



**Environmental Report  
July to September 2011  
Report No. ARM-2011-035b  
Palmerston Site No.2  
Department of Environment and  
Heritage Division**

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# Contents

<b>1. Introduction.....</b>	<b>6</b>
1.1 Australian Standards .....	6
<b>2. Methodology .....</b>	<b>7</b>
2.1 Meteorological data .....	7
2.2 Pollutants.....	7
2.3 Capture rates.....	8
2.4 Quality assurance activities.....	10
2.5 Health, safety and environmental issues .....	10
2.6 Measurement uncertainties .....	10
2.7 Ambient Air Quality Goals .....	11
<b>3. Summary of maximums for the reporting period Jul to Sep 2011 .....</b>	<b>12</b>
3.1 Calibration history – gaseous parameters.....	12
<b>4. Reports .....</b>	<b>13</b>
4.1 Monthly validated data capture report based on hourly data - July .....	13
4.2 Monthly validated data capture report based on hourly data - August .....	13
4.3 Monthly validated data capture report based on hourly data - September .....	14
4.4 July – Summary of maximums .....	14
4.5 August – Summary of maximums .....	15
4.6 September – Summary of maximums.....	16
4.7 July – Gaseous and Particulate Data Summaries – 24 hour averages .....	17
4.8 August – Gaseous and Particulate Data Summaries – 24 hour averages .....	18
4.9 September – Gaseous and Particulate Data Summaries – 24 hour averages .....	19
<b>Appendix.....</b>	<b>19</b>
• July Pollution Roses	
• August Pollution Roses	
• September Pollution Roses	



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The following parameters are included in the scope of accreditation.

Air monitoring parameters – carbon monoxide; light scattering; nitrogen oxides; ozone; particulates-PM<sub>10</sub>, PM<sub>2.5</sub>, total suspended; sulfur dioxide

Meteorological parameters and Radiation – global, net; rainfall; relative humidity; temperature; wind direction; wind speed – horizontal.

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Date: 1/12/2011

This report consists of 29 pages

Distribution:  
Lear Siegler Australasia P/L  
Dep't of Environment and Heritage Division  
Charles Darwin University  
File

# 1. Introduction

Lear Siegler Australasia Pty Ltd appointed Aurecon Australia in June 2011 to produce quarterly NATA endorsed reports for an ambient air quality monitoring program being conducted in Palmerston, Darwin, NT.

The addresses of the recipient parties are:

Lear Siegler Australasia P/L  
Unit 6, Howleys Road  
NottingHill Vic 3168

Department of Environment and Heritage Division  
Darwin Plaza Building  
41 Smith Street  
Darwin NT 0800

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Casuarina, NT 0810

Aurecon Australia  
PO Box 612  
MORWELL Vic 3840

Table 1 below indicates the location and identity of the air monitoring site.

**Table1**

Air Monitoring Site	Location
Palmerston Site No. 2	S12°30'27.8" E130° 56' 53.8"

All data are in Central Standard Time, (Darwin).  
Sample head height is approx 4.5 meters.  
Anemometer mast height is 10 metres.  
The site is located at the Palmerston Waste Water Ponds.

## 1.1 Australian Standards

The following standards have been followed in the operation, maintenance and calibration activities at the monitoring station and in the production of this report:

- AS3580.1.1 Methods for sampling and analysis of ambient air – Guide to siting air monitoring equipment;
- AS3580.2.2 Preparation of reference test atmospheres -Compressed gas Method;
- AS3580.4.1 Determination of sulfur dioxide - Direct Reading Instrument Method;
- AS3580.5.1 Determination of Oxides of Nitrogen – Chemiluminescence Method;
- AS3580.6.1 Determination of Ozone – Direct Reading instrument Method;
- AS3580.7.1 Determination of Carbon Monoxide – Direct Reading instrument Method;
- AS3580.9.8 Determination of Suspended Particulate Matter – PM10 Continuous Direct Mass Method Using Tapered Element Oscillating Microbalance Analyser

## 2. Methodology

The air monitoring site consists of an air conditioned instrument shed, which houses all instrumentation. A single gas sampling manifold supplies atmospheric gases for nitrogen oxides, ozone, sulfur dioxide and carbon monoxide determination. Instruments for wind speed, wind direction, temperature and humidity are attached to a 10 metre mast. PM<sub>10</sub> and PM<sub>2.5</sub> (measured by TEOM 1405D), atmospheric pressure and rainfall instruments are attached to the roof of the structure.

The following sections give a brief outline of the meteorological parameters and pollutants that are being measured.

### 2.1 Meteorological data

Wind Speed is measured by an ultrasonic anemometer – type RM Young, model 85000.

Wind direction is also measured by the above instrument.

Sigma Theta is a measure of wind dispersion and is calculated by the data logger.

Temperature is measured by a sensor – type RM Young, model 41382LC

Humidity is also measured by the above RM Young, model 41382LC.

Rain is measured by a tipping bucket rain gauge – type RM Young, model 52203.

Global solar radiation is measured by a solar pyrradiometer – type Middleton, model SK08.

Barometric pressure is measured by a digital barometer– type RM Young, model 61202L.

Data from each instrument are stored locally in an ENVIDAS datalogger, which is downloaded via a modem to a central computer based in Notting Hill, Victoria for data storage and subsequent processing.

Maintenance is carried out at two levels; namely routine and non-routine.

Routine maintenance involves daily review of data from the central computer, monthly observations by a local office, routine maintenance and calibration as required by the supplier and a calibration schedule.

The non-routine maintenance may require a call-out of the contractor to correct the instrument failure or transport the instrument for major repairs and ensure a high recovery of valid data.

### 2.1 Pollutants

Nitrogen Oxides are measured by chemiluminescence technique – Thermo Model 42i.

Sulfur Dioxide is measured by the UV fluorescence technique – Thermo Model 43i.

Ozone is measured by UV absorption - Thermo Model 49i.

Carbon Monoxide is measured by Infra-Red detection - Thermo Model 48i.

Signals from each instrument are stored locally in a datalogger, which is downloaded via a modem to a central computer based in Notting Hill, Victoria for data storage and subsequent processing.

Maintenance is carried out at two levels, namely routine and non-routine.

Routine maintenance involves daily review of data from the central computer, monthly observations by a local office, routine maintenance and calibration as required by the relevant Australian Standard.

The non-routine maintenance may require a call-out of the local office to correct the instrument failure or transport the instrument for major repairs and ensure a high recovery of valid data.

## 2.2 Capture rates

### 2.2.1 Data capture rate

For any parameter at the site, the data capture rate ("DCR") will be calculated as:

$$\text{DCR} = A/B * 100$$

- A = Number of 5 (or 10) minute average recordings (for which there are data) logged per month after editing of data has been completed in accordance with the Quality Assurance requirements detailed in the Contract Quality Plan. Data logged during calibrations and daily zero/spans are **not included** in this calculation.
- B = Number of 5 (or 10) minute averages during the month excluding any 5 (or 10) minute intervals where data is lost because of any of the following:
- Loss of the 240V, 50 Hz electricity supply to any site from the local distribution system where rectification of the supply is the responsibility of the local distribution board.
  - Acts of Vandalism.
  - Flood.
  - Earthquake.
  - Cyclone.
  - Lightning strike.
  - Damage to the system by wildlife that cannot be reasonably controlled by the Contractor.
  - Bushfire.
  - Requests from the owner, which result in interruptions to monitoring.
  - Schedule relocations of mobile sites.

The monthly data capture rate shall be calculated as follows:

Monthly data capture rate is:

$$\text{DCR}(\text{month}) = \frac{\sum[\text{DCR (for each parameter)}]}{n}$$

DCR (month) = Monthly data capture rate for all parameters: defined as the sum of the data capture rates for each parameter at the site divided by the specified number of parameters.

n = Total number of parameters specified in the Terms of Reference.

The maximum DCR that can be obtained are as follows:

- 96% for gaseous parameters (4% of data not available due to 24 hour auto span checks)
- 100% for wind speed and wind direction
- 100% for Rainfall, Temperature, Humidity and Barometric Pressure
- 100% for TEOM PM<sub>2.5</sub> and PM<sub>10</sub>

### 2.2.2 Instrument availability report

For any parameter at the site, the Instrument Availability Report ("IAR") will be calculated as:

$$\text{IAR} = \text{A/B} * 100$$

- A = Number of 5 (or 10) minute average recordings (for which there are data) logged per month after editing of data has been completed in accordance with the Quality Assurance requirements detailed in the Contract Quality Plan. Data logged during calibrations and daily zero/spans are **included** in this calculation.
- B = Number of 5 (or 10) minute averages during the month excluding any 5 (or 10) minute intervals where data is lost because of any of the following:
- a) Loss of the 240V, 50 Hz electricity supply to any site from the local distribution system where rectification of the supply is the responsibility of the local distribution board
  - b) Acts of Vandalism
  - c) Flood
  - d) Earthquake
  - e) Cyclone
  - f) Lightning strike
  - g) Damage to the system by wildlife that cannot be reasonably controlled by the Contractor
  - h) Bushfire
  - i) Requests from the owner, which result in interruptions to monitoring
  - j) Schedule relocations of mobile sites

The monthly instrument availability report shall be calculated as follows:

Monthly instrument availability report is:

$$\text{IAR}(\text{month}) = \frac{\sum[\text{IAR (for each parameter)}]}{n}$$

IAR (month) = Monthly instrument availability report for all parameters: defined as the sum of the instrument availability report for each parameter at the site divided by the specified number of parameters.

n = Total number of parameters specified in the Terms of Reference.

The maximum IAR that can be obtained are as follows:

- 100% for gaseous parameters
- 100% for wind speed and wind direction
- 100% for Rainfall, Temperature, Humidity and Barometric Pressure
- 100% for TEOM PM<sub>2.5</sub> and PM<sub>10</sub>

## 2.3 Quality assurance activities

All data has been assured under the Aurecon Quality Management System and with respect to the Terms of Reference.

### 2.3.1 Data Validation

Validation of the data has been undertaken using the following references:

- Site logs;
- Single point and multi-point calibrations;
- Overnight span checks;
- Instrument drift (zero and span);

Using the EnvistaARM editing facility, data are adjusted accordingly and used in the production of this report. Any data considered to be invalid is appropriately flagged and does not appear in this report. Raw data remains intact as a separate database.

Note: In accordance with Victorian EPAV procedures and instrument accuracy, PM<sub>10</sub> and PM<sub>2.5</sub> hourly data have been flagged invalid for values < -5.0µgm<sup>-3</sup>.

## 2.4 Health, safety and environmental issues

No issues are reported during the period of the report.

