# Annual Summary for 2009
# Report No.ARM-2010-03
# Latrobe Valley Air Monitoring Network (LVAMN)

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# Contents

# Forward

This report presents the annual air quality summary for the Latrobe Valley Air Monitoring Network (LVAMN) for the year 2009. The LVAMN consists of three air monitoring stations and an acoustic sounder operated on behalf of PowerWorks and two air monitoring stations operated on behalf of EPA Victoria. All of these stations were operated and maintained by Aurecon's NATA accredited facility in Morwell.

The two EPA stations are performance monitoring stations for the purposes of the *State environment protection policy (Ambient Air Quality)*. Assessment of air quality against the goals set in the policy is undertaken at these performance monitoring stations.

The data reported has been determined in accordance with the following Australian Standards:

- AS 3580.5.1 - 1993 Methods for sampling and analysis of ambient air – Determination of oxides of nitrogen – Chemiluminescence method.
- AS 3580.4.1 - 1990 Methods for sampling and analysis of ambient air – Determination of sulfur dioxide – Direct-reading instrumental method.
- AS 3580.6.1 - 1990 Methods for sampling and analysis of ambient air – Determination of ozone – Direct-reading instrumental method.
- AS 3580.9.6 - 2003 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – $PM_{10}$ high volume sampler with size selective inlet – Gravimetric method.
- AS 3580.9.8 - 2001 Method for sampling and analysis of ambient air – Determination of suspended particulate matter – $PM_{10}$ continuous direct mass method using a tapered element oscillating microbalance, (TEOM) analyser.
- AS 2923 – 1987 [1] Ambient air - guide for measurement of horizontal wind for air quality applications.
- AS 3580.1.1 - 2008 Guide to siting of air monitoring equipment

Determination of local visual distance (LVD) has been performed in accordance with EPA Victoria's designated method that is based on AS/NZS 3580.12.1:2001.

All requirements for instrument performance (measured as available data generated for the year) have been met.

The summary is therefore an accurate record of the state of the Latrobe Valley's air quality at this time.

The summaries for all stations were prepared from validated data sets stored on the central computer system housed in Aurecon's offices at 3 Lignite Court, Morwell, Victoria.

Validated data have been provided to EPA for archiving, and is available from EPA on request.

David Guy (EPA Victoria)
Convener
LVAMN Operations & Performance Review Committee

[1] The sites at Moe, Traralgon and Jeeralang Hill do not meet all the requirements of this standard with regard to adequate distances from disturbances such as trees.

# Summary


**LATROBE VALLEY AIR MONITORING NETWORK**

**ANNUAL AIR QUALITY COMMENTARY 2009**

Annual air quality summaries and commentaries are presented for each air quality station in the Latrobe Valley Air Monitoring Network (LVAMN) for the year January to December 2009.

The highest measured values of sulfur dioxide ($SO_2$) in the Latrobe Valley can usually be attributed to power station emissions. The highest 1hr average concentration in 2009 (0.254 ppm) was measured on 19 January at Jeeralang Hill in the Strzelecki Ranges. The *State Environment Protection Policy (Ambient Air Quality*) ("SEPP") 1hr Environmental Quality Objective of 0.20 ppm (refer Table 2) was exceeded at Jeeralang Hill on two occasions during the year.

The highest 1hr average $SO_2$ concentration measured on the floor of the Latrobe Valley was 0.110 ppm at Traralgon on 25 January.

The highest 1hr average nitric oxide (NO) concentration, 0.400 ppm, was measured at Rosedale South on 7 February. This was attributed to the extreme bushfire activity occurring in the Strzelecki Ranges, south of the Latrobe Valley. There is no SEPP Objective for nitric oxide.

The highest 1hr average nitrogen dioxide ($NO_2$) concentration, 0.094 ppm measured at Rosedale South on 7 February, was also attributed to bushfire activity in the Strzelecki ranges. Although elevated, this was still below the SEPP 1hr Objective for $NO_2$ of 0.12 ppm.

Particulate matter less than 10 microns in diameter ($PM_{10}$) is measured by two different methods, but all data are compared against the same Objective of 50.0µg/m$^3$, 24-hour average. Several exceedences of the SEPP Objective occurred at Moe (7 days) and Traralgon (5 days). The highest 24 hour average $PM_{10}$ concentration using TEOM[1] method was 169.6 µg/m$^3$, measured at Moe. The highest 24 hour average $PM_{10}$ concentration measured at Traralgon using TEOM[1] method was 125.7µg/m$^3$ and the highest using a high volume sampler was 51.4µg/m$^3$ measured at Jeeralang Hill.

The SEPP 1hr Objective for Local Visual Distance (LVD) of 20 km was exceeded on 38 separate days during the year. The SEPP goal is that exceedences should occur on no more than 3 days per year per site. The most exceedence days recorded by a single station was 25 at Moe, which breached the SEPP goal. The Goal was also breached at Traralgon, with 23 exceedence days. Widespread LVD breaches were attributed mainly to extreme bushfire activity and planned burning. The total number of exceedences for the Network was 59, which is comparable to most recent years.

The highest 1hr average ozone ($O_3$) concentration for the year was 0.104 ppm, which occurred on 31 January at Traralgon. This is the only exceedence of the SEPP 1hr Air Quality Objective of 0.10 ppm.

The highest 4hr rolling average $O_3$ concentration for the year, 0.088 ppm, occurred at Rosedale on 30 January. This measurement is the only exceedence of the SEPP Objective of 0.08 ppm. The SEPP Goal was therefore met.


