

## **Report on Air Quality Assessment for the Oxygen Fire Incident**



Environmental Protection Agency

28/03/14

## Contents

1. Introduction .....	3
1.1 Overview of Oxigen Site .....	3
1.2 Details of the Incident .....	4
1.3 EPA Response .....	6
2. Ambient Air Quality Monitoring .....	7
2.1 Ambient Air Quality Monitoring Stations in Relation to Ballymount .....	7
2.2 Particulate matter (PM10) .....	8
2.3 Particulate matter (PM2.5) .....	12
2.4 Nitrogen dioxide (NO2) .....	14
2.5 Sulphur dioxide (SO2) .....	16
2.6 Benzene and toluene at Rathmines monitoring station .....	18
2.7 Polycyclic aromatic hydrocarbons (PAH) .....	21
3. Supplementary Air Monitoring .....	22
3.1 Selection of appropriate assessment levels .....	22
3.1.1 Acute Exposure Guideline Levels (AEGL) .....	22
3.1.2 Emergency Response Planning Guideline Values (ERPG) .....	22
3.2 Supplementary monitoring results .....	23
3.2.1 Colour indicator tube results .....	23
3.2.2 Portable gas analyser results .....	25
3.2.3 Osiris particulate sampler results .....	27
4. HSE Review .....	29
5. Conclusions .....	31
Annex 1. A: AEGL Information .....	32
Annex 1. B: ERPG Information .....	32
Annex 2: Twitter timeline .....	33
Annex 3: References .....	41

## **1. Introduction**

This report provides an assessment of the impact on air quality of the fire which occurred over the period Saturday January 25<sup>th</sup> to Wednesday January 29<sup>th</sup> at the Oxygen facility in Ballymount. The assessment is based on two datasets, firstly the data available from a number of fixed sites in Dublin which form part of the national network of air quality monitoring stations, and secondly measurements of air quality collected in close proximity to the fire using portable monitoring equipment operated by EPA personnel.

The Health Service Executive (HSE) was consulted during the fire to seek public health advice for local residents and has also provided further information in relation to human health impacts arising from the incident. This information and advice is included in this report.

### **1.1 Overview of Oxygen Site**

Oxygen Environmental is licensed under Waste Licence W0208-01 to operate a materials recovery facility for non-hazardous waste and a transfer station for hazardous waste at Merrywell Industrial Estate, Ballymount Road Lower, Clondalkin, Dublin 22. The total quantity of waste which may be accepted per annum is 350,000 tonnes consisting of segregated household waste, commercial & industrial (C&I), construction & demolition (C&D) waste and hazardous waste. The licence was granted on 7/3/06.

The following waste processes are undertaken at the site

- C&D waste recovery;
- Recovery of dry recyclables;
- Production of SRF (solid recovered fuel). Solid recovered fuel is a waste derived fuel consisting of shredded paper, cardboard, plastic, textiles and is used as an alternative fuel in cement kilns;
- Baling and repackaging processes;
- Storage of hazardous and non-hazardous waste.

The site is located in Ballymount which is primarily an industrial and commercial area just inside the M50 between the Tallaght and N7 exits. There are a number of residential properties within the estate, the nearest being a group of cottages within 180m of the site boundary. There are large residential areas in Walkinstown to the west, Ballyfermot to the North and in Tallaght and Clondalkin to the east. Figures 1-1 illustrates the site location.

**Figure 1-1** Map indicating location of Oxygen Site



## 1.2 Details of the Incident

The fire started at approximately 3:00am on Saturday 25th January 2014 and spread rapidly through the buildings. Dublin Fire Brigade attended the scene as well as Gardaí from Clondalkin Garda Station. Oxygen Environmental notified the EPA of the fire on the EPA emergency line at approximately 5:00am.

There was an extensive smoke plume from the fire and the smell was reported widely throughout Dublin and received extensive media coverage. The prevailing wind direction and wind speeds during the period of the fire are illustrated in Figure 1-2 (for the meteorological stations at Casement Aerodrome). The 'wind rose' indicates the direction from which the wind was blowing. The numbers on the radials indicate the number of hours of wind from that direction (i.e. the markings of 10, 20, 30, 40 indicate the number of hours), while the colour of the segment indicates the wind speed in metres per second and knots as per the legend on the chart. The chart indicates that the main wind direction encountered during the fire was from 220 degrees, i.e. south-westerly (with approximately 37 hours of wind from this direction), and the wind speed for these winds was in excess of 8.2 metres/second (approximately force 4 - 5 on the Beaufort scale). These higher wind speeds would tend to result in better dispersion of a smoke plume than would be encountered on calm/still days, and this would have helped to reduce the down-wind concentration of the pollutants in the plume.

The fire was brought under control on Sunday 26th January but continued to burn for a further 3 days, with Dublin Fire Brigade stepping down on the afternoon of Wednesday 29th January 2014. Once the blaze was contained the fire fighting strategy moved to removing the burning waste from

the buildings to the yard area and dowsing it with water until extinguished. The extinguished waste has been removed for disposal.

Based on the stock report compiled by Oxygen Environmental there was a range of wastes on site on Friday 24th January consisting of mixed dry recyclables (processed and unprocessed), segregated dry recyclables (e.g. cardboard, plastic, glass), construction and demolition waste (processed and unprocessed), loose SRF and bales of SRF and hazardous waste including asbestos, paint and batteries.

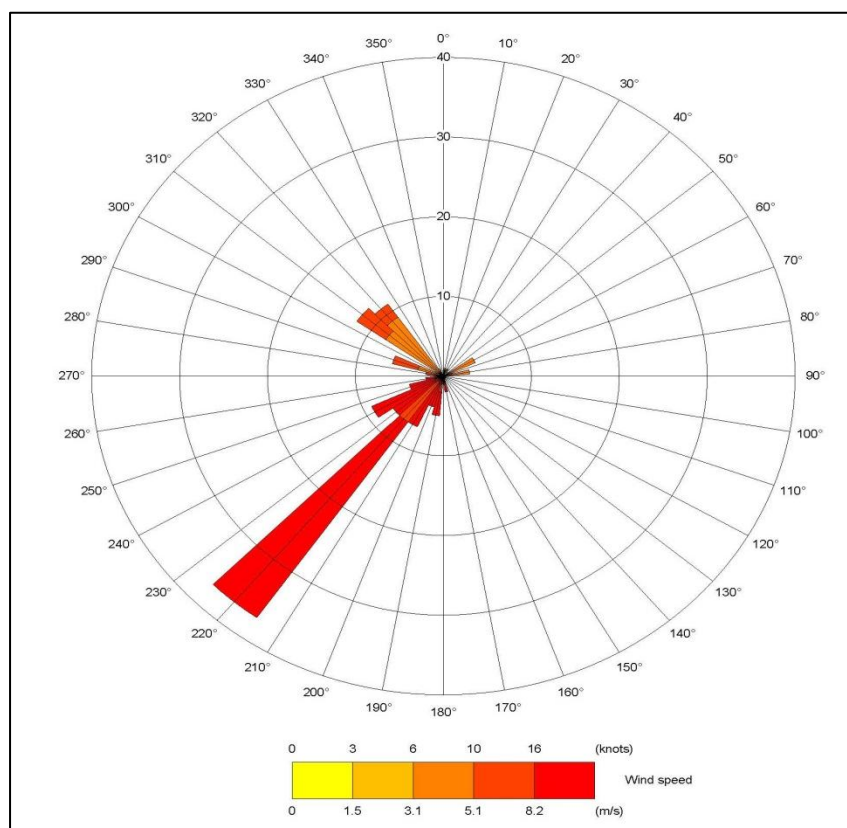
The exact quantities of waste consumed in the fire cannot be determined however the materials combusted included mixed waste and plastics, paint and car batteries. Asbestos was being stored in containers and trailers in the yard area and was not significantly impacted by the fire.

Information on possible air emissions can be provided with reference to the UK Environment Agency 'Review of Emission Factors for Incident Fires, Science Report SC060037/SR3'. Typical emissions of combustion related pollutants would include particulates, sulphur dioxide (SO<sub>2</sub>), carbon monoxide (CO), volatile organic compounds (VOC), polycyclic aromatic hydrocabons (PAH) and nitrogen oxides (NO and/or NO<sub>2</sub>). Measurements of these parameters in the ambient air were completed during the course of the fire and are assessed in Sections 2 and 3 of this report.

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**Figure 1-2** Wind rose of hourly wind direction and speed for the duration of the fire

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### 1.3 EPA Response

EPA inspectors attended the scene on each day that the fire was burning to assess conditions at the site and has continued to monitor the situation on site.

EPA inspectors conducted air monitoring in the vicinity of the site between January 25<sup>th</sup> and 31<sup>st</sup>. Details of the results are discussed below. The EPA issued advice on air quality through its twitter feed @EPAAirQuality on Saturday 25<sup>th</sup> January and issued regular updates after that until the fire was extinguished. Details of the twitter feed contents are summarised in Annex 2 of this report.

The EPA also consulted with the HSE to obtain public health advice in the event that the wind changed direction and directed the smoke plume towards nearest residences (which did not happen). The detail of the advice provided was as follows:

*Any smoke can be an irritant and the advice is to keep out of the smoke. Staying indoors with the doors and windows closed will give a good level of protection. If people need to be outdoors, they are advised to avoid areas affected by any smoke and to limit the time they spend in it. Smoke can worsen existing health problems so people who have respiratory conditions such as chronic bronchitis, emphysema and asthma may notice these effects more than others. Some of the substances in smoke can irritate the lining of the air passages, the skin and the eyes. Respiratory symptoms can include coughing, wheezing and breathlessness. If symptoms occur, people should avoid affected areas, reduce their level of activity, take their medications as prescribed and seek medical advice.*



## 2. Ambient Air Quality Monitoring

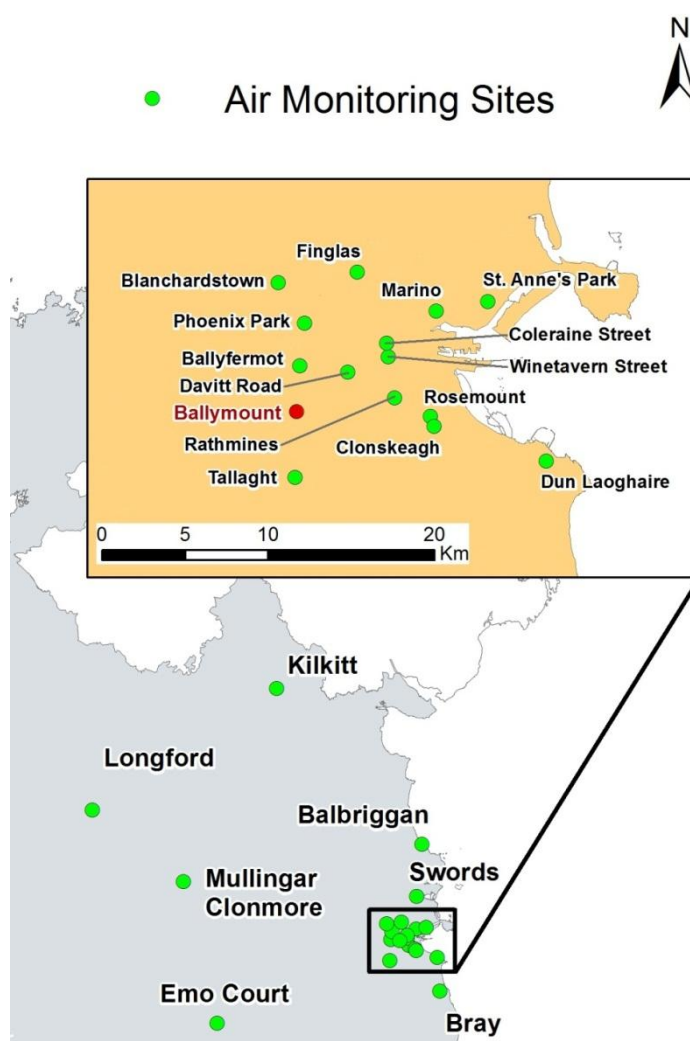
This section presents an analysis of ambient air quality data from various monitoring stations from the national air quality monitoring network for the period of January 24<sup>th</sup> to January 31<sup>st</sup> 2014. These are part of a permanent network of monitoring stations operated by the EPA, Dublin City Council and South Dublin County Council and were not put in place specifically for the purposes of monitoring the impact of the fire. However, the density/location of the stations in Dublin allowed for a significant quantity of data to be gathered on the impacts of the fire across the region.