## 2.5 Measurement uncertainties

Parameter	Mnemonic	Units	Uncertainty of measurement @ 95%CL
Nitrogen Oxides	NO <sub>x</sub>	ppb	Expanded uncertainty ± 5.0 ppb
Sulphur Dioxide	SO <sub>2</sub>	ppb	Expanded uncertainty ± 5.0 ppb
Ozone	O <sub>3</sub>	ppb	Expanded uncertainty ± 5.0 ppb
Carbon Monoxide	CO	ppm	Expanded uncertainty ± 0.5 ppm
< 10micron particulate	PM <sub>10</sub>	µgm <sup>-3</sup>	Expanded uncertainty ± 1.0 µgm <sup>-3</sup>
< 2.5micron particulate	PM <sub>2.5</sub>	µgm <sup>-3</sup>	Expanded uncertainty ± 1.0 µgm <sup>-3</sup>

Calculated with a coverage factor of 2

(CL) – Confidence Limit

The above measurement uncertainties have been determined from the on-site instrumentation and calibration system installed at the site together with observed instrument drift characteristics and supporting documentation.

## 2.6 Ambient Air Quality Goals

Standards and goals for pollutants in accordance with the National Environment Protection Measure (NEPM) for Ambient Air Quality are shown below:

Pollutant	Averaging Period	Environmental Quality Objectives <sup>1</sup>	Goal within 10 years Maximum allowable exceedances
Nitrogen Dioxide	1 hour	0.12 ppm or 120 ppb	1 day per year
	1 year	0.03 ppm or 30 ppb	None
Sulphur Dioxide	1 hour	0.20 ppm or 200 ppb	1 day per year
	1 day	0.08 ppm or 80 ppb	1 day per year
	1 year	0.02 ppm or 20 ppb	None
Ozone (photochemical oxidant)	1 hour	0.10 ppm or 100ppb	1 day per year
	4 hour rolling average <sup>2</sup>	0.08 ppm or 80 ppb	1 day per year
Carbon Monoxide	8 hour rolling average <sup>2</sup>	9.0 ppm	1 day per year
Particulates < 10µm	24 hours	50.0 µgm <sup>-3</sup>	5 days per year

Advisory standards and goals for pollutants in accordance with the NEPM for Ambient Air Quality are shown below:

Pollutant	Averaging Period	Environmental Quality Objectives <sup>1</sup>	Goal within 10 years Maximum allowable exceedances
Particulates < 2.5µm	24 hour	25.0 µgm <sup>-3</sup>	Not applicable
	1 year	8.0 µgm <sup>-3</sup>	

Notes to table:

1. Objectives are maximum concentrations in each case.
2. Rolling averages based on consecutive 1 hour averages

### 3. Summary of maximums for the reporting period Jul to Sep 2011

Parameter	Average	NEPM limit	Maximum	Date	Time	Wind Speed	Wind Direction
NO <sub>2</sub>	1 hour	120 ppb	17.1 ppb	10/09/2011	03:00	1.5 m/s	140 deg
SO <sub>2</sub>	1 hour	200 ppb	2.7 ppb	15/08/2011	12:00	3.3 m/s	122 deg
O <sub>3</sub>	1 hour	100 ppb	81.6 ppb	15/08/2011	12:00	3.3 m/s	122 deg
O <sub>3</sub>	4 hour	80 ppb	67.0 ppb	15/09/2011	15:00	2.9 m/s	140 deg
CO	8 hour	9.0 ppm	0.8 ppm	25/08/2011	03:00	1.0 m/s	109 deg
PM <sub>10</sub>	1 hour	n/a	139.2µgm <sup>-3</sup>	24/08/2011	20:00	1.4 m/s	66 deg
PM <sub>2.5</sub>	1 hour	n/a	105.3µgm <sup>-3</sup>	24/08/2011	20:00	1.4 m/s	66 deg
PM <sub>10</sub>	24 hour	50.0 µgm <sup>-3</sup>	46.5 µgm <sup>-3</sup>	23/08/2011	24hr ave	2.4 m/s	112 deg
PM <sub>2.5</sub>	24 hour	#25.0µgm <sup>-3</sup>	29.0 µgm <sup>-3</sup>	13/07/2011	24hr ave	2.4 m/s	90 deg

# Advisory

#### 3.1 July Calibration history – gaseous parameters

Calibration Type	Parameter(s)	Date
Single Point	CO	4 July
Single Point	NOx	5 July
Single Point	O <sub>3</sub>	7 July
Single Point	NOx, SO <sub>2</sub> , O <sub>3</sub> , CO	12 July
Single Point	NOx	13 July
Single Point	NOx	14 July
Single Point	NOx, SO <sub>2</sub>	18 July
Single Point	NOx	20 July
Single Point	NOx	27 July

#### 3.2 August Calibration history – gaseous parameters

Calibration Type	Parameter(s)	Date
Multi Point	NOx, SO <sub>2</sub> , O <sub>3</sub> , CO	9 August
Single Point	NOx	30 August

#### 3.3 September Calibration history – gaseous parameters

Calibration Type	Parameter(s)	Date
Single Point	NOx, SO <sub>2</sub> , O <sub>3</sub> , CO	5 September
Single Point	NOx	13 September
Single Point	NOx	30 September

Please note that there will be no day average for any parameter if the data availability for that day is less than 80%.

## 4. Reports

### 4.1 Monthly validated data capture report based on hourly data - July

Parameter	DCR	IAR
Nitrogen Oxides	78	100
Sulphur Dioxide	96	100
Ozone	94	100
Carbon Monoxide	94	100
PM <sub>10</sub>	97	100
PM <sub>2.5</sub>	99	100
<b>Total DCR &amp; IAR</b>	<b>93.0%</b>	<b>100.0%</b>

### 4.2 Monthly validated data capture report based on hourly data - August

Parameter	DCR	IAR
Nitrogen Oxides	90	100
Sulphur Dioxide	90	100
Ozone	90	100
Carbon Monoxide	90	100
PM <sub>10</sub>	93	100
PM <sub>2.5</sub>	93	100
<b>Total DCR &amp; IAR</b>	<b>91.0%</b>	<b>100.0%</b>

### 4.3 Monthly validated data capture report based on hourly data - September

Parameter	DCR	IAR
Nitrogen Oxides	95	100
Sulphur Dioxide	96	100
Ozone	91	100
Carbon Monoxide	88	100
PM <sub>10</sub>	99	100
PM <sub>2.5</sub>	98	100
<b>Total DCR &amp; IAR</b>	<b>94.5%</b>	<b>100.0%</b>

### 4.4 July – Summary of maximums

Parameter	Average	NEPM limit	Maximum	Date	Time	Wind Speed	Wind Direction
NO <sub>2</sub>	1 hour	120 ppb	10.7 ppb	13/07/2011	01:00	1.5 m/s	110 deg
SO <sub>2</sub>	1 hour	200 ppb	2.0 ppb	27/07/2011	16:00	3.0 m/s	99 deg
O <sub>3</sub>	1 hour	100 ppb	61.8 ppb	04/07/2011	15:00	1.8 m/s	123 deg
O <sub>3</sub>	4 hour	80 ppb	51.7 ppb	14/07/2011	17:00	2.3 m/s	315 deg
CO	8 hour	9.0 ppm	0.5 ppm	10/07/2011	06:00	1.3 m/s	121 deg
PM <sub>10</sub>	1 hour	n/a	117.3 µgm <sup>-3</sup>	29/07/2011	18:00	1.3 m/s	92 deg
PM <sub>2.5</sub>	1 hour	n/a	75.7 µgm <sup>-3</sup>	13/07/2011	11:00	4.1 m/s	88 deg

#### 4.4.1 July – PM<sub>10</sub> & PM<sub>2.5</sub> - 24hr maximums

Parameter	NEPM limit	Value	Date	Wind vector
PM <sub>10</sub>	50.0 µgm <sup>-3</sup>	40.3 µgm <sup>-3</sup>	13/07/2011	2.4 m/s @ 90 deg
PM <sub>2.5</sub>	# 25.0 µgm <sup>-3</sup>	29.0 µgm <sup>-3</sup>	13/07/2011	2.4 m/s @ 90 deg

# Advisory only

#### 4.4.2 July – Exceedences

There were no exceedences of the gaseous NEPM goals during July 2011.

Exceedences of the NEPM particulate objectives are detailed below:

Parameter	NEPM limit	Value	Date	Wind vector
PM <sub>2.5</sub>	# 25.0 µgm <sup>-3</sup>	29.0 µgm <sup>-3</sup>	13/07/2011	2.4 m/s @ 90 deg

# Advisory only

## 4.5 August – Summary of maximums

Parameter	Average	NEPM limit	Maximum	Date	Time	Wind Speed	Wind Direction
NO <sub>2</sub>	1 hour	120 ppb	16.2 ppb	23/08/2011	23:00	1.0 m/s	57 deg
SO <sub>2</sub>	1 hour	200 ppb	2.7 ppb	15/08/2011	12:00	1.0 m/s	146 deg
O <sub>3</sub>	1 hour	100 ppb	81.6 ppb	15/08/2011	12:00	1.6 m/s	143 deg
O <sub>3</sub>	4 hour	80 ppb	59.5 ppb	15/08/2011	15:00	2.8 m/s	163 deg
CO	8 hour	9.0 ppm	0.8 ppm	25/08/2011	03:00	1.0 m/s	109 deg
PM <sub>10</sub>	1 hour	n/a	139.2µgm <sup>-3</sup>	24/08/2011	20:00	1.0 m/s	159 deg
PM <sub>2.5</sub>	1 hour	n/a	105.3µgm <sup>-3</sup>	24/08/2011	20:00	0.8 m/s	128 deg

### 4.5.1 August – PM<sub>10</sub> & PM<sub>2.5</sub> - 24hr maximums

Parameter	NEPM limit	Value	Date	Wind vector
PM <sub>10</sub>	50.0 µgm <sup>-3</sup>	46.5 µgm <sup>-3</sup>	23/08/2011	2.4 m/s @ 112 deg
PM <sub>2.5</sub>	# 25.0 µgm <sup>-3</sup>	26.3 µgm <sup>-3</sup>	26/08/2011	2.0 m/s @ 89 deg

# Advisory only

### 4.5.2 August – Exceedences

There were no exceedences of the gaseous NEPM goals during August 2011.