[1] Tapered element oscillating microbalance

# 1. Introduction

Annual summaries of air quality statistics and commentaries for the Latrobe Valley Air Monitoring Network (LVAMN) are presented for the period January to December 2009. All monitoring stations were operated and maintained by Aurecon on behalf of PowerWorks and EPA Victoria. A list of all current LVAMN stations is given in Table 1 and their locations are shown in Figure 1.

The data reported have been determined in accordance with the following Australian Standards:

| | |
|---|---|
| AS 3580.5.1 - 1993 | Oxides of Nitrogen ($NO_X$, $NO_2$, and NO) |
| AS 3580.4.1 - 1990 | Sulphur Dioxide ($SO_2$) |
| AS 3580.6.1 - 1990 | Ozone ($O_3$) |
| AS 3580.9.6 - 2003 | Suspended Particulate Matter ($PM_{10}$) Hi-Vol method |
| AS 3580.9.8 - 2001 | Suspended Particulate Matter ($PM_{10}$) TEOM method |
| AS 2923 - 1987 | Measurement of horizontal wind for air quality applications |
| AS 3580.1.1 – 2008 | Guide to siting of air monitoring equipment |

Determination of Local Visual Distance (LVD) has been undertaken in accordance with the Environment Protection Authority of Victoria designated method that is based on AS/NZS 3580.12.1:2001.

Table 2 shows the *State Environment Protection Policy (Ambient Air Quality)* ("SEPP") Environmental Quality Objectives and Goals for Victoria (Victoria, 1981). While the Objectives apply to all ambient air in Victoria, it should be noted that evaluation of air quality against the Goals is to be undertaken at performance monitoring stations located in urban or populated areas only. The Moe and Traralgon monitoring stations are performance monitoring stations.

The rural sites of Darnum North, Jeeralang Hill and Rosedale South serve as surveillance sites and measurements are used for air quality modelling, plume impact and other studies.

# 2. LVAMN Operations for 2009

## 2.1 Network operations

Three air monitoring stations were in operation for the complete twelve months; these were Traralgon urban site and Rosedale South and Jeeralang Hill rural sites. Darnum North, a rural site, operated for six months only (January to March and October to December).

The urban site at Moe was decommissioned on 26 October 2009 to make way for urban developments by Latrobe City Council.

The parameters measured at each monitoring station are:
**Darnum North:** Ozone, Wind Speed, Wind Direction for the spring and summer (October to March) period only as ozone concentrations are not a concern during the winter months.

**Rosedale South:** Nitrogen Oxides, Sulphur Dioxide, Ozone, Local Visual Distance, Dry Bulb Temperature, Wet Bulb Temperature, Wind Speed, Wind Direction, Global Solar Radiation, Ultra-Violet Radiation and Inhalable Particles (HiVol $PM_{10}$ size selective inlet method).

**Jeeralang Hill:** Ozone, Sulphur Dioxide, Wind Speed, Wind Direction and Inhalable Particles (Hivol $PM_{10}$ size selective inlet method).

**Moe:** Nitrogen Oxides, Sulphur Dioxide, Ozone, Local Visual Distance, Dry Bulb Temperature, Wind Speed, Wind Direction and Inhalable Particles (TEOM continuous $PM_{10}$ method).

**Traralgon:** Nitrogen Oxides, Sulphur Dioxide, Ozone, Local Visual Distance, Dry Bulb Temperature, Wind Speed, Wind Direction and Inhalable Particles (TEOM continuous $PM_{10}$ method).
An acoustic sounder is located at "The Ridge" in Morwell at the southern end of the PowerWorks building. The sounder measures wind speed, wind direction and temperature at a range of heights to enable more accurate tracking of stack emissions and provides important data for the modelling of emissions and atmospheric dispersion.

The urban monitoring sites of Moe and Traralgon are regarded as "Performance Monitoring" sites and are equipped with continuous analysers in accordance with the NEPM[1] measurement criteria.

A complete list of current LVAMN stations is shown in Table 1 and the locations of these stations are shown in Figure 1.

## 2.2 Network performance

All monitoring equipment used in the LVAMN stations performed extremely well for the year. All parameters performed above the individual minimum requirement of 80% valid data capture. Data losses from power interruptions and air conditioner breakdowns (causing over temperature trips) were the most significant causes of lost data (refer to Table 7 "LVAMN Air Quality Instrument Performance Statistics for 2009").

The NEPM requires 75% valid data capture for each parameter in each calendar quarter. This requirement was met at the Moe and Traralgon performance monitoring stations.

[1] *National Environment Protection (Ambient Air Quality) Measure*

# 3. Latrobe Valley Air Quality 2009

The summary of air quality measurements for the Latrobe Valley Air Monitoring Network for the period January 2009 to December 2009 is shown in Table 3 and Table 4.

The highest values[2] measured in the Latrobe Valley for each year from September 1980 to December 2009 are shown in Tables 5a, 5b and 5c.

Measured concentrations are rounded to the nearest 0.001 ppm, 0.1 km or 0.1 µg/m$^3$ in accordance with reporting protocols agreed under the NEPM and with EPAV.

## 3.1 Nitric oxide (NO)

Nitric oxide is discharged mainly from combustion processes. It is not considered to be harmful and it has no air quality objective. Its presence in air usually indicates the impact of a combustion source.

The highest concentrations of NO usually occur at township stations, which measure far higher concentrations of NO than do rural stations. The highest levels usually occur in near-calm conditions in the evening or early morning in winter when the local emissions from traffic, heating and cooking are not flushed away by the wind.

