# NSW Environment Protection Authority Review of Coal Fired Power Stations Air Emissions and Monitoring

## Attachment E:

## NPI Emission Estimation Methodology

EPA 2018P0704

*Table 1 – Summary of Emission Estimation Techniques applied by NSW Power Stations.*

| General Emission Estimation Methodology – approved method except as noted in red font. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Power Station** | **Total solid particles (TSP)** | **$PM_{10}$** | **$PM_{2.5}$** | **Fluoride** | **$NO_x$** | **$SO_2$** | **Metals/Others** | |
| | | | | | | | **Direct Measure** | **NPI EF** |
| **Bayswater 2015/16 2014/15** | DM - Calc_FGV[1] x stack test conc. | DM - Calc_FGV x stack test conc. | $PM_{10}$ x 0.58 | DM - Calc_FGV x stack test conc. | DM - Calc_FGV x CEMS monthly weighted av (Unit 1 CEMS NOx ppm used for all units) | DM - Calc_FGV x CEMS[2] monthly weighted av (Unit 1 CEMS SO2 ppm used for all units) | As, Be, Cd, Co, Cu, Pb, - Calc_FGV x stack test conc. | All others |
| **Bayswater 2013/14** | DM - Calc_FGV x stack test conc. | DM - Calc_FGV x stack test conc. | $PM_{10}$ x 0.58 | DM - Calc_FGV x stack test conc. | DM - Calc_FGV x CEMS monthly weighted av (Unit 1 CEMS NOx ppm used for all units) | DM - Calc_FGV x CEMS monthly weighted av (Unit 1 CEMS SO2 ppm used for all units) | Be, Cd, Cu, Pb, - Calc_FGV x stack test conc. | All others |
| **Bayswater 2012/13** | DM – Stack test FGV rate x test conc. | DM – Stack test FGV rate x test conc. | $PM_{10}$ x 0.58 | Mass balance | DM - Calc_FGV x CEMS monthly weighted av (Unit 1 CEMS NOx ppm used for all units) | DM - Calc_FGV x CEMS monthly weighted av (Unit 1 CEMS SO2 ppm used for all units) | N/A | All |
| **Bayswater 2011/12** | DM – Stack test FGV rate x test conc. | DM – Stack test FGV rate x test conc. | $PM_{10}$ x 0.58 | DM – Stack test FGV rate x test conc. | DM - Calc_FGV x CEMS monthly weighted av (Unit 1 CEMS NOx ppm used for all units) | DM - Calc_FGV x CEMS monthly weighted av (Unit 1 CEMS SO2 ppm used for all units) | As, Be, Co, Pb, Se - Calc_FGV x stack test conc.[3] | All others |
| **Eraring 2015/16 2014/15 2013/14 2012/13** | DM - Calc_FGV x stack test conc. | TSP x 0.99 | TSP x 0.53 | DM – Stack test FGV rate x test conc. | DM - Calc_FGV x CEMS monthly weighted av | DM - Calc_FGV x CEMS monthly weighted av | Hg – Calc_FGV x stack test conc. | All others |
| **Eraring 2011/12** | DM – Stack test FGV rate x test conc. | TSP x 0.99 | TSP x 0.53 | DM – Stack test FGV rate x test conc. | DM - Calc_FGV x CEMS monthly weighted av | DM - Calc_FGV x CEMS monthly weighted av | Hg – Calc_FGV x stack test conc. [4] | All others |

[1] DM = direct measurement (periodic or continuous) stack tests, Calc_FGV = calculated flue gas volume, stack test conc. is the measured stack test pollutant concentration.
[2] CEMS = continuous emission monitoring (direct measurement)
[3] The use of a calculated flue gas volume (Calc_FGV) was not approved for estimation of particles, metals or Fluoride until December 2012
[4] The use of a calculated flue gas volume (Calc_FGV) was not approved for estimation of particles, metals or Fluoride until December 2012