The purpose of the monitoring network is to assess air quality in Ireland against statutory air quality standards as specified in Irish and European legislation. Further detail on the network and the relevant standards are available on the EPA website at <http://www.epa.ie/air/quality/standards/>.

### 2.1 Ambient Air Quality Monitoring Stations in Relation to Ballymount

Figure 2-1 is a map showing the location of ambient air quality monitoring stations in Dublin and surrounding areas, in relation to the site at Ballymount.

Figure 2-1 Map of ambient air quality monitoring stations in Dublin and surrounding areas



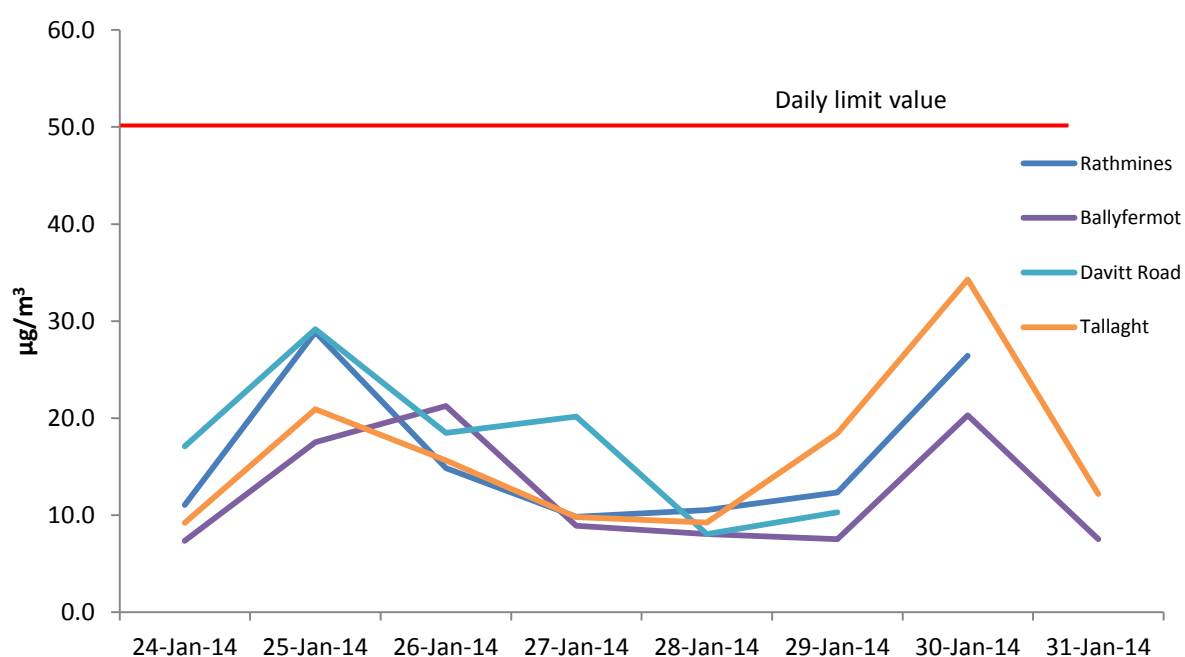
## 2.2 Particulate matter (PM<sub>10</sub>)

PM<sub>10</sub> are very small particles with diameters of 10µm (micrometres) or less. The health impact of particulate matter relates to its ability to penetrate into the respiratory tract, possibly increasing the risk, severity and frequency of respiratory and cardiopulmonary disorders. It is particularly harmful for those who have a pre-existing respiratory illness<sup>1</sup>.

Figure 2-2 shows daily averaged concentrations of PM<sub>10</sub> observed at Rathmines, Ballyfermot, Davitt Road and Tallaght for the period of the 24<sup>th</sup> January to the 31<sup>st</sup> January. These four monitoring stations were the closest to the Ballymount fire.

It should be noted that Rathmines, Ballyfermot and Davitt Road were predominantly downwind of the fire for this period, while the Tallaght monitoring station was primarily upwind of Ballymount. Concentrations of PM<sub>10</sub> observed during this period were below the daily limit value at these four stations. The levels of PM<sub>10</sub> observed at these stations are reported as 24 hour average concentrations, and are considered to be typical of levels of PM<sub>10</sub> which are observed at these stations throughout the year, and do not suggest any significant impact of the fire on the measured concentrations.

**Figure 2-2 Daily averaged PM<sub>10</sub> at four Dublin monitoring stations 24/01/14 - 31/01/14**



<sup>1</sup> European Environment Agency, 2011. Air quality in Europe 2011. EEA Technical Report No. 12/2011.



**Figure 2-3** Daily averaged PM<sub>10</sub> at four Dublin monitoring stations 01/01/14 - 02/02/14

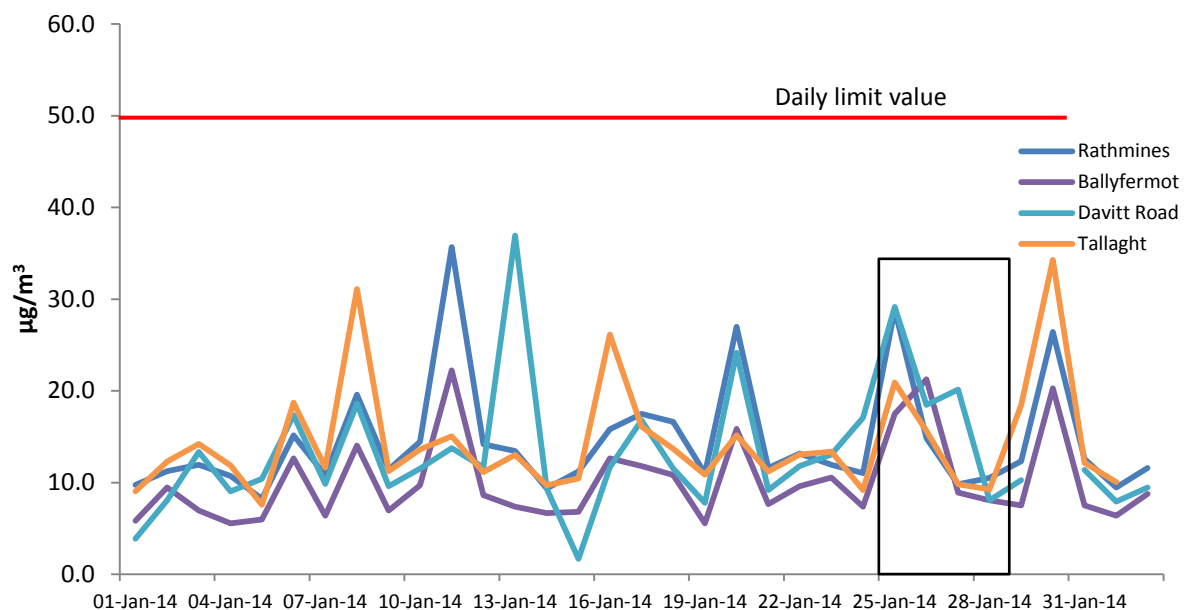


Figure 2-3 shows daily averaged concentrations of PM<sub>10</sub> observed at Rathmines, Ballyfermot, Davitt Road and Tallaght for the period of the 1<sup>st</sup> January to the 2<sup>nd</sup> February. This examination of concentrations of PM<sub>10</sub> over the longer timeframe, shows that levels over the period of the fire (highlighted) were within normal variations.

Figure 2-4 shows daily averaged  $PM_{10}$  concentrations for all Dublin monitoring stations for the period of the 24<sup>th</sup> January to 31<sup>st</sup> January. Again all concentrations of  $PM_{10}$  were below the limit value and show minimal impact on ambient air across the wider city from the Ballymount fire incident.

**Figure 2-4** Daily averaged  $PM_{10}$  at all Dublin monitoring stations 24/01/14 - 31/01/14

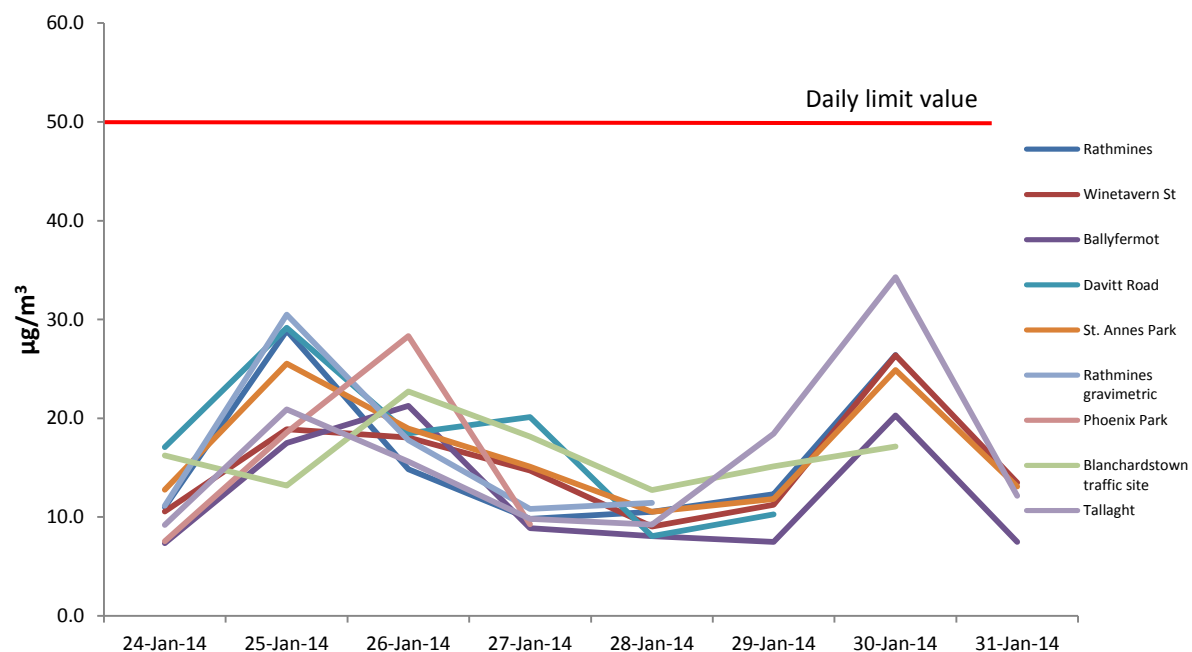
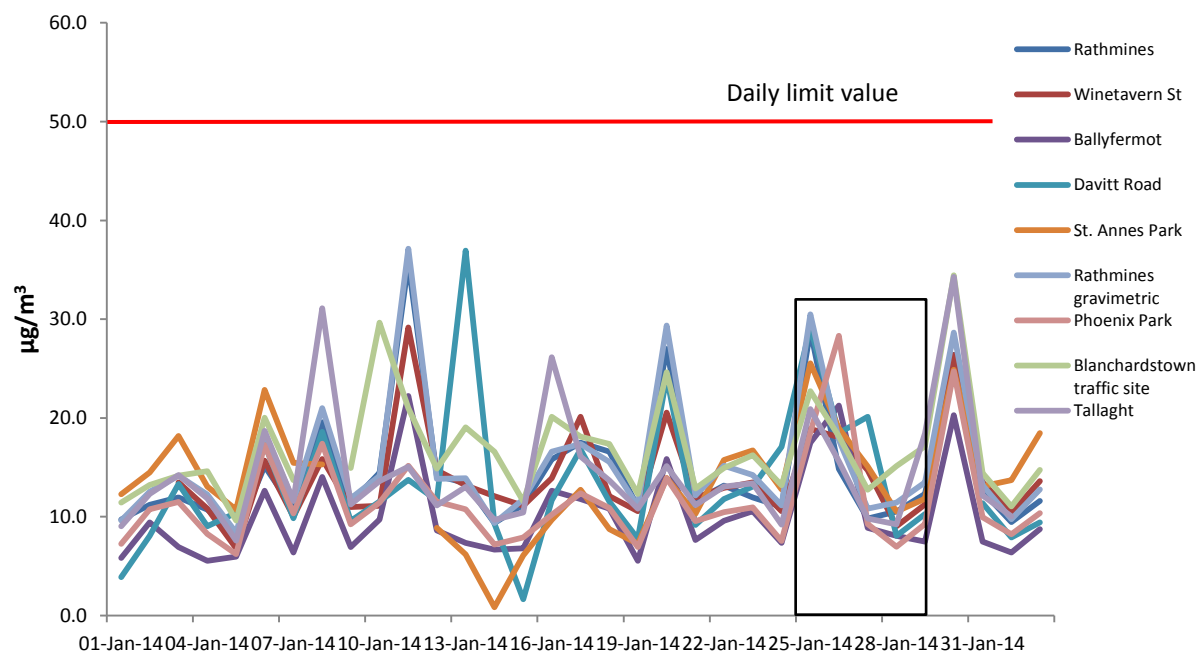