Exceedences of the NEPM particulate objectives are detailed below:

Parameter	NEPM limit	Value	Date	Wind vector
PM <sub>2.5</sub>	# 25.0 µgm <sup>-3</sup>	26.3 µgm <sup>-3</sup>	26/08/2011	2.0 m/s @ 89 deg
PM <sub>2.5</sub>	# 25.0 µgm <sup>-3</sup>	25.3 µgm <sup>-3</sup>	17/08/2011	2.1 m/s @ 321 deg

# Advisory only

## 4.6 September – Summary of maximums

Parameter	Average	NEPM limit	Maximum	Date	Time	Wind Speed	Wind Direction
NO <sub>2</sub>	1 hour	120 ppb	17.1 ppb	10/09/2011	03:00	1.5 m/s	140 deg
SO <sub>2</sub>	1 hour	200 ppb	2.2 ppb	02/09/2011	14:00	5.4 m/s	278 deg
O <sub>3</sub>	1 hour	100 ppb	69.0 ppb	15/09/2011	13:00	2.9 m/s	162 deg
O <sub>3</sub>	4 hour	80 ppb	67.0 ppb	15/09/2011	15:00	2.9 m/s	140 deg
CO	8 hour	9.0 ppm	0.6 ppm	02/09/2011	07:00	0.6 m/s	91 deg
PM <sub>10</sub>	1 hour	n/a	117.7 µgm <sup>-3</sup>	28/09/2011	19:00	3.1 m/s	342deg
PM <sub>2.5</sub>	1 hour	n/a	58.8 µgm <sup>-3</sup>	11/09/2011	18:00	1.7 m/s	359 deg

### 4.6.1 September – PM<sub>10</sub> & PM<sub>2.5</sub> - 24hr maximums

Parameter	NEPM limit	Value	Date	Wind vector
PM <sub>10</sub>	50.0 µgm <sup>-3</sup>	44.9 µgm <sup>-3</sup>	15/09/2011	2.3 m/s @ 133 deg
PM <sub>2.5</sub>	# 25.0 µgm <sup>-3</sup>	25.7 µgm <sup>-3</sup>	15/09/2011	2.3 m/s @ 133 deg

# Advisory only

### 4.6.2 September – Exceedences

There were no exceedences of the gaseous NEPM goals during September 2011.

There were however, exceedences of the NEPM goals for PM<sub>10</sub> & PM<sub>2.5</sub> particulates as per the following:

Parameter	NEPM limit	Value	Date	Wind vector
PM <sub>2.5</sub>	# 25.0 µgm <sup>-3</sup>	25.7 µgm <sup>-3</sup>	15/09/2011	2.3 m/s @ 133 deg

# Advisory only

#### 4.7 July – Gaseous and Particulate Data Summaries – 24 hour averages

Date & Time	NO	NO <sub>2</sub>	NO <sub>x</sub>	SO <sub>2</sub>	CO	O <sub>3</sub>	PM <sub>25</sub>	PM <sub>10</sub>
	ppb	ppb	ppb	ppb	ppm	ppb	µg/m <sup>3</sup>	µg/m <sup>3</sup>
1/07/2011	0.3	2.3	2.6	0.5	0.2	20.5	8.3	14.2
2/07/2011	0.3	2.2	2.5	0.4	0.2	17.6	8.1	14.3
3/07/2011	0.1	1.4	1.5	0.5	0.2	19.6	6.1	11.7
4/07/2011	0.4	1.9	2.3	0.5	<Samp	21.5	10.7	17.9
5/07/2011	0.2	2.5	2.7	0.5	0.2	21.2	10.1	18.3
6/07/2011	0.2	2.3	2.5	0.5	0.2	19.3	10.0	16.2
7/07/2011	0.4	3.0	3.3	0.6	0.2	<Samp	14.8	22.7
8/07/2011	0.1	2.0	2.1	0.7	0.2	29.7	20.4	33.2
9/07/2011	0.1	2.2	2.4	0.7	0.2	28.3	19.2	28.6
10/07/2011	0.2	3.4	3.6	0.9	0.3	27.1	23.5	32.9
11/07/2011	NoData	NoData	NoData	0.7	0.2	29.3	11.9	21.5
12/07/2011	<Samp	<Samp	<Samp	0.8	0.3	27.3	19.0	28.4
13/07/2011	0.6	3.2	3.7	0.8	0.3	29.9	29.0	40.3
14/07/2011	<Samp	<Samp	<Samp	0.6	0.3	33.2	22.6	31.8
15/07/2011	0.4	2.0	2.4	0.6	0.3	29.3	22.9	31.3
16/07/2011	0.3	1.1	1.4	0.6	0.2	21.6	9.2	15.3
17/07/2011	NoData	NoData	NoData	0.6	0.3	18.5	9.1	15.8
18/07/2011	NoData	NoData	NoData	0.6	0.3	21.9	5.8	<Samp
19/07/2011	NoData	NoData	NoData	0.6	0.3	25.6	7.4	15.1
20/07/2011	<Samp	<Samp	<Samp	0.7	0.3	25.0	9.2	15.2
21/07/2011	0.4	2.5	2.9	0.7	0.3	25.5	9.8	15.6
22/07/2011	0.2	1.8	2.1	0.8	0.3	28.6	16.2	22.8
23/07/2011	0.2	1.8	2.0	0.7	0.3	30.3	15.4	22.8
24/07/2011	0.1	1.6	1.7	0.7	0.3	30.1	11.2	18.0
25/07/2011	0.3	2.2	2.5	0.8	0.3	29.3	11.2	18.9
26/07/2011	0.4	2.1	2.5	0.6	0.3	26.8	14.7	25.1
27/07/2011	0.4	2.3	2.7	0.8	0.3	29.3	13.4	23.5
28/07/2011	0.4	1.4	1.7	0.6	0.3	26.7	9.4	17.5
29/07/2011	0.2	1.6	1.8	0.7	0.3	31.7	13.7	24.8
30/07/2011	0.3	1.4	1.7	0.7	0.4	29.9	17.7	26.4
31/07/2011	0.3	1.8	2.1	0.7	0.4	27.5	14.2	21.7
Minimum	0.1	1.1	1.4	0.4	0.2	17.6	5.8	11.7
MinDate	03/07/2011	16/07/2011	16/07/2011	02/07/2011	01/07/2011	02/07/2011	18/07/2011	03/07/2011
Maximum	0.6	3.4	3.7	0.9	0.4	33.2	29.0	40.3
MaxDate	13/07/2011	10/07/2011	13/07/2011	10/07/2011	31/07/2011	14/07/2011	13/07/2011	13/07/2011
Avg	0.3	2.1	2.4	0.7	0.3	26.1	13.7	22.1
Num	24	24	24	31	30	30	31	30
Data[%]	77	77	77	100	97	97	100	97
STD	0.1	0.6	0.6	0.1	0	4.3	5.7	6.9

- NoData** - No data available due to removal during validation and editing – e.g. calibration failure, instrument fault, maintenance etc.
- <Samp** - Insufficient samples to produce a valid average – e.g. maintenance, calibration etc

## August – Gaseous and Particulate Data Summaries – 24 hour averages

Date & Time	NO	NO <sub>2</sub>	NO <sub>x</sub>	SO <sub>2</sub>	CO	O <sub>3</sub>	PM <sub>2.5</sub>	PM <sub>10</sub>
	ppb	ppb	ppb	ppb	ppm	ppb	µg/m <sup>3</sup>	µg/m <sup>3</sup>
1/08/2011	0.3	1.8	2.1	0.7	0.4	31.5	16.0	23.4
2/08/2011	0.8	2.6	3.4	0.7	0.4	32.3	17.3	27.4
3/08/2011	0.5	2.4	3.0	0.8	0.4	35.1	14.7	25.7
4/08/2011	0.5	2.1	2.6	0.7	0.4	33.5	14.4	24.8
5/08/2011	0.6	1.9	2.5	0.6	0.3	30.0	10.0	19.8
6/08/2011	0.5	2.1	2.6	0.6	0.3	26.3	7.9	14.3
7/08/2011	0.5	2.0	2.6	0.7	0.4	25.4	8.3	16.8
8/08/2011	0.8	2.1	2.9	0.7	0.4	27.0	11.3	22.1
9/08/2011	<Samp	<Samp	<Samp	<Samp	<Samp	<Samp	10.3	20.6
10/08/2011	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
11/08/2011	0.7	4.9	5.7	0.9	0.4	33.6	15.4	28.5
12/08/2011	1.0	3.4	4.3	0.9	0.3	30.9	11.1	22.5
13/08/2011	0.8	3.2	4.0	0.9	0.4	34.2	16.6	31.0
14/08/2011	1.0	3.1	3.8	0.9	0.4	34.6	15.0	32.0
15/08/2011	1.1	3.1	4.3	1.2	0.4	38.2	20.2	34.8
16/08/2011	1.6	4.0	5.6	1.1	0.4	36.0	23.7	38.4
17/08/2011	1.4	4.3	5.8	1.1	0.5	33.2	25.3	40.6
18/08/2011	<Samp	<Samp	<Samp	<Samp	<Samp	<Samp	<Samp	<Samp
19/08/2011	0.5	2.2	2.7	0.9	0.4	31.6	11.6	31.1
20/08/2011	0.6	1.9	2.5	1.0	0.4	30.7	10.2	24.2
21/08/2011	0.6	2.2	2.9	1.1	0.4	30.8	18.9	34.7
22/08/2011	0.7	2.6	3.3	1.0	0.4	31.6	18.6	37.8
23/08/2011	0.8	3.8	4.5	1.1	0.4	33.7	19.1	46.5
24/08/2011	0.9	2.6	3.5	1.2	0.4	35.8	24.7	46.3
25/08/2011	1.0	2.5	3.5	1.0	0.5	34.3	24.7	41.1
26/08/2011	1.2	3.5	4.7	1.1	0.5	35.2	26.3	43.6
27/08/2011	0.9	2.3	3.2	1.0	0.5	34.8	22.1	37.3
28/08/2011	1.0	2.8	3.9	1.1	0.5	30.2	21.4	35.8
29/08/2011	1.0	1.9	3.0	1.1	0.5	29.9	19.3	32.4
30/08/2011	1.0	2.8	3.8	1.1	0.5	31.0	19.2	32.3
31/08/2011	1.2	2.6	3.9	1.0	0.5	32.9	20.5	34.1
Minimum	0.3	1.8	2.1	0.6	0.3	25.4	7.9	14.3
MinDate	01/08/2011	01/08/2011	01/08/2011	06/08/2011	06/08/2011	07/08/2011	06/08/2011	06/08/2011
Maximum	1.6	4.9	5.8	1.2	0.5	38.2	26.3	46.5
MaxDate	16/08/2011	11/08/2011	17/08/2011	15/08/2011	26/08/2011	15/08/2011	26/08/2011	23/08/2011
Avg	0.8	2.8	3.6	0.9	0.4	32.3	17.0	31.0
Num	28	28	28	28	28	28	29	29
Data[%]	90	90	90	90	90	90	94	94
STD	0.3	0.8	1.0	0.2	0.1	2.9	5.3	8.5