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Liddell 2015/16 2014/15** | DM - Calc_FGV x stack test conc. | DM - Calc_FGV x stack test conc. | $PM_{10}$ x 0.58 | DM - Calc_FGV x stack test conc. | DM - Calc_FGV x CEMS monthly weighted av | DM - Calc_FGV x CEMS monthly weighted av | As, Be, Cd, Cu, Pb, Hg - Calc_FGV x stack test conc. | All others |
| **Liddell 2013/14** | DM - Calc_FGV x stack test conc. | DM - Calc_FGV x stack test conc. | $PM_{10}$ x 0.58 | DM - Calc_FGV x stack test conc. | DM - Calc_FGV x CEMS monthly weighted av | DM - Calc_FGV x CEMS monthly weighted av | As, Be, Hg - Calc_FGV x stack test conc. | All others |
| **Liddell 2012/13** | DM – Stack test FGV rate x test conc. | DM – Stack test FGV rate x test conc. | $PM_{10}$ x 0.58 | DM – Stack test FGV rate x test conc. | DM - Calc_FGV x CEMS monthly weighted av | Mass balance | As – Meas FGV x stack test conc. | All others |
| **Liddell 2011/12** | DM – Stack test FGV rate x test conc. | DM – Stack test FGV rate x test conc. | $PM_{10}$ x 0.58 | DM – Stack test FGV rate x test conc. | DM - Calc_FGV x CEMS monthly weighted av | Mass balance | N/A | All |
| **Mount Piper 2015/16 (2015 CY) 2014/15 (2014 CY) 2013/14 (2013 CY) 2012/13(2012 CY)** | DM - Calc_FGV x stack test conc. | DM - Calc_FGV x stack test conc. | $PM_{10}$ x 0.58 | DM - Calc_FGV x stack test conc. | PEMS conc. x Calc_FGV | Mass balance | As,Hg,Pb, Dioxins - Calc_FGV x stack test conc. | All others |
| **Mount Piper 2011/12 (2011 CY)** | DM - Calc_FGV x stack test conc. [4] | DM - Calc_FGV x stack test conc.[4] | $PM_{10}$ x 0.58 | DM - Calc_FGV x stack test conc. [4] | PEMS conc. x Calc_FGV | Mass balance | As, Hg ,Pb, Dioxins - Calc_FGV x stack test conc. [4] | All others |
| **Vales Point 2015/16 2014/15 2013/14 2012/13** | DM - Calc_FGV x stack test conc. | DM - Calc_FGV x stack test conc. | $PM_{10}$ x 0.53[5] | DM - Calc_FGV x stack test conc. | DM - Calc_FGV x CEMS monthly weighted av | DM - Calc_FGV x CEMS monthly weighted av | As, Pb, Hg - Calc_FGV x stack test conc. | All others |
| **Vales Point 2011/12 (2011 CY)** | DM – Test mass rate x op time. | DM – Test mass rate x op time. | $PM_{10}$ x 0.58 | DM – Test mass rate x op time | DM - Calc_FGV x CEMS monthly weighted av | DM - Calc_FGV x CEMS monthly weighted av | As, Pb, Hg - Test mass rate x op time. | All others |

[5] The use of a size factor to calculate $PM_{2.5}$ is approved and published in table 5 of the NPI emission estimation manual, however the 0.53 factor should be multiplied by total solid particles not $PM_{10}$. The correct size factor to estimate $PM_{2.5}$ from $PM_{10}$ is 0.58.

*Figure 1 – Reported Annual $PM_{10}$ and $PM_{2.5}$ Emissions and Emissions Intensity*