Figure 2-5 shows daily averaged PM<sub>10</sub> concentrations for all Dublin monitoring stations for the period of the 1<sup>st</sup> January to 2<sup>nd</sup> February. This examination of concentrations of PM<sub>10</sub> over the longer timeframe shows that levels over the period of the fire (highlighted) were within normal variations.

**Figure 2-5 Daily averaged PM10 at all Dublin monitoring stations 01/01/14 - 02/02/14**

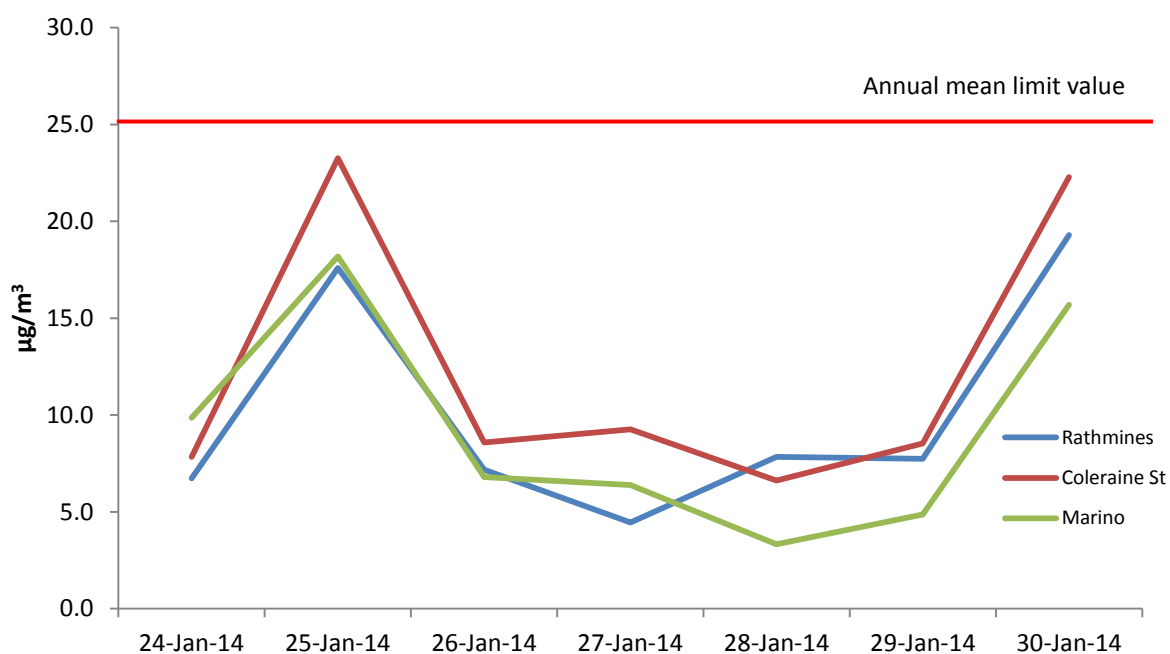


### 2.3 Particulate matter (PM<sub>2.5</sub>)

PM<sub>2.5</sub> or 'fine' particulate matter is particle pollution made of a mixture of solids and liquids of size 2.5µm or less. PM<sub>2.5</sub> is considered a better indicator of 'man-made' air pollution than PM<sub>10</sub>. Figure 2-6 shows daily averaged PM<sub>2.5</sub> data from the air quality monitoring stations at Rathmines, Coleraine Street and Marino over the period of the fire incident. This data is compared to the annual mean limit value.

While this mean annual limit value is not directly applicable to daily averaged concentrations, PM<sub>2.5</sub> values over the time period were within normal ranges and are below this annual average limit value at these monitoring stations.

Figure 2-6 Daily averaged PM<sub>2.5</sub> at Dublin monitoring stations 24/01/14 - 30/01/14



**Figure 2-7** Daily averaged PM<sub>2.5</sub> at Dublin monitoring stations 01/01/14 - 02/02/14

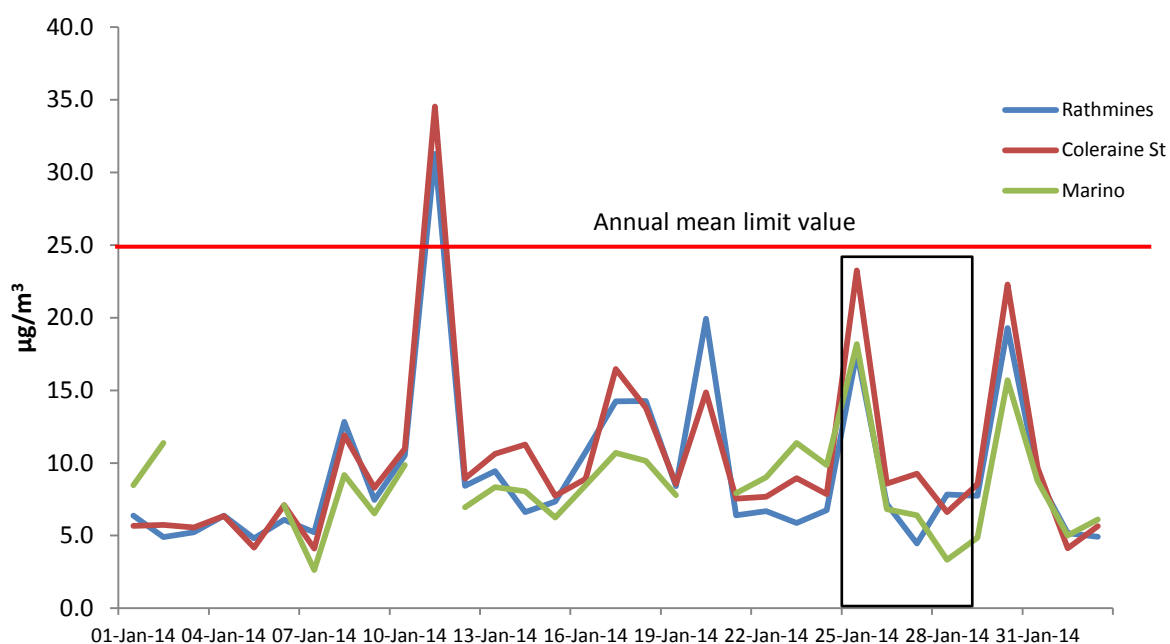


Figure 2-7 shows daily averaged PM<sub>2.5</sub> concentrations for all Dublin PM<sub>2.5</sub> monitoring stations for the period of the 1<sup>st</sup> January to 2<sup>nd</sup> February. This data is compared to the annual mean limit value. While this limit value is not applicable to daily averages, it shows that concentrations of PM<sub>2.5</sub> for the period of the fire (highlighted) were within normal variations for that time of year in Dublin.

## 2.4 Nitrogen dioxide (NO<sub>2</sub>)

NO<sub>2</sub> is a pollutant that is produced during high temperature combustion. Short-term exposure to NO<sub>2</sub> is linked to adverse respiratory effects including airway inflammation in healthy people and increased respiratory symptoms in asthmatics. Figure 2-8 shows hourly averaged NO<sub>2</sub> concentrations for all Dublin monitoring stations for the period of the 24<sup>th</sup> January to 31<sup>st</sup> January. All concentrations observed during this period are below the hourly limit value.

