

## Development of the Air Quality Index for Health (AQIH)

Good	1
	2
	3

Fair	4
	5
	6

Poor	7
	8
	9

Very Poor	10
-----------	----

Air Quality Health Information Working Group

April 2013



The co-operation of the UK Committee on Medical Effects of Air Pollution (COMEAP) is gratefully acknowledged.

Members of the Air Quality Health Information Group (April 2013)

Department of Environment, Community and Local Government	Mr Gary McGuinn, Assistant Principal
Department of Environment, Community and Local Government	Mr Micheal Young, Senior Advisor
Environmental Protection Agency	Dr Ian Marnane, Manager Air Enforcement
Environmental Protection Agency	Dr Micheál O'Dwyer, Specialist National Ambient Air Quality Programme
Environmental Protection Agency	Ms Barbara O'Leary, Manager National Ambient Air Quality Programme
Health Service Executive	Dr John Cuddihy, Specialist in Public Health Medicine
Health Service Executive	Dr Tessa Greally, Specialist in Public Health Medicine
Health Service Executive	Dr Patricia McDonald, Specialist in Public Health Medicine
Health Service Executive	Dr Mary O'Mahony, Specialist in Public Health Medicine
Met Éireann	Mr Gerald Fleming, Head of Forecasting

In addition, the following people contributed to development of the AQIH.

Dublin City Council	Mr Martin Fitzpatrick, Principal Environmental Health Officer, Air Quality and Noise Unit
Health Service Executive	Ms Hilary Cowley, Public Health Research Officer
Health Service Executive	Ms Gemma Leane, Public Health Research Officer

## Contents

1. Introduction .....	1
2. The AQIH and Accompanying Information .....	2
3. Calculating the Index.....	7
3.1. Hourly Index.....	7
3.2. Daily Index.....	7
3.3. Composite Indices and AQIH Regions.....	7
Table 3.1. Definition of AQIH Regions. ....	8
3.3.1. Limitations with using a Composite Index and Disclaimer .....	8
Table 3.2. Proposed monitoring stations for composite index. ....	9
4. Explanation of the Index .....	10
4.1. Presentation of the Index .....	10
Table 4.1. Comparison of bands of AQIH and DAQI .....	10
4.2. Parameters.....	10
4.2.1. Ozone .....	10
Table 4.2. Results for 2011 from ozone stations to be used in the AQIH composite indices ...	11
4.2.2. Nitrogen Dioxide .....	11
Table 4.3. Results for 2011 from nitrogen dioxide stations to be used in the AQIH composite indices .....	11
4.2.3. Sulphur Dioxide.....	12
Table 4.4. Results for 2011 from sulphur dioxide stations to be used in the AQIH composite indices .....	12
4.2.4. PM <sub>2.5</sub> Particles .....	12
Table 4.5. Results for 2011 from PM <sub>2.5</sub> stations to be used in the AQIH composite indices...	13
4.2.5. PM <sub>10</sub> Particles.....	13
Table 4.6. Results for 2011 from PM <sub>10</sub> stations to be used in the AQIH composite indices...	13
5. Trigger Values .....	14
6. Index Use.....	14
Appendix 1 Summary: Air Quality Index for Health (AQIH) .....	15
Appendix 2 Review of Evidence Base.....	24
Appendix 3 Sample Calculations .....	26
Appendix 4 Cities and Towns in Large Towns and Small Towns AQIH Regions.....	27
Appendix 5 – Available real-time monitors by AQIH Region .....	30
Appendix 6 – Index Colours in RGB and Hex Codes.....	31
Appendix 7 – Calculation of Factor for PM <sub>10</sub> /PM <sub>2.5</sub> Conversion .....	32

## 1. Introduction

The first Air Quality Index used in Ireland was developed by the Environmental Protection Agency (EPA) in 2004<sup>1</sup> and used by the EPA from 2005 onwards.

The Air Quality Health Information Working Group was formed in 2011. One of the objectives of the group was to agree an index appropriate for Ireland including health information. The Health Service Executive (HSE) undertook a comprehensive review of the existing evidence base for the health impact of air pollution and examined a selection of air quality indices used across the world<sup>2</sup>. Further details of this review and the recommendations are available in Appendix 2.

The review recommended aligning health messages with those of Northern Ireland to avoid confusing messages in border regions. The conclusions of the review are similar to the conclusions reached in the Committee on the Medical Effects of Air Pollution (COMEAP) 2011 review based on international health evidence. For these reasons the EPA examined the feasibility of using the proposed UK Air Quality Index within the Irish air quality monitoring infrastructure<sup>3</sup>.

The new Air Quality Index for Health is the outcome of the work by the HSE and the EPA. The AQIH is closely aligned to the UK Daily Air Quality Index (DAQI) index<sup>4</sup>. The DAQI was introduced in January 2012 and is derived from the COMEAP 2011 recommendations.

A summary of the index is contained in Appendix 1. This is the minimum amount of information which should be available to users of the index. It may be used independently of the remainder of this document. The summary is written in Plain English and is available at [www.epa.ie/air/quality/index/](http://www.epa.ie/air/quality/index/). It is available to download as a separate document *Air Quality Index for Health Summary* from [www.epa.ie/pubs/reports/air/quality/](http://www.epa.ie/pubs/reports/air/quality/).

---

<sup>1</sup>Environmental Protection Agency, 2004. *Ambient Air Quality Index for Ireland*. Final version October 2004.

<sup>2</sup>Health Service Executive, 2011. *Air Quality Indices and Health Related Messages. Review of the existing evidence base for the Air Quality Health Information Group*.

<sup>3</sup>Environmental Protection Agency, 2012. *Application of COMEAP Proposed UK Air Quality Index in Ireland. Feasibility Study prepared for the Air Quality Health Information Working Group, January 2012*

<sup>4</sup><http://uk-air.defra.gov.uk/air-pollution/daq/> - accessed 25 June 2013

## 2. The AQIH and Accompanying Information

The Air Quality Index for Health (AQIH) is presented on a scale of 1 to 10, divided into four bands – good, fair, poor and very poor. The index should normally be presented with the number, band and colour included.

The AQIH is based on measurements of five air pollutants, all of which can harm health. The five are ozone, nitrogen dioxide, sulphur dioxide, PM<sub>2.5</sub> (particles with a diameter < 2.5 µm) and PM<sub>10</sub> (particles with a diameter <10 µm). The index for each pollutant is calculated separately. The overall AQIH is the worst index of the five pollutant indices. The table below shows the concentration ranges for each pollutant.

Further information on the calculation and presentation of the AQIH is provided in Chapters 3 and 4. A summary of the index is presented in Appendix 1. This summary is written in Plain English and contains the minimum amount of information that should accompany the AQIH.

