



**Environmental Report
January to March 2011
Report No. ARM-2011-023c
Palmerston Site No.2
Department of Environment and
Heritage Division**

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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-PM₁₀, PM_{2.5}, total suspended; sulfur dioxide

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

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File

This report consists of 29 pages

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:

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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 is in Eastern Standard Time.
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. PM₁₀ and PM_{2.5} (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.

2.2 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.

2.3 Capture rates

2.3.1 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
- 100% for wind speed and wind direction
- 100% for Rainfall, Temperature, Humidity and Barometric Pressure
- 100% for TEOM PM_{2.5} and PM₁₀

2.3.2 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_{2.5} and PM₁₀

2.4 Quality assurance activities

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

2.4.1 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, PM₁₀ and PM_{2.5} hourly data have been flagged invalid for values < -5.0µgm⁻³.

2.5 Health, safety and environmental issues

No issues are reported during the period of the report.

2.6 Measurement uncertainties

Parameter	Mnemonic	Units	Uncertainty of measurement @ 95%CL
Nitrogen Oxides	NO _x	ppb	Expanded uncertainty ± 5.0 ppb
Sulphur Dioxide	SO ₂	ppb	Expanded uncertainty ± 5.0 ppb
Ozone	O ₃	ppb	Expanded uncertainty ± 5.0 ppb
Carbon Monoxide	CO	ppm	Expanded uncertainty ± 0.5 ppm
< 10micron particulate	PM ₁₀	µgm ⁻³	Expanded uncertainty ± 1.0 µgm ⁻³
< 2.5micron particulate	PM _{2.5}	µgm ⁻³	Expanded uncertainty ± 1.0 µgm ⁻³

Calculated with a coverage factor of 2

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.

2.7 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	Maximum Concentration	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
Carbon Monoxide	4 hour rolling average	0.08 ppm or 80 ppb	1 day per year
Particulates < 10µm	24 hours	50.0 µgm ⁻³	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	Maximum Concentration	Goal within 10 years Maximum allowable exceedances
Particulates < 2.5µm	1 hour	25.0 µgm ⁻³	Not applicable
	1 year	8.0 µgm ⁻³	

3. Summary of maximums for the reporting period Jan to Mar 2011

Parameter	Average	NEPM limit	Maximum	Date	Time	Wind Speed	Wind Direction
NO ₂	1 hour	120 ppb	12.2 ppb	14/03/2011	15:00	4.9 m/s	296 deg
SO ₂	1 hour	200 ppb	1.5 ppb	08/03/2011	15:00	2.5 m/s	330 deg
O ₃	1 hour	100 ppb	47.5 ppb	31/01/2011	13:00	3.5 m/s	346 deg
O ₃	4 hour	80 ppb	36.8 ppb	31/01/2011	12:00	3.0 m/s	326 deg
CO	8 hour	9.0 ppm	1.1 ppm	01/02/2011	08:00	2.8 m/s	283 deg
PM ₁₀	1 hour	n/a	50.4 µgm ⁻³	11/03/2011	15:00	5.4 m/s	309 deg
PM _{2.5}	1 hour	n/a	16.0 µgm ⁻³	09/01/2011	18:00	4.6 m/s	304 deg
PM ₁₀	24 hour	50.0 µgm ⁻³	25.4 µgm ⁻³	11/03/2011	24hr average	5.2 m/s	309 deg
PM _{2.5}	24 hour	25.0 µgm ⁻³	8.6 µgm ⁻³	22/03/2011	24hr average	2.3 m/s	324 deg

3.1 Calibration history – gaseous parameters

Calibration Type	Parameter(s)	Date
Single Point	NOx	5, 11, 15 January
Single Point	NOx, SO ₂	2,8 February
Single Point	CO, O ₃	2 February
Single Point	NOx, SO ₂ , O ₃ , CO	9 March
Single Point	NOx	10, 14 March

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 - January

Parameter	DCR	IAR
Nitrogen Oxides	43	100
Sulphur Dioxide	96	100
Ozone	96	100
Carbon Monoxide	96	100
PM ₁₀	99	100
PM _{2.5}	100	100
Total DCR & IAR	88.3%	100.0%

4.2 Monthly validated data capture report based on hourly data - February

Parameter	DCR	IAR
Nitrogen Oxides	12	100
Sulphur Dioxide	76	100
Ozone	76	100
Carbon Monoxide	76	100
PM ₁₀	74	100
PM _{2.5}	78	100
Total DCR & IAR	65.3%	100.0%

4.3 Monthly validated data capture report based on hourly data - March

Parameter	DCR	IAR
Nitrogen Oxides	94	100
Sulphur Dioxide	96	100
Ozone	96	100
Carbon Monoxide	96	100
PM ₁₀	97	100
PM _{2.5}	100	100
Total DCR & IAR	96.5%	100.0%

4.4 January – Summary of maximums

Parameter	Average	NEPM limit	Maximum	Date	Time	Wind Speed	Wind Direction
NO ₂	1 hour	120 ppb	6.7 ppb	21/01/2011	08:00	1.4 m/s	20 deg
SO ₂	1 hour	200 ppb	1.5 ppb	17/01/2011	07:00	2.5 m/s	295 deg
O ₃	1 hour	100 ppb	47.5 ppb	31/01/2011	13:00	3.5 m/s	346 deg
O ₃	4 hour	80 ppb	36.8 ppb	31/01/2011	12:00	3.0 m/s	326 deg
CO	8 hour	9.0 ppm	1.1 ppm	30/01/2011	16:00	1.8 m/s	23 deg
PM ₁₀	1 hour	n/a	39.4 µgm ⁻³	11/01/2011	18:00	4.2 m/s	355 deg
PM _{2.5}	1 hour	n/a	16.0 µgm ⁻³	09/01/2011	18:00	4.6 m/s	304 deg

4.4.1 January – PM₁₀ & PM_{2.5} - 24hr maximums

Parameter	NEPM limit	Value	Date	Wind vector
PM ₁₀	50.0 µgm ⁻³	22.6 µgm ⁻³	12/01/2011	6.4 m/s @ 321 deg
PM _{2.5}	# 25.0 µgm ⁻³	8.1 µgm ⁻³	10/02/2011	4.3 m/s @ 306 deg

Advisory

4.4.2 January – Exceedences

There were no exceedences of the the gaseous or particulate NEPM goals during January 2011

4.5 February – Summary of maximums

Parameter	Average	NEPM limit	Maximum	Date	Time	Wind Speed	Wind Direction
NO ₂	1 hour	120 ppb	7.3 ppb	24/02/2011	15:00	2.6 m/s	279 deg
SO ₂	1 hour	200 ppb	1.2 ppb	14/02/2011	18:00	5.3 m/s	299 deg
O ₃	1 hour	100 ppb	31.5 ppb	01/02/2011	12:00	3.5 m/s	271 deg
O ₃	4 hour	80 ppb	30.7 ppb	02/02/2011	08:00	1.6 m/s	273 deg
CO	8 hour	9.0 ppm	1.1 ppm	01/02/2011	08:00	2.8 m/s	283 deg
PM ₁₀	1 hour	n/a	28.0 µgm ⁻³	25/02/2011	13:00	3.9 m/s	333 deg
PM _{2.5}	1 hour	n/a	11.4 µgm ⁻³	20/02/2011	17:00	2.4 m/s	297 deg

4.5.1 February – PM₁₀ & PM_{2.5} - 24hr maximums

Parameter	NEPM limit	Value	Date	Wind vector
PM ₁₀	50.0 µgm ⁻³	13.2 µgm ⁻³	20/02/2011	2.5 m/s @ 3 deg
PM _{2.5}	# 25.0 µgm ⁻³	6.3 µgm ⁻³	20/02/2011	2.5 m/s @ 3 deg

Advisory

4.5.2 February – Exceedences

There were no exceedences of the the gaseous or particulate NEPM goals during February 2011