**Figure 2-8** Hourly averaged NO<sub>2</sub> data for all Dublin monitoring stations 24/01/14 - 31/01/14

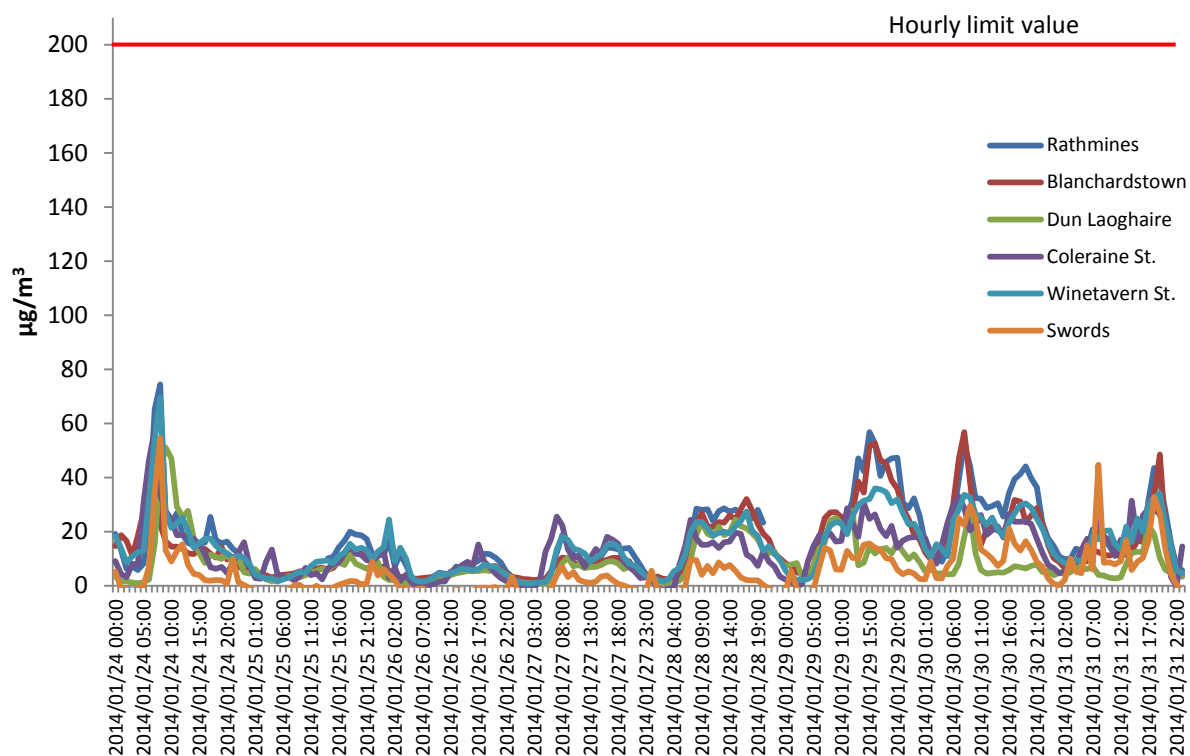
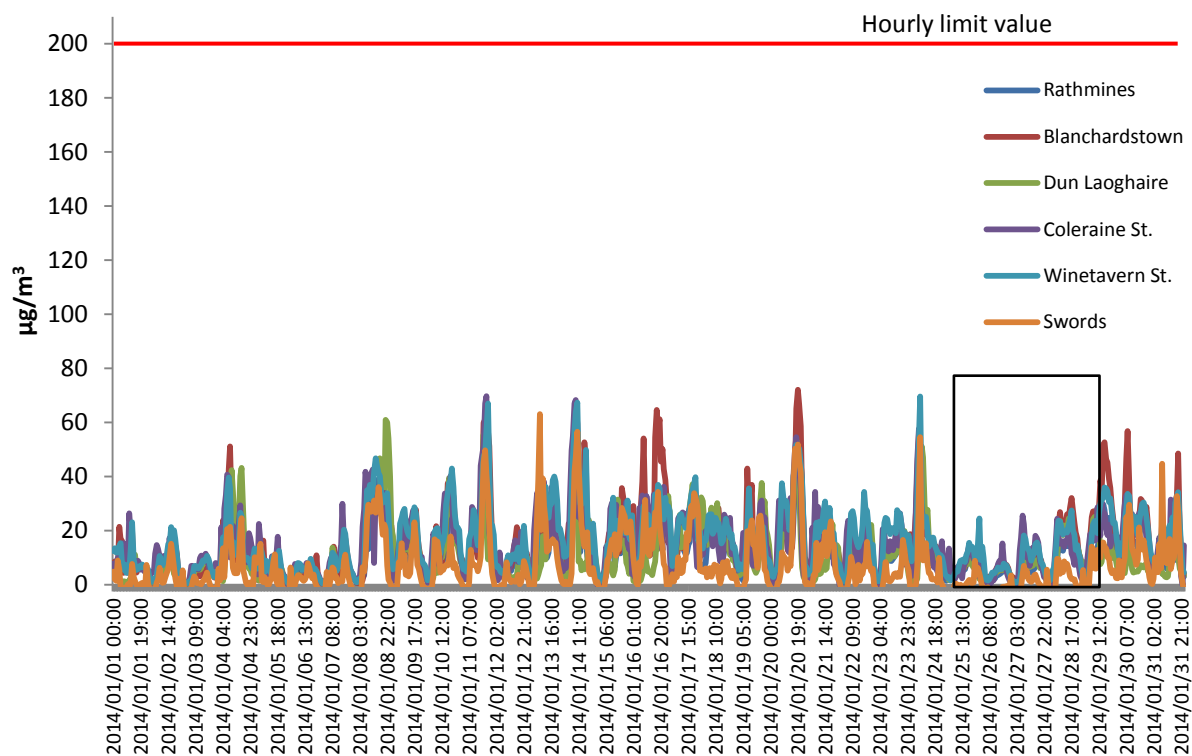


Figure 2-9 shows hourly averaged  $\text{NO}_2$  concentrations for all Dublin monitoring stations for the period of the 1<sup>st</sup> January to 31<sup>st</sup> January. This shows that concentrations of  $\text{NO}_2$  observed during the time period of the fire (highlighted) were within the normal variations observed in Dublin at that time of year.

**Figure 2-9** Hourly averaged  $\text{NO}_2$  data for all Dublin monitoring stations 01/01/14 - 31/01/14





## 2.5 Sulphur dioxide (SO<sub>2</sub>)

SO<sub>2</sub> is a gas which is formed when sulphur containing compounds are combusted. Figure 2-10 shows SO<sub>2</sub> hourly averaged data for the time period 24<sup>th</sup> January to 31<sup>st</sup> January, compared to the hourly limit value. Concentrations are low for this period, and there is no indication of any impact from the fire on the measured concentrations. While Section 3 of this report indicates relatively elevated concentrations of SO<sub>2</sub> close to the fire, the data below suggests good dispersion of the plume between the fire site and the location of the monitoring stations.

**Figure 2-10** Hourly averaged SO<sub>2</sub> data for all Dublin monitoring stations 24/01/14 - 31/01/14

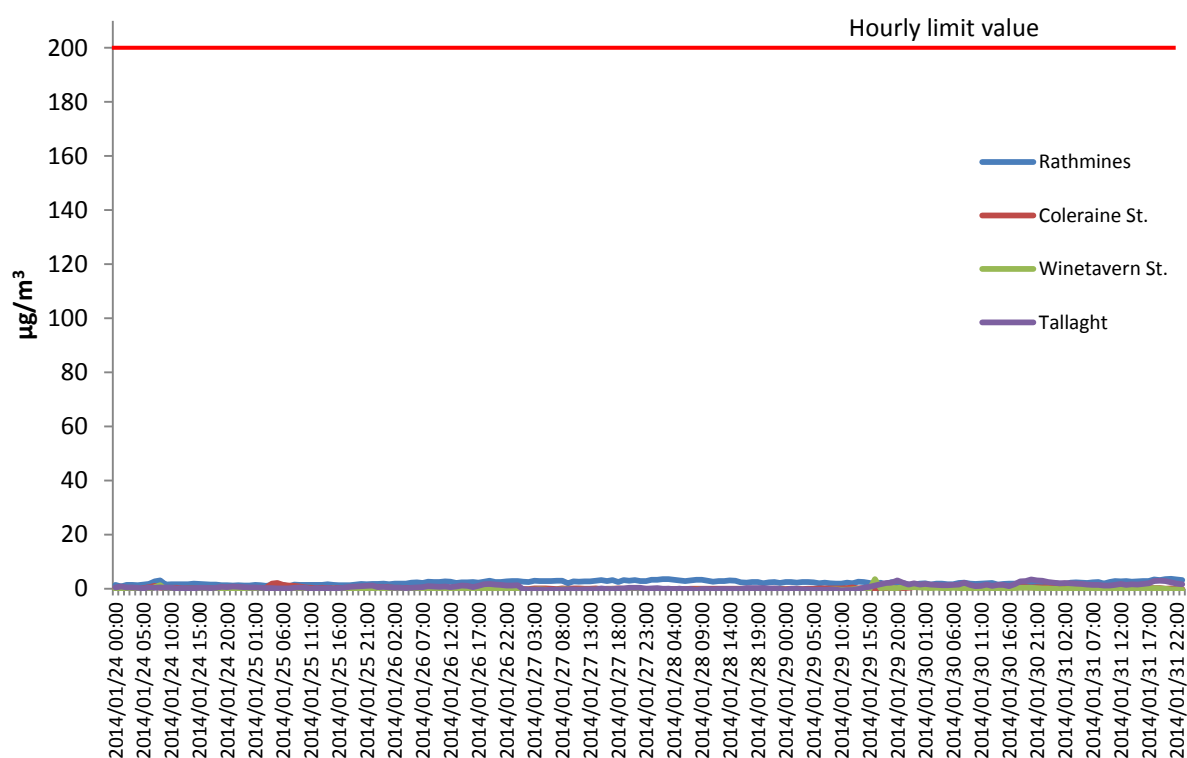
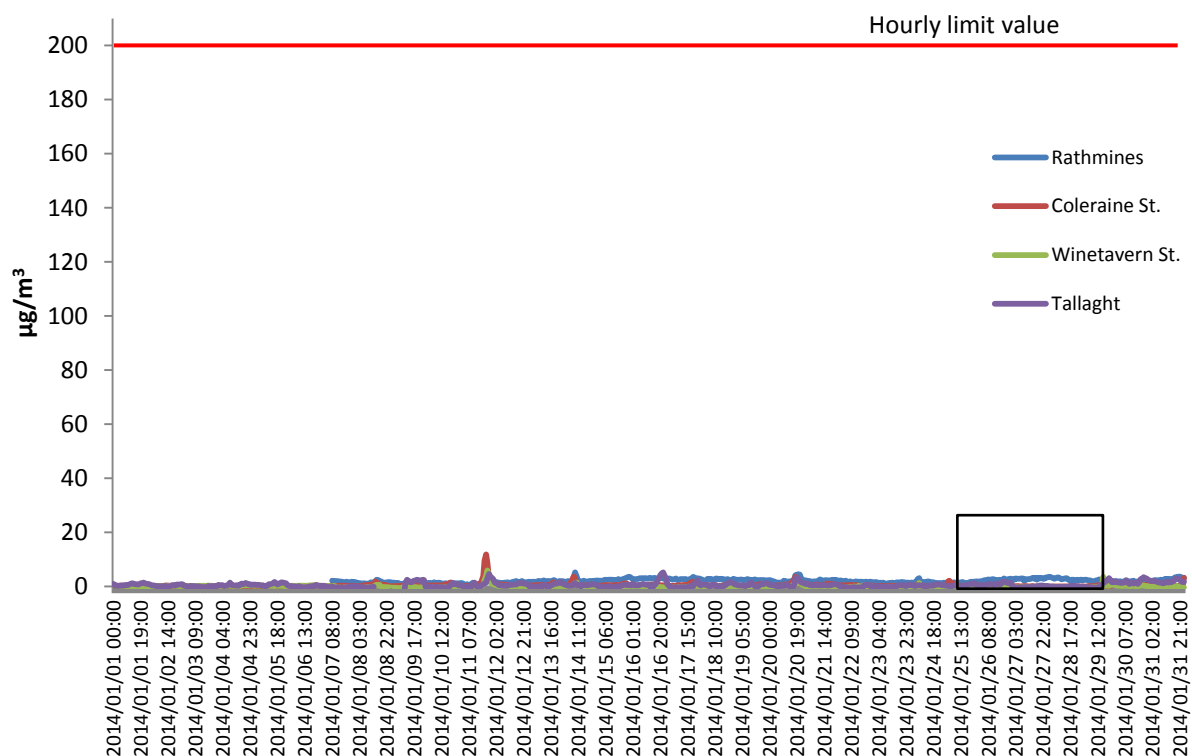


Figure 2-11 shows SO<sub>2</sub> hourly averaged data for the time period 1<sup>st</sup> January to 31<sup>st</sup> January. This graph shows that concentrations observed over the time period of the fire (highlighted), were within normal variations observed in Dublin at that time of year.

**Figure 2-11** Hourly averaged SO<sub>2</sub> data for all Dublin monitoring stations 01/01/14 - 31/01/14



## 2.6 Benzene and toluene at Rathmines monitoring station

Benzene and Toluene are volatile organic compounds (VOCs), which can be produced from combustion sources such as transportation and fires. Acute (short-term) inhalation exposure of humans to benzene may cause drowsiness, dizziness, headaches, as well as eye, skin, and respiratory tract irritation and, at high levels, unconsciousness. Figure 2-12 shows hourly benzene concentrations observed at the Rathmines monitoring station for the period of the 24<sup>th</sup> January to the 31<sup>st</sup> of January. There is no hourly or daily limit value for benzene; however the average over the period can be indicatively compared to the annual average limit value of  $5\mu\text{g}/\text{m}^3$ . Concentrations over the period are typical for benzene in urban areas and do not suggest any significant impact from the fire at this monitoring location.