Band	Index	Ozone	Nitrogen dioxide	Sulphur dioxide	PM <sub>2.5</sub> particles	PM <sub>10</sub> particles
		Running 8-hour mean (µg/m <sup>3</sup> )	1-hour mean (µg/m <sup>3</sup> )	1-hour mean (µg/m <sup>3</sup> )	Running 24-hour mean (µg/m <sup>3</sup> )	Running 24-hour mean (µg/m <sup>3</sup> )
Good	1	0-33	0-67	0-29	0-11	0-16
	2	34-66	68-134	30-59	12-23	17-33
	3	67-100	135-200	60-89	24-35	34-50
Fair	4	101-120	201-267	90-119	36-41	51-58
	5	121-140	268-334	120-149	42-47	59-66
	6	141-160	335-400	150-179	48-53	67-75
Poor	7	161-187	401-467	180-236	54-58	76-83
	8	188-213	468-534	237-295	59-64	84-91
	9	214-240	535-600	296-354	65-70	92-100
Very Poor	10	241 or more	601 or more	355 or more	71 or more	101 or more

The index will be accompanied by the following information:

- A How to use the Air Quality Index for Health
- B Information on the Short-term Effects of Air Pollution
- C Health Advice to Accompany the Air Quality Index for Health

The primary location for the index is [www.airquality.epa.ie](http://www.airquality.epa.ie)

## A How to use the Air Quality Index for Health (AQIH)

**Step 1** Determine whether you (or your children) are likely to be at risk from air pollution. Information on groups who may be affected is given in section B on 'Information on the short-term effects of air pollution'. Your doctor may also be able to give you advice.

**Step 2** Determine which AQIH region you are in using the [map](#) or the [list of regions](#). There are 6 AQIH regions:

Dublin City	Large Towns	Rural West
Cork City	Small Towns	Rural East

**Step 3** If you may be at risk, and are planning strenuous activity outdoors; check the AQIH for your region on [airquality.epa.ie](http://airquality.epa.ie). If you are close to the border of another AQIH region, check the AQIH for that region also.

**Step 4** Use the health advice messages in Section C corresponding to the air quality index as a guide.

### Disclaimer

Usage of the AQIH constitutes acceptance of the terms and conditions. The index is based on information from monitoring instruments at representative locations in each region. The index will not reflect local incidents of air pollution. Site-specific conditions may give a false index reading. The EPA is not liable for any consequences from decisions made based on the AQIH.

## **B Information on the Short-term Effects of Air Pollution**

The Air Quality Index for Health has been developed to provide advice on expected levels of air pollution. In addition, information on the short-term effects on health that might be expected to occur at the different bands of the AQIH (Good, Fair, Poor and Very Poor) is provided here.

### **Short-term effects of air pollution on health**

Air pollution has a range of effects on health. However, air pollution in Ireland does not rise to levels at which people need to make major changes to their habits to avoid exposure; nobody need fear going outdoors.

**Adults and children with heart or lung conditions including asthma** It is known that, when levels of air pollutants rise, adults suffering from heart conditions, and adults and children with lung conditions, are at increased risk of becoming ill and needing treatment. Only a minority of those who suffer from these conditions are likely to be affected and it is not possible to predict in advance who will be affected. Some people are aware that air pollution affects their health: adults and children with asthma may notice that they need to increase their use of inhaled reliever medication on days when levels of air pollution are **fair**, **poor** or **very poor**. Individuals who are very sensitive to air pollution may experience health effects even on days with **good** air quality.

**Older people** are more likely to suffer from heart and lung conditions than young people and so it makes good sense for them to be aware of current air quality.

**General population** At **very poor** levels of air quality, some people may experience a sore or dry throat, sore eyes or, in some cases, a tickly cough – even healthy individuals. Children need not be kept from school or prevented from taking part in games.

**Children** need not be kept from school or prevented from taking part in games. Children with asthma may notice that they need to increase their use of reliever medication on days when levels of air pollution are higher than average.

### C Health Advice to Accompany the Air Quality Index for Health

Band		Accompanying health messages for at-risk groups and the general population	
		At-risk individuals *	General population
Good	1	<i>Enjoy</i> your usual outdoor activities.	<i>Enjoy</i> your usual outdoor activities.
	2		
	3		
Fair	4	Adults and children with lung problems, and adults with heart problems, <i>who experience symptoms</i> , should consider reducing strenuous physical activity, particularly outdoors.	<i>Enjoy</i> your usual outdoor activities.
	5		
	6		
Poor	7	Adults and children with lung problems, and adults with heart problems, should <i>reduce</i> strenuous physical activity, particularly outdoors, and particularly if they experience symptoms. People with asthma may find they need to use their reliever inhaler more often. Older people should also <i>reduce</i> physical exertion.	Anyone experiencing discomfort such as sore eyes, cough or sore throat should <i>consider reducing</i> activity, particularly outdoors.
	8		
	9		
Very Poor	10	Adults and children with lung problems, adults with heart problems, and older people, should <i>avoid</i> strenuous physical activity. People with asthma may find they need to use their reliever inhaler more often.	<i>Reduce</i> physical exertion, particularly outdoors, especially if you experience symptoms such as cough or sore throat.

\* Adults and children with heart or lung problems are at greater risk of symptoms. Follow your doctor's usual advice about exercising and managing your condition. It is possible that very sensitive individuals may experience health effects even on days with Good air quality. Anyone experiencing symptoms should follow the guidance provided in the following section 'Additional information on action that can be taken when there are increased levels of air pollution'.



## Additional information on action that can be taken when there are increased levels of air pollution

When levels of air pollution increase it would be sensible for those who have noticed that they are affected to limit their exposure to air pollutants. This does not mean staying indoors, but reducing levels of exercise outdoors would be reasonable.

**Older people and those with heart and lung conditions** might avoid exertion on days with **poor** or **very poor** air quality.

**Adults and children with asthma** should check that they are taking their medication as advised by their health practitioner and may notice that they need to increase their use of inhaled reliever medication.

**Adults with heart and circulatory conditions** should not modify their treatment schedules on the basis of advice provided by the air quality index for health: such modification should only be made on a health practitioner's advice.

**Some athletes**, even if they are not asthmatic, may find their performance is less good than expected when levels of a certain air pollutant (ground-level ozone) cause **poor** or **very poor** air quality, and they may notice that deep breathing causes some discomfort in the chest. This might be expected in summer on days when ground-level ozone levels are raised. This does not mean that they are in danger but it may be sensible for them to limit their activities on such days.

**Older people and those with heart and lung conditions** might avoid exertion on days with **poor** or **very poor** air quality.