- NoData** - No data available due to removal during validation and editing – e.g. calibration failure, instrument fault, maintenance etc.
- <Samp** - Insufficient samples to produce a valid average – e.g. maintenance, calibration etc

#### 4.8 September – Gaseous and Particulate Data Summaries – 24 hour averages

Date & Time	NO	NO <sub>2</sub>	NO <sub>x</sub>	SO <sub>2</sub>	CO	O <sub>3</sub>	PM <sub>25</sub>	PM <sub>10</sub>
	ppb	ppb	ppb	ppb	ppm	ppb	µg/m <sup>3</sup>	µg/m <sup>3</sup>
1/09/2011	0.7	2.2	3.0	1.1	0.5	37.5	20.8	36.4
2/09/2011	1.1	3.7	4.8	1.1	0.5	27.0	20.9	37.0
3/09/2011	0.7	2.1	2.8	1.1	NoData	31.4	19.1	33.8
4/09/2011	1.0	2.1	3.1	1.0	NoData	<Samp	12.2	25.2
5/09/2011	0.9	2.2	3.1	0.8	<Samp	<Samp	12.8	26.2
6/09/2011	1.3	3.0	4.2	0.6	0.3	31.5	14.2	26.6
7/09/2011	0.8	2.8	3.5	0.6	0.3	33.2	11.5	24.0
8/09/2011	0.6	2.4	3.0	0.7	0.3	33.6	10.3	23.2
9/09/2011	0.6	2.2	2.8	0.7	0.3	36.6	14.6	28.1
10/09/2011	1.1	3.6	4.8	0.7	0.2	37.8	10.3	26.3
11/09/2011	0.4	1.9	2.2	1.0	0.2	42.8	11.7	32.4
12/09/2011	0.4	2.2	2.7	1.0	0.2	41.3	14.0	34.3
13/09/2011	0.8	2.5	3.1	0.9	0.3	43.3	19.6	39.0
14/09/2011	0.5	2.3	2.8	0.8	0.3	47.8	18.9	38.3
15/09/2011	0.5	2.3	2.8	0.8	0.4	49.0	25.7	44.9
16/09/2011	0.5	2.3	2.8	0.8	0.4	40.7	21.8	37.6
17/09/2011	0.6	2.6	3.2	0.8	0.3	33.4	16.4	32.1
18/09/2011	0.4	1.2	1.6	0.7	0.3	30.2	13.5	25.4
19/09/2011	0.5	1.1	1.6	0.7	0.3	29.4	10.7	21.2
20/09/2011	0.4	1.6	2.0	0.7	0.3	28.8	10.0	21.0
21/09/2011	0.4	1.7	2.1	0.7	0.3	25.5	9.7	22.4
22/09/2011	0.5	1.5	2.0	0.7	0.3	27.7	10.3	21.7
23/09/2011	0.8	2.8	3.6	0.8	0.4	28.8	14.0	27.6
24/09/2011	0.3	1.4	1.7	0.8	0.3	34.7	14.7	32.3
25/09/2011	0.4	1.1	1.5	0.8	0.4	33.4	14.3	29.0
26/09/2011	0.4	1.3	1.7	0.8	0.4	33.0	14.2	28.4
27/09/2011	0.4	2.0	2.4	0.9	0.4	38.5	16.9	32.6
28/09/2011	0.3	2.0	2.3	0.8	0.4	40.4	17.1	35.2
29/09/2011	0.3	1.8	2.2	0.8	0.4	34.1	13.5	30.1
30/09/2011	0.5	0.9	1.5	0.8	0.4	28.4	10.3	20.7
Minimum	0.3	0.9	1.5	0.6	0.2	25.5	9.7	20.7
MinDate	24/09/2011	30/09/2011	30/09/2011	06/09/2011	11/09/2011	21/09/2011	21/09/2011	30/09/2011
Maximum	1.3	3.7	4.8	1.1	0.5	49.0	25.7	44.9
MaxDate	06/09/2011	02/09/2011	02/09/2011	02/09/2011	01/09/2011	15/09/2011	15/09/2011	15/09/2011
Avg	0.6	2.1	2.7	0.8	0.3	35.0	14.8	29.8
Num	30	30	30	30	27	28	30	30
Data[%]	100	100	100	100	90	93	100	100
STD	0.3	0.7	0.9	0.1	0.1	6.1	4.1	6.2

**NoData** - No data available due to removal during validation and editing – e.g. calibration failure, instrument fault, maintenance etc.

**<Samp** - Insufficient samples to produce a valid average – e.g. maintenance, calibration etc

## Appendix A

### Special Note:

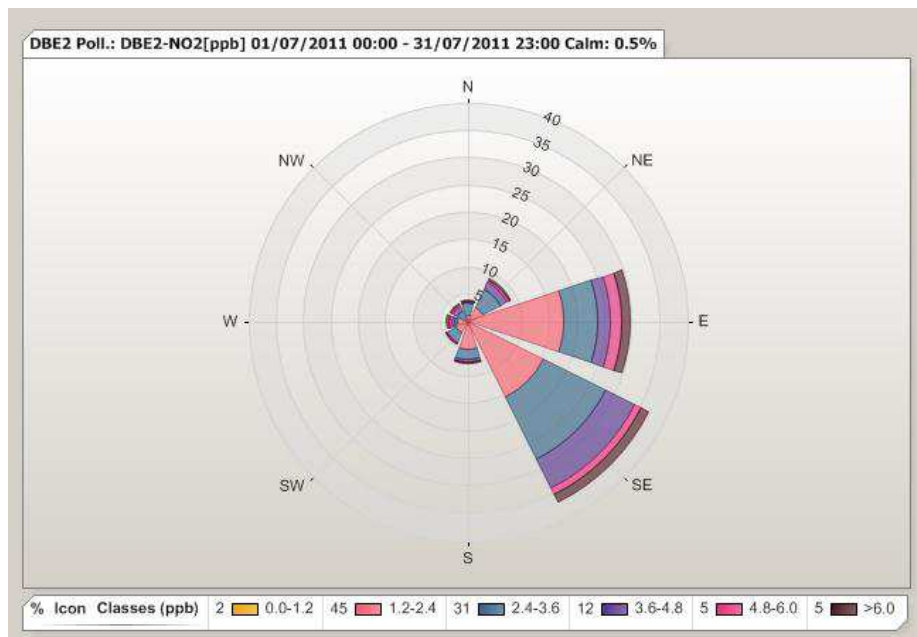
**The content of this section is segregated from the main body of the report as the wind speed and direction data used to produce the pollution roses are not covered under the accreditation of this monitoring facility.**