**Figure 2-12** Rathmines hourly Benzene concentrations 24/01/14 - 31/01/14

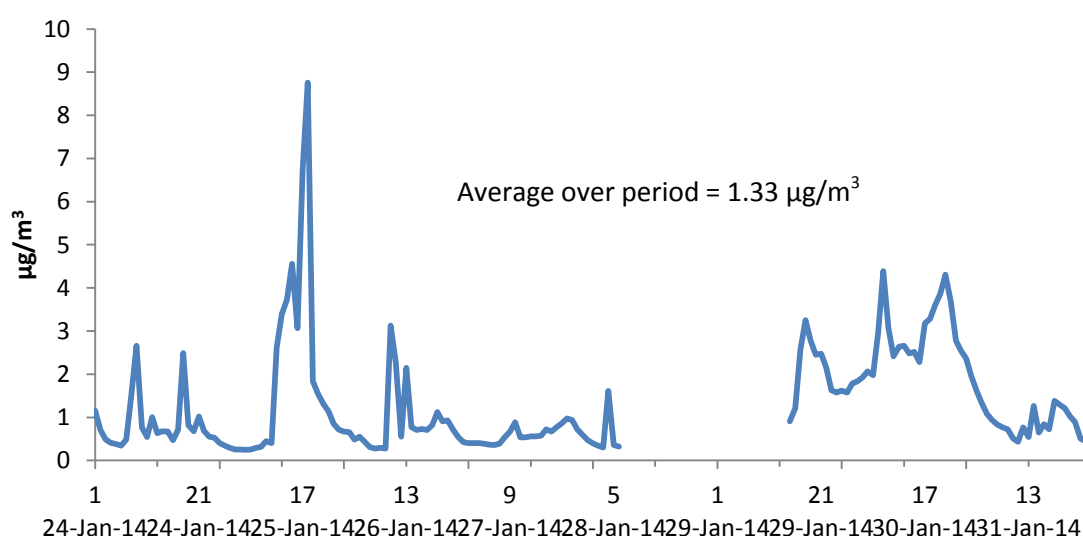


Figure 2-13 shows hourly benzene concentrations observed at the Rathmines monitoring station for the period of the 1<sup>st</sup> January to the 31<sup>st</sup> of January. This graph shows that benzene concentrations over the period of the fire (highlighted) were within the normal variations observed in Dublin at this time of year.

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**Figure 2-13**      **Rathmines hourly Benzene concentrations 01/01/14 - 31/01/14**

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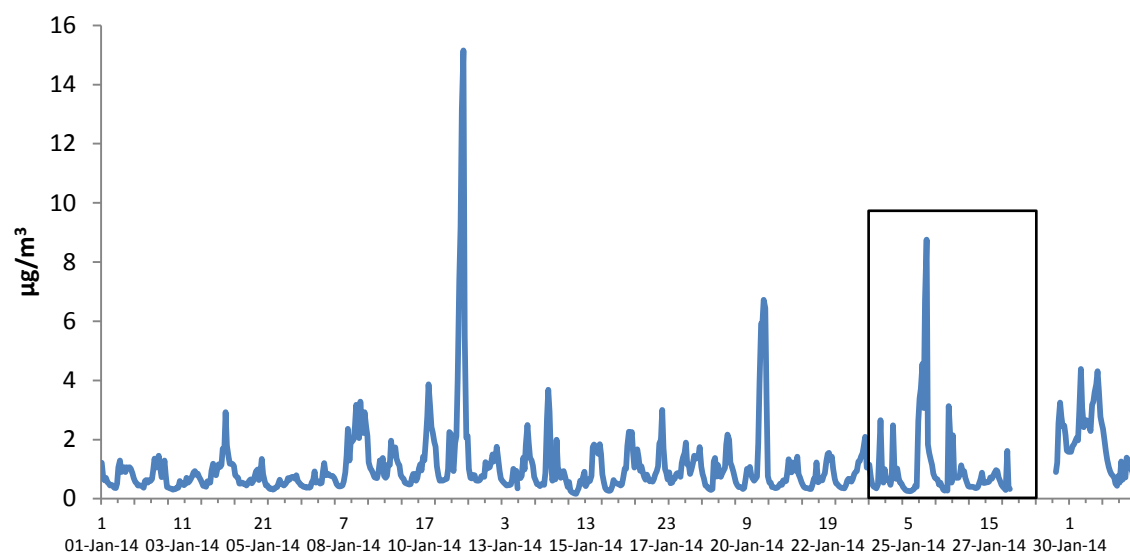


Figure 2-14 shows hourly toluene concentrations at Rathmines from the 24<sup>th</sup> of January to the 31<sup>st</sup> of January. There is no limit value for toluene. Concentrations over the period are typical for toluene in urban areas and do not suggest any significant impact from the fire at this monitoring location.

**Figure 2-14** Rathmines hourly Toluene concentrations 24/01/14 - 31/01/14

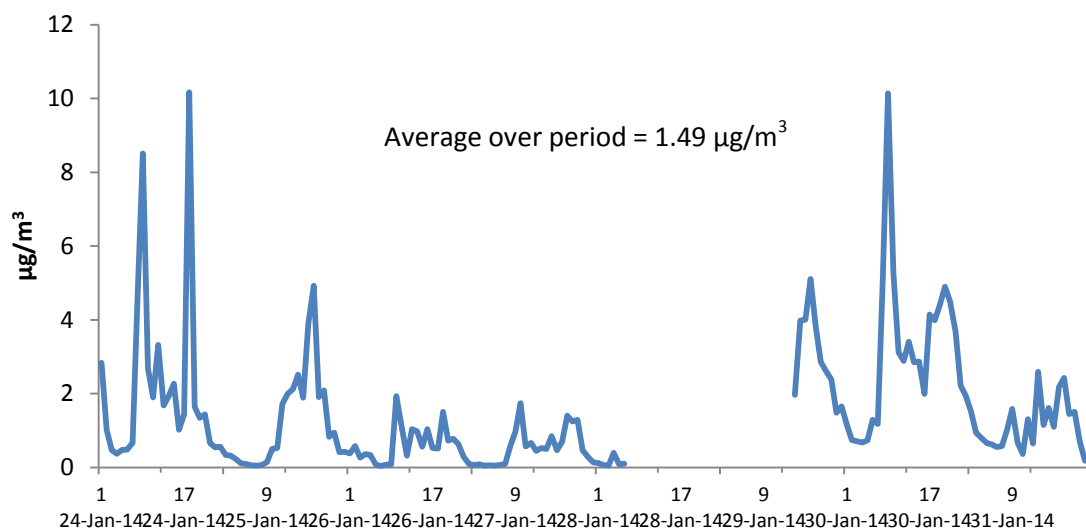
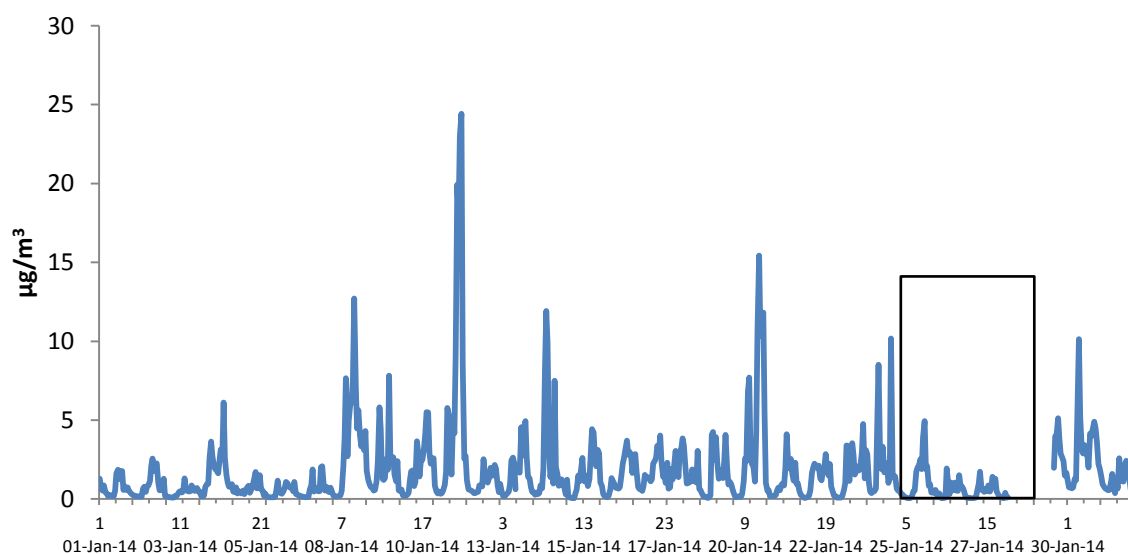


Figure 2-15 shows hourly toluene concentrations observed at the Rathmines monitoring station for the period of the 1<sup>st</sup> January to the 31<sup>st</sup> of January. This graph shows that benzene concentrations over the period of the fire (highlighted) were within the normal variations observed in Dublin at this time of year.

**Figure 2-15** Rathmines hourly Toluene concentrations 01/01/14 - 31/01/14



## 2.7 Polycyclic aromatic hydrocarbons (PAH)

PAH are chemical compounds which consist of two or more fused aromatic rings made entirely from carbon and hydrogen. PAH are emitted domestically from the combustion of solid fuels, such as wood and coal. In general they are emitted from incomplete combustion of carbon containing compounds. Short-term exposure to high levels of PAH may cause eye irritation, nausea, diarrhoea, vomiting and confusion. Three filters from a gravimetric PM<sub>10</sub> sampler at Rathmines, for the dates 25<sup>th</sup>, 26<sup>th</sup> and 27<sup>th</sup> of January were analysed for the presence of PAH.

Table 2-1 shows the average concentration of PAH observed in these three filters. Benzo(a)pyrene is used as a marker for PAH (highlighted in Table below), and has an annual average limit value of 1ng/m<sup>3</sup>. Although this limit is not directly applicable to this three day average, all PAH measurements were below this limit value.

**Table 2-1** Average concentrations of PAH in PM<sub>10</sub> at Rathmines monitoring station 25/01/14 -27/01/14

Values in ng/m <sup>3</sup>	Jan 25th- Jan 27th
Naphthalene	0.8
Acenaphthylene	0.0
Acenaphthene	0.0
Fluorene	0.2
Phenanthrene	0.1
Anthracene	0.1
Fluoranthene	0.1
Pyrene	0.1
Chrysene	0.1
Benz[a]anthracene	0.3
Benzo(b)fluoranthene	0.5
Benzo(k)fluoranthene	0.2
Benzo(j)fluoranthene	0.2
Benzo(a)pyrene	0.2
Benzo(g,h,i)perylene	0.4
Dibenzo(a,h)anthracene	0.3
Indeno(1,2,3-cd)pyrene	0.4

### 3. Supplementary Air Monitoring

In response to the fire at Oxigen Environmental a programme of indicative air quality monitoring was commenced on Saturday January 25<sup>th</sup>. These measurements were all taken directly in the plume in close proximity to the source of the smoke. This programme ran until the afternoon of Friday January 31<sup>st</sup>. Three monitoring techniques were utilised during this monitoring campaign. These were: 1) colour indicator tubes with a manual sampling pump, 2) a portable gas analyser, 3) a semi-portable particulate (dust) sampler. Monitoring locations were determined by observations at the scene (e.g. dispersion of smoke) and locations of vulnerable receptors including residences and businesses. This programme acted as an addition to the network of ambient air quality monitoring stations already in place in the Dublin metropolitan area; with this supplementary monitoring being carried out in closer proximity to the location of the fire.