**Adults and children with asthma** should check that they are taking their medication as advised by their health practitioner and may notice that they need to increase their use of inhaled reliever medication.

**Adults with heart and circulatory conditions** should not modify their treatment schedules on the basis of advice provided by the air quality index for health: such modification should only be made on a health practitioner's advice.

**Some athletes**, even if they are not asthmatic, may find their performance is less good than expected when levels of a certain air pollutant (ground-level ozone) cause **poor** or **very poor** air quality, and they may notice that deep breathing causes some discomfort in the chest. This might be expected in summer on days when ground-level ozone levels are raised. This does not mean that they are in danger but it may be sensible for them to limit their activities on such days.

### 3. Calculating the Index

The AQIH can be used for an hourly or daily calculation. Appendix 3 contains sample hourly and daily calculations.

#### 3.1.Hourly Index

All figures are rounded to the nearest whole number using commercial rounding rules<sup>5</sup>. The index for each of the five parameters is calculated each hour and the overall index for the hour is equivalent to the worst<sup>6</sup> rating assigned to a parameter. The key parameter should be mentioned if possible, i.e. that which caused the worst rating. If one or more parameter is missing, e.g. due to an instrument malfunction, the index is derived using the remaining parameters.

#### 3.2.Daily Index

The index for the day is the worst rating from the hourly values for the day.

#### 3.3.Composite Indices and AQIH Regions

Six composite AQIH are calculated, one for each of six AQIH Regions. These regions are defined in Table 3.1. The cut-off point of 5,000 for small towns was chosen based on number of towns, availability of monitoring data and applicability to GIS display.

Table 3.2 shows the proposed monitoring stations to be included in the composite indices. The only difference between the Rural West index and Rural East index is the ozone station. Concentrations of ozone vary geographically and are higher in the west than in the east. Analysis of monitoring data shows this geographical variation is relevant in rural areas but not in towns and cities. Concentrations of ozone are higher in rural areas than in towns and cities where ozone reacts with oxides of nitrogen emitted from traffic.

There is no real-time PM<sub>10</sub> or PM<sub>2.5</sub> monitor in the Cork City. Analysis of monitoring data shows PM concentrations in Cork City correspond better to those in Small Towns rather than those in Dublin City or Large Towns therefore the Small Towns PM data will be used for the Cork City AQIH.

The list of all available stations for each composite index is contained in Appendix 5.

---

<sup>5</sup>Examples are available in *Data Policy for the National Air Quality Monitoring Network May 2010*, Environmental Protection Agency, 2010.

<sup>6</sup> In this document, 'worst' means worst air quality. *Very Poor* is worse than *Poor* is worse than *Fair* is worse than *Good*.

**Table 3.1. Definition of AQIH Regions.**

<b>AQIH Region</b>	<b>Definition</b>	<b>Comparison with air quality management zone<sup>7</sup></b>
<b>Dublin City</b>	Dublin agglomeration from Shankill in south Dublin to Lucan in west Dublin to Swords in north Dublin.	Corresponds to Zone A
<b>Cork City</b>	Cork agglomeration incorporating Cork City Council jurisdiction with additional built-up areas.	Corresponds to Zone B
<b>Large Towns</b>	Towns and cities with a population greater than 15,000 (excluding Dublin and Cork) <sup>8</sup> .	Corresponds to Zone C
<b>Small Towns</b>	Towns and cities with a population between 5,000 and 15,000 <sup>9</sup> .	Corresponds to part of Zone D
<b>Rural West</b>	Towns with population less than 5,000, villages and rural areas in Counties Clare, Cork, Donegal, Galway, Kerry, Leitrim, Limerick, Mayo, Roscommon, Sligo	Corresponds to part of Zone D
<b>Rural East</b>	Towns with population less than 5,000, villages and rural areas in Counties Carlow, Cavan, Dublin, Kildare, Kilkenny, Laois, Longford, Louth, Meath, Monaghan, Offaly, Tipperary, Waterford, Westmeath, Wexford, Wicklow	Corresponds to part of Zone D

### 3.3.1. Limitations with using a Composite Index and Disclaimer

The AQIH calculated at each region is based on information from monitoring instruments at a limited number of locations in the region. This means the AQIH may not reflect local incidents of air pollution, for e.g. a fire. Conversely a pollution event close to the location of a single monitor will influence the AQIH for the region and may give a false reading. The EPA is not liable for any consequences from decisions made based on the AQIH.

<sup>7</sup> Ireland is divided into four zones for the purpose of air quality management. Details are available on [www.epa.ie/air/quality/zones/](http://www.epa.ie/air/quality/zones/).

<sup>8</sup> The list of towns and cities is given in Appendix 4.

<sup>9</sup> The list of towns is given in Appendix 4.

**Table 3.2. Proposed monitoring stations for composite index.**

<b>Pollutant</b>	<b>Averaging Period</b>	<b>Dublin City</b>	<b>Cork City</b>	<b>Large Towns</b>	<b>Small Towns</b>	<b>Rural West</b>	<b>Rural East</b>
<b>Ozone</b>	running 8-hour	Dublin Clonskeagh	Cork Old Station Road	Kilkenny Seville Lodge	Mayo Castlebar	Galway Mace Head	Monaghan Kilkitt
<b>NO<sub>2</sub></b>	1-hour	Dublin Rathmines	Cork Old Station Road	Kilkenny Seville Lodge	Mayo Castlebar	Monaghan Kilkitt	Monaghan Kilkitt
<b>SO<sub>2</sub></b>	1-hour	Dublin Rathmines	Cork Old Station Road	Clare Ennis	Limerick Shannon Estuary	Monaghan Kilkitt	Monaghan Kilkitt
<b>PM<sub>10</sub></b>	24-hour	Dublin Rathmines	None – use Small Towns	Wicklow Bray	Longford Longford Town	Mayo Claremorris <sup>10</sup>	Mayo Claremorris
<b>PM<sub>2.5</sub></b>	24-hour	Dublin Rathmines	None – use Small Towns	Clare Ennis	Longford <sup>11</sup> Longford Town	Mayo Claremorris	Mayo Claremorris

<sup>10</sup> 24-hour running mean not available from Claremorris. The previous day's 24-hr mean will be used.

<sup>11</sup> The COMEAP recommendation allows for PM<sub>2.5</sub> to be derived from PM<sub>10</sub> and vice versa therefore a station does not require monitoring of both parameters. This applies in the Small Towns region where only PM<sub>2.5</sub> is measured. A factor of 0.6 is used.

## 4. Explanation of the Index

This section gives a summary explanation of aspects of the AQIH, particularly where it differs from the DAQI (UK). A full explanation is available in the *COMEAP Report*.

