

# Preston New Road

April 2018

## Background Air Quality Monitoring

In August 2017 we deployed a Mobile Monitoring Facility (MMF) in the vicinity of Cuadrilla's shale gas exploratory site at Preston New Road, Little Plumpton.

The purpose of carrying out monitoring at this stage is to understand the background level of the types of pollutants that may be detectable before the hydraulic fracturing and well testing stages commence. We will use this information to assess the concentrations of each substance in the environment before contributions are made during the flaring stage of operations. Our monitoring of air quality will continue during these stages to identify any changes. We also carry out a comparison of before, during and after operations for both surface water and groundwater monitoring.

The pollutants that have been measured are oxides of nitrogen ( $\text{NO}_x$ ,  $\text{NO}$ ,  $\text{NO}_2$ ), particulates ( $\text{PM}_{10}$  and  $\text{PM}_{2.5}$ ), methane ( $\text{CH}_4$ ), benzene, toluene, ethylbenzene and m&p-xylene (BTEX), wind speed and wind direction.

This is the fifth report to be produced since we started monitoring air quality. We shall publish subsequent reports to our citizen space page.

Figure 1. Photograph of a Mobile Monitoring Facility



The tables below show levels of pollutants from the 23rd August 2017 up until the 2nd April 2018. The BTEX data is only reported from the 9th September 2017, due to technical problems with the instrument prior to this date.

The TEOM instruments that measure particulate matter were turned off on the 6th March 2018 due to a complaint about noise coming from the monitoring station. This has hopefully now been resolved and particulate data should be available once again in the next report.

## Results

Provisional data for each pollutant, from the 23rd August 2017 until the 2nd April 2018, is shown in a series of time series plots below.

### Particulates

Figure 2 shows the hourly particulate concentrations ( $PM_{10}$  and  $PM_{2.5}$ ) at the monitoring site. The particulate data was collected using TEOM instruments.  $PM_{10}$  data has been adjusted using the King's College London (KCL) Volatile Correction Model (VCM), which allows you to make a small adjustment to TEOM measurements to correct for the loss of volatile components of  $PM_{10}$ . The VCM uses FDMS instrument data from sites within 130km distance of the MMF in order to adjust the  $PM_{10}$  measurements to be comparable with the reference method. There is not currently a validated correction factor for  $PM_{2.5}$  TEOM data.

The AQS has two objectives for  $PM_{10}$ , the first is to limit the annual mean concentration to  $40\mu g/m^3$  and the second objective states that the 24-hour mean (midnight – midnight) must not exceed  $50\mu g/m^3$  on more than 35 occasions during one year.

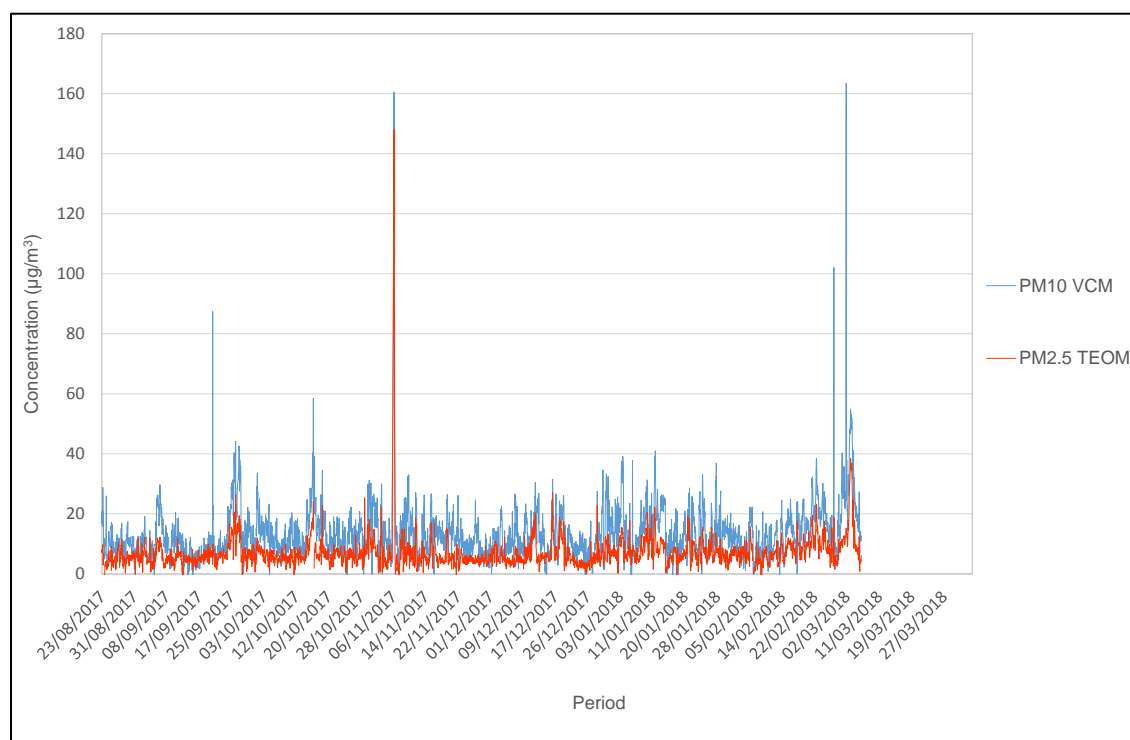
The mean  $PM_{10}$  concentration over the monitoring period at the MMF was  $13.6\mu g/m^3$ . If the assumption is made that the conditions during the monitoring period were representative of a typical year, then the results would indicate that the AQS annual mean objective would not be exceeded at the monitoring site. However, it is important to note that this does not take into account changes in weather conditions or changes to the site operations that might occur outside of the monitoring period.

Figure 3 shows that for  $PM_{10}$  the 24-hour (midnight-midnight) mean concentration at the MMF site was greater than  $50\mu g/m^3$  on 1 day during the monitoring period, the maximum concentration being  $55.4\mu g/m^3$ . This exceedance was the result of the build-up of emissions from bonfire night below the atmospheric boundary layer (see Figure 4). If the assumption is made that the conditions during the monitoring period were representative of a typical year (subject to the limitations mentioned in the paragraph above) then over a year the  $50\mu g/m^3$  level would be exceeded on 2 days and thus the AQS for 24-Hours (midnight-midnight) mean  $PM_{10}$  concentrations would not be exceeded at the monitoring site.

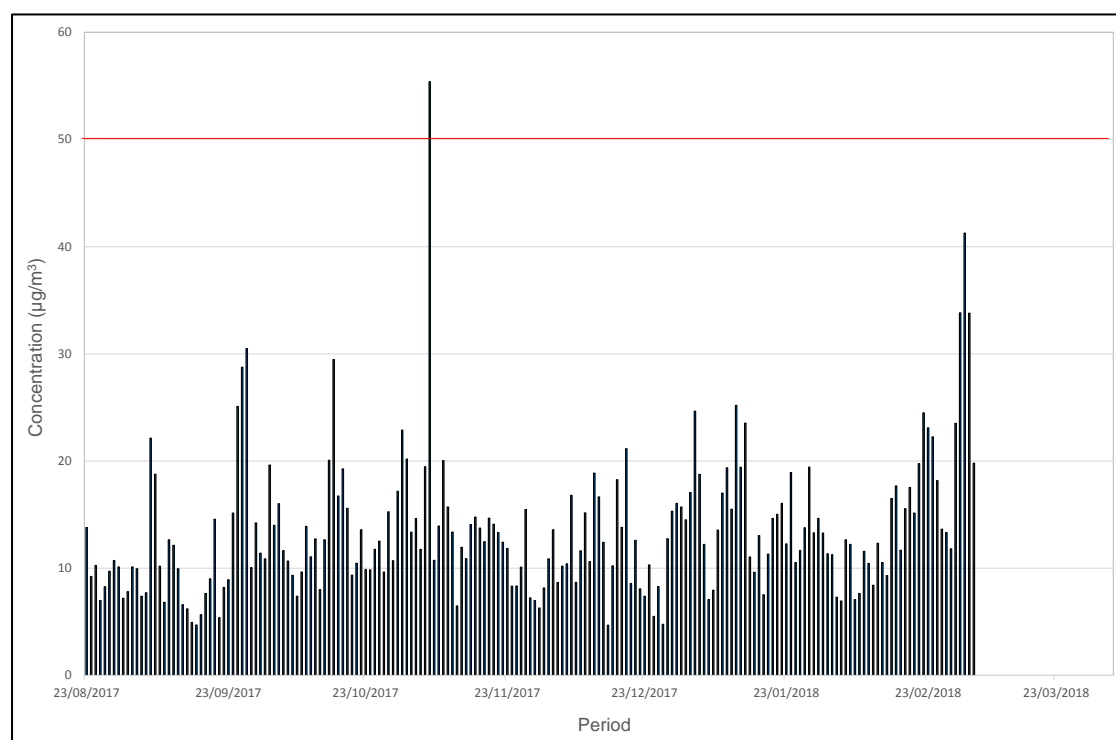
The AQS objective for  $PM_{2.5}$  is an annual mean concentration of  $25\mu g/m^3$ . The mean  $PM_{2.5}$  concentration over the monitoring period at the MMF was  $7.10\mu g/m^3$ . If the assumption is made that the conditions during the monitoring period were representative of a typical year (again subject to the limitations explained above), then the results would indicate that the AQS annual mean objective for  $PM_{2.5}$  would not be exceeded at the monitoring site.

As well as the spike in particulate caused by bonfire night emissions, Figure 2 also shows a spike in the 1-hour  $PM_{10}$  data at the beginning of March. This may be associated with the start of water main works by United Utilities at the entrance to the PNR site. However, the rise in concentrations at this time did not cause an exceedance of the  $PM_{10}$  24-hour AQS and the air quality index for the day in question was still in the low banding.

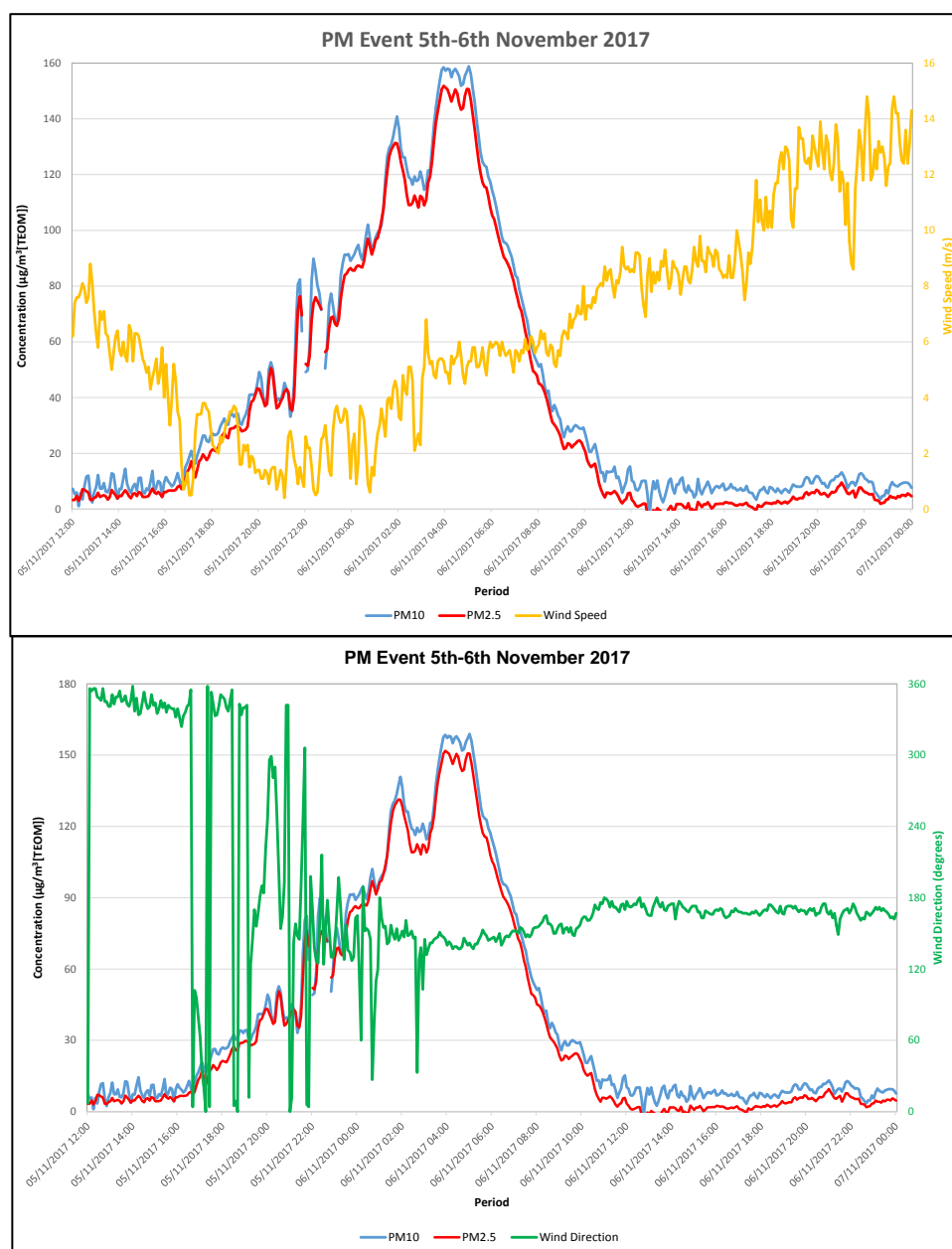
**Figure 2. Time series plot of PM<sub>10</sub> and PM<sub>2.5</sub> 1-Hour Mean Concentrations.**



**Figure 3. 24-hour (midnight-midnight) mean PM<sub>10</sub> concentrations at the monitoring site**