The two highest 1hr average NO concentrations at Traralgon were 0.223 ppm on 20 July, and 0.172 ppm on 26 June. The two highest 1hr average NO concentrations at Moe were 0.158 ppm on 5 June, and 0.156 ppm on 17 July. These urban measurements were characteristic of traffic, heating and cooking emissions accumulating during near calm stable conditions, and were consistent with previous years' data.

The two highest 1hr average NO concentrations measured at the rural Rosedale South station were 0.400 ppm on 7 February and 0.210 ppm on 26 April. These elevated measurements were attributed to bushfire activity and planned burns respectively. Generally, these readings are considerably lower than at the urban Traralgon and Moe sites.

## 3.2 Nitrogen dioxide ($NO_2$)

$NO_2$ is largely formed in the atmosphere by the oxidation of NO emissions that originate from urban and industrial sources.

Historically the measured levels have been well below the SEPP 1hr Air Quality Objective, and the maximum 1hr average concentration in 2009 (0.094 ppm at Rosedale on 7 February) although the highest measurement since 1980/81, was still below the SEPP 1hr Objective for $NO_2$ of 0.12 ppm. This maximum $NO_2$ was attributed to extreme bushfire activity in the Strzelecki Ranges.

The highest 1hr average concentration measured at an urban site was 0.067 ppm at Traralgon also on 7 February. This maximum was also attributed to the extreme bushfire activity in the region.

The highest annual average $NO_2$ concentration measured at either an urban or rural site during 2009 was 0.007 ppm at Traralgon, well below the SEPP objective of 0.03 ppm.

[2] The lowest values for local visual distance (LVD).

## 3.3 Sulfur dioxide ($SO_2$)

About 95% of all $SO_2$ in the Latrobe Valley originates from industrial sources. The highest values can usually be attributed to power station emissions.

The highest 1hr average $SO_2$ concentration during 2009, 0.254 ppm measured at Jeeralang Hill on 19 January 2009, was attributed to a plume strike from Loy Yang A and B Power Stations occurring under stable conditions during the early morning. A total of two exceedences occurred at Jeeralang Hill with a level of 203 ppb recorded on 30 October. Other elevated SO2 concentrations at Jeeralang Hill, indicative of power station emission impacts, included measurements exceeding 0.100 ppm on 18 days and 0.05 ppm on 40 days. These impacts are indicative of those likely to occur along the northern slopes of the Strzelecki Ranges.

The SEPP Goal of less than 0.20 ppm for all but one day per year was met at the urban monitoring sites.

The highest 1hr average $SO_2$ concentration measured on the Latrobe Valley floor was 0.110 ppm. This occurred at Traralgon on 25 January. This was attributed to power station emissions being convectively mixed to ground level under unstable conditions. The second highest event was 0.104 ppm measured at Rosedale South also on 25 January. This measurement was also attributed to power station plume impact.

The highest 24hr average concentration of $SO_2$ measured by the LVAMN was 0.035 ppm at Jeeralang Hill on 30 October 2009. While this value did not breach the SEPP 24hr Objective of 0.08 ppm, the plume impact was evident for approximately 11 hours at the monitoring station.

The SEPP Objective for the annual average concentration of $SO_2$ is 0.020 ppm and is not to be exceeded. The highest annual average concentration of $SO_2$ was 0.003 ppm, measured at Jeeralang Hill. This is well below the Objective.

## 3.4 Ozone ($O_3$)

Photochemical pollution (the action of sunlight on a mixture of oxides of nitrogen and hydrocarbons) is responsible for most of the measured high levels of ozone in the Latrobe Valley.

In 2009 the highest 1hr ozone concentration was 0.104 ppm, recorded at Traralgon on 31January. Other maxima recorded in the network were 0.092 ppm at Rosedale South, 0.085 ppm at Jeeralang Hill, 0.084 ppm at Darnum North, and 0.057 ppm at Moe. The Goal is that the Objective may be exceeded on one day only per year per site. The SEPP 1hr Air Quality Objective of 0.10 ppm for ozone was therefore met at all monitoring sites.

The highest rolling 4hr average $O_3$ concentration for 2009 was 0.088 ppm, recorded at Rosedale South on 30 January. This was the only measurement to exceed the SEPP Objective of 0.080 ppm. The SEPP Goal for 4hr ozone, was therefore met.

## 3.5 Visibility reducing particles (measured as LVD)

The SEPP Objective for visibility reducing particles is based on aesthetic considerations. The Objective is measured as local visual distance (which is degraded by airborne particles smaller than 2.5 µm in diameter) and states that the LVD should be at least 20 km. The Goal is that the Objective be exceeded for no more than 3 days per year per site. The Goal has been breached at one or more sites every year since the commencement of the LVAMN. Low LVD measured at ground level has been found to occur mainly in calm, stable conditions which result in the accumulation of pollution from ground based sources (Joynt, 1988).

The SEPP Objective of 20 km was exceeded on 38 separate days during the year. The objective was breached at Moe on 25 days, at Traralgon on 23 days, and at the rural station, Rosedale South, on 11

days, (total of 59days). Breaches occurred at all three stations on 7 days, and at two of three stations on 7 days, indicating widespread visibility degradation on these 14 days. The remaining 24 exceedences occurred at only one station on each given day, indicating a greater likelihood that these were due to local sources.

Bushfire activity and/or planned burning activities caused these impacts on 8 days over January, February, March and April. With the exception of one exceedence at Rosedale South during October, the remaining exceedences occurred at Moe and Traralgon during the evening or early morning and were due to local urban (principally household and traffic) emissions.