### 4.1. Presentation of the Index

In line with the *COMEAP Report*, the index is presented as a ten-point colour-coded index divided into four bands. The colour code is similar to that used in the DAQI which is slightly different to that presented in the *COMEAP Report*. Details of each colour in RGB and hex code format are given in Appendix 6. The index should be displayed using the ten-point scale with the colour code and band. Where this is not possible, the AQIH may be displayed using the four bands with their colour code.

The *COMEAP Report* found both air pollution and air quality based descriptors acceptable to the public. The AQIH is an air quality index in order to keep consistency with the previous Irish index which was also an air quality index. The DAQI is an air pollution index because the index it replaced was an air pollution index. The corresponding bands of the two AQIs are shown in Table 4.1.

**Table 4.1. Comparison of bands of AQIH and DAQI**

AQIH	DAQI
Good	Low
Fair	Moderate
Poor	High
Very Poor	Very High

### 4.2. Parameters

The index includes pollutants regulated under EU and Irish ambient air quality legislation which can have a short term effect on health.

#### 4.2.1. Ozone

The ozone index is based on the World Health Organisation guidelines and is similar to that used in the DAQI but different to that recommended in the *COMEAP Report*. Table 4.2 shows the number of **Fair**, **Poor** and **Very Poor** days that occurred in 2011 with respect to ozone. In Ireland the majority of days will be **Good**; **Fair** days will occur, particularly in spring and summer and particularly in the Rural West and Rural East regions; **Poor** days will occur occasionally; and **Very Poor** days are unlikely to occur.

**Table 4.2. Results for 2011 from ozone stations to be used in the AQIH composite indices**

Station	AQIH Region	Number of Fair Days	Number of Poor Days	Number of Very Poor Days
Dublin Clonskeagh	Dublin City	8	0	0
Cork Old Station Road	Cork City	1	0	0
Limerick Park Road *	Large Towns	6	0	0
Mayo Castlebar	Small Towns	6	0	0
Galway Mace Head	Rural West	26	0	0
Monaghan Kilkitt	Rural East	18	0	0

\* Kilkenny Seville Lodge replaced Limerick Park Road in 2012

#### 4.2.2. Nitrogen Dioxide

The nitrogen dioxide index is that recommended in the *COMEAP Report* and is identical to the DAQI. Table 4.3 shows the number of **Fair**, **Poor** and **Very Poor** days that occurred in 2011 with respect to nitrogen dioxide. In Ireland the majority of days will be **Good**; **Fair** days will occur occasionally, most likely in winter and in the Dublin City and Cork City regions; **Poor** and **Very Poor** days are unlikely to occur.

**Table 4.3. Results for 2011 from nitrogen dioxide stations to be used in the AQIH composite indices**

Station	AQIH Region	Number of Fair Days	Number of Poor Days	Number of Very Poor Days
Dublin Rathmines	Dublin City	0	0	0
Cork Old Station Road	Cork City	1	0	0
Limerick Park Road *	Large Towns	0	0	0
Mayo Castlebar	Small Towns	0	0	0
Monaghan Kilkitt	Rural West	0	0	0
Monaghan Kilkitt	Rural East	0	0	0

\* Kilkenny Seville Lodge replaced Limerick Park Road in 2012

### 4.2.3. Sulphur Dioxide

The sulphur dioxide index is a 1-hour mean. The DAQI uses a 15-minute index as recommended in the *COMEAP Report*. Levels of sulphur dioxide in Ireland are very low therefore it was decided the resources required to implement a 15-minute index would not be worthwhile. The 1-hour bands of the AQIH correspond to approximately one-third of the DAQI 15-minute bands.

Table 4.4 shows the number of **Fair**, **Poor** and **Very Poor** days that occurred in 2011 with respect to sulphur dioxide. In Ireland the majority of days will be **Good**; **Fair**, **Poor** and **Very Poor** days are unlikely to occur.

**Table 4.4. Results for 2011 from sulphur dioxide stations to be used in the AQIH composite indices**

Station	AQIH Region	Number of Fair Days	Number of Poor Days	Number of Very Poor Days
Dublin Rathmines	Dublin City	0	0	0
Cork Old Station Road	Cork City	0	0	0
Clare Ennis	Large Towns	0	0	0
Limerick Shannon Estuary	Small Towns	0	0	0
Monaghan Kilkitt	Rural West	0	0	0
Monaghan Kilkitt	Rural East	0	0	0

### 4.2.4. PM<sub>2.5</sub> Particles

The PM<sub>2.5</sub> index uses a 24-hour running mean (where available) instead of the 24-hour mean recommended in the *COMEAP Report*. In the absence of an air quality forecast in Ireland, using a 24-hour running mean allows for an up-to-date index. The bands for the AQIH are identical to those for the DAQI and in the *COMEAP Report*. Where no PM<sub>2.5</sub> is available in a zone, the PM<sub>10</sub> result will be used according to the following equation:  $PM_{2.5} = PM_{10} * 0.6$ . The equation is derived from the average ratio between PM<sub>10</sub> and PM<sub>2.5</sub> in Ireland. The ratio differs across the world depending on the dominant sources of PM and climatic conditions, particularly temperature, humidity and wind speed. In Ireland the average ratio is 0.6. The DAQI uses a factor of 0.7 which is the average ratio in the UK. Appendix 7 contains further information.

Table 4.5 shows the number of **Fair**, **Poor** and **Very Poor** days that occurred in 2011 with respect to PM<sub>2.5</sub>. In Ireland the majority of days will be **Good**; **Fair** days will occur, particularly in towns and cities and are more likely in winter; **Poor** and **Very Poor** days will occur occasionally.

**Table 4.5. Results for 2011 from PM<sub>2.5</sub> stations to be used in the AQIH composite indices.**

Station	AQIH Region	Number of Fair Days	Number of Poor Days	Number of Very Poor Days
Dublin Rathmines	Dublin City	12	2	0
Cork Old Station Road*	Cork City	14	3	3
Clare Ennis	Large Towns	21	6	6
Longford Longford Town	Small Towns	11	0	0
Mayo Claremorris	Rural West	1	0	0
Mayo Claremorris	Rural East	1	0	0

\* The Cork station is not real-time and is included for comparison. The Small Towns PM<sub>2.5</sub> station will be used to calculate the Cork City AQIH.