# Graphs

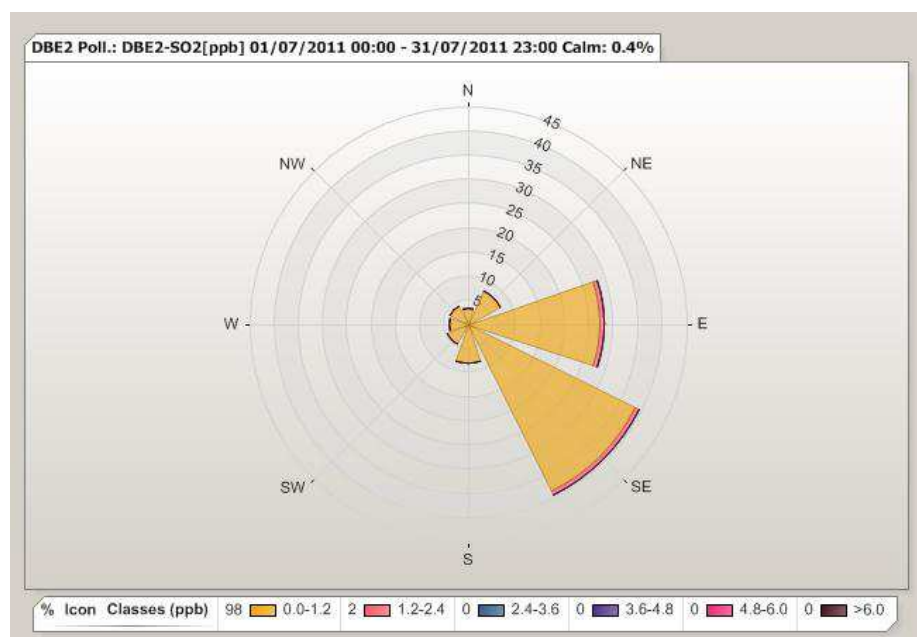
## Pollution Roses

### July

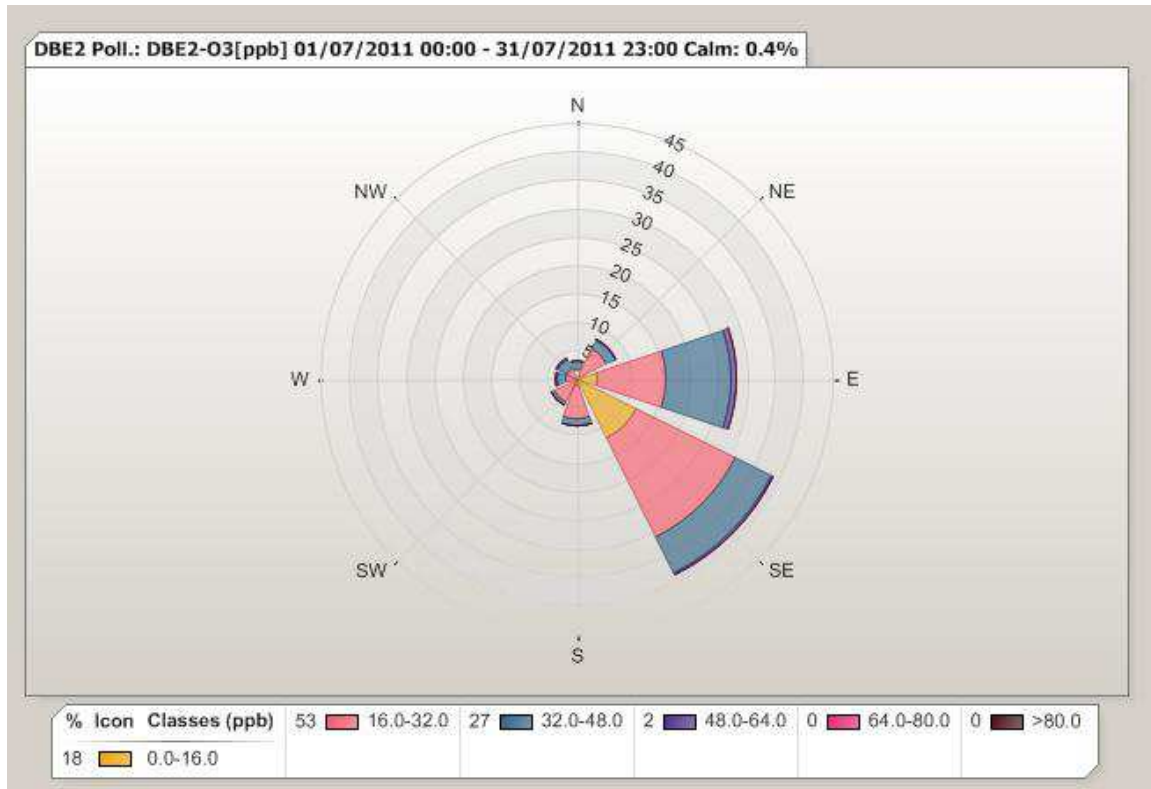
#### NO<sub>2</sub> Pollution Rose



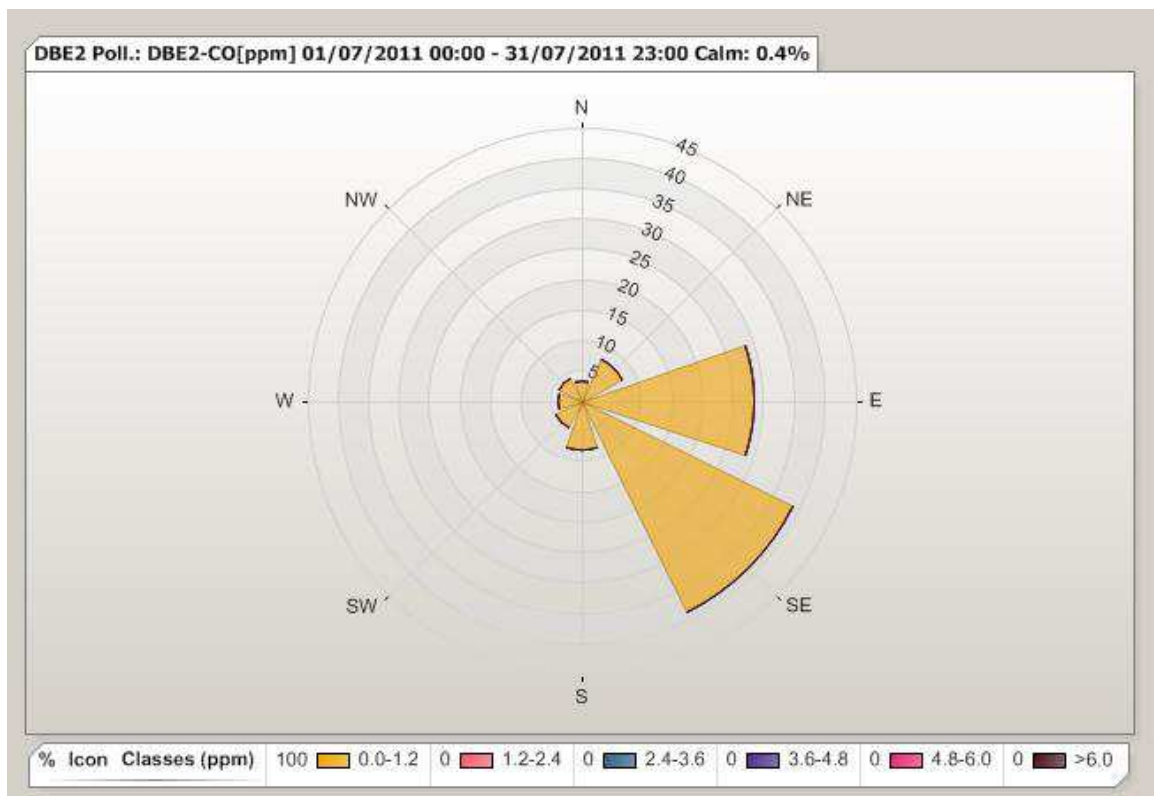
#### SO<sub>2</sub> Pollution Rose



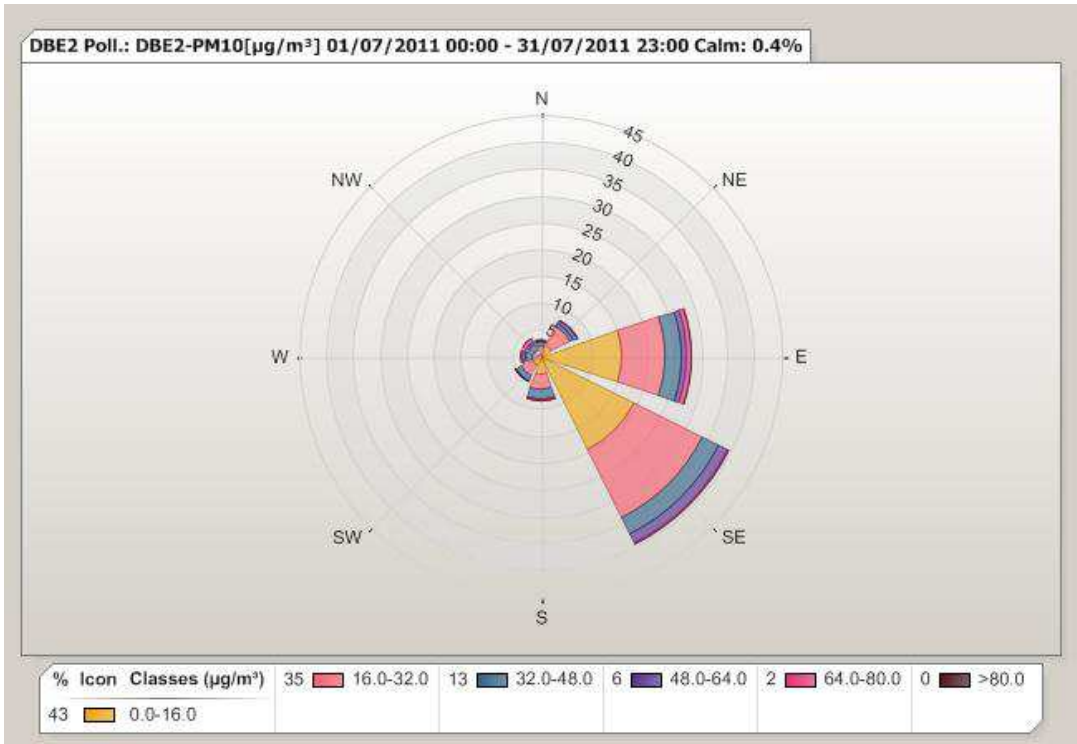
### O<sub>3</sub> Pollution Rose



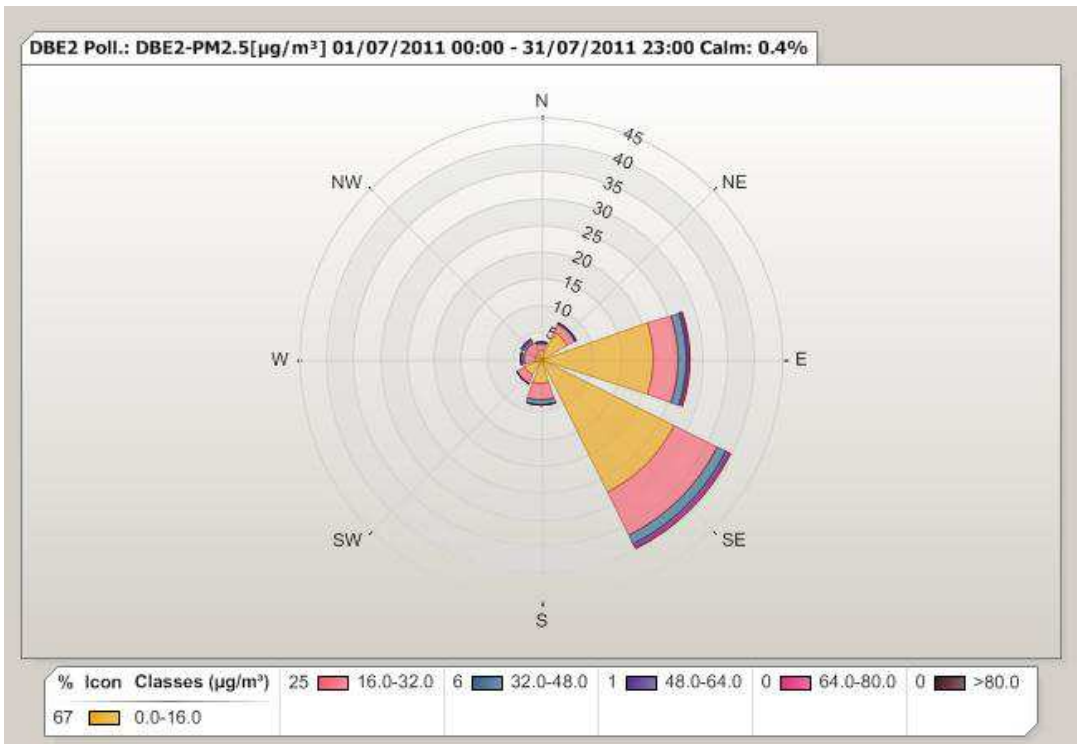