## 3.6 Particulate matter less than 10 microns ($PM_{10}$)

$PM_{10}$ (particles less than 10µm) is a measure of inhalable particles that are generally larger than those causing visibility degradation. The Objective and Goal are based on human health considerations. In general, the highest concentrations of 24 hour $PM_{10}$ measured in the Latrobe Valley can be attributed to bushfires and planned burns.

$PM_{10}$ is measured in two ways in the LVAMN. The urban stations at Moe and Traralgon use a continuous analyser known as a TEOM[3], which obtains measurements every hour of the year. 24-hour averages are calculated for each day. Note that the 24hr average concentration values presented in this report have been adjusted for temperature to account for the loss of volatiles, in accordance with the standard method. Values presented in Table 6 have also been adjusted for temperature accordingly.

The rural stations at Rosedale South and Jeeralang Hill use high volume samplers which obtain a 24-hour average measurement on every sixth day.

The highest 24 hour average $PM_{10}$ concentration of 169.6µg/m$^3$ was measured on 7 February at Moe. The highest 24 hour average at Traralgon, 125.7µg/m$^3$ was also measured on 7 February. The $PM_{10}$ Objective was exceeded on 7 occasions at Moe and 5 occasions at Traralgon thereby breaching the SEPP Goal at both sites. Exceedences were attributed to extreme bushfire activity and planned burning activities.

The highest $PM_{10}$ measurement at a rural station occurred at Jeeralang Hill, where a 24-hour average $PM_{10}$ concentration of 51.4µg/m$^3$ was caused by bushfire smoke on the 23 January. The 24hr SEPP Objective of 50.0µg/m$^3$ was also exceeded at this site on 23 April with a 24hr measurement of 51.0µgm$^{-3}$.

Monthly and yearly average $PM_{10}$ concentrations for the LVAMN sites are given in Table 6. The highest annual concentration of $PM_{10}$ was 19.8 µg/m$^3$ measured at Traralgon. There is no SEPP Objective for the annual concentration, but this measured value is slightly higher than in previous years for the LVAMN sites.

[3] Tapered element oscillating microbalance

# 4. References

LVAMN Network Database - WINCOLLECT - Validated data from January 2009 to December 2009.

LVAMN Annual Air Quality Commentary, January to December 2008, CW Report No CWM-2009-01.

Victoria. (1999). State Environment Protection Policy (Ambient Air Quality), Victoria Government Gazette S19, 9 February 1999. Amendments as per Victoria Government Gazette S240, 21 December 2001, page 48.

Information provided by the Department of Sustainability and Environment (DSE) on planned burning and bushfire activity in the Gippsland Region during 2009.

Joynt, R C, (1988). Airborne Particles in the Latrobe Valley. Clean Air. Vol 22. No4, November 1988.

# 5. Tables

## Table 1: Latrobe Valley Air Monitoring Network Stations 2009

| Station Number | Station Short Name | Station Name | Station Type | Station Start Date | *Sampling Height (m agl)* | *Station Location* | |
|---|---|---|---|---|---|---|---|
| | | | | | | *Coordinates (mE) (mN)* | *Description* |
| 1 | DN | Darnum North ** | AQR | 11/05/79[%] 25/09/00[#] | 3 | 413400 5779000 | Nilma-Shady Creek Road, Approx 100m north of Halls and Porches Rd. |
| 12 | MO | Moe ++ | AQU | 05/05/82 | 3 | 434900 5773400 | Vale St Oval, via South St, Moe |
| 13 | TR | Traralgon | AQU | 6/01/82 | 3 | 459200 5772300 | Kay St, Traralgon, adjacent to pool |
| 17 | RS | Rosedale South | AQR | 2/06/87 | 3 | 480500 5772200 | West of Willung Road, Rosedale South |
| 36 | JH | Jeeralang Hill | AQR | 1/09/96 | 3 | 454010 5755500 | 1km north of Jeeralang North Road (Thomson Road) |
| 37 | PS | PowerWorks SODAR | AS | 11/05/01 | Multiple[@] | 448550 5766390 | South of PowerWorks building, Ridge Rd, Morwell |

Notes:
AQR - Air Quality Rural
AQU - Air Quality Urban
AS - Acoustic Sounder
** Darnum North is operated for six months per year: January to March, October to December.
[%] Initial installation with complete instrument set as per Rosedale South.
[#] Commencement of six months per year operation with ozone measurement only.
++ Moe decommissioned on 26th November 2009.
[@] Measures at various pre-selected heights up to approx 1500metres.
Map reference is the National Topographic Map series 1:100,000 (Sheets 8121 Moe, 8221 Traralgon).
The sampling height of anemometers and wind direction sensors at air monitoring stations is 10m above ground level (agl).

## Table 2: State Environmental Protection Policy (SEPP) Air Quality Objectives

State Environment Protection Policy (Ambient Air Quality)
Environmental Quality Objectives and Goals

| Pollutant | Averaging Period | Environmental Quality Objectives [1] | Goal -Maximum Allowable Exceedences |
|---|---|---|---|
| Carbon monoxide | 8 hours[2] | 9.0 ppm | 1 day a year |
| Nitrogen dioxide | 1 hour<br>1 year | 0.12ppm<br>0.03 ppm | 1 day a year<br>None |
| Photochemical oxidant (as ozone) | 1 hour<br>4 hours [2] | 0.10 ppm<br>0.08 ppm | 1 day a year<br>1 day a year |
| Sulphur dioxide | 1 hour<br>1 day<br>1 year | 0.20 ppm<br>0.08 ppm<br>0.02 ppm | 1 day a year<br>1 day a year<br>None |
| Lead | 1 year | 0.50 $\mu g/m^3$ | None |
| Particles as $PM_{10}$ | 1 day | 50 $\mu g/m^3$ | 5 days a year [3] |
| Visibility Reducing Particles | 1 hour | 20 km [4] | 3 days a year |

Notes to table:
1. Objectives are maximum concentrations in each case, except for visibility reducing particles which is a minimum visual distance.
2. Rolling averages based on consecutive 1 hour averages.
3. Five exceedences per year allowed for daily monitoring (equivalent to 1 exceedence per year where measurements are undertaken on a one day in six basis).
4. Minimum visual distance.