#### 4.2.5. PM<sub>10</sub> Particles

The PM<sub>10</sub> index uses a 24-hour running mean (where available) instead of the 24-hour mean recommended in the *COMEAP Report*. In the absence of an air quality forecast in Ireland, using a 24-hour running mean allows for an up-to-date index. The bands for the AQIH are identical to those for the DAQI and in the *COMEAP Report*. Where no PM<sub>10</sub> is available in a zone, the PM<sub>2.5</sub> result will be used according to the following equation:  $PM_{10} = PM_{2.5} / 0.6$

Table 4.6 shows the number of Fair, Poor and Very Poor days that occurred in 2011 with respect to PM<sub>10</sub>. In Ireland the majority of days will be Good; Fair days will occur, particularly in towns and cities and are more likely in winter; Poor and Very Poor days will occur occasionally.

**Table 4.6. Results for 2011 from PM<sub>10</sub> stations to be used in the AQIH composite indices.**

Station	AQIH Region	Number of Fair Days	Number of Poor Days	Number of Very Poor Days
Dublin Rathmines	Dublin City	10	2	0
Cork Old Station Road*	Cork City	20	2	0
Clare Ennis	Large Towns	15	5	4
Longford Longford Town (PM <sub>2.5</sub> / 0.6)	Small Towns	11	0	0
Mayo Claremorris	Rural West	0	0	0
Mayo Claremorris	Rural East	0	0	0

\* The Cork station is not real-time and is included for comparison. The Small Towns PM<sub>10</sub> station will be used to calculate the Cork City AQIH.



## 5. Trigger Values

The *COMEAP Report* recommends using trigger values for ozone, PM<sub>10</sub> and PM<sub>2.5</sub> to indicate a period of **Fair**, **Poor** and **Very Poor** air pollution may be taking place or likely to happen soon. The applicability and value of the **Poor** and **Very Poor** trigger values to Ireland was assessed using 2011 data.

Results of the analyses indicate that when trigger values occur, they are inaccurate more than 80% of the time in forecasting a **Poor** and **Very Poor** air quality episode. On the occasion they are accurate, they usually provide information less than 5 hours before the AQIH would have provided the same information.

Implementing trigger values would involve additional resources, particularly for PM<sub>10</sub> and PM<sub>2.5</sub> as hourly averages for these parameters are not used routinely in the ambient air quality monitoring network. The analysis indicates that the information provided by the trigger values is not of sufficient value to justify the resources required.

## 6. Index Use

From 1 April 2013, the AQIH will be used by the Environmental Protection Agency to accompany the up-to-date air quality information on the EPA air quality web pages [airquality.epa.ie](http://airquality.epa.ie).

The HSE, the DECLG and Met Éireann will use the AQIH on any occasion they provide up-to-date air quality information to the public.

The AQIH may be used by any other individual or organisation. Where the AQIH is used, the EPA should be acknowledged and a link to [airquality.epa.ie](http://airquality.epa.ie) provided.

The terms AQIH and/or Air Quality Index for Health may only be used when the index is calculated and presented as described in this document. The summary information in Appendix 1 should be made available to users of the index.

## Appendix 1 Summary: Air Quality Index for Health (AQIH)

This summary is written in Plain English. It is available to download as a separate document at [www.epa.ie/pubs/reports/air/quality/](http://www.epa.ie/pubs/reports/air/quality/).



### What is the Air Quality Index for Health?

The Air Quality Index for Health (AQIH) is a number from one to 10 that tells you what the air quality currently is in your region and whether or not this might affect the health of you or your child. A reading of 10 means the air quality is very poor and a reading of one to three inclusive means that the air quality is good. The AQIH is calculated every hour. You can see the current readings on the AQIH map at [www.airquality.epa.ie](http://www.airquality.epa.ie).

Using the AQIH can help you better protect the health of you or your child, particularly if either of you are very sensitive to air pollution.

This summary gives you information on:

- how you use the AQIH,
- the short-term health effects of air pollution,
- health advice messages to follow when using the AQIH, and
- how we work out (calculate) the AQIH.

This summary is available on the EPA website at [www.epa.ie/air/quality/index/](http://www.epa.ie/air/quality/index/)

## How do I use the Air Quality Index for Health (AQIH)?

**Step 1** Read '[What are the short-term effects of air pollution?](#)' to see if you or your child is likely to be at risk from air pollution. Your doctor may also be able to advise you.

**Step 2** Figure out which AQIH region you are in using the [map](#) or the table of '[Air Quality Index for Health Regions](#)'.

**Step 3** Check the AQIH for your region on [www.airquality.epa.ie](http://www.airquality.epa.ie) if you think you may be at risk, and are planning strenuous activity outdoors such as sports. If you are close to the border of another AQIH region, check the AQIH for that region also.

**Step 4** Read the [health advice messages](#) for the current AQIH for your region.

### Disclaimer

If you use the AQIH, this means you accept this disclaimer. The AQIH is based on information from monitoring instruments at representative locations in each of the six AQIH Regions. It may not reflect local incidents of air pollution. Site-specific conditions near a monitoring station may give a false reading. The Environmental Protection Agency is not liable for the consequence of any decisions you make based on the AQIH.

## Step 1: What are the short-term effects of air pollution?

Air pollution has a range of effects on health. However, air pollution in Ireland does not, in general, rise to levels at which people need to make major changes to their habits to avoid exposure; nobody need fear going outdoors.

Below, we list the main short-term effects of air pollution on health **for different groups of people** at the four different bands of the AQIH. The four bands are:

- **Good Air Quality**
- **Fair Air Quality,**
- **Poor Air Quality,** and
- **Very Poor Air Quality**

### **Adults and children with heart or lung conditions including asthma**

If you or your children suffer from a heart or lung condition, you are more likely to become ill and need treatment but only a **small number** of you are likely to be affected. It is not possible to predict in advance who will be affected.

If you are very sensitive to air pollution, you may experience health effects even on days with **good** air quality (reading of 1-3 on the AQIH).

If you are **asthmatic** you may notice that you need to increase your use of inhaled reliever medication on days when air pollution is **fair, poor** or **very poor**.

### **Older people**

Older people are more likely to suffer from heart and lung conditions than younger people. So if you are older it makes sense to be aware of current air quality in your region and to follow the appropriate health advice messages.

## General population

At **very poor** levels of air quality (reading 10 on the AQHI), some of us, even if we are healthy, may get:

- a sore or dry throat,
- sore eyes or,
- in some cases, a tickly cough.

## Children

Children need not be kept from school or prevented from taking part in games. If your child has asthma, they may need to use their reliever medication on days when levels of air pollution are higher than average.

## Steps 2 and 3: What is the Air Quality in your region?

If you think you may be at risk, and are planning strenuous activity outdoors such as sports, check the AQIH for your region on [www.airquality.epa.ie](http://www.airquality.epa.ie). If you are close to the border of another AQIH region, check the AQIH for that region also.