### CO Pollution Rose



## PM<sub>10</sub> Pollution Rose

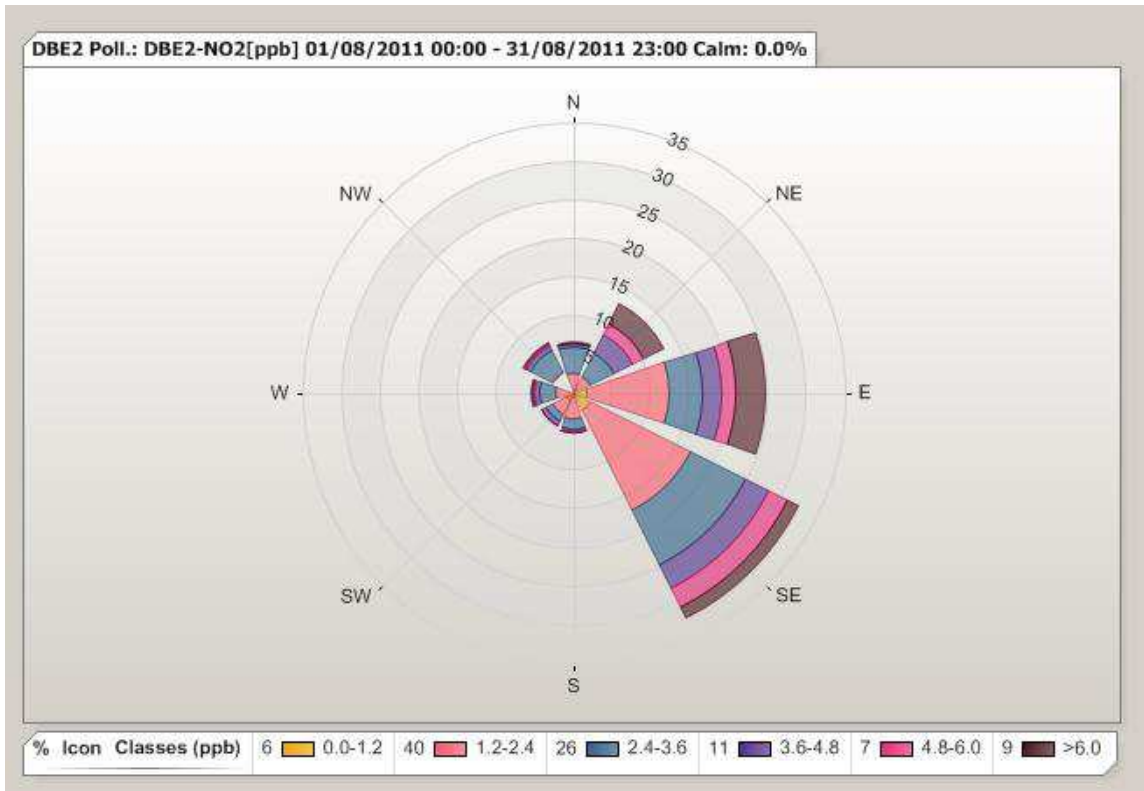


## PM<sub>2.5</sub> Pollution Rose

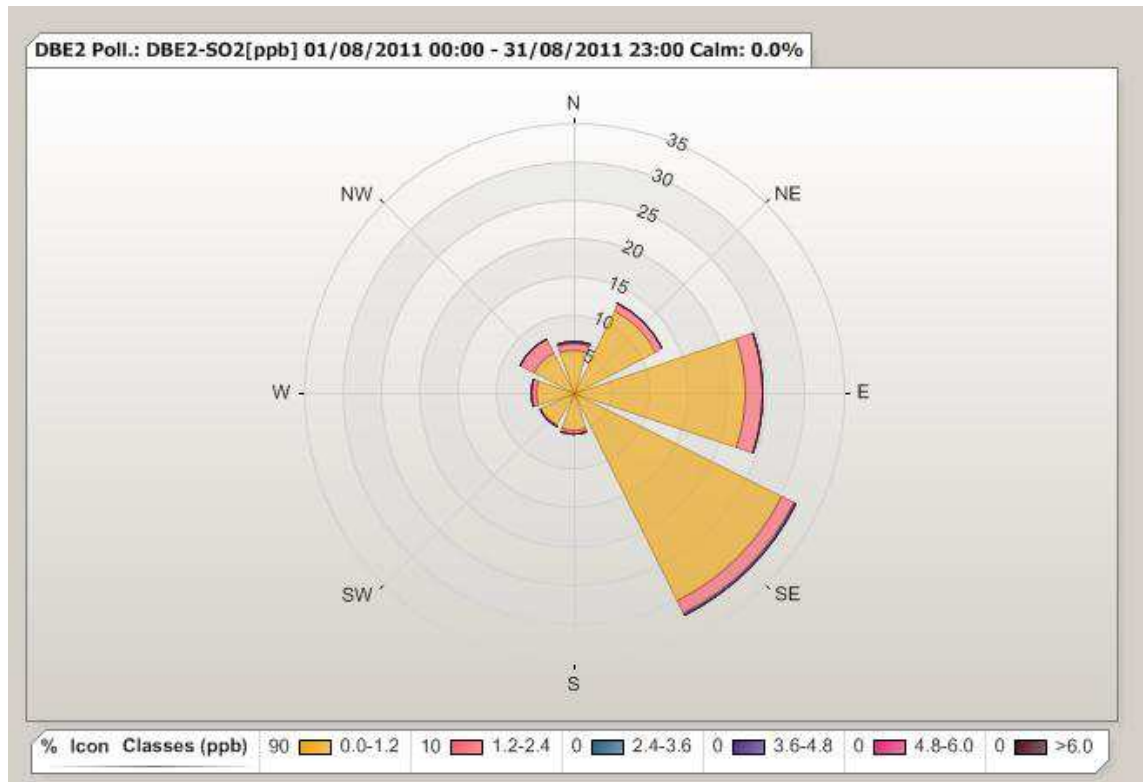


# August

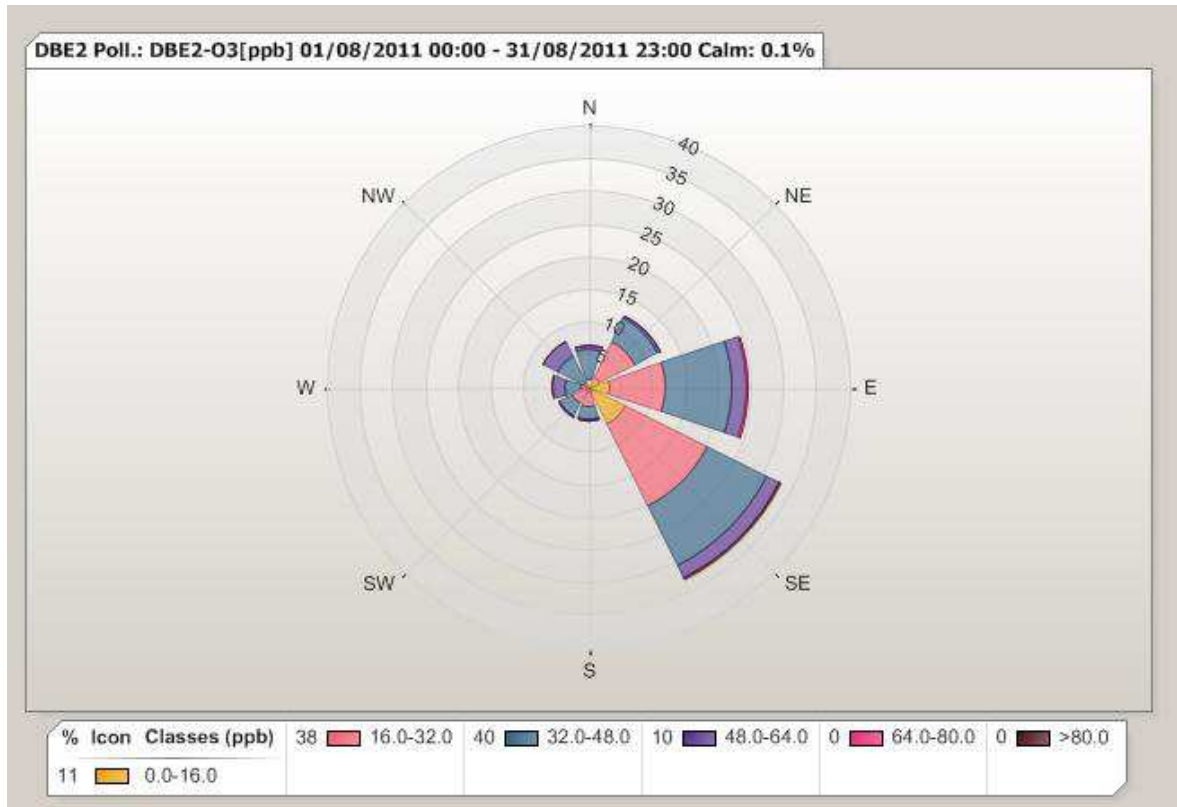
## NO<sub>2</sub> Pollution Rose



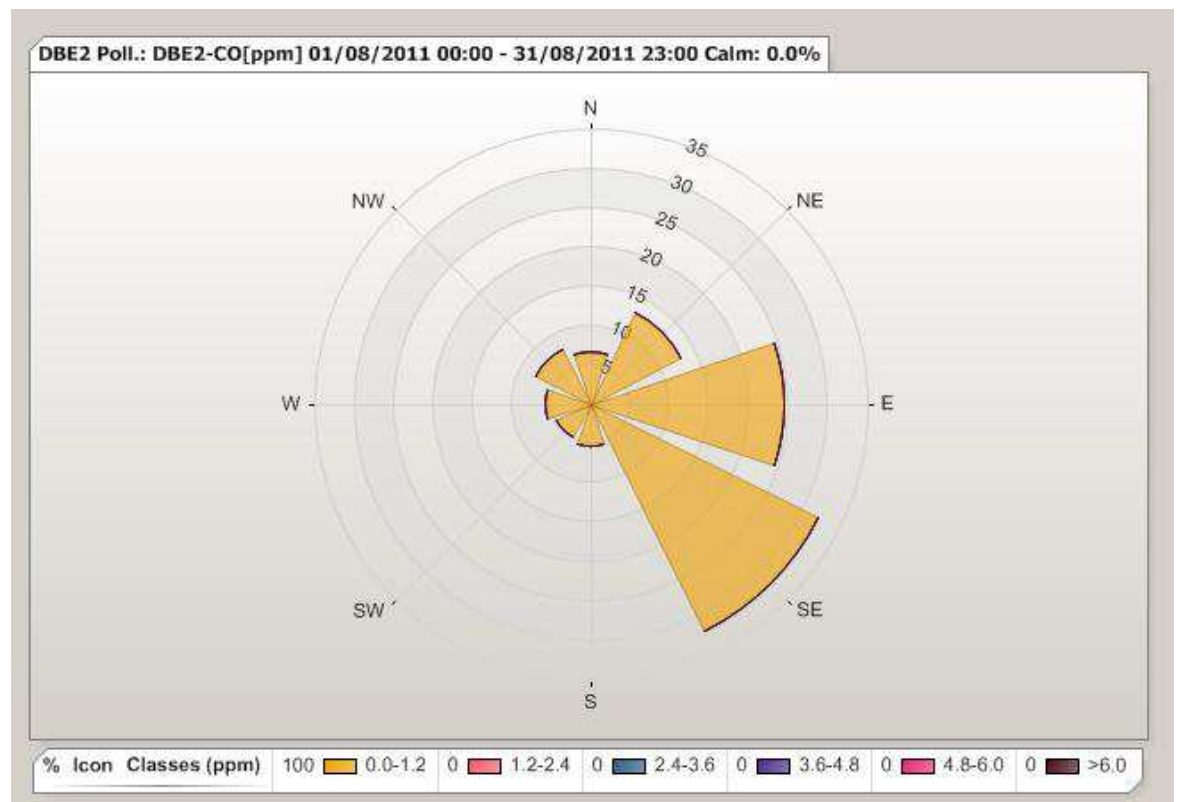