*Important Note:*
The above air quality objectives apply to ambient air throughout Victoria.
The urban sites of Moe and Traralgon have been designated “performance monitoring sites” in accordance with the National Environment Protection Measure to monitor and assess the air quality in populated areas.
Rural air quality is monitored at the sites of Darnum North, Jeeralang Hill and Rosedale South. These sites also serve as surveillance sites and measurements are used for air quality modelling, plume impact and other studies.

## Table 3: Air Quality January 2009 to December 2009 – 1 Hour Averages

| STATION | | | DN | MO | TR | RS | JH | SEPP |
|---|---|---|---|---|---|---|---|---|
| STATION NUMBER | | | 1 | 12 | 13 | 17 | 36 | Objectives |
| NUMBER OF MONTHS IN SERVICE | | | 6 (a) | 10 (d) | 12 | 12 | 12 | and Goals |
| HOURS OF AVAILABLE DATA | NO | | N/A | 6839 | 8358 | 8307 | N/A | |
| | $NO_2$ | | N/A | 6839 | 8358 | 8309 | N/A | |
| (Total annual hours per parameter = 8784 hrs) | $SO_2$ | | N/A | 6839 | 8340 | 8305 | 8073 | |
| | $O_3$ | | 4049 | 6832 | 8011 | 8237 | 7749 | |
| | LVD | | N/A | 6845 | 8317 | 8218 | N/A | |
| | TEOM | | N/A | 7114 | 8660 | N/A | N/A | |
| MAXIMUM MEASURED CONCENTRATION | NO | (ppb) | N/A | 158 | 223 | 400 | N/A | |
| | $NO_2$ | (ppb) | N/A | 63 | 67 | 94 | N/A | |
| | $SO_2$ | (ppb) | N/A | 54 | 110 | 104 | 254 | |
| | $O_3$ | (ppb) | 84 | 57 | 104 | 104 | 85 | |
| MINIMUM MEASURED VISIBILITY | LVD | (km) | N/A | 4.2 | 3.3 | 4.3 | N/A | |
| SECOND HIGHEST DAILY MAXIMUM | NO | (ppb) | N/A | 156 | 171 | 210 | N/A | |
| | $NO_2$ | (ppb) | N/A | 25 | 33 | 72 | N/A | 120ppb (b) |
| | $SO_2$ | (ppb) | N/A | 53 | 54 | 50 | 203 | 200ppb (b) |
| | $O_3$ | (ppb) | 80 | 48 | 57 | 79 | 77 | 100ppb (b) |
| FOURTH LOWEST DAILY MINIMUM | LVD | (km) | N/A | 7.2 | 5.9 | 8.5 | N/A | 20km (c) |
| DAYS WITH VISIBILITY MINIMUM < 20 km | | | N/A | 25 | 23 | 11 | N/A | 3 days |
| DAYS WITH 1-HR $O_3$ MAXIMUM > 100ppb | | | 0 | 0 | 1 | 1 | 0 | 1 day |

NOTES TO TABLE

(a) Darnum North is operated for six months per year: January to March and October to December.

(b) Not to be exceeded on more than one day in any one year.

(c) Not to be exceeded on more than three days in any one year.

(d) Moe station decommissioned on 26 October.

## Table 4: Air Quality January 2009 to December 2009 – Longer Term Averages

| STATION | | | DN | MO | TR | RS | JH | SEPP |
|---|---|---|---|---|---|---|---|---|
| STATION NUMBER | | | 1 | 12 | 13 | 17 | 36 | Objectives |
| NUMBER OF MONTHS IN SERVICE | | | 6 (a) | 10 (i) | 12 | 12 | 12 | and Goals |
| PERIODS OF AVAILABLE DATA | 24-HOUR NO | | N/A | 298 | 364 | 365 | N/A | |
| (e.g. 1 period = 24 hours and represents 75% | 24-HOUR $NO_2$ | | N/A | 298 | 364 | 361 | N/A | |
| or greater data capture for the period) | 24-HOUR $SO_2$ | | N/A | 298 | 363 | 361 | 348 | |
| | 24-HOUR $O_3$ | | 170 | 298 | 348 | 357 | 333 | |
| | 24-HOUR $PM_{10}$ | | N/A | 298 | 365 | 59 | 57 | |
| | 4-HOUR $O_3$ (b) | | 4148 | 7131 | 8266 | 8595 | 8057 | |
| MAXIMUM MEASURED CONCENTRATION | 24-HOUR NO | (ppb) | N/A | 40 | 44 | 59 | N/A | |
| | 24-HOUR $NO_2$ | (ppb) | N/A | 16 | 18 | 20 | N/A | |
| | 24-HOUR $SO_2$ | (ppb) | N/A | 11 | 12 | 13 | 35 | |
| | 24-HOUR $PM_{10}$ | ($\mu g/m^3$) | N/A | 169.6 | 125.7 | 43.1 | 51.4 | |
| | 4-HOUR $O_3$ (b) | (ppb) | 77 | 47 | 74 | 88 | 76 | |
| SECOND HIGHEST DAILY MAXIMUM (c) | 24-HOUR NO | (ppb) | N/A | 36 | 42 | 36 | N/A | |
| | 24-HOUR $NO_2$ | (ppb) | N/A | 13 | 15 | 12 | N/A | |
| | 24-HOUR $SO_2$ | (ppb) | N/A | 9 | 10 | 10 | 23 | 80ppb (d) |
| | 4-HOUR $O_3$ (b) | (ppb) | 76 | 42 | 52 | 68 | 73 | 80ppb (d) |
| SECOND HIGHEST DAILY MAXIMUM (c) | 24-HOUR $PM_{10}$ | ($\mu g/m^3$) | N/A | N/A | N/A | 39.2 | 51.0 | 50$\mu g/m^3$ (d,g) |
| SIXTH HIGHEST DAILY MAXIMUM (c) | 24-HOUR $PM_{10}$ | ($\mu g/m^3$) | N/A | 53.2 | 42.6 | N/A | N/A | 50$\mu g/m^3$ (f) |
| DAYS WITH 4-HR $O_3$ MAXIMUM > 80ppb | | | 0 | 0 | 0 | 1 | 0 | 1 day |
| DAYS WITH $PM_{10}$ > 50 $\mu g/m^3$ | | | N/A | 7 | 5 | 0 | 2 | See note (e) |
| ANNUAL AVERAGE CONCENTRATION | NO | (ppb) | N/A | 5 | 6 | 2 | N/A | |
| | $NO_2$ | (ppb) | N/A | 6 | 7 | 3 | N/A | 30ppb (h) |
| | $SO_2$ | (ppb) | N/A | 2 | 2 | 2 | 3 | 20ppb (h) |
| | $PM_{10}$ | ($\mu g/m^3$) | N/A | 18.9 | 19.8 | 15.2 | 14.5 | |
| | $O_3$ | (ppb) | 20 | 10 | 14 | 17 | 24 | |