The six AQIH Regions are described in the table below. A list of towns in the Large Towns and Small Towns Region is available at [www.epa.ie/air/quality/index/](http://www.epa.ie/air/quality/index/)

**Air Quality Index for Health Regions**

<b>AQIH Region</b>	<b>Definition</b>
<b>Dublin City</b>	Dublin city region from Shankill in South Dublin to Lucan in West Dublin to Swords in North Dublin.
<b>Cork City</b>	Cork city region incorporating Cork City Council district with additional built-up areas.
<b>Large Towns</b>	Towns and cities with a population greater than 15,000 (excluding Dublin and Cork).
<b>Small Towns</b>	Towns and cities with a population between 5,000 and 15,000.
<b>Rural West</b>	Towns with population less than 5,000, villages and rural areas in Counties Clare, Cork, Donegal, Galway, Kerry, Leitrim, Limerick, Mayo, Roscommon and Sligo.
<b>Rural East</b>	Towns with population less than 5,000, villages and rural areas in counties Carlow, Cavan, Dublin, Kildare, Kilkenny, Laois, Longford, Louth, Meath, Monaghan, Offaly, Tipperary, Waterford, Westmeath, Wexford and Wicklow.

## Step 4: What are the AQIH health advice messages?

The AQIH health advice messages are messages to help you and your family better manage your health. The table below gives health messages for individuals who are sensitive to air pollution (at risk) and for the general population.

Air Quality		HEALTH MESSAGES FOR AT-RISK GROUPS AND THE GENERAL POPULATION	
Band	Index	At-risk individuals *	General population
Good	1	Enjoy your usual outdoor activities.	Enjoy your usual outdoor activities.
	2		
	3		
Fair	4	Adults and children with lung or heart problems, <b>who experience symptoms</b> , should consider reducing strenuous physical activity, particularly outdoors.	Enjoy your usual outdoor activities.
	5		
	6		
Poor	7	Adults and children with lung problems, and adults with heart problems, should reduce strenuous physical activity, particularly outdoors, and particularly if they experience symptoms.	Anyone experiencing discomfort such as sore eyes, cough or sore throat should consider reducing activity, particularly outdoors.
	8		
	9	People with asthma may find they need to use their reliever inhaler more often. Older people should also reduce physical exertion.	
Very Poor	10	Adults and children with lung problems, adults with heart problems, and older people, should <b>avoid</b> strenuous physical activity. People with asthma may find they need to use their reliever inhaler more often.	<b>Reduce</b> physical exertion, particularly outdoors, especially if you experience symptoms such as cough or sore throat.

\* If you or your child has heart or lung problems, you are at greater risk of symptoms from air pollution. You need to follow your doctor's advice about exercising and managing your condition. If you are very sensitive, you may have health effects even on days when the air quality is good. Anyone experiencing symptoms should follow the guidance provided in the section ['What can I do when there are increased levels of air pollution?'](#)

## What can I do when there are increased levels of air pollution?

If you have noticed that you are usually affected by increased levels of air pollution, you can go out when levels of air pollution increase but you might **reduce the amount of exercise** you do outdoors.

### Older people and those with heart and lung conditions

If you are older or have a heart or lung condition, you might **avoid physical exertion** on days with **poor** or **very poor** air quality (7-10 ratings).

### Adults and children with asthma

If you or your child has asthma, you should make sure that you are **taking your medication correctly**. If you are unsure, ask your health care practitioner (your local doctor or pharmacist). You may notice that you have to use your inhaled reliever medication more.

### Adults with heart and circulatory conditions

If you have heart and circulatory conditions, you should **not change** your treatment schedules on the basis of advice provided by the AQIH. You should seek advice from your health care practitioner (your local doctor or pharmacist) if you need to.

### Some athletes

If you are an athlete, even if you are not asthmatic, you may find you are not performing as well as you expect when levels of a certain air pollutant (called ground-level ozone) causes **poor** or **very poor** air quality (readings 7-10 on the AQIH).

You may notice that when you breathe deeply you feel some discomfort in your chest. This does not mean that you are in any danger but it may be better if you do **less exercise** on these days. In Ireland, levels of ground-level ozone rarely reach **poor** or **very poor** (readings 7-10 on the AQIH).

## How we work out (calculate) the Air Quality Index for Health

The Air Quality Index for Health (AQIH) has 10 points ranging from 1 to 10. These points are divided into four coloured bands:

- **good** (readings of 1-3),
- **fair** (readings of 4-6),
- **poor** (readings of 7-9), and
- **very poor** (reading of 10).

The higher the number the worse the quality of the air. **For example**, an AQIH reading of 10 means that the air quality is very poor and a reading of 1, 2 or 3 means that the air quality is good (see the table on the next page).

The AQIH is based on measurements of **five air pollutants** all of which can harm health. The five pollutants are:

- Ozone gas,
- Nitrogen dioxide gas,
- Sulphur dioxide gas,
- PM<sub>2.5</sub> particles, and
- PM<sub>10</sub> particles.

We use automatic air quality monitors to measure how much pollutant there is. We work this out per each cubic metre – m<sup>3</sup> every hour. We work out the index (number) for each pollutant separately. The **overall AQIH** is the highest of the five pollutant indices. For example, if there is more ozone than sulphur dioxide, we give the higher number for the ozone as the overall AQIH. The table on the next page shows the ranges of concentration (amounts) for each pollutant. Examples of how the AQIH is calculated are given below the table.



		FIVE AIR POLLUTANTS WHICH CAN HARM YOUR HEALTH:				
FOUR BANDS OF AIR QUALITY:	INDEX (1-10):	Ozone	Nitrogen dioxide	Sulphur dioxide	PM <sub>2.5</sub> particles	PM <sub>10</sub> particles
		Running 8-hour mean (µg/m <sup>3</sup> )	1-hour mean (µg/m <sup>3</sup> )	1-hour mean (µg/m <sup>3</sup> )	Running 24-hour mean (µg/m <sup>3</sup> )	Running 24-hour mean (µg/m <sup>3</sup> )
Good air quality	1	0-33	0-67	0-29	0-11	0-16
	2	34-65	68-134	30-59	12-23	17-33
	3	67-100	135-200	60-89	24-35	34-50
Fair air quality	4	101-120	201-267	90-119	36-41	51-58
	5	121-140	268-334	120-149	42-47	59-66
	6	141-160	335-400	150-179	48-53	67-75
Poor air quality	7	161-187	401-467	180-236	54-58	76-83
	8	188-213	468-534	237-295	59-64	84-91
	9	214-240	535-600	296-354	65-70	92-100
Very Poor air quality	10	241 or more	601 or more	355 or more	71 or more	101 or more

### Example 1 of how to calculate the AQIH

Below is a list of the pollutants. As we said above, the **overall AQIH** is highest of the five pollutant indices. You can see that this number is 6. This means that the overall AQIH is 6, so the air quality is fair.