4.6 March – Summary of maximums

Parameter	Average	NEPM limit	Maximum	Date	Time	Wind Speed	Wind Direction
NO ₂	1 hour	120 ppb	12.2 ppb	14/03/2011	15:00	4.9 m/s	296 deg
SO ₂	1 hour	200 ppb	1.5 ppb	08/03/2011	15:00	2.5 m/s	330 deg
O ₃	1 hour	100 ppb	25.1 ppb	16/03/2011	13:00	3.3 m/s	277 deg
O ₃	4 hour	80 ppb	23.9 ppb	16/03/2011	12:00	3.3 m/s	287 deg
CO	8 hour	9.0 ppm	0.6 ppm	20/03/2011	00:00	1.3 m/s	93 deg
PM ₁₀	1 hour	n/a	50.4 µgm ⁻³	11/03/2011	15:00	5.4 m/s	309 deg
PM _{2.5}	1 hour	n/a	15.2 µgm ⁻³	01/03/2011	08:00	3.7 m/s	338 deg

4.6.1 March – PM₁₀ & PM_{2.5} - 24hr maximums

Parameter	NEPM limit	Value	Date	Wind vector
PM ₁₀	50.0 µgm ⁻³	25.4 µgm ⁻³	11/03/2011	5.2 m/s @ 309 deg
PM _{2.5}	# 25.0 µgm ⁻³	8.6 µgm ⁻³	22/03/2011	2.3 m/s @ 324 deg

Advisory

4.6.2 March – Exceedences

There were no exceedences of the the gaseous or particulate NEPM goals during March 2011

4.7 January – Gaseous and Particulate Data Summaries – 24 hour averages

Date & Time	NO	NO ₂	NO _x	SO ₂	CO	O ₃	PM ₂₅	PM ₁₀
Units	ppb	ppb	ppb	ppb	ppm	ppb	µg/m ³	µg/m ³
01/01/2011	NoData	NoData	NoData	0.49	0.70	15.22	3.5	7.3
02/01/2011	NoData	NoData	NoData	0.48	0.70	17.03	1.2	4.8
03/01/2011	NoData	NoData	NoData	0.47	0.70	14.89	1.2	5.6
04/01/2011	NoData	NoData	NoData	0.49	0.70	12.46	1.6	6.4
05/01/2011	NoData	NoData	NoData	0.50	0.70	12.79	2.3	5.6
06/01/2011	NoData	NoData	NoData	0.53	0.70	13.97	2.3	6.4
07/01/2011	NoData	NoData	NoData	0.50	0.70	23.06	1.1	6.4
08/01/2011	NoData	NoData	NoData	0.48	0.70	22.91	2.2	9.5
09/01/2011	NoData	NoData	NoData	0.52	0.70	24.12	5.9	15.5
10/01/2011	NoData	NoData	NoData	0.57	0.70	27.00	8.1	19
11/01/2011	NoData	NoData	NoData	0.53	0.80	21.85	5.6	17.7
12/01/2011	NoData	NoData	NoData	0.52	0.80	28.09	5.6	22.6
13/01/2011	NoData	NoData	NoData	0.54	0.80	22.38	5.4	21.2
14/01/2011	NoData	NoData	NoData	0.55	0.80	23.99	3.5	13.7
15/01/2011	NoData	NoData	NoData	0.58	0.80	16.31	2.1	8.9
16/01/2011	NoData	NoData	NoData	0.62	0.80	22.71	0.6	5.6
17/01/2011	NoData	NoData	NoData	0.69	0.80	14.06	5.2	18.5
18/01/2011	0.82	3.02	3.16	0.73	0.80	15.32	4.1	16
19/01/2011	0.62	2.40	2.33	0.58	0.80	16.00	3.2	12.7
20/01/2011	0.65	2.57	2.53	0.67	0.90	16.49	4.1	12.4
21/01/2011	0.73	3.24	3.29	0.61	0.90	17.79	5.2	14.8
22/01/2011	0.47	2.63	2.41	0.59	0.90	20.02	2.2	11.3
23/01/2011	0.36	2.77	2.47	0.58	0.90	20.61	2.2	9.6
24/01/2011	0.45	3.25	3.02	0.60	0.90	19.19	3.1	10
25/01/2011	0.38	2.83	2.53	0.63	1.00	19.82	6.4	12.2
26/01/2011	0.30	2.50	2.12	0.67	1.00	23.83	3.5	7
27/01/2011	0.36	2.21	1.90	0.66	1.00	19.99	4	8.2
28/01/2011	0.43	2.77	2.53	0.65	1.00	18.16	2.2	6.9
29/01/2011	0.23	2.43	1.98	0.64	1.00	17.15	1.9	6.9
30/01/2011	0.62	2.33	2.28	0.69	1.00	15.74	2.8	8.8
31/01/2011	0.55	2.61	2.47	0.68	1.00	25.04	1.3	7.4
Minimum	0.23	2.21	1.90	0.47	0.7	12.46	0.6	4.8
MinDate	29/01/11	27/01/11	27/01/11	03/01/11	01/01/11	04/01/11	16/01/11	02/01/11
Maximum	0.82	3.25	3.29	0.73	1.00	28.09	8.1	22.6
MaxDate	18/01/2011	24/01/2011	21/01/2011	18/01/2011	25/01/2011	12/01/2011	10/01/2011	12/01/2011
Avg	0.50	2.68	2.50	0.58	0.80	19.289	3.3	10.9
Num	14	14	14	31	31	31	31	31
DCR[%]	45	45	45	100	100	100	100	100
STD	0.2	0.3	0.4	0.1	0.1	4.2	1.8	5

4.8 February – Gaseous and Particulate Data Summaries – 24 hour averages

Date & Time	NO	NO ₂	NO _x	SO ₂	CO	O ₃	PM _{2.5}	PM ₁₀
Units	ppb	ppb	ppb	ppb	ppm	ppb	µg/m ³	µg/m ³
01/02/2011	NoData	NoData	NoData	0.57	1.10	12.20	2	7
02/02/2011	NoData	NoData	NoData	0.55	0.50	11.56	1.7	6.5
03/02/2011	NoData	NoData	NoData	0.49	0.20	11.49	1.5	7.2
04/02/2011	NoData	NoData	NoData	0.50	0.20	15.89	1.9	7.1
05/02/2011	NoData	NoData	NoData	0.49	0.20	13.93	2.3	8.1
06/02/2011	NoData	NoData	NoData	0.49	0.20	12.59	2.4	8.1
07/02/2011	NoData	NoData	NoData	0.50	0.20	16.79	0.6	3.2
08/02/2011	NoData	NoData	NoData	0.49	0.20	16.50	-0.1	2.6
09/02/2011	NoData	NoData	NoData	0.50	0.30	10.55	1.1	8.3
10/02/2011	NoData	NoData	NoData	0.51	0.30	11.52	2	6.6
11/02/2011	NoData	NoData	NoData	0.51	0.20	12.05	1.6	6.5
12/02/2011	NoData	NoData	NoData	0.52	0.30	11.84	0.9	3.5
13/02/2011	NoData	NoData	NoData	0.57	0.30	11.04	1.1	4.6
14/02/2011	NoData	NoData	NoData	0.59	0.30	15.77	0.4	6.2
15/02/2011	NoData	NoData	NoData	0.53	0.20	17.83	0.7	10.6
16/02/2011	NoData	NoData	NoData	<Samp	<Samp	<Samp	<Samp	<Samp
17/02/2011	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
18/02/2011	<Samp	<Samp	<Samp	<Samp	<Samp	<Samp	<Samp	<Samp
19/02/2011	NoData	NoData	NoData	0.56	0.30	21.19	3.5	11.5
20/02/2011	NoData	NoData	NoData	0.57	0.40	16.65	6.3	13.2
21/02/2011	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
22/02/2011	NoData	NoData	NoData	<Samp	<Samp	<Samp	<Samp	<Samp
23/02/2011	NoData	NoData	NoData	<Samp	<Samp	<Samp	<Samp	<Samp
24/02/2011	<Samp	<Samp	<Samp	<Samp	<Samp	<Samp	<Samp	<Samp
25/02/2011	0.71	1.92	2.62	0.58	0.30	19.85	1.8	8.9
26/02/2011	0.22	1.40	1.62	0.61	0.30	17.44	2.7	10.4
27/02/2011	0.08	0.95	1.03	0.62	0.30	16.95	2.5	9.4
28/02/2011	<Samp	<Samp	<Samp	<Samp	<Samp	<Samp	<Samp	<Samp
Minimum	0.08	0.95	1.03	0.49	0.2	10.55	-0.1	2.6
MinDate	27/02/11	27/02/11	27/02/11	03/02/11	03/02/11	09/02/11	08/02/11	08/02/11
Maximum	0.71	1.92	2.62	0.62	1.10	21.19	6.3	13.2
MaxDate	25/02/2011	25/02/2011	25/02/2011	27/02/2011	1/02/2011	19/02/2011	20/02/2011	20/02/2011
Avg	0.33	1.42	1.76	0.54	0.30	14.681	1.8	7.5
Num	3	3	3	20	20	20	20	20
Data[%]	11	11	11	71	71	71	71	71
STD	0.3	0.4	0.7	0	0.2	3.1	1.3	2.7