## SO<sub>2</sub> Pollution Rose



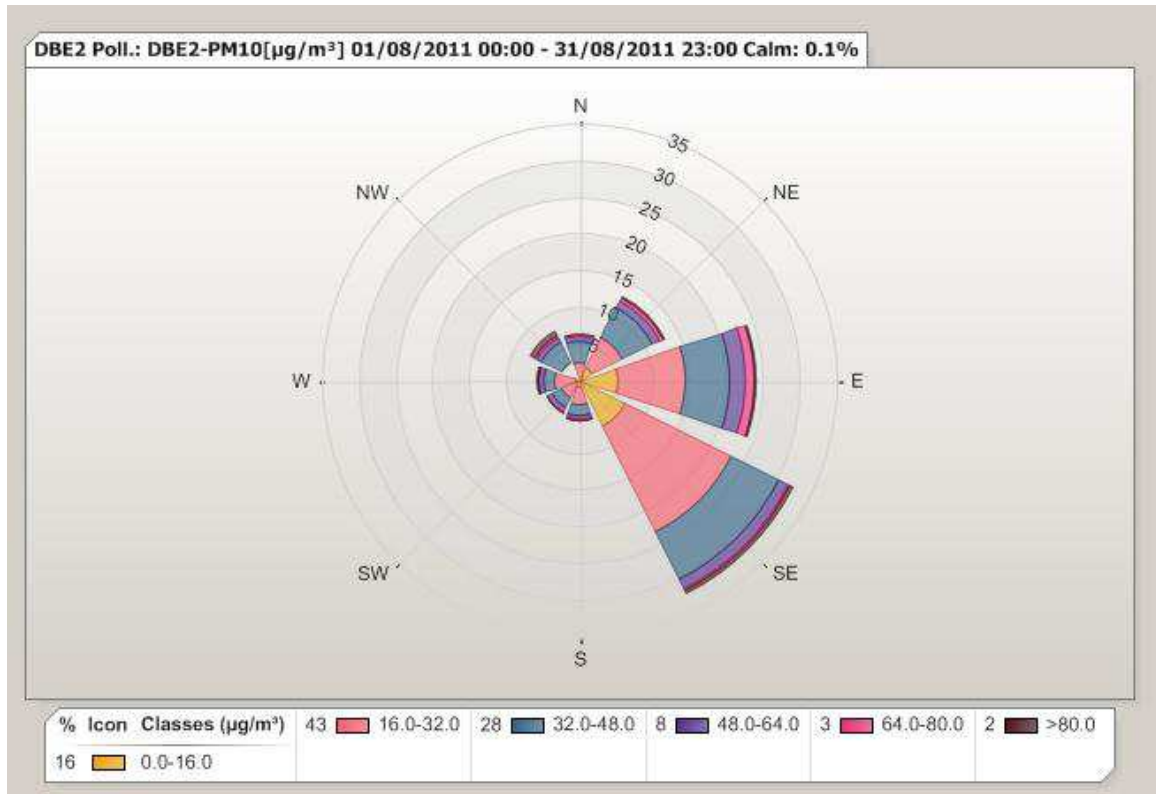
### O<sub>3</sub> Pollution Rose



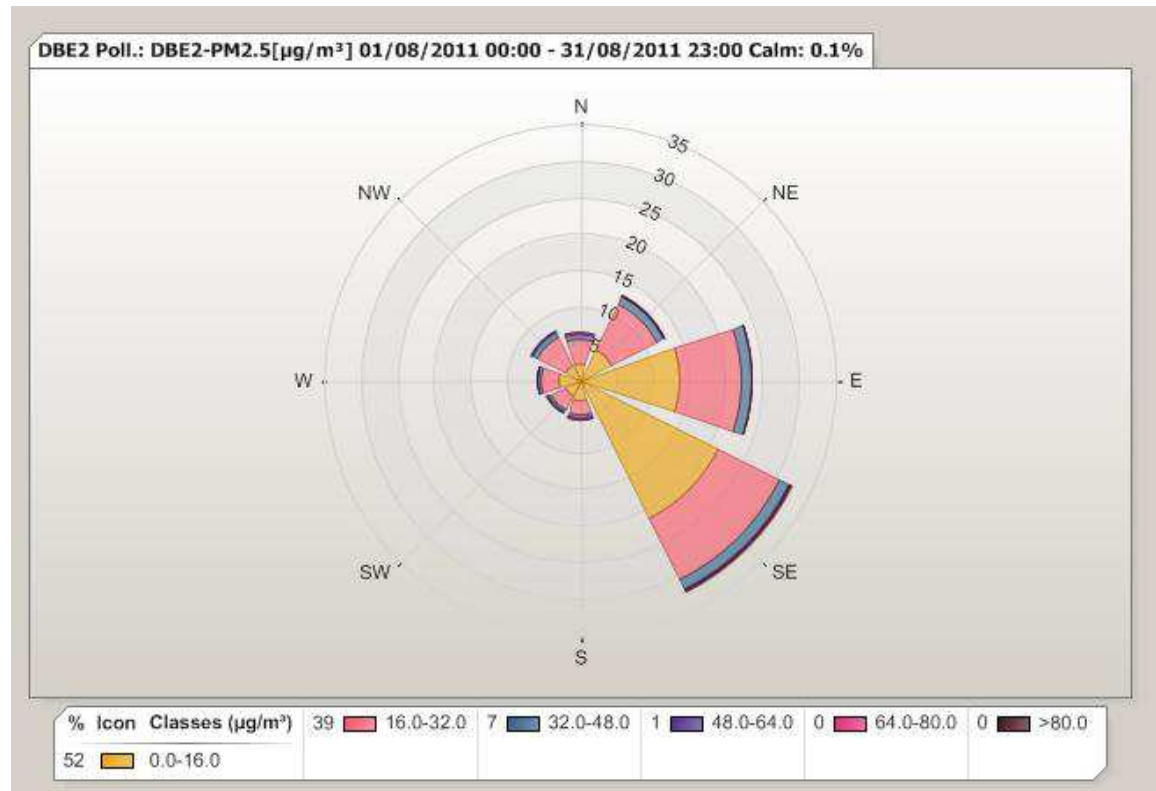
### CO Pollution Rose



## PM<sub>10</sub> Pollution Rose

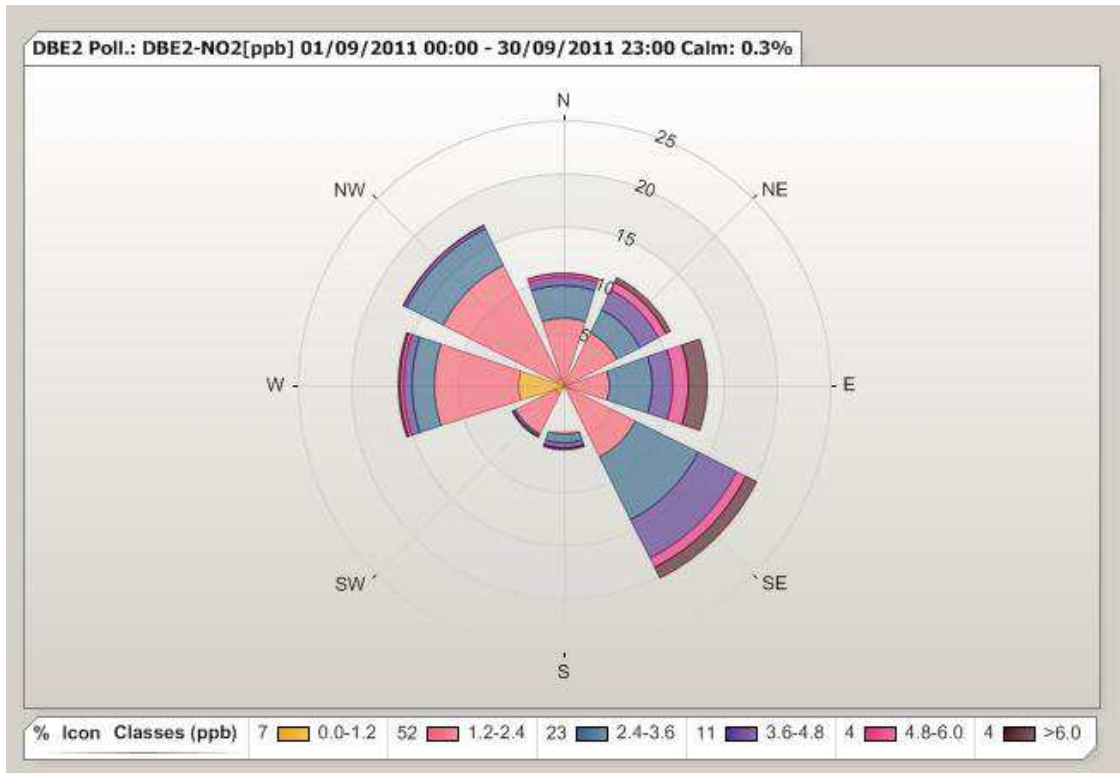


## PM<sub>2.5</sub> Pollution Rose

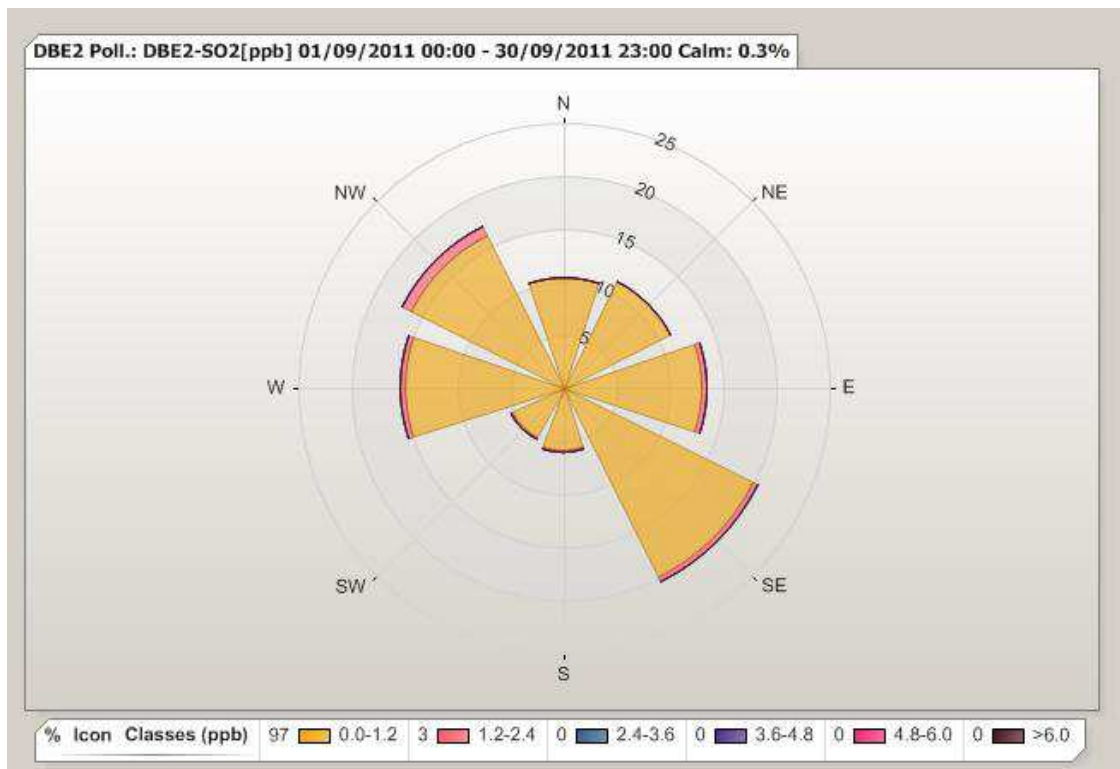