Pollutant	Measurement	Index
Ozone	80	3 - Good
Nitrogen Dioxide	35	1 - Good
Sulphur Dioxide	10	1 - Good
PM <sub>2.5</sub> particles	51	<b>6 - Fair = highest index</b>
PM <sub>10</sub> particles	63	5 - Fair

The AQIH is **6 - Fair**

### Example 2 of how to calculate the AQIH

In this case, you can see that the highest pollutant index is 3.

Pollutant	Measurement	Index
Ozone	80	3 - Good
Nitrogen Dioxide	35	1 - Good
Sulphur Dioxide	10	1 - Good
PM <sub>2.5</sub> particles	25	3 - Good
PM <sub>10</sub> particles	50	<b>3 - Good = highest index</b>

The AQIH is **3 - Good**

## Appendix 2      Review of Evidence Base

In preparation for the development of the AQIH, the HSE undertook a comprehensive review of the existing evidence base and examined a selection of air quality indices used across the world. This appendix summarises the results. The complete review is presented in the report<sup>12</sup>: *Air Quality Indices and Health Related Messages. Review of the existing evidence base for the Air Quality Health Information Group*. The report was prepared by the following HSE staff:

Dr. Tessa Greally, Specialist in Public Health Medicine, Dept. of Public Health, HSE West MW  
Dr. John Cuddihy, Specialist in Public Health Medicine, Dept. of Public Health, HSE South SE  
Gemma Leane, Research Officer, Dept. of Public Health, HSE South SE  
Hilary Cowley, Research Officer, Dept. of Public Health, HSE West MW

The HSE reviewed the most recent evidence for the health impact of air pollution. This evidence was provided by a range of publications including the WHO Air Quality Guidelines 2005<sup>13</sup> and a 2011 review by the UK Committee on the Medical Effects of Air Pollution<sup>14</sup>.

The review examined the following AQIs:

- Irish Air Quality Index
- Common Air Quality Index (CAQI) for Europe
- South African indices
- US EPA Air Quality Index (AQI)
- Canadian Air Quality Health Index (AQHI)
- UK Air Quality Index.

The review presented recommendations for a new Air Quality Index for Ireland. The recommendations include: basing the index and associated advice thresholds on health-evidence; the pollutants for inclusion; communication of the index with separate advice streams for vulnerable groups and the general population; and frequency of review of the index.

The review recommended aligning health messages with those of Northern Ireland to avoid confusing messages in border regions. The conclusions of the review are similar to the

---

<sup>12</sup>Health Service Executive, 2011. *Air Quality Indices and Health Related Messages. Review of the existing evidence base for the Air Quality Health Information Group*.

<sup>13</sup>World Health Organisation, 2006. *WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide. Global update 2005. Summary of risk assessment*. Geneva: World Health Organization.

<sup>14</sup>Committee on the Medical Effects of Air Pollution, 2011. *Review of the UK Air Quality Index*. [www.comeap.org.uk](http://www.comeap.org.uk)

conclusions in the COMEAP 2011 review<sup>15</sup>. For these reasons the EPA examined the feasibility of using the proposed UK Air Quality Index in Ireland<sup>16</sup>.

The new Air Quality Index for Health is the outcome of the work by the HSE and the EPA. The AQIH is closely aligned to the DAQI UK index<sup>17</sup> which was introduced in January 2012.

---

<sup>15</sup>Committee on the Medical Effects of Air Pollution, 2011. *Review of the UK Air Quality Index*. [www.comeap.org.uk](http://www.comeap.org.uk)

<sup>16</sup>Environmental Protection Agency, 2012. *Application of COMEAP Proposed UK Air Quality Index in Ireland. Feasibility Study prepared for the Air Quality Health Information Working Group, January 2012*

<sup>17</sup><http://uk-air.defra.gov.uk/news?view=158>

## Appendix 3 Sample Calculations

### Hourly Calculation

Parameter	Value ( $\mu\text{g}/\text{m}^3$ )	Index
Ozone running 8-hr mean	110	Fair - 4
Nitrogen dioxide 1-hr mean	15	Good -1
Sulphur dioxide 1-hr mean	3	Good -1
PM <sub>2.5</sub> running 24-hr mean	44	Fair - 5
PM <sub>10</sub> running 24-hr mean	56	Fair - 4

Overall Index for the hour **Fair – 5** Key parameter: PM<sub>2.5</sub>

### Daily Calculation

Hour	Index	Key Parameter
1	Good - 3	Ozone
2	Good - 3	Ozone
3	Good - 3	Ozone
4	Good - 2	Ozone
5	Good - 2	Ozone
6	Good - 2	Ozone
7	Good - 3	Nitrogen dioxide, PM <sub>2.5</sub>
8	Fair - 5	PM <sub>2.5</sub>
9	Fair - 4	PM <sub>2.5</sub> , PM <sub>10</sub>
10	Fair - 4	PM <sub>2.5</sub> ,
11	Fair - 4	PM <sub>2.5</sub> ,
12	Good - 3	PM <sub>2.5</sub> , PM <sub>10</sub>
13	Good - 3	PM <sub>2.5</sub> , PM <sub>10</sub>
14	Good - 3	PM <sub>2.5</sub> , PM <sub>10</sub>
15	Good - 3	PM <sub>2.5</sub> , PM <sub>10</sub>
16	Good - 3	PM <sub>2.5</sub> , PM <sub>10</sub>
17	Fair - 4	Ozone
18	Fair - 4	Ozone
19	Fair - 4	Ozone
20	Good - 2	Ozone, PM <sub>2.5</sub>
21	Good - 2	Ozone, PM <sub>2.5</sub>
22	Good - 2	Ozone
23	Good - 2	Ozone
24	Good - 2	Ozone

Overall Index for the day **Fair – 5** Key parameter: PM<sub>2.5</sub>

## Appendix 4 Cities and Towns in Large Towns and Small Towns AQIH Regions.

### Large Towns Region

	County	City/Town Name	Population <sup>18</sup>
1	Limerick	Limerick	91,454
2	Galway	Galway	76,778
3	Waterford	Waterford	51,519
4	Louth	Drogheda	38,578
5	Louth	Dundalk	37,816
6	Wicklow	Bray	31,872
7	Meath	Navan	28,559
8	Clare	Ennis	25,360
9	Kilkenny	Kilkenny	24,423
10	Kerry	Tralee	23,693
11	Carlow	Carlow	23,030
12	Kildare	Newbridge	21,561
13	Kildare	Naas	20,713
14	Westmeath	Athlone	20,153
15	Laois	Portlaoise	20,145
16	Westmeath	Mullingar	20,103
17	Wexford	Wexford	20,072
18	Dublin	Balbriggan	19,960
19	Donegal	Letterkenny	19,588
20	Kildare	Celbridge	19,537
21	Sligo	Sligo	19,452
22	Tipperary	Clonmel	17,908
23	Wicklow	Greystones	17,468
24	Kildare	Leixlip	15,452