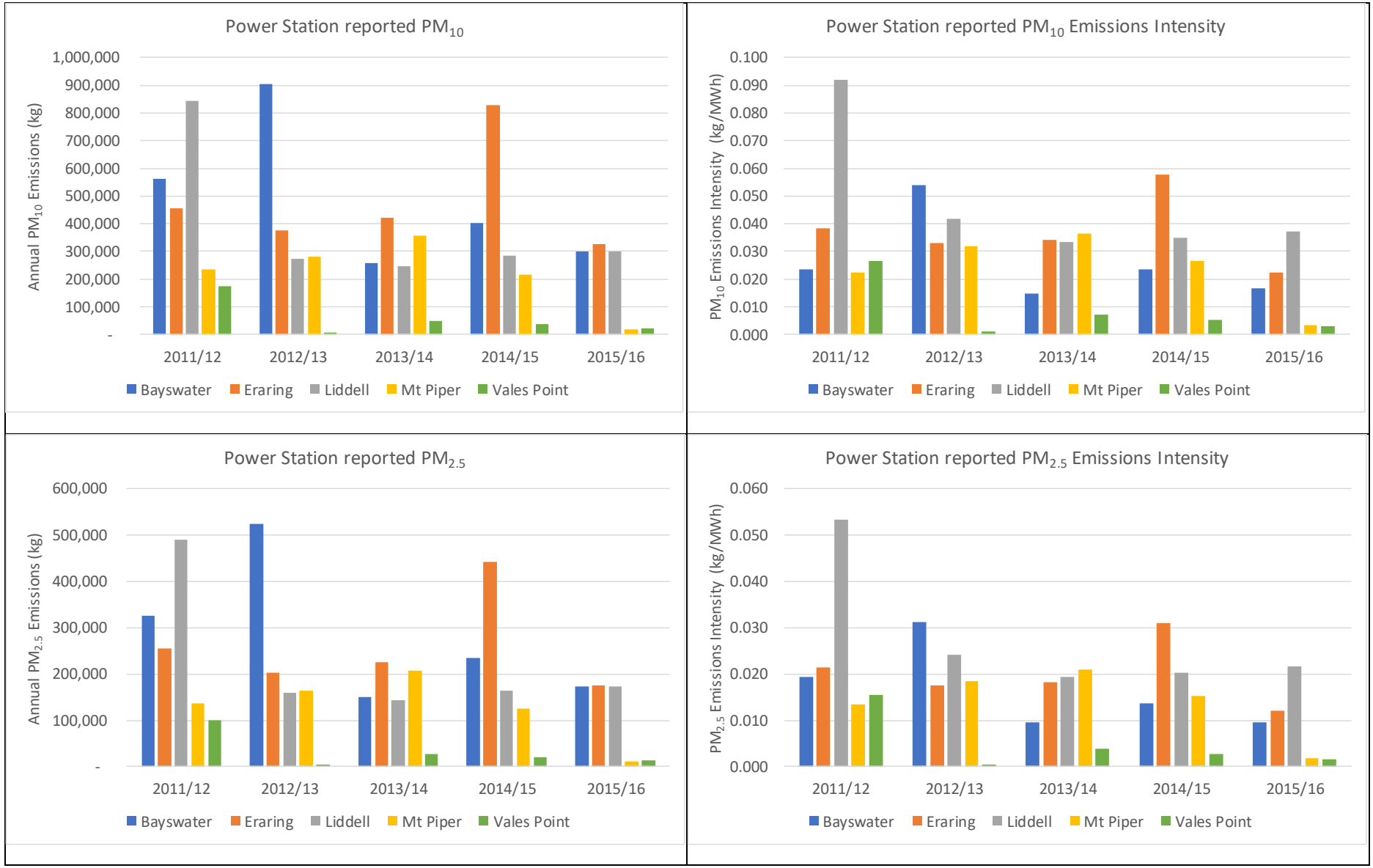