NOTES TO TABLE

(a) Darnum North is operated for six months per year: January to March and October to December.

(b) 4-hour rolling averages.

(c) Equal daily maxima counted separately.

(d) Not to be exceeded on more than one day in any year.

(i) Moe station decommissioned on 26 October.

(e) No more than one day in any year at RS and JH, and no more than five days in any year at MO and TR.

(f) Not to be exceeded on more than five days in any year.

(g) One day in six operation.

(h) Never to be exceeded.

## Table 5(a): Air Quality Extremes and SEPP Objective Exceedences (1980 – 1992)

| Year<br>Parameter | #1980<br>/81 | #1981<br>/82 | #1982<br>/83 | #1983<br>/84 | #1984<br>/85 | #1985<br>/86 | #1986<br>/87 | #1987<br>/88 | #1988<br>/89 | #1989<br>/90 | #1990<br>/91 | #1991<br>/92 | $1992 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **NO (1h, ppm)** | 0.30 | 0.44 | 0.29 | 0.38 | 0.41 | 0.33 | 0.44 | 0.34 | 0.28 | 0.38 | 0.32 | 0.36 | 0.16 |
| **$NO_2$ (1h, ppm)** | 0.09 | 0.07 | 0.05 | 0.07 | 0.05 | 0.05 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.05 | 0.03 |
| Days>0.12ppm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **$SO_2$ (1h, ppm)** | 0.05 | 0.06 | 0.05 | 0.05 | 0.04 | 0.07 | 0.09 | 0.15 | 0.08 | 0.09 | 0.07 | 0.08 | 0.06 |
| Days>0.20ppm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **$O_3$ (1h, ppm)** | 0.08 | 0.09 | 0.10 | 0.08 | 0.08 | 0.07 | 0.10 | 0.08 | 0.07 | 0.08 | 0.06 | 0.06 | 0.05 |
| Days>0.10ppm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **CO (1h, ppm)** | 4 | N/A | 5 | 8 | 8 | 6 | 9 | 8 | 5 | N/A | N/A | N/A | N/A |
| **LVD (1h, km)** | 4 | 5 | 4 | 4 | 4 | 6 | 5 | 8 | 7 | 5 | 5 | 6 | 7 |
| Days<20km | &47 | &80 | 47 | 42 | 38 | 36 | 49 | 32 | 14 | 35 | 32 | 44 | 9 |
| **$O_3$ (4h, ppm)** | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 0.04 |
| Days>0.08ppm | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 0 |
| **$O_3$ (8h, ppm)** | 0.06 | 0.06 | 0.07 | 0.05 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.05 | 0.04 |
| Days>0.05ppm | 2 | 2 | 9 | 0 | 1 | 1 | 1 | 3 | 1 | 5 | 2 | 0 | 0 |
| **$PM_{10}$ (24h, µg/m$^3$) *** | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 50 | 67 | 46 | 22 |
| Days>50µg/m$^3$ | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 0 | 1 | 0 | 0 |
| **$PM_{10}$ (24h, µg/m$^3$) +** | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Days>50µg/m$^3$ | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

& Incomplete data set during commissioning of the Leeds and Northrup logging system.
# Seasonal Year (September to August).
$ September 1992 to December 1992.
* High volume sampler method.
\+ TEOM method (commenced Nov 2002).
N/A Not available.