#### 3.1 Selection of appropriate assessment levels

Air monitoring data obtained was assessed against two appropriate assessment levels as described in the following two sections.

##### 3.1.1 Acute Exposure Guideline Levels (AEGL)

While there are air quality thresholds specified in the Air Quality Standards Regulations (S.I. 180 of 2011), its focus and priority is in managing ambient air quality over longer timeframes. The legislation does not specifically refer to emergencies, accidents or incidents such as this event. For that reason the AEGLs were considered. The AEGLs were developed in a collaborative effort by public and private sectors worldwide, co-ordinated by the United States EPA. AEGLs are intended to describe the risk to humans resulting from once-in-a-lifetime, or rare, exposure to airborne pollutants. Note that there is no AEGL for particulate, as the programme focuses exclusively on chemicals. AEGLs are subdivided into three levels of severity, presented below.

**Table 3.1** AEGL levels 1-3

AEGL 1	The level of the chemical in air at or above which the general population could experience notable <b>discomfort</b> ;
AEGL 2:	The level of the chemical in air at or above which there may be irreversible or other <b>serious long-lasting effects</b> or impaired ability to escape;
AEGL 3	The level of the chemical in air at or above which the general population could experience <b>life-threatening</b> health effects or death.

Full details for the specific AEGLs for the principal parameters expected of incidents such as this fire are included in Annex 1A.

##### 3.1.2 Emergency Response Planning Guideline Values (ERPG)

The American Industrial Hygiene Association (AIHA) is a work-place cleanliness non-profit organisation. In 2010 it published the Emergency Response Planning Guideline Values and Workplace Environmental Exposure Level Guides Handbook. This publication contains ERPG limit



values for a selected amount of pollutant parameters. As with the AEGL guidelines there is no ERPG value for particulate as its focus is exclusively on chemicals. ERPG values for each pollutant parameter are subdivided into three levels. These are presented below:

**Table 3.2 ERPG levels 1-3**

ERPG 1	Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1hr without experiencing other than <b>mild transient adverse health effects</b> or perceiving a clearly defined, <b>objectionable odour</b> .
ERPG 2	Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1hr without experiencing or developing irreversible or other <b>serious health effects or symptoms</b> which could impair an individual's ability to take protective action.
ERPG 3	Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1hr without experiencing or developing <b>life-threatening</b> health effects.

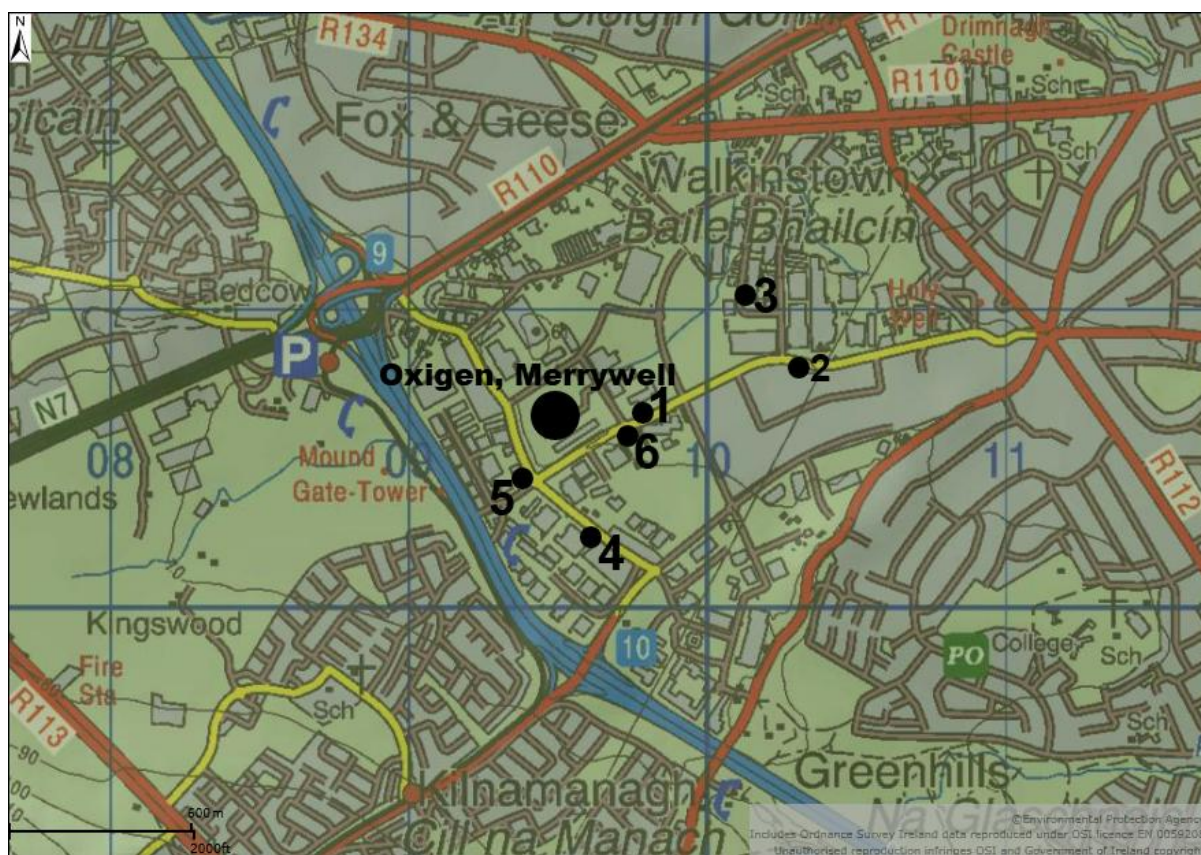
Full details for the specific ERPG for the principal parameters expected of incidents such as this fire are included in Annex 1B.

## 3.2 Supplementary monitoring results

### 3.2.1 Colour indicator tube results

Indicative air quality monitoring using colour indicator tubes and a manual sampling pump for a range of pollutants (carbon monoxide, sulphur dioxide, oxides of nitrogen and aromatic hydrocarbons) was carried out at off-site locations in the area local to the Oxigen waste facility. The results are considered to be indicative of the air quality being experienced at the time of sampling. The sample is taken over a very short time period (typically in the range of 5 seconds to 30 seconds) with air being drawn through a glass tube filled with a proprietary material which will change colour depending on the quantity of pollutant present in the sampled air.

**Figure 3-1** Locations of tube samples referred to in Tables 3.3 and 3.4.



**Table 3.3** Colour indicator tube summary.

Parameter	Number of samples taken	Assessment values for comparison		Number of elevated results
		AEGL level 1 guideline	ERPG Level 1 value	
CO	11	none	200ppm	0
SO <sub>2</sub>	11	0.2ppm	0.3ppm	4 (see Table 3.4)
NO <sub>x</sub> (as NO <sub>2</sub> )	11	0.5ppm	1ppm	0
Aromatic hydrocarbons	11	130ppm	50ppm	0

Note: CO = carbon monoxide, SO<sub>2</sub> = sulphur dioxide, NO<sub>x</sub> = oxides of nitrogen.

From Table 3.3 it can be seen that SO<sub>2</sub> reached the AEGL level-1 four times and the ERPG level-1 once. Details of those occurrences are presented below in Table 3.4.

**Table 3.4** Colour indicator tube results for SO<sub>2</sub> where elevated results were observed.

Date	Time	Location*	Result (ppm)	Comparison range	AEGL	ERPG
					ppm	
25/01/2014 (Saturday)	16:30	Ballymount Road. Close to site, inside Garda cordon (1)	0.4	AEGL-1 & ERPG -1	0.2	0.3
25/01/2014 (Saturday)	16:00	Maxol Garage, Ballymount Road (2)	0.2	AEGL-1		
28/01/2014 (Tuesday)	14:30	Ballymount Road, Swan Plant hire (4)	0.2	AEGL-1		
28/01/2014 (Tuesday)	15:30	Galco Steel, Ballymount Road (6)	0.2	AEGL-1		

\*see Figure 3-1 above for location map.

Only on one of these four occasions was the AEGL-1 value actually exceeded, with the value for the other three occasions being at the AEGL-1 level. The location at which the exceeding sample was taken was inside the boundary of the area cordoned-off by An Garda Siochana. There were no residents or open businesses located within that area at the time of sampling. AEGL level-1 is the least severe of the AEGL levels and represents the *“level of chemical in air at or above which the general population could experience notable discomfort”*.

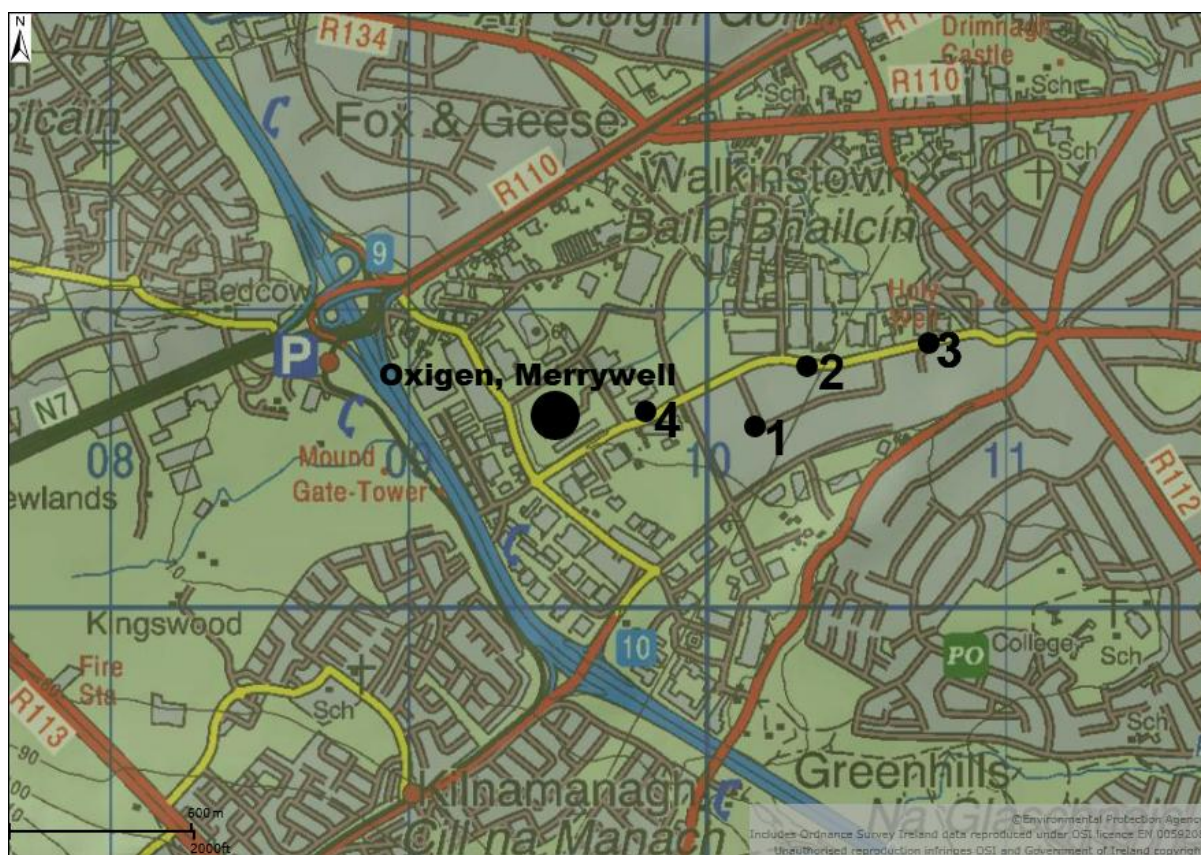
The only sample that met or exceeded any ERPG level was for one SO<sub>2</sub> sample, which was taken inside the Garda cordoned area.