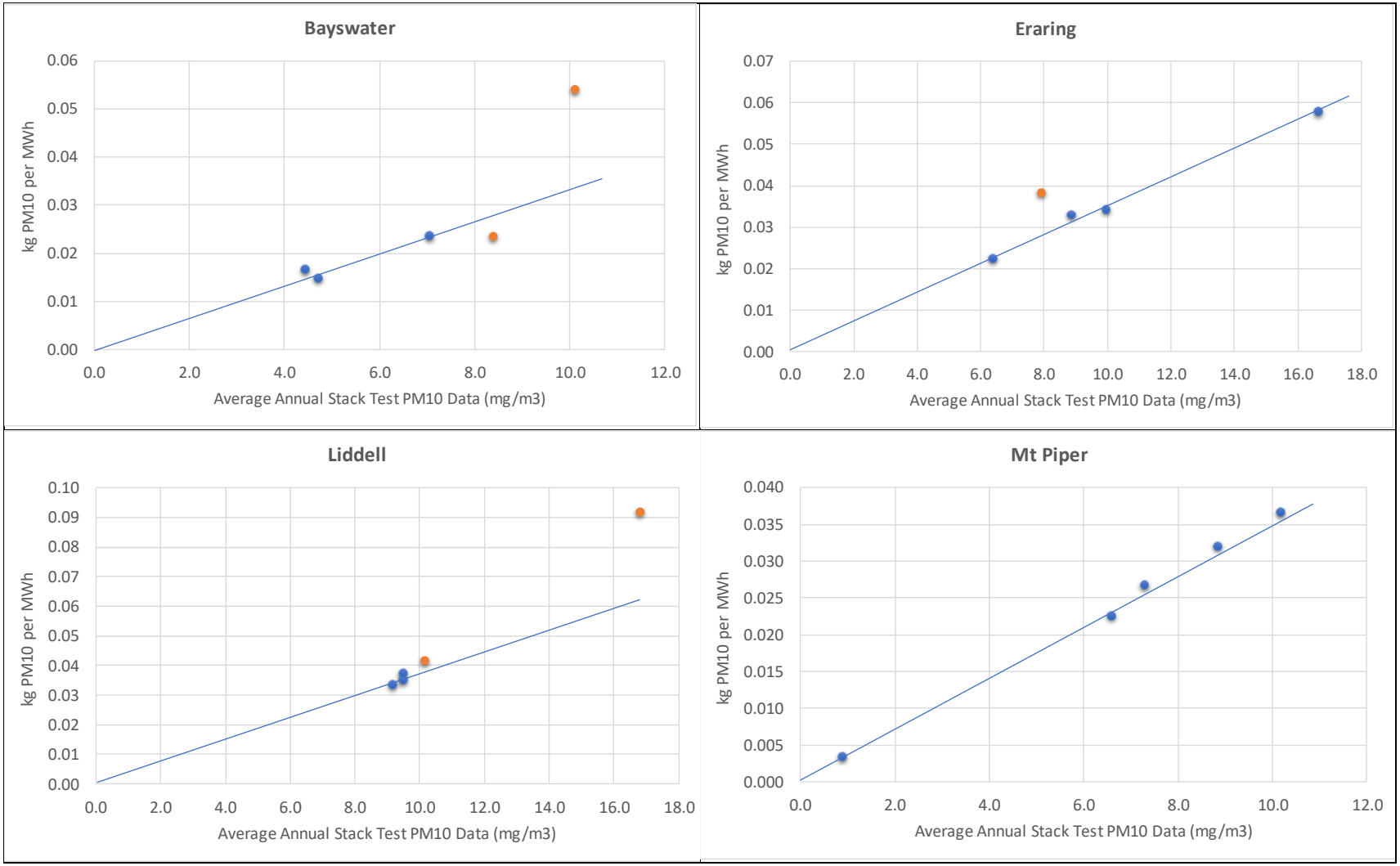