## Table 5(b): Qir Quality Extremes and SEPP Objective Exceedences (1993 – 2007)

| Year<br>Parameter | @1993 | @1994 | @1995 | @1996 | @1997 | @1998 | @1999 | @2000 | @2001 | @2002 | @2003 | @2004 | @2005 | @2006 | @2007 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **NO (1h, ppm)** | 0.37 | 0.22 | 0.25 | 0.30 | 0.36 | 0.29 | 0.31 | 0.28 | 0.26 | 0.28 | 0.25 | 0.26 | 0.225 | 0.208 | 0.269 |
| **$NO_2$ (1h, ppm)** | 0.05 | 0.04 | 0.04 | 0.04 | 0.04 | 0.05 | 0.05 | 0.05 | 0.04 | 0.04 | 0.05 | 0.04 | 0.040 | 0.058 | 0.038 |
| ^Days>0.12ppm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **$SO_2$ (1h, ppm)** | 0.13 | 0.17 | 0.14 | 0.10 | 0.20 | 0.24 | 0.25 | 0.29 | 0.61 | 0.25 | 0.23 | 0.35 | 0.297 | 0.272 | 0.195 |
| ^Days>0.20ppm | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 4 | 1 | 1 | 5 | 1 | 2 | 0 |
| **$O_3$ (1h, ppm)** | 0.06 | 0.07 | 0.07 | 0.07 | 0.11 | 0.07 | 0.07 | 0.10 | 0.08 | 0.07 | 0.09 | 0.07 | 0.067 | 0.138 | 0.099 |
| ^Days>0.10ppm | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| **LVD (1h, km)** | 5 | 5 | 11 | 7 | 7 | 7 | 11 | 12 | 9 | 4 | 2 | 4 | 4.4 | 0.5 | 0.5 |
| ^Days<20km | 16 | 65 | 42 | 25 | 35 | 38 | 31# | 27# | 31# | 26# | 43# | 20# | 30 | 47 | 47 |
| **$O_3$ (4h, ppm)** | 0.05 | 0.07 | 0.06 | 0.05 | 0.09 | 0.06 | 0.07 | 0.06 | 0.08 | 0.06 | 0.09 | 0.06 | 0.06 | 0.124 | 0.09 |
| ^Days>0.08ppm | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 2 |
| **$O_3$ (8h, ppm)** | 0.05 | 0.06 | 0.06 | 0.05 | 0.07 | 0.06 | 0.06 | 0.05 | 0.07 | N/A | N/A | N/A | N/A | N/A | N/A |
| ^Days>0.05ppm | 0 | 2 | 1 | 0 | 3 | 3 | 1 | 1 | 1 | N/A | N/A | N/A | N/A | N/A | N/A |
| **$PM_{10}$ (24h, µg/m$^3$)** * | 79 | 58 | 31 | 63 | 55 | 88 | 50 | 36 | 39 | 42 | 85 | 34 | 32.8 | 69.3 | 60.1 |
| ^Days>50µg/m$^3$ | 1 | 1 | 0 | 1 | 1 | 4 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 |
| **$PM_{10}$ (24h, µg/m$^3$)** + | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 42 | 289 | 57 | 44.9 | 254.0 | 151.2 |
| ^Days>50µg/m$^3$ | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 0 | 11 | 1 | 0 | 15 | 14 |

@ Calendar Year.
* High volume sampler method.
+ TEOM method (commenced Nov 2002).
# Exceedences adjusted to account for change in calibration reference temperature.
^ Number of days when the relevant SEPP objective was exceeded at one or more monitoring stations.
N/A Not available.

## Table 5(c): Air Quality Extremes and SEPP Objective Exceedences 2008 & 2009

| Year<br>Parameter | @2008 | @2009 |
|---|---|---|
| **NO (1h, ppm)** | 0.175 | 0.400 |
| **$NO_2$ (1h, ppm)**<br>^Days>0.12ppm | 0.046<br>0 | 0.094<br>0 |
| **$SO_2$ (1h, ppm)**<br>^Days>0.20ppm | 0.334<br>4 | 0.254<br>2 |
| **$O_3$ (1h, ppm)**<br>^Days>0.10ppm | 0.074<br>0 | 0.104<br>1 |
| **LVD (1h, km)**<br>^Days<20km | 2.1<br>31 | 3.3<br>38 |
| **$O_3$ (4h, ppm)**<br>^Days>0.08ppm | 0.061<br>0 | 0.088<br>1 |
| **$O_3$ (8h, ppm)**<br>^Days>0.05ppm | N/A<br>N/A | N/A<br>N/A |
| **$PM_{10}$ (24h, µg/m$^3$) ***<br>^Days>50µg/m$^3$ | 36.2<br>0 | 51.4<br>2 |
| **$PM_{10}$ (24h, µg/m$^3$) +**<br>^Days>50µg/m$^3$ | 90.9<br>6 | 169.6<br>8 |

@ Calendar Year.
* High volume sampler method.
+ TEOM method (commenced Nov 2002).
# Exceedences adjusted to account for change in calibration reference temperature
^ Number of days when the relevant SEPP objective was exceeded at one or more monitoring stations.
N/A Not available.

## Table 6: Inhalable Particulate Summary for 2009

*From January 2009 through December 2009*
$PM_{10}$ Monthly Averages in µg/m$^3$

| Month | JH | RS | MO[1] | TR[1] |
|---|---|---|---|---|
| January | 28.8 | 29.9 | 25.6 | 26.6 |
| February | 21.3 | 20.2 | 30.5 | 24.7 |
| March | 21.9 | 18.9 | 21.5 | 22.1 |
| April | 16.5 | 15.4 | 17.4 | 17.6 |
| May | 13.7 | 17.1 | 20.0 | 21.2 |
| June | 5.8 | 6.2 | 14.5 | 17.8 |
| July | 4.7 | 8.2 | 12.7 | 17.1 |
| August | 13.7[2] | 12.2 | 13.7 | 16.7 |
| September | 9.3 | 11.0 | 16.9 | 18.7 |
| October | 8.3 | 8.5 | 16.1 | 16.6 |
| November | 17.1 | 20.7 | nd | 21.3 |
| December | 13.4 | 14.1 | nd | 17.4 |
| **12 month average** | **14.5** | **15.2** | **18.9[3]** | **19.8** |

[1] Moe and Traralgon $PM_{10}$ data have been adjusted for temperature to account for loss of volatiles – hence TEOM data can be directly compared with high volume sampler data from Rosedale South and Jeeralang Hill.