4.9 March – Gaseous and Particulate Data Summaries – 24 hour averages

Date & Time	NO	NO ₂	NO _x	SO ₂	CO	O ₃	PM ₂₅	PM ₁₀
Units	ppb	ppb	ppb	ppb	ppm	ppb	µg/m ³	µg/m ³
01/03/2011	0.20	1.86	2.01	0.58	0.30	14.99	7.1	18.1
02/03/2011	0.32	2.42	2.68	0.54	0.30	12.72	5.4	14.2
03/03/2011	0.22	2.19	2.35	0.56	0.30	12.93	2.7	9.4
04/03/2011	0.12	1.82	1.88	0.54	0.30	15.78	2.5	7.1
05/03/2011	0.41	2.86	3.22	0.59	0.30	13.51	3.5	7.8
06/03/2011	0.26	2.32	2.52	0.58	0.40	13.06	4.8	10.5
07/03/2011	0.16	1.91	2.02	0.59	0.30	14.21	5.3	11.6
08/03/2011	0.45	2.42	2.83	0.72	0.30	12.11	1.7	8.5
09/03/2011	0.20	2.06	2.20	0.67	0.40	13.57	5.1	15.7
10/03/2011	<Samp	<Samp	<Samp	0.70	0.40	14.93	5.8	19.8
11/03/2011	0.15	2.03	2.15	0.70	0.40	15.76	7.7	25.4
12/03/2011	0.08	1.68	1.72	0.62	0.40	15.15	4.3	21.2
13/03/2011	1.24	1.77	2.94	0.63	0.40	13.36	3.3	17.3
14/03/2011	0.87	3.50	4.04	0.66	0.40	15.23	7.3	16.9
15/03/2011	0.88	3.93	4.63	0.65	0.40	11.99	6.8	15.3
16/03/2011	0.49	3.25	3.74	0.66	0.50	15.23	6.6	14.2
17/03/2011	0.46	2.62	3.07	0.65	0.50	11.64	4.7	12.1
18/03/2011	0.69	2.93	3.62	0.68	0.50	9.73	3.4	11.7
19/03/2011	0.67	2.83	3.50	0.67	0.50	8.52	3	9.9
20/03/2011	1.24	3.01	4.25	0.69	0.50	8.89	3.2	13.1
21/03/2011	0.92	2.91	3.83	0.69	0.50	8.73	4.6	13.6
22/03/2011	1.02	2.26	3.27	0.80	0.50	7.99	8.6	15.4
23/03/2011	1.11	3.54	4.64	0.73	0.50	8.65	6.5	14.2
24/03/2011	0.58	3.38	3.96	0.70	0.50	9.12	1.6	7.9
25/03/2011	0.50	3.48	3.98	0.73	0.60	12.81	1.7	9.9
26/03/2011	0.42	2.89	3.31	0.77	0.60	15.09	2.7	11.5
27/03/2011	0.38	2.60	2.98	0.74	0.60	11.90	0.3	7.5
28/03/2011	0.42	2.78	3.19	0.75	0.60	10.76	-0.3	5.8
29/03/2011	0.41	2.79	3.19	0.74	0.60	9.80	0.4	6.8
30/03/2011	0.39	2.56	2.95	0.75	0.60	9.68	-0.2	5.7
31/03/2011	0.36	2.38	2.74	0.78	0.60	9.63	-0.9	4.7
Minimum	0.08	1.68	1.72	0.54	0.3	7.99	-0.9	4.7
MinDate	12/03/11	12/03/11	12/03/11	02/03/11	01/03/11	22/03/11	31/03/11	31/03/11
Maximum	1.24	3.93	4.64	0.80	0.60	15.78	8.6	25.4
MaxDate	13/03/2011	15/03/2011	23/03/2011	22/03/2011	25/03/2011	4/03/2011	22/03/2011	11/03/2011
Avg	0.52	2.63	3.11	0.67	0.50	12.176	3.8	12.3
Num	30	30	30	31	31	31	31	31
Data[%]	97	97	97	97	97	97	100	100
STD	0.3	0.6	0.8	0.1	0.1	2.5	2.5	4.9

Appendix A

Special Note:

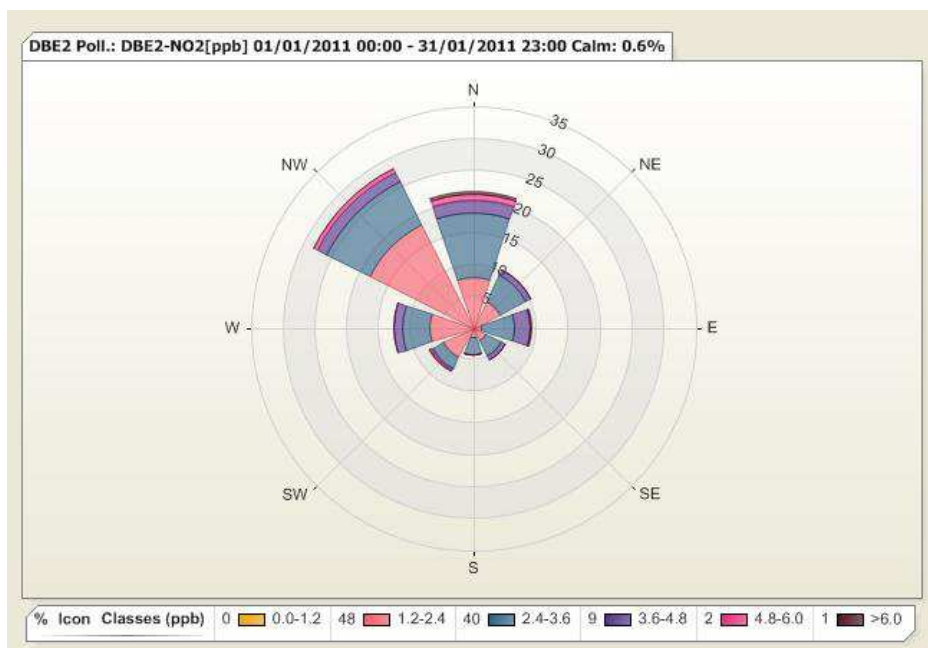
The content of this section is segregated from the main body of the report as the wind speed and direction data used to produce the pollution roses are not covered under the accreditation of this monitoring facility.