*Figure 2 – Plots of kg of $PM_{10}$ per MWh electricity versus annual average stack test concentration for NPI reporting periods 2011/12 to 2015/16*
*(Blue data points are most recent reporting periods using the calculated flue gas volume, orange data points are earlier years using stack test measured FGV)*



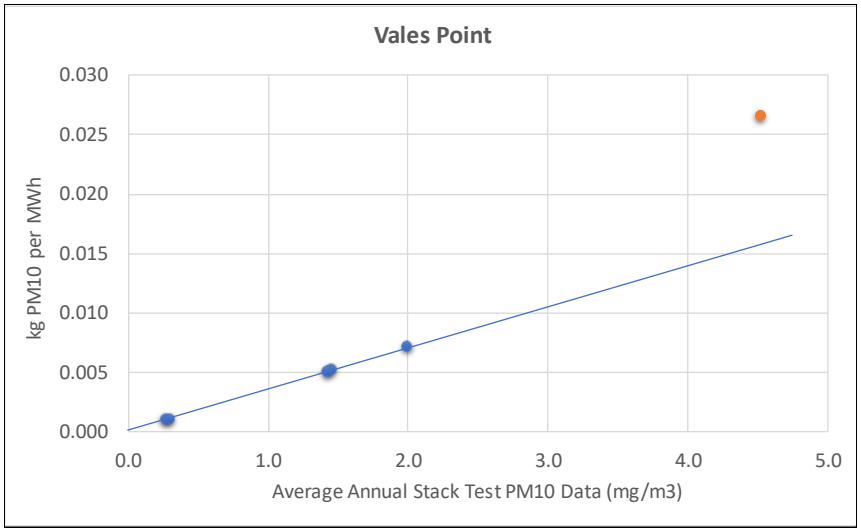

Vales Point
0.030
0.025
0.020
0.015
0.010
0.005
0.000
kg PM10 per MWh
0.0
1.0
2.0
3.0
4.0
5.0
Average Annual Stack Test PM10 Data (mg/m3)

*Table 2 – $PM_{2.5}$ to $PM_{10}$ ratios and calculated baghouse total solid particle (TSP) Control Efficiency.*

| Station | Year | Av TSP ($mg/m^3$) | Av PM10 ($mg/m^3$) | Av P10:TSP | TSP Control Eff. | TSP Emission % | 5 year Av TSP Control | 5 year Av TSP Emission % |
|---|---|---|---|---|---|---|---|---|
| Bayswater | 2015/16 | 13.7 | 4.5 | 33% | 99.950% | 0.050% | | |
| Bayswater | 2014/15 | 10.9 | 7.1 | 65% | 99.964% | 0.036% | | |
| Bayswater | 2013/14 | 9.0 | 4.9 | 55% | 99.969% | 0.031% | | |
| Bayswater | 2012/13 | 13.8 | 6.1 | 44% | 99.907% | 0.093% | | |
| Bayswater | 2011/12 | 12.2 | 6.5 | 53% | 99.947% | 0.053% | 99.948% | 0.052% |
| Eraring | 2015/16 | 6.6 | - | - | 99.975% | 0.025% | | |
| Eraring | 2014/15 | 17.0 | - | - | 99.927% | 0.073% | | |
| Eraring | 2013/14 | 10.0 | - | - | 99.962% | 0.038% | | |
| Eraring | 2012/13 | 10.4 | - | - | 99.958% | 0.042% | | |
| Eraring | 2011/12 | 7.8 | - | - | 99.966% | 0.034% | 99.957% | 0.043% |
| Liddell | 2015/16 | 34.5 | 9.5 | 27% | 99.883% | 0.117% | | |
| Liddell | 2014/15 | 19.8 | 9.5 | 48% | 99.935% | 0.065% | | |
| Liddell | 2013/14 | 18.8 | 9.1 | 49% | 99.942% | 0.058% | | |
| Liddell | 2012/13 | 19.0 | 10.7 | 56% | 99.939% | 0.061% | | |
| Liddell | 2011/12 | 21.8 | 17.0 | 78% | 99.935% | 0.065% | 99.927% | 0.073% |
| Mt Piper | 2015/16 | 2.9 | 0.90 | 31% | 99.988% | 0.012% | | |
| Mt Piper | 2014/15 | 11.0 | 7.30 | 66% | 99.953% | 0.047% | | |
| Mt Piper | 2013/14 | 13.4 | 10.18 | 76% | 99.942% | 0.058% | | |
| Mt Piper | 2012/13 | 12.5 | 8.85 | 71% | 99.951% | 0.049% | | |
| Mt Piper | 2011/12 | 8.5 | 6.60 | 78% | 99.967% | 0.033% | 99.960% | 0.040% |
| Vales Point | 2015/16 | 2.20 | 0.85 | 39% | 99.988% | 0.012% | | |
| Vales Point | 2014/15 | 3.55 | 1.46 | 41% | 99.981% | 0.019% | | |
| Vales Point | 2013/14 | 2.61 | 2.00 | 77% | 99.987% | 0.013% | | |
| Vales Point | 2012/13 | 0.46 | 0.27 | 58% | 99.998% | 0.002% | | |
| Vales Point | 2011 | 9.83 | 4.64 | 47% | 99.939% | 0.061% | 99.979% | 0.021% |