[2] Average of three 24 hour samples only at Jeeralang Hill.

[3] Average based on 10 months only.

## Table 7: Air Quality Instrument Performance Statistics for 2009

| STATION | $NO_2$ | NO | $SO_2$ | $O_3$ | LVD | DBT | WS | WD | GLB | UVA | TEOM | $PM_{10}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Darnum [1] | | | | 92 | | | 71 | 96 | | | | |
| Rosedale | 95 | 95 | 95 | 94 | 94 | 98 | 99 | 99 | 99 | 99 | | 98 |
| Jeeralang | | | 92 | 88 | | | 98 | 98 | | | | 95 |
| Moe [2] | 94 | 94 | 94 | 94 | 94 | 98 | 98 | 98 | | | 98 | |
| Traralgon | 95 | 95 | 95 | 94 | 94 | 98 | 100 | 100 | | | 99 | |

The above table represents the percentage of validated data capture for the LVAMN. The maximum achievable data capture for the calibrated parameters $NO_2$, NO, $SO_2$, $O_3$ and LVD is 96%, because 1 hour per day is spent in calibration mode.

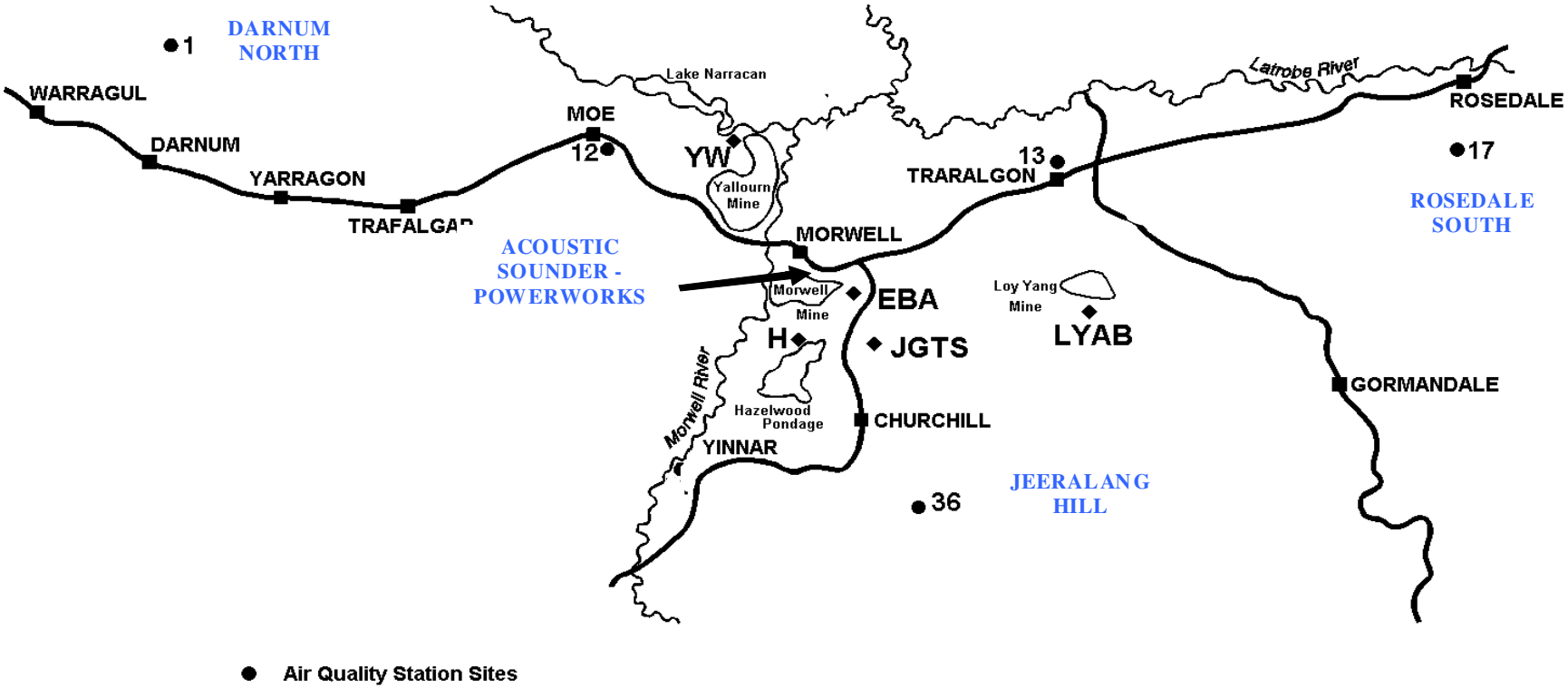
1. Darnum North was operated only from 1 January to 31 March and from 1 October to 31 December and the reported percentages relate to this six month period.

2. Moe statistics based on 10 months operation only.

Note: Target for instrument performance is 80% valid data capture per parameter per calendar year.

# 6. Figures

**Figure 1: Latrobe Valley Air Monitoring Network 2009**




**Major power station sources**

**YW – Yallourn W**
**JGTS –Jeeralang (Gas Turbine Station)**
**EBA – Energy Brix**
**LYAB – Loy Yang A, Loy Yang B**
**H – Hazelwood**