The magnitude of the measured results and the significance levels associated with the relevant AEGL and ERPG criteria is consistent with the advice given at the time of the fire to remain indoors and avoid physical exertion. These measurements were taken in the smoke plume and represented worst-case conditions in very close proximity to the fire. Adherence to the health advice would have further reduced exposure.

### 3.2.2 Portable gas analyser results

A small handheld analyser (MultiRae Pro analyser) was used to measure carbon monoxide (CO), ammonia (NH<sub>3</sub>), nitrogen dioxide (NO<sub>2</sub>), volatile organic compounds (VOC), hydrogen sulphide (H<sub>2</sub>S) and formaldehyde (HCHO). This analyser gives instantaneous real-time measurements of the levels of these pollutants in the sampled air. The analyser logs the measurements and the data can then be downloaded and assessed.

**Figure 3-2** Locations of portable gas analyser sampling



**Table 3.5** Portable gas analyser summary

Parameter*	Number of samples taken**	Assessment values for comparison		Number of elevated results
		AEGL level 1 guideline	ERPG Level 1 value	
CO	12	none	200ppm	0
HCHO	12	0.9ppm	1ppm	0
NO <sub>x</sub> (as NO <sub>2</sub> )	12	0.5ppm	1ppm	0
VOC	12	130ppm	50ppm	0

\* Other parameters measured but not detected: hydrogen sulphide and ammonia

\*\*12 separate sampling periods: values used are averaged from each sampling period.

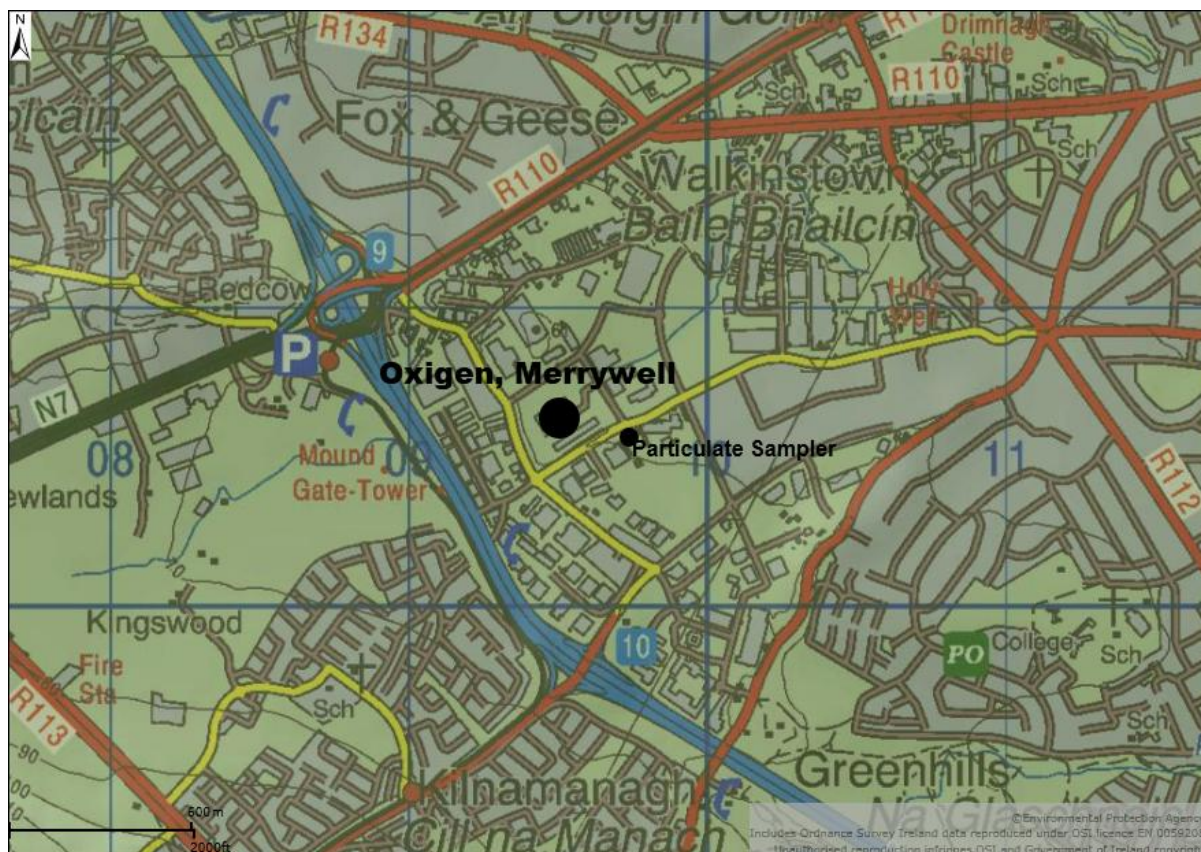
The monitoring in Table 3.5 was undertaken on January 25, 27, 28 and 29 and the sampling durations in each case were of short duration (5 – 10 minute averages). The results indicate that none of the measured pollutant concentrations were above the AEGL-1 or ERPG-1 threshold levels, hence no significant acute impact was expected as a result of exposure to these pollutants.



### 3.2.3 Osiris particulate sampler results

This instrument measures PM<sub>10</sub>, PM<sub>2.5</sub>, PM<sub>1</sub> and total particulate using light scatter technology and is a certified indicative particulate analyser. This analyser was located within 300 metres of the fire location (at Galco Steel) which was generally suited to the prevailing wind direction at the time. Figure 3-3 indicates the relative location to the site of the fire.

**Figure 3-3** Location of Osiris particulate sampler



As there are no AEGL or ERPG levels for particulate, and as the samples were taken over a 24 hour period, a comparison using the air quality standard (AQS) levels (available for PM<sub>10</sub> and PM<sub>2.5</sub>) has been made and the results are presented in Table 3.6.

**Table 3.6** PM<sub>10</sub> and PM<sub>2.5</sub> summary results for Osiris particulate sampler.

Parameter	Number of samples taken*	Assessment values for comparison			Number of elevated results
		AQS	AEGL level 1 guideline	ERPG Level 1 value	
PM <sub>10</sub>	2	50µg/m <sup>3</sup> (daily limit)	None specified	None specified	1 (see Table 3.7)
PM <sub>2.5</sub>	2	25µg/m <sup>3</sup> (annual average limit)	None specified	None specified	1 (see Table 3.7)

\*Sample duration ≥24hrs

**Table 3.7 Complete record of particulate data from Osiris sampler**

Date	Total particles ( $\mu\text{g}/\text{m}^3$ )	PM <sub>10</sub> particles ( $\mu\text{g}/\text{m}^3$ )	PM <sub>2.5</sub> particles ( $\mu\text{g}/\text{m}^3$ )	PM <sub>1</sub> particles ( $\mu\text{g}/\text{m}^3$ )
28-29/01/2014 (24 hours)	129	110	45	15
30-31/01/2014 (24 hours)	11	9	6	3

Particulate results presented in Table 3.7 for a 24-hour period on 28-29/01/2014 indicate elevated levels of PM<sub>10</sub> and PM<sub>2.5</sub> compared to the AQS. The AQS allows for 35 daily exceedences of the PM<sub>10</sub> standard in a year before it is considered to be a breach of the limit, hence the measured value could not in itself be considered a breach of the legislative standard, though it does indicate elevated particulate levels were present in close proximity to the fire. The criteria for categorising air quality under the EPA Air Quality Index for Health (see <http://www.epa.ie/air/quality/index/>) can be applied to assess the significance of these measured results. The measured concentration is equivalent to 'very poor' air quality based on the measured PM<sub>10</sub> or 'fair' air quality based on the measured PM<sub>2.5</sub>. The advice given at the time of the fire to remain indoors and out of the plume is consistent with the advice given under the Air Quality Index for Health for very poor air quality.

Particulate results for the second sampling period (30-31/01/2014) were greatly reduced to levels typical of normal ambient conditions.

## 4. HSE Review

The EPA requested comments from the HSE on the likely short-term and long-term health effects of the fire emissions based on the available information on pollutant concentrations as presented in Section 2 and 3 above. The feedback from the HSE is presented in the remainder of this Section:

- Outside the immediate zone of a fire, the public health concern is generally exposure to irritant gases and particulates. The ambient air quality results in this report indicate that, for the parameters measured, the fire has no significant effect on the air quality in the wider Dublin area. Some peaks in monitoring occurred but levels remained low and similar to normal monitoring trends.
- The results of the supplementary monitoring carried out in close proximity to the fire and in the plume suggest that the air quality within the plume was very poor:
  - Elevation in SO<sub>2</sub> levels: One result on the 25<sup>th</sup> exceeded the AEGL-1 (0.2ppm) in which the general population, if exposed, could experience considerable discomfort. This sample was inside the area cordoned off by the police. There were no residents or open businesses located within that area at the time of the sampling. It was below the level where there may be irreversible or other serious long lasting effects (AEGL-2 0.75ppm). The other three samples (25<sup>th</sup> and 28<sup>th</sup>) were at the AEGL-1 level (0.2ppm).
  - Elevated PM<sub>10</sub> and PM<sub>2.5</sub> over the 24 hour period 28<sup>th</sup> to the 29<sup>th</sup> of January. This relates to the last two days of the fire. The results correspond to very poor air quality on the Air Quality and Health Index. The particulate results for the 24 hour period from 30<sup>th</sup> to the 31<sup>st</sup> of January after the fire was out show a return to normal ambient levels.

The presence of pollutants does not necessarily mean exposure. Reports from the site suggest that residential and public exposure to the main plume was low. The fire was in an industrial estate. The weather was very windy and the wind direction was away from the nearest residents. These weather conditions would be very favourable to dilution and dispersion. The EPA issued advice to shelter and following this advice would be expected to reduce any exposure. In addition staying out of the plume (including removing oneself from the plume if in it) would be expected to reduce any exposure.

Irritant gases are present in most fires. The injury following exposure to an irritant gas depends on the chemical involved, its concentration and the exposure duration. Adverse effects resulting from exposure to these irritant gases are likely to resolve following removal from exposure.

Particulate matter (PM), particles of organic and inorganic matter are likely to be released during all types of fires involving organic material. Particles below 10 µm may be inhaled into the respiratory tract. Acute exposure to PM<sub>10</sub> has been associated with exacerbations of respiratory and cardiac disease.

Individuals most at risk from exposure to hazardous combustion products are those who have pre-existing respiratory diseases, such as asthma or chronic obstructive pulmonary disease. Acute



exposure to smoke is likely to exacerbate these conditions. Elderly individuals, smokers and those with cardiac conditions may also be at greater risk than the general population.

Long term health effects of smoke from fires cannot be completely ruled out but the risk of this happening is considered to be very low. The fire started on the 25<sup>th</sup> and was declared extinguished on the 29<sup>th</sup>. The exposure was short term.

The risk of carcinogenicity from complex molecules, like PAHS or dioxins, from a single exposure is likely to be very low. Following exposure to any chemical, the adverse health effects encountered depend on several factors, including the amount (dose), the mechanism of exposure, the duration of exposure, the form of the chemical and exposure to any other chemicals. Predicting the risks that might be associated with exposure to the majority of carcinogens is made more difficult by the fact that no threshold of effect can be identified. This means that we have to assume that even a very small exposure could be associated with some increase in risk. However, much of what we know about the carcinogenicity of compounds is derived from studies of long term exposure in occupational settings (often for years) and from studies of life-time exposure of experimental animals. Exposure for several years seems to be necessary for an increase in the level of cancer in the exposed population to be detected.

A number of relevant references are included in Annex 3.

## **5. Conclusions**

The ambient air quality monitoring data in Section 2 of this report indicates that the fire had no significant impact on air quality across the greater Dublin area with all measured results being below the relevant air quality standards.

As expected, the levels of pollutants in the smoke plume in close proximity to the fire were elevated in a number of cases, however this exposure would not be typical of exposed residents downwind of the fire. The results indicated the potential for short-term effects (e.g. discomfort) for exposed individuals. However those following the health advice to shelter and avoid physical exertion are unlikely to have experienced these levels for any significant period of time.

Overall the results of the air quality monitoring indicate that the air quality impact of the fire was localised and transient, and there was no significant potential for any long-term health impacts as a result of this incident.

## Annex 1. A: AEGL Information

Below are full details for the specific AEGLs for the principal parameters expected at incidents such as this fire.

AEGL for carbon monoxide (ppm)

	<b>10 min</b>	<b>30 min</b>	<b>60 min</b>	<b>4 hr</b>	<b>8 hr</b>
AEGL 1	NR	NR	NR	NR	NR
AEGL 2	420	150	83	33	27
AEGL 3	1,700	600	330	150	130

(NR = Not recommended due to insufficient data)

AEGL for sulphur dioxide (ppm)

	<b>10 min</b>	<b>30 min</b>	<b>60 min</b>	<b>4 hr</b>	<b>8 hr</b>
AEGL 1	0.20	0.20	0.20	0.20	0.20
AEGL 2	0.75	0.75	0.75	0.75	0.75
AEGL 3	30	30	30	19	9.6

AEGL for nitrogen dioxide (ppm)

	<b>10 min</b>	<b>30 min</b>	<b>60 min</b>	<b>4 hr</b>	<b>8 hr</b>
AEGL 1	0.50	0.50	0.50	0.50	0.50
AEGL 2	20	15	12	8.2	6.7
AEGL 3	34	25	20	14	11

AEGL for VOC as benzene (ppm). An interim AEGL

	<b>10 min</b>	<b>30 min</b>	<b>60 min</b>	<b>4 hr</b>	<b>8 hr</b>
AEGL 1	130	73	52	18	9.0
AEGL 2	2,000	1,100	800	400	200
AEGL 3	9,700	5,600	4,000	2,000	990

AEGL for formaldehyde (ppm). An interim AEGL

	<b>10 min</b>	<b>30 min</b>	<b>60 min</b>	<b>4 hr</b>	<b>8 hr</b>
AEGL 1	.90	.90	.90	.90	.90
AEGL 2	14	14	14	14	14
AEGL 3	100	70	56	35	35

## Annex 1. B: ERPG Information


Below are details for the specific ERPGs for the principal parameters expected at incidents such as this fire.

ERPG levels 1-3 for measured parameters








<b>Parameter</b>	<b>ERPG-1</b>	<b>ERPG-2</b>	<b>ERPG-3</b>
CO	200ppm	350ppm	500ppm
SO <sub>2</sub>	0.3ppm	3ppm	25ppm
NO <sub>x</sub> (as NO <sub>2</sub> )	1ppm	15ppm	30ppm
VOC (as benzene)	50ppm	150ppm	1000ppm
Formaldehyde (HCHO)	1ppm	10ppm	40ppm

## Annex 2: Twitter timeline


Timeline of tweets sent by EPA Air Quality from start of Ballymount fire to the moment when the fire was announced as extinguished. Please note the time stamp of the tweet is in the bottom left hand corner.

**EPA Air Quality** @EPAAirQuality · Jan 25  
Smoke plume in Dublin from major fire on Ballymount Road. Keep windows closed and stay indoors if in direct path of plume.  
[Collapse](#) [Reply](#) [Delete](#) [Favorite](#) [More](#)


RETWEETS  
**19**



9:25 AM - 25 Jan 2014 · [Details](#)

**EPA Air Quality** @EPAAirQuality · Jan 25  
High levels of pollution in region of smoke plume in Dublin. Anyone experiencing symptoms such as sore eyes, cough or sore throat should  
[Collapse](#) [Reply](#) [Delete](#) [Favorite](#) [More](#)

RETWEET  
**1**



9:27 AM - 25 Jan 2014 · [Details](#)

**EPA Air Quality** @EPAAirQuality · Jan 25  
consider reducing activity particularly outdoors  
[Collapse](#) [Reply](#) [Delete](#) [Favorite](#) [More](#)

RETWEET  
**1**



9:27 AM - 25 Jan 2014 · [Details](#)



**EPA Air Quality** @EPAAirQuality · Jan 25

If affected by the smoke plume, adults and children with lung problems and adults with heart problems should

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RETWEETS

2

FAVORITE

1



9:29 AM - 25 Jan 2014 · [Details](#)



**EPA Air Quality** @EPAAirQuality · Jan 25

reduce strenuous physical activity particularly outdoors and particularly if they experience symptoms.

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RETWEET

1



9:30 AM - 25 Jan 2014 · [Details](#)



**EPA Air Quality** @EPAAirQuality · Jan 25

If near the smoke plume, people with asthma may find they need to use their reliever inhaler more often.

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RETWEETS

2



9:32 AM - 25 Jan 2014 · [Details](#)



**EPA Air Quality** @EPAAirQuality · Jan 25

If near the pollution from the Dublin smoke plume from fire on Ballymount Road, older people should also reduce physical exertion.

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RETWEETS

8



9:33 AM - 25 Jan 2014 · [Details](#)



**EPA Air Quality** @EPAAirQuality · Jan 25

Poor air quality likely in parts of Dublin affected by the smoke plume. Follow the AQIH health advice [epa.ie/air/quality/in...](http://epa.ie/air/quality/in...)

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RETWEETS

4



1:19 PM - 25 Jan 2014 · [Details](#)



**EPA Air Quality** @EPAAirQuality · Jan 25

Sat 5PM: Air Quality Index for Health indicates that air quality is GOOD in all regions [bit.ly/122pU7H](http://bit.ly/122pU7H)

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5:04 PM - 25 Jan 2014 · [Details](#)



**EPA Air Quality** @EPAAirQuality · Jan 25

In Dublin, air quality may be poor in any area impacted by the smoke plume. Follow health advice for poor air quality [epa.ie/air/quality/in...](http://epa.ie/air/quality/in...)

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RETWEETS

3



5:37 PM - 25 Jan 2014 · [Details](#)



**EPA Air Quality** @EPAAirQuality · Jan 25

Smoke from Ballymount fire expected to continue all evening. If in direct path of plume, keep windows and doors closed.

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RETWEETS

2



5:38 PM - 25 Jan 2014 · [Details](#)



**EPA Air Quality** @EPAAirQuality · Jan 25

Sat 8PM: Air Quality Index for Health indicates that air quality is GOOD in all regions [bit.ly/122pU7H](http://bit.ly/122pU7H)

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8:04 PM - 25 Jan 2014 · [Details](#)



**EPA Air Quality** @EPAAirQuality · Jan 25

In Dublin, air quality may be poor in any area impacted by the smoke plume. Health advice at [airquality.epa.ie](http://airquality.epa.ie)

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RETWEETS

7



8:14 PM - 25 Jan 2014 · [Details](#)



**EPA Air Quality** @EPAAirQuality · Jan 26

In Dublin, smoke from fire on Ballymount Road may cause poor air quality in impacted areas today. Health advice at [airquality.epa.ie](http://airquality.epa.ie)

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RETWEET

1



2:13 PM - 26 Jan 2014 · [Details](#)



**EPA Air Quality** @EPAAirQuality · Jan 26

Monitoring shows air quality good in Dublin however local poor air quality is possible in vicinity of smoke plume. [airquality.epa.ie](http://airquality.epa.ie)

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5:25 PM - 26 Jan 2014 · [Details](#)





**EPA Air Quality** @EPAAirQuality · Jan 26

Sun 5pm: Air Quality Index for Health indicates air quality is GOOD in all regions. [airquality.epa.ie](http://airquality.epa.ie)

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5:27 PM - 26 Jan 2014 · [Details](#)



Retweeted by EPA Air Quality



**Asthma Society** @AsthmaIreland · Jan 27

For anyone with #asthma affected by smoke plume caused by fire on Ballymount Rd our Advice-line opens at 10am 1850 44 54 64

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[↩ Reply](#) [↻ Retweeted](#) [★ Favorite](#) [⋮ More](#)

RETWEETS

6



9:02 AM - 27 Jan 2014 · [Details](#)



**EPA Air Quality** @EPAAirQuality · Jan 27

In Dublin, smoke from Ballymount fire may cause poor air quality in local areas for the rest of today. Health advice [airquality.epa.ie](http://airquality.epa.ie)

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RETWEETS

6



3:24 PM - 27 Jan 2014 · [Details](#)



Retweeted by EPA Air Quality



**EPA Ireland** @EPAIreland · Jan 27

EPA update about Oxigen Environmental Waste Facility fire, Ballymount, Dublin available at [bit.ly/MIDYpl](http://bit.ly/MIDYpl)

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3

FAVORITE

1



6:07 PM - 27 Jan 2014 · [Details](#)



**EPA Air Quality** @EPAAirQuality · Jan 27

Mon 6pm: Air Quality Index for Health indicates air quality is GOOD in all regions. [airquality.epa.ie](http://airquality.epa.ie).

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6:19 PM - 27 Jan 2014 · [Details](#)



**EPA Air Quality** @EPAAirQuality · Jan 27

In Dublin, smoke from the Ballymount fire may lead to poor air quality in local areas. Health advice at [airquality.epa.ie](http://airquality.epa.ie)

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FAVORITE

1



6:21 PM - 27 Jan 2014 · [Details](#)



**EPA Air Quality** @EPAAirQuality · Jan 28

Smoke emissions continuing from fire on Ballymount Road. If in an affected area, follow the health advice at [airquality.epa.ie](http://airquality.epa.ie)

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10:22 AM - 28 Jan 2014 · [Details](#)



**EPA Air Quality** @EPAAirQuality · Jan 28

Tues 10am: Air Quality Index for Health indicates air quality is GOOD in all regions. [airquality.epa.ie](http://airquality.epa.ie)

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10:27 AM - 28 Jan 2014 · [Details](#)



**EPA Air Quality** @EPAAirQuality · Jan 28

In Dublin, smoke from Ballymount fire may cause poor air quality in local areas today (28/01/2014). Health advice [airquality.epa.ie](http://airquality.epa.ie)

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RETWEET

1



11:41 AM - 28 Jan 2014 · Details



**EPA Air Quality** @EPAAirQuality · Jan 29

Smoke levels from Ballymount fire are much reduced today but air quality may be poor locally. Follow health advice at [airquality.epa.ie](http://airquality.epa.ie)

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RETWEET

1



10:59 AM - 29 Jan 2014 · Details



**EPA Air Quality** @EPAAirQuality · Jan 29

Wed 5PM: Air Quality Index for Health indicates that air quality is GOOD in all regions [bit.ly/122pU7H](http://bit.ly/122pU7H)

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5:05 PM - 29 Jan 2014 · Details



**EPA Air Quality** @EPAAirQuality · Jan 29

The fire at O'xigen, Ballymount is extinguished. Dublin Fire Brigade have stood down this afternoon.

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5

FAVORITES

3



6:17 PM - 29 Jan 2014 · Details



**EPA Air Quality** @EPAAirQuality · Jan 30

Thu 8AM: Air Quality Index for Health indicates that air quality is GOOD in all regions [bit.ly/122pU7H](http://bit.ly/122pU7H)

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8:05 AM - 30 Jan 2014 · Details

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