Graphs

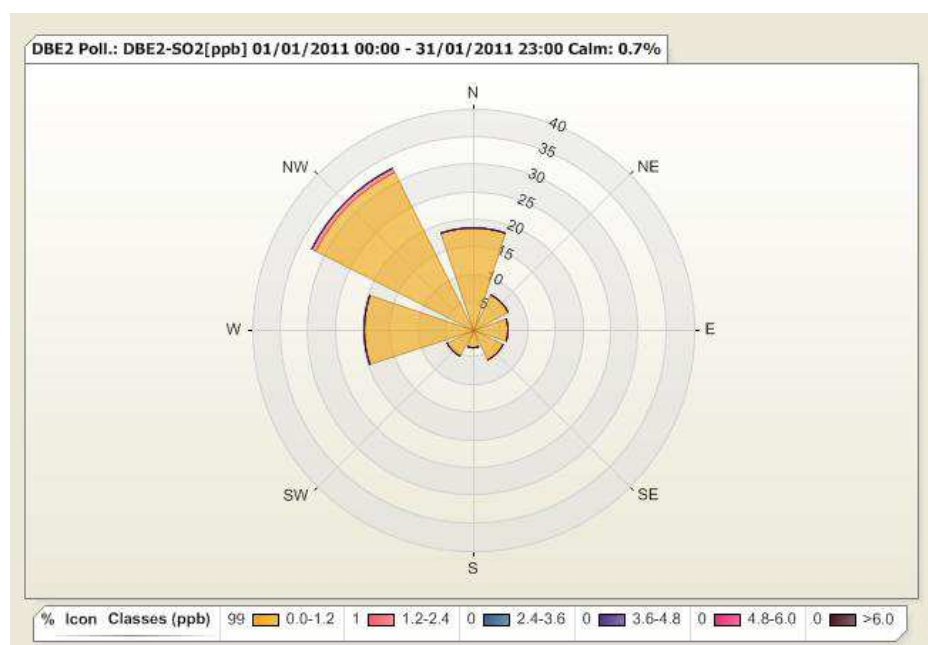
Pollution Roses – based on hourly data

January

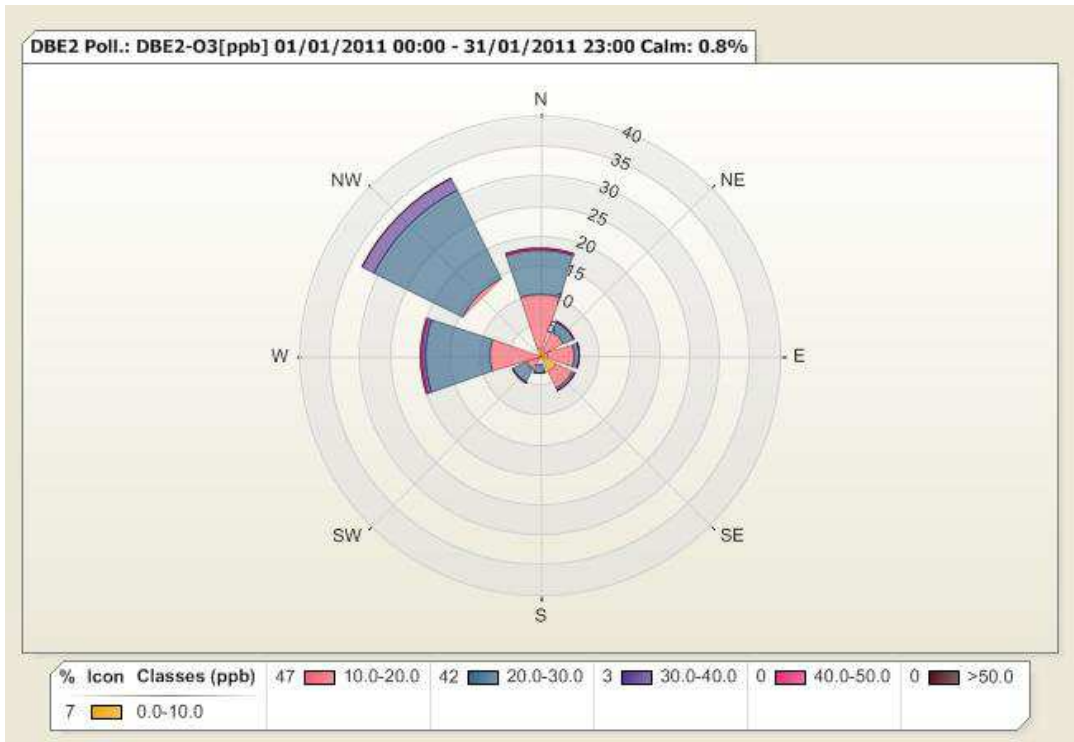
NO₂ Pollution Rose



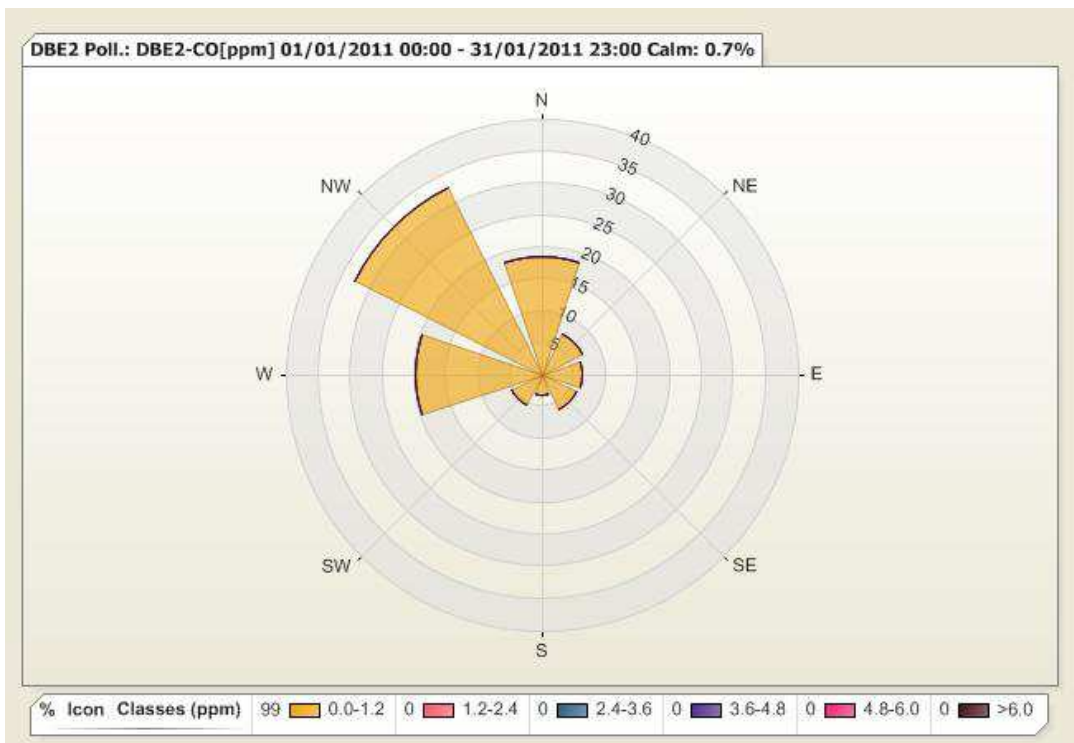
SO₂ Pollution Rose



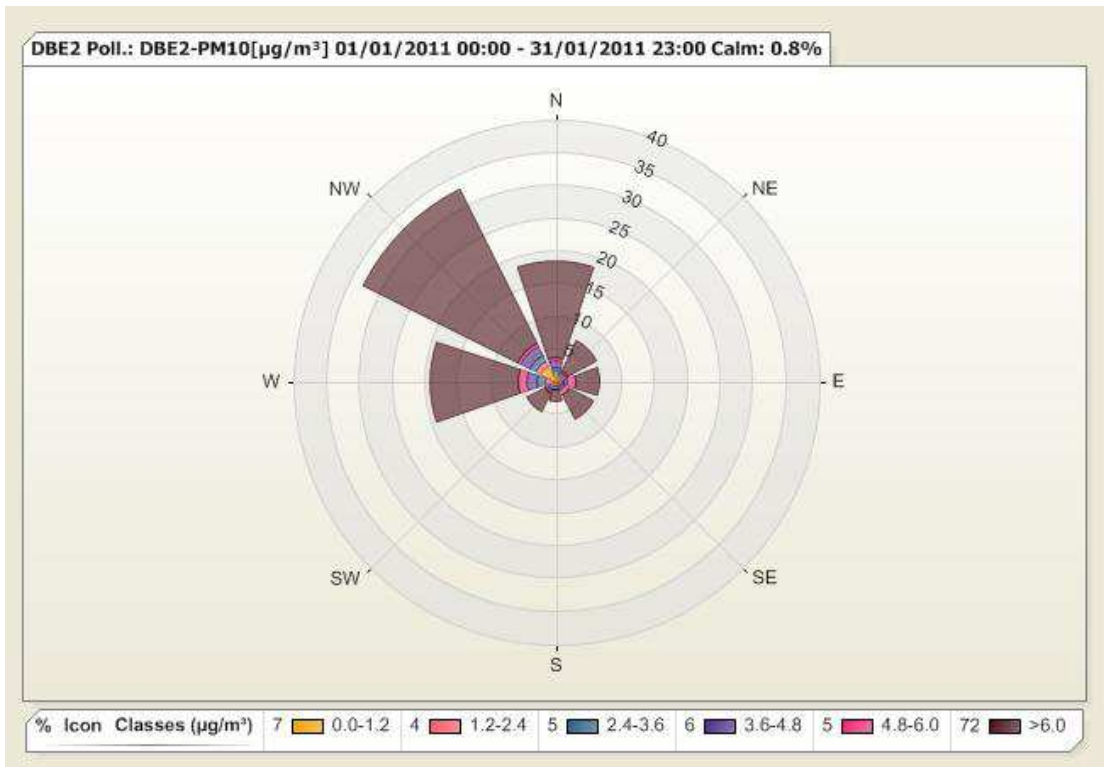
O₃ Pollution Rose



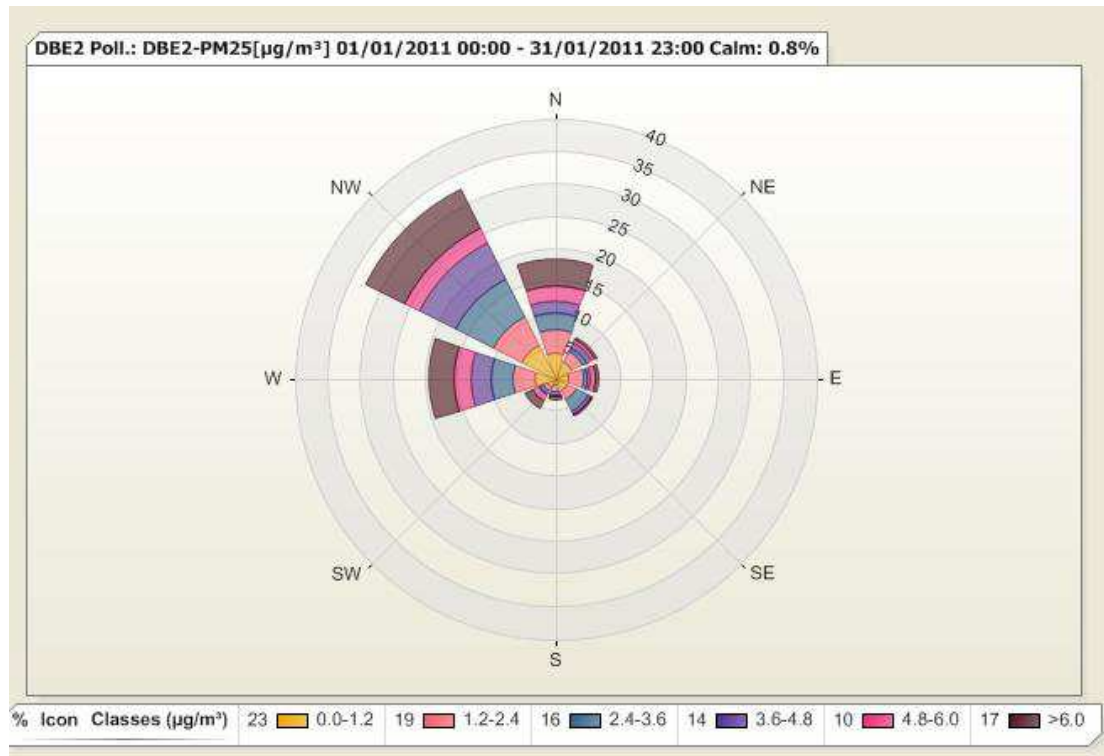
CO Pollution Rose



PM₁₀ Pollution Rose



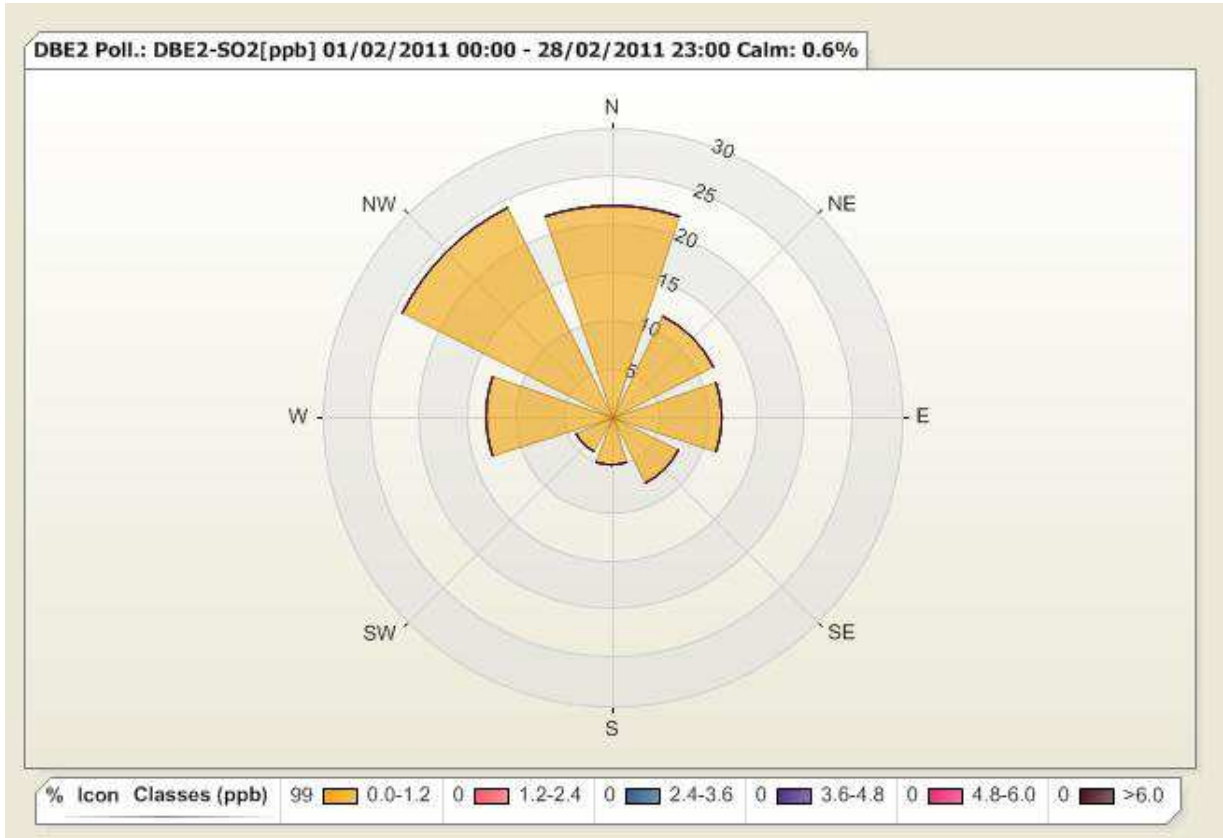
PM_{2.5} Pollution Rose



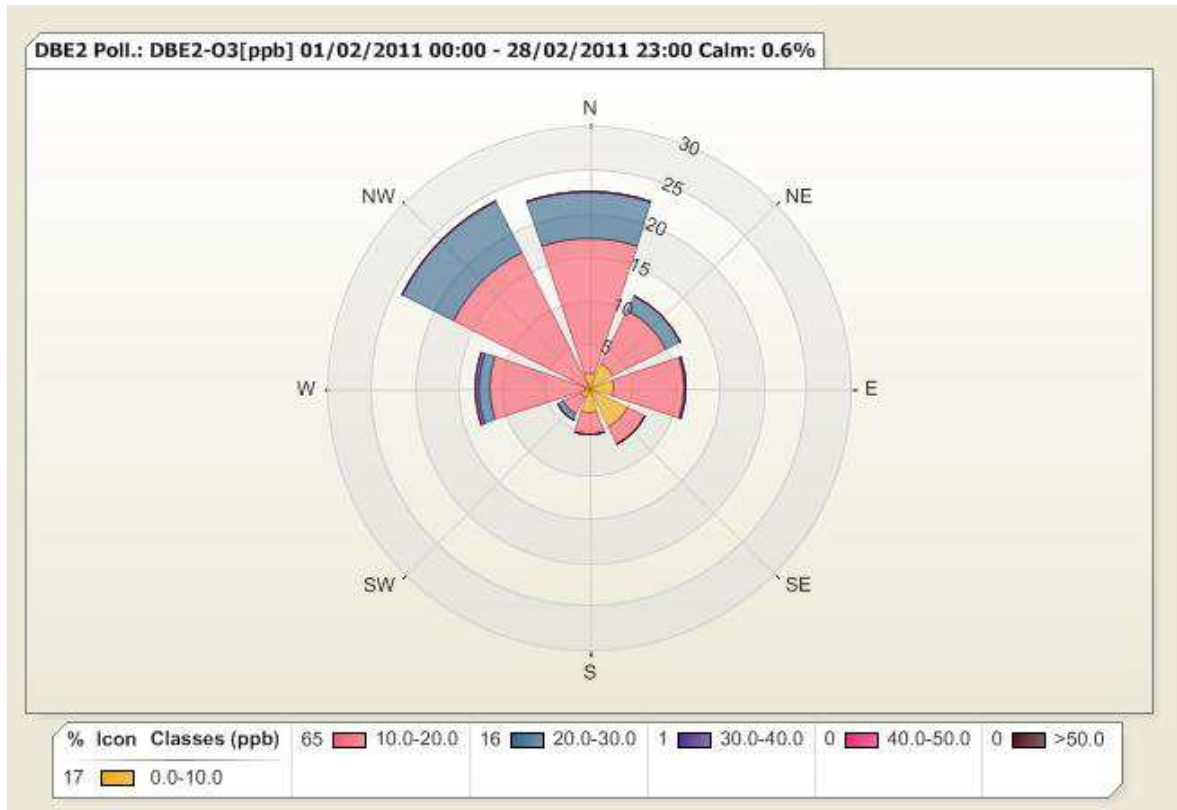
February

NO₂ Pollution Rose – insufficient data to produce a valid graph

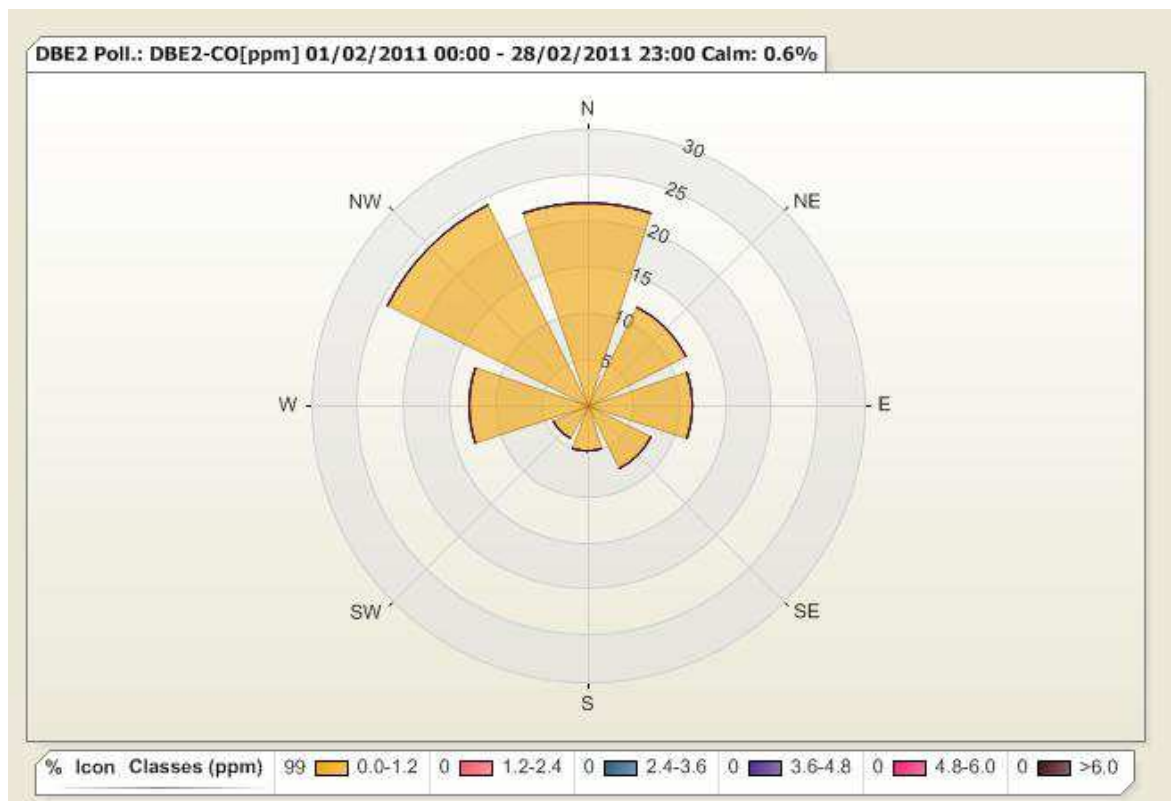
SO₂ Pollution Rose



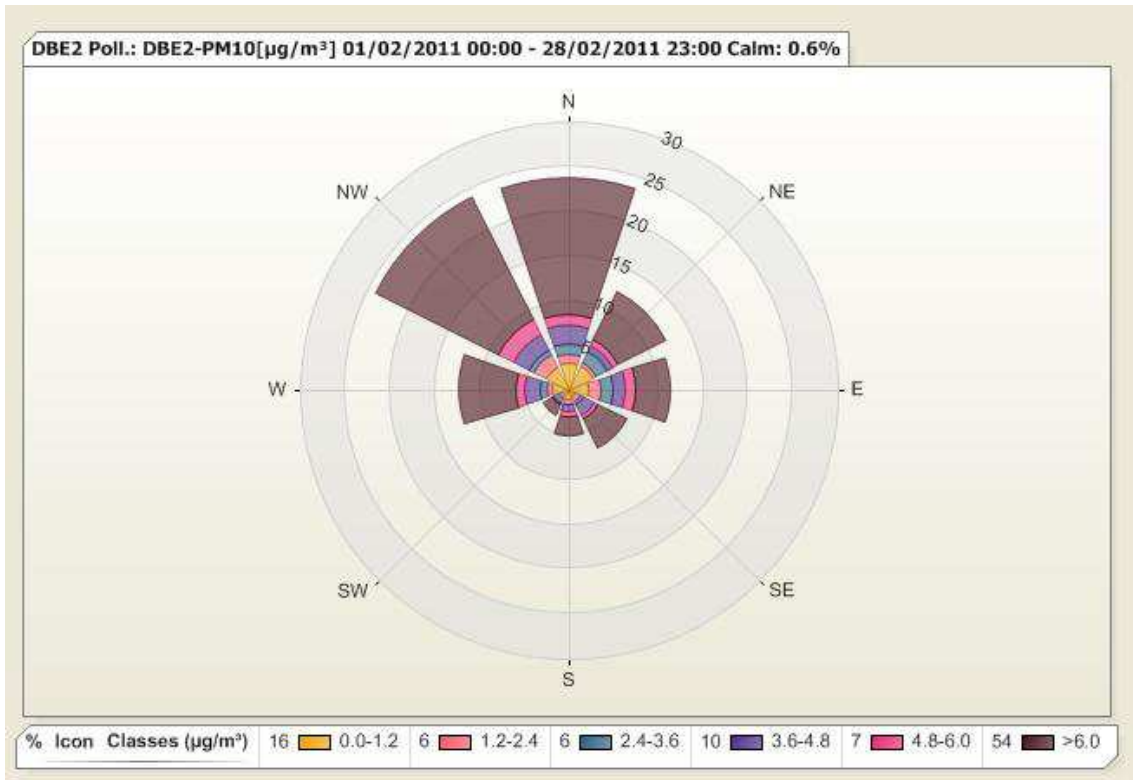
O₃ Pollution Rose



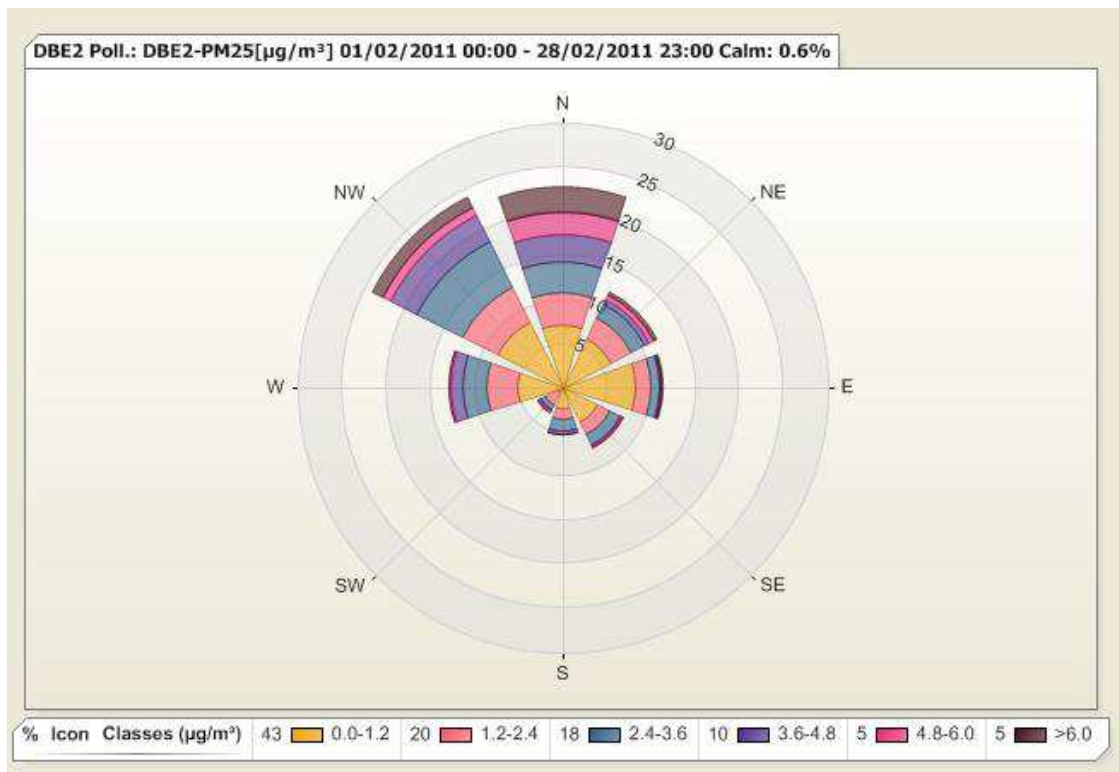
CO Pollution Rose



PM₁₀ Pollution Rose

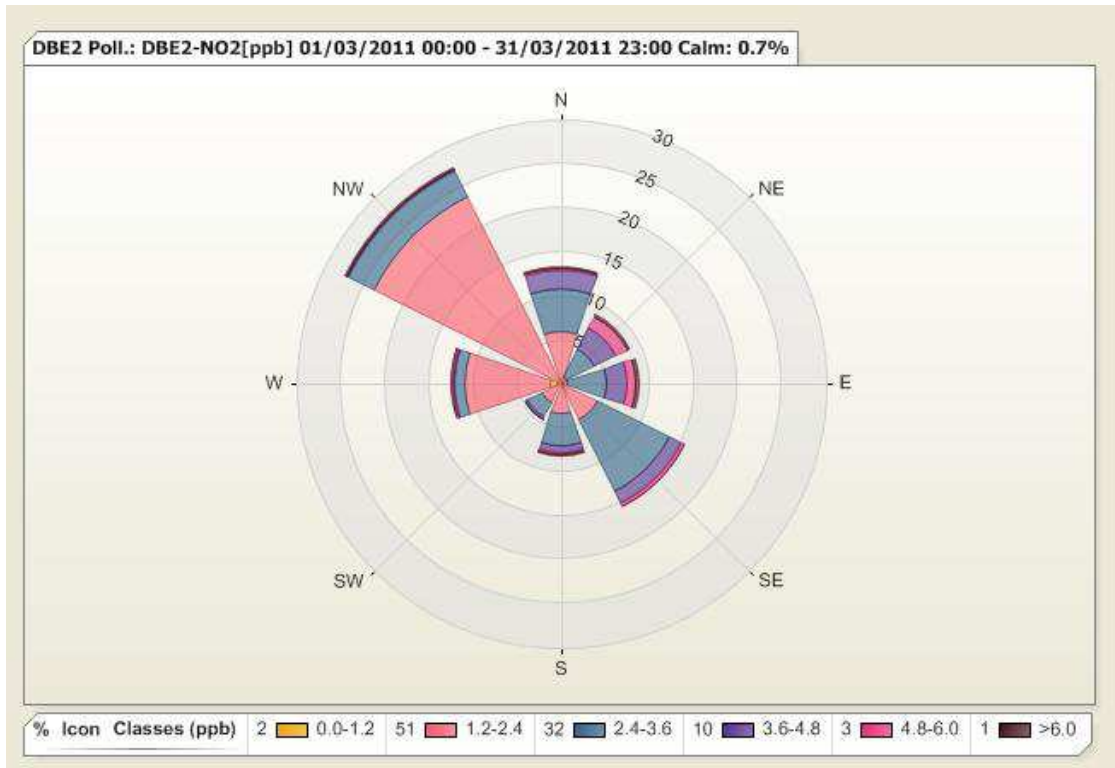


PM_{2.5} Pollution Rose

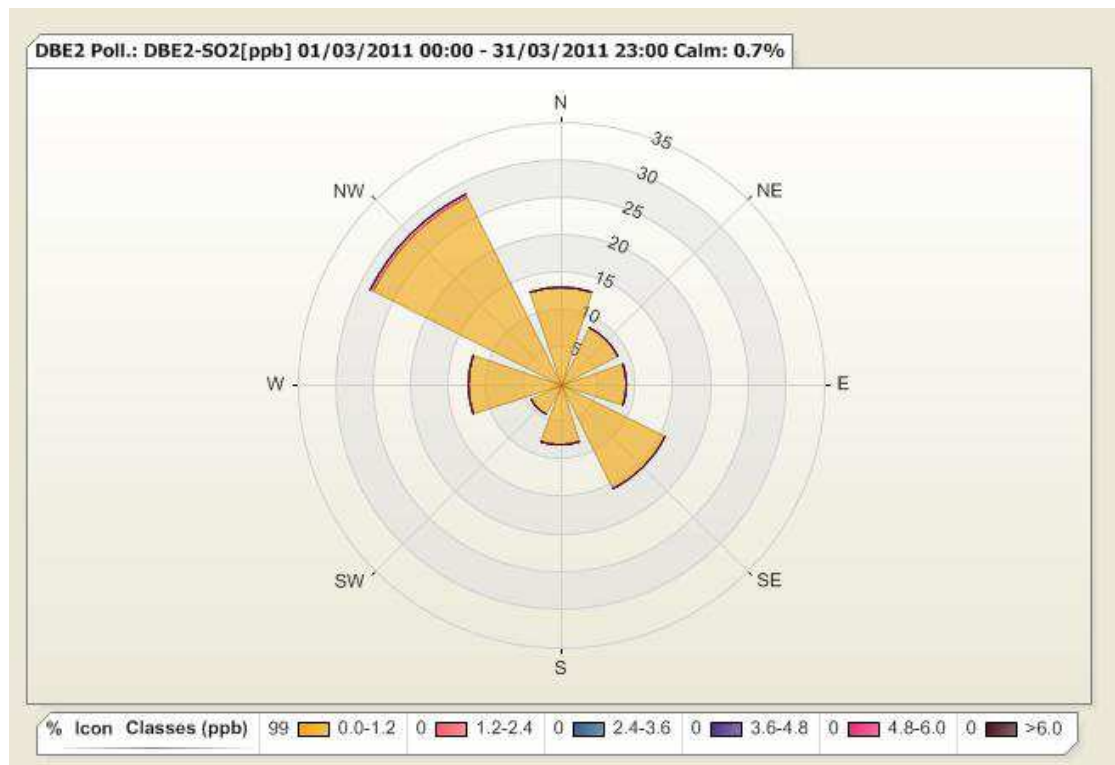


March

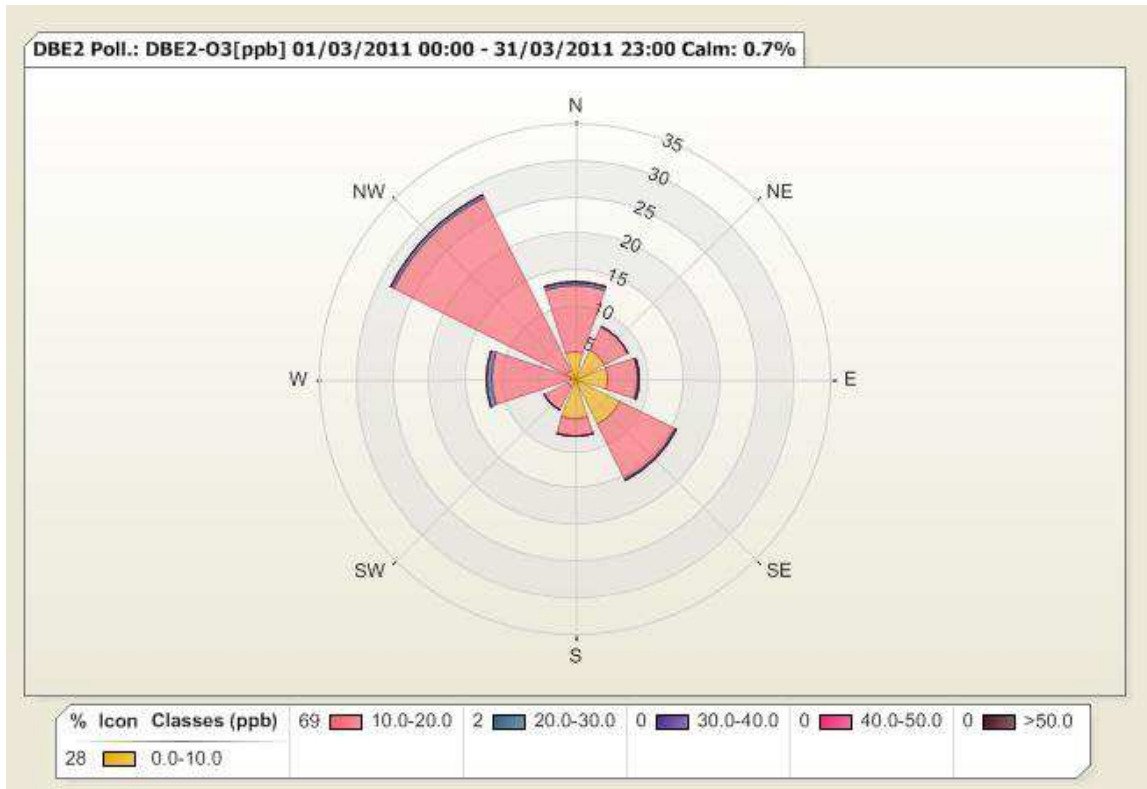
NO₂ Pollution Rose



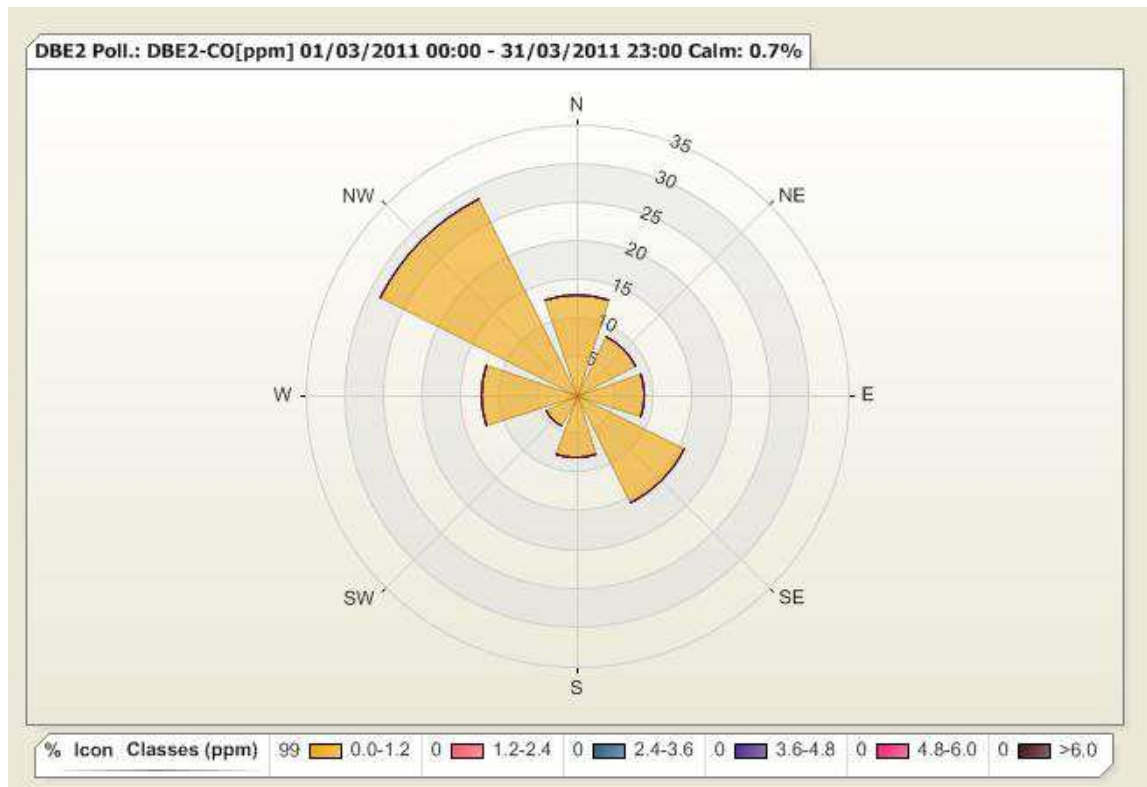
SO₂ Pollution Rose



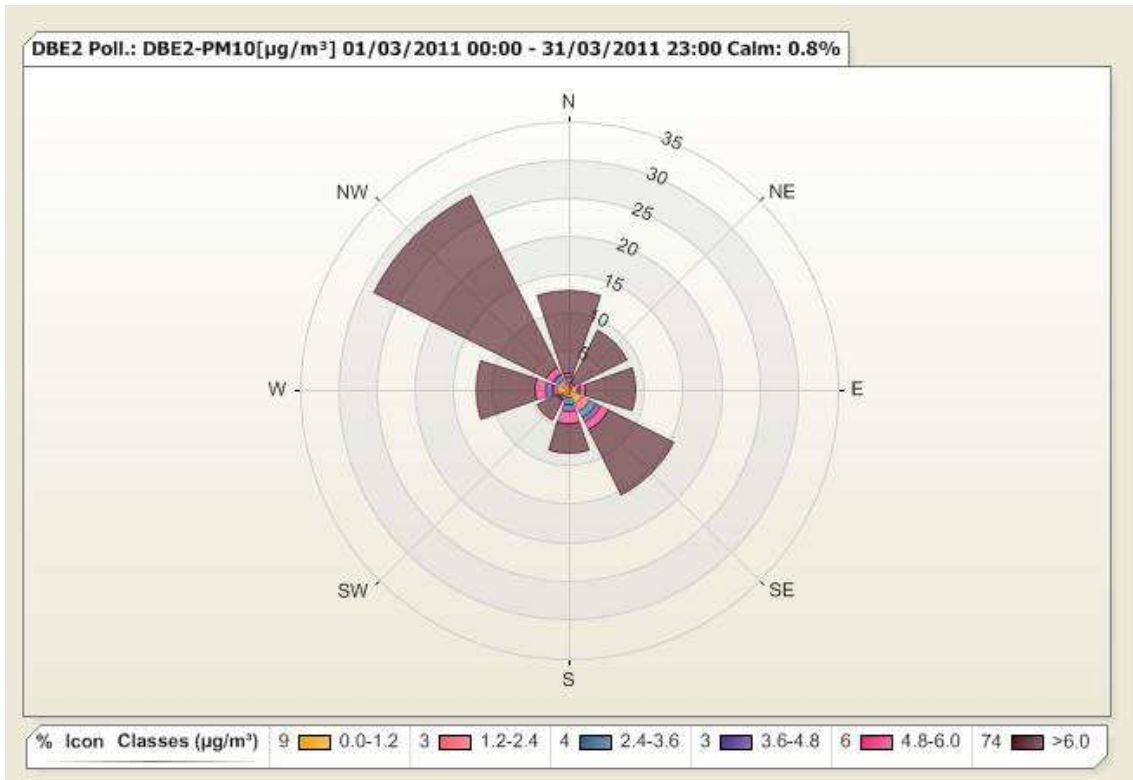
O₃ Pollution Rose



CO Pollution Rose



PM₁₀ Pollution Rose



PM_{2.5} Pollution Rose