<sup>18</sup> Central Statistics Office (CSO), 2012. Table 7 – Population Classified by Area

## Small Town Region

	County	City/Town Name	Population <sup>19</sup>
1	Cork	Carrigaline	14,775
2	Offaly	Tullamore	14,361
3	Kerry	Killarney	14,219
4	Wicklow	Arklow	13,009
5	Kildare	Maynooth	12,510
6	Cork	Cobh	12,347
7	Mayo	Castlebar	12,318
8	Cork	Midleton	12,001
9	Cork	Mallow	11,605
10	Meath	Ashbourne	11,355
11	Mayo	Ballina	11,086
12	Meath	Laytown-Bettystown-Mornington	10,889
13	Wexford	Enniscorthy	10,358
14	Wicklow	Wicklow	10,356
15	Waterford	Tramore	10,328
16	Cavan	Cavan	10,205
17	Kildare	Athy	9,926
18	Clare	Shannon	9,673
19	Dublin	Skerries	9,671
20	Longford	Longford	9,601
21	Waterford	Dungarvan	9,427
22	Dublin	Rush	9,231
23	Wexford	Gorey	9,114
24	Meath	Ratoath	9,043
25	Tipperary	Nenagh	8,439
26	Meath	Trim	8,268

<sup>19</sup> Central Statistics Office (CSO), 2012. Table 7 – Population Classified by Area

	<b>County</b>	<b>City/Town Name</b>	<b>Population<sup>19</sup></b>
27	Galway	Tuam	8,242
28	Waterford	New Ross	8,151
29	Kildare	Kildare	8,142
30	Tipperary	Thurles	7,933
31	Cork	Youghal	7,794
32	Laois	Portarlinton	7,788
33	Monaghan	Monaghan	7,452
34	Dublin	Lusk	7,022
35	Offaly	Edenderry	6,977
36	Meath	Dunboyne	6,959
37	Donegal	Buncrana	6,839
38	Dublin	Donabate	6,778
39	Kildare	Clane	6,702
40	Galway	Ballinasloe	6,659
41	Cork	Bandon	6,640
42	Cork	Fermoy	6,489
43	Limerick	Newcastle West	6,327
44	Mayo	Westport	6,063
45	Tipperary	Carrick-on-Suir	5,931
46	Meath	Kells	5,888
47	Offaly	Birr	5,822
48	Cork	Passage West	5,790
49	Roscommon	Roscommon	5,693
50	Kildare	Kilcock	5,533
51	Tipperary	Roscrea	5,403
52	Tipperary	Tipperary	5,310
53	Kildare	Sallins	5,283
54	Galway	Loughrea	5,062
55	Wicklow	Blessington	5,010



## Appendix 5 – Available real-time monitors by AQIH Region

Pollutant	Averaging Period	Dublin City	Cork City	Large Towns	Small Towns	Rural West <sup>20</sup>	Rural East
<b>Ozone</b>	running 8-hour	Rathmines	Old Station Road	Kilkenny Bray	Mayo Castlebar	Kerry Valentia	Monaghan Kilkitt
		Clonskeagh Swords				Galway Mace Head	Laois Emo
<b>NO<sub>2</sub></b>	1-hour	Rathmines	Old Station Road	Kilkenny	Mayo Castlebar	Monaghan Kilkitt	Monaghan Kilkitt
		Swords				Laois Emo	Laois Emo
		Blanchards-town					
		Dun Laoghaire					
		Winetavern St Coleraine St					
<b>SO<sub>2</sub></b>	1-hour	Rathmines	Old Station Road	Ennis	None	Monaghan Kilkitt	Monaghan Kilkitt
		Tallaght				Limerick Shannon Estuary	Limerick Shannon Estuary
		Winetavern St					
		Coleraine St					
<b>PM<sub>10</sub><sup>21</sup></b>	running 24-hour	Rathmines	None	Ennis Bray	Longford	Claremorris <sup>22</sup>	Claremorris
<b>PM<sub>2.5</sub></b>	running 24-hour	Rathmines	None	Ennis	Longford	Claremorris	Claremorris

<sup>20</sup> The available stations for all pollutants apart from ozone are the same in Rural West as in Rural East because the concentrations of these pollutants are the same.

<sup>21</sup> The COMEAP recommendation allows for PM<sub>2.5</sub> to be derived from PM<sub>10</sub> (using a factor of 0.6) therefore a station does not require both parameters

<sup>22</sup> Instrument provides one 24-hr average daily; it does not provide a rolling 24-hr value.

## Appendix 6 – Index Colours in RGB and Hex Codes

<b>Index</b>	<b>R</b>	<b>G</b>	<b>B</b>	<b>Hex Code</b>
1	191	215	48	#BFD730
2	101	179	69	#65B345
3	50	132	50	#328432
4	242	190	26	#F2BE1A
5	247	147	30	#F7931E
6	242	101	34	#F26522
7	237	28	36	#ED1C24
8	177	17	23	#B11117
9	116	54	24	#743618
10	180	63	151	#B43F97

## Appendix 7 – Calculation of Factor for PM<sub>10</sub>/PM<sub>2.5</sub> Conversion

Year	PM <sub>10</sub> Station	PM <sub>2.5</sub> Station	PM <sub>10</sub> Annual Average	PM <sub>2.5</sub> Annual Average	PM <sub>2.5</sub> / PM <sub>10</sub>
2011	Claremorris	Claremorris	12	6	0.5
2011	Ennis	Ennis	22	14	0.6
2011	Rathmines	Rathmines	16	12	0.8
2011	Old Station Road	Old Station Road	21	12	0.6
2011	Winetavern St	Coleraine St	14	11	0.8
2011	Castlebar	Longford	14	9	0.6
2010	Ennis	Ennis	27	16	0.6
2010	Rathmines	Rathmines	18	12	0.7
2010	Old Station Road	Old Station Road	22	15	0.7
2010	Winetavern St	Coleraine St	19	12	0.6
2009	Ennis	Ennis	16	10	0.6
2009	Rathmines	Rathmines	15	11	0.7
2009	Old Station Road	Old Station Road	18	11	0.6
2009	Winetavern St	Coleraine St	17	10	0.6
2008	Old Station Road	Old Station Road	16	9	0.6
				<b>Average</b>	<b>0.6</b>