# September

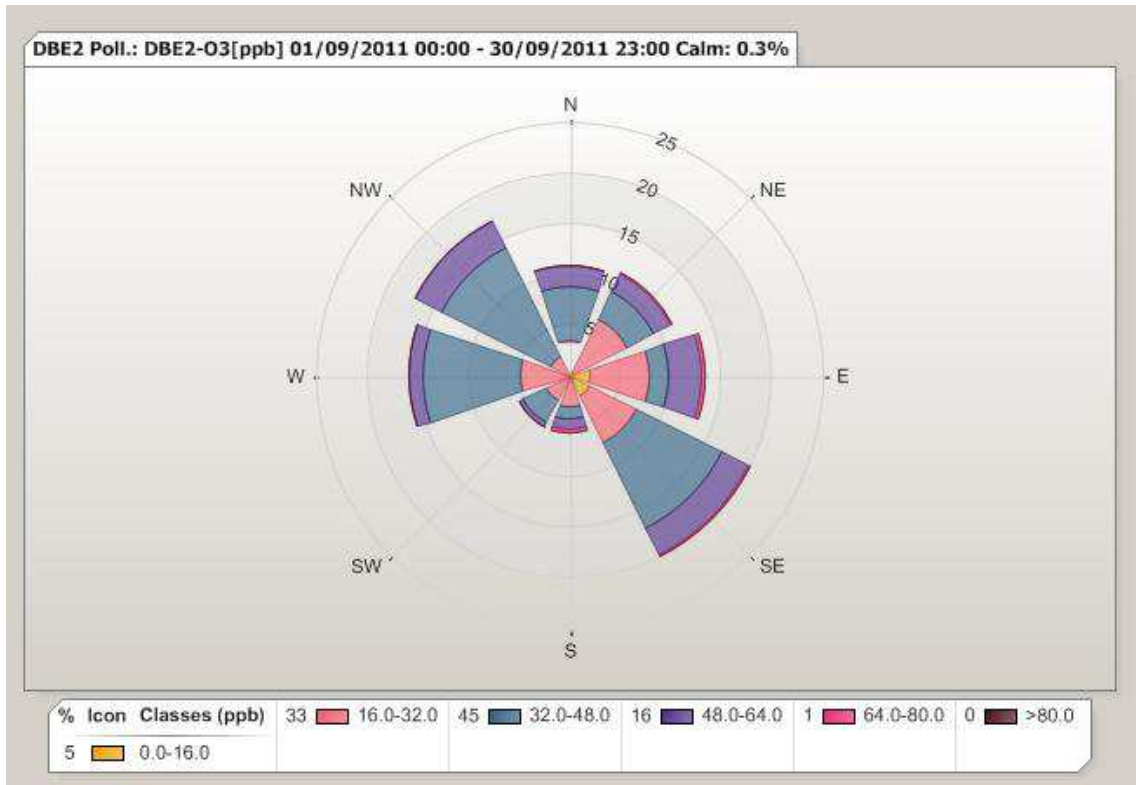
## NO<sub>2</sub> Pollution Rose



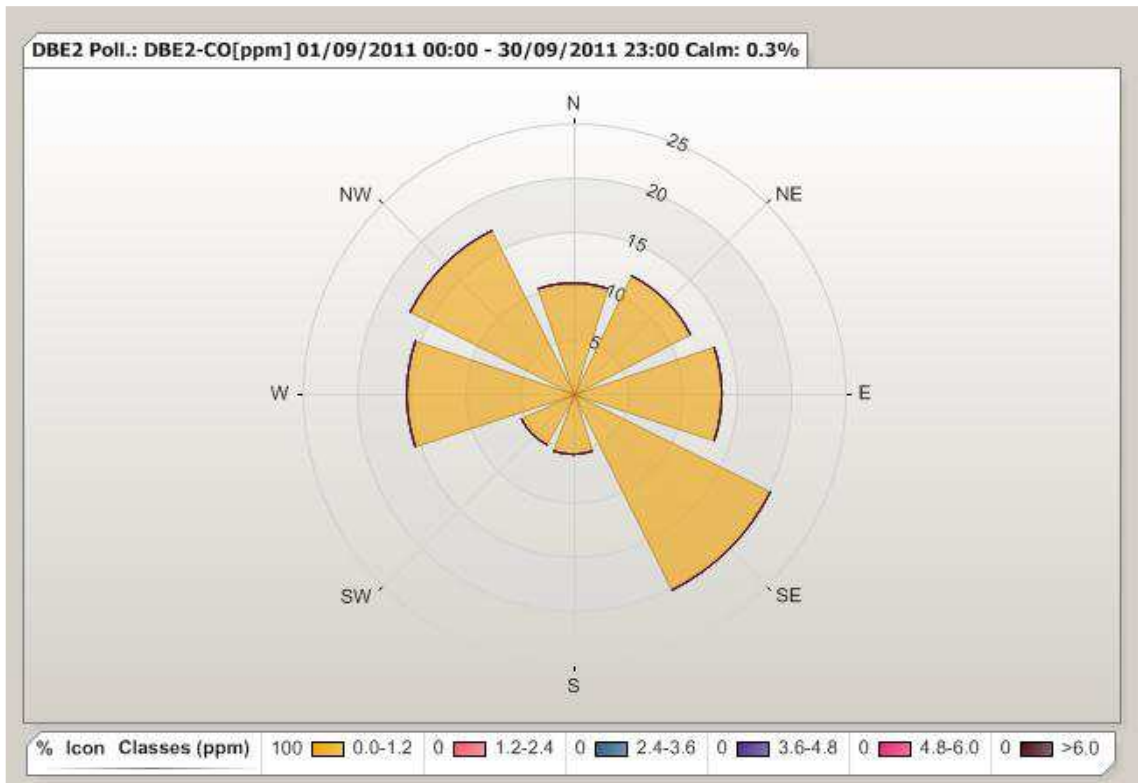
## SO<sub>2</sub> Pollution Rose



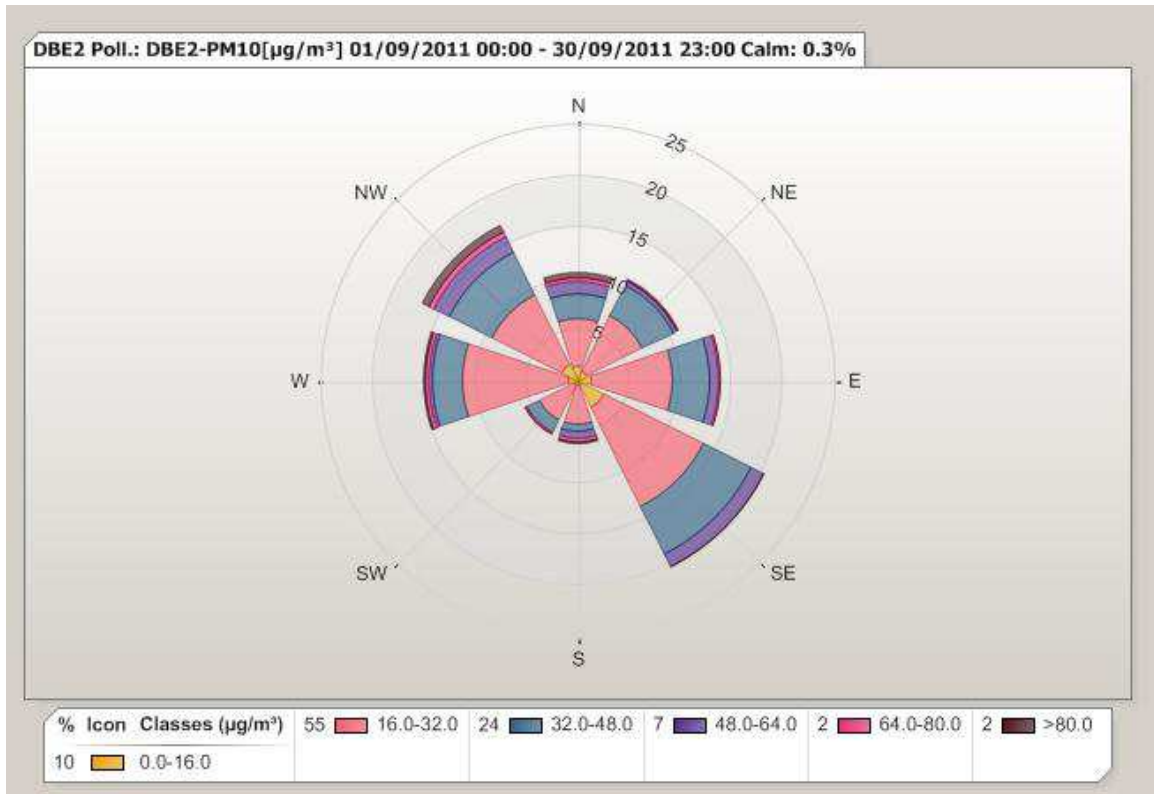
### O<sub>3</sub> Pollution Rose



### CO Pollution Rose



### PM<sub>10</sub> Pollution Rose



### PM<sub>2.5</sub> Pollution Rose

