between 12 and 17 gram per kg of wood burnt[4], and taking the figure of 7.2 million tonnes of wood consumed in 2008, the estimated Tasmanian forest planned-burn particle production in 2008 was between 86,000 and 120,000 tonnes. Note that this represents the total emission to the airshed, and is not an estimate of population exposure.

[3] R. Chuter, 'Review of the implementation and effectiveness of the 2008 interim fire management/smoke dispersal guidelines', report to the Tasmanian FPA, 2008.

[4] The lower value is from the National Pollution Inventory (NPI) agriculture estimation manual, the higher value is from a CSIRO/Bushfire Co-operative Research Centre study, for fuel with a 10% moisture content.

An estimate of particle emission to the airshed due to Tasmania's domestic wood-heaters can also be found. Figures from the Australian Bureau of Statistics[5] lead to an estimate of 42,000 combustion stoves and 4,300 open fireplaces in Tasmanian residences in 2008. Assuming particle emission rates of 10 grams per kilogram of wood burnt for combustion stoves (from a CSIRO study of 'real-world' wood heater use in Launceston) and 17 grams per kilogram of wood burnt for open fires, and assuming each domestic heater uses 10 tonnes of wood per annum, this leads to an estimate of 5,000 tonnes of emitted particles from domestic wood heating per annum. Thus forest industry planned burns particle production in 2008 was approximately seventeen to twenty four times that from woodheaters.

These values need to be interpreted cautiously, as they represent estimates only of total emissions to the airshed. They do not attempt to account for proximity to or impact on populations. However, they do indicate that the total emission to the airshed from forestry planned burns is likely to be many times that from domestic wood heaters. Note that particle production from both forest industry burns and woodheater use will vary from year to year, depending on the level of forest industry operations and meteorological conditions.

A previous estimate of the relative levels of PM_{10} particle emissions from domestic woodheaters and forest burning (which included fuel reduction and regeneration burns and smoke from bushfires) into the Tasmanian airshed was presented in the *Tasmanian Air Quality Strategy* (2006)[6], using National Pollution Inventory (NPI) data from 2003-2004. Domestic solid fuel heating was reported to contribute 41% of the total PM_{10} particle emissions in Tasmania, while forest burning contributed 3%. That is, in the *Tasmanian Air Quality Strategy*, forest burns were estimated to contribute to the Tasmanian airshed only about one fourteenth as many particles as domestic heating. The new calculation presented above has substantially revised upwards the levels of particle production from forest burns, so that it would now clearly appear to be the dominant emission source of particles to the Tasmanian airshed. Work is underway to identify the reasons for what appears to be an underestimate of the forestry/bushfire particle contribution in the *Tasmanian Air Quality Strategy* (2006) figures.

In Tasmania planned burns take place under a comprehensive set of guidelines that aim to minimise smoke impacts. The guidelines include taking account of forecast meteorological conditions for smoke dispersion and the likely trajectory of the plume. Given the estimated quantity of the planned burn emissions, even if only a small fraction of the particles produced by planned burns impacted on populated areas the effects could be significant. Some effects on air quality in Launceston and Hobart due to planned burns has already been noted . Neither city is particularly near to areas of planned burn operation. It is likely that towns and settlements located nearer to planned burn activities would also experience degraded air quality at times. There is however a current lack of hard data to verify or refute this. In the financial year 2008/2009 the Tasmanian government, through the Environmental Protection Authority, has initiated a pilot program to obtain air quality data over a wider area of the state to address this gap and to assist in the management of smoke from planned burns. A new monitoring network will be created, known as BLANkET (*Base-Line Air Network of EPA Tasmania*). The network will consist of up to 15 low-cost stations distributed around the state

[5] ABS, ENVIRONMENTAL ISSUES: Energy use and Conservation, 4602.0.55.001, March 2008, page 60

[6] Available at http://www.environment.tas.gov.au/index.aspx?base=222. See Figure 2, page 28.

and reporting indicative data in real-time. The network is intended to be fully operational for the 2010 autumn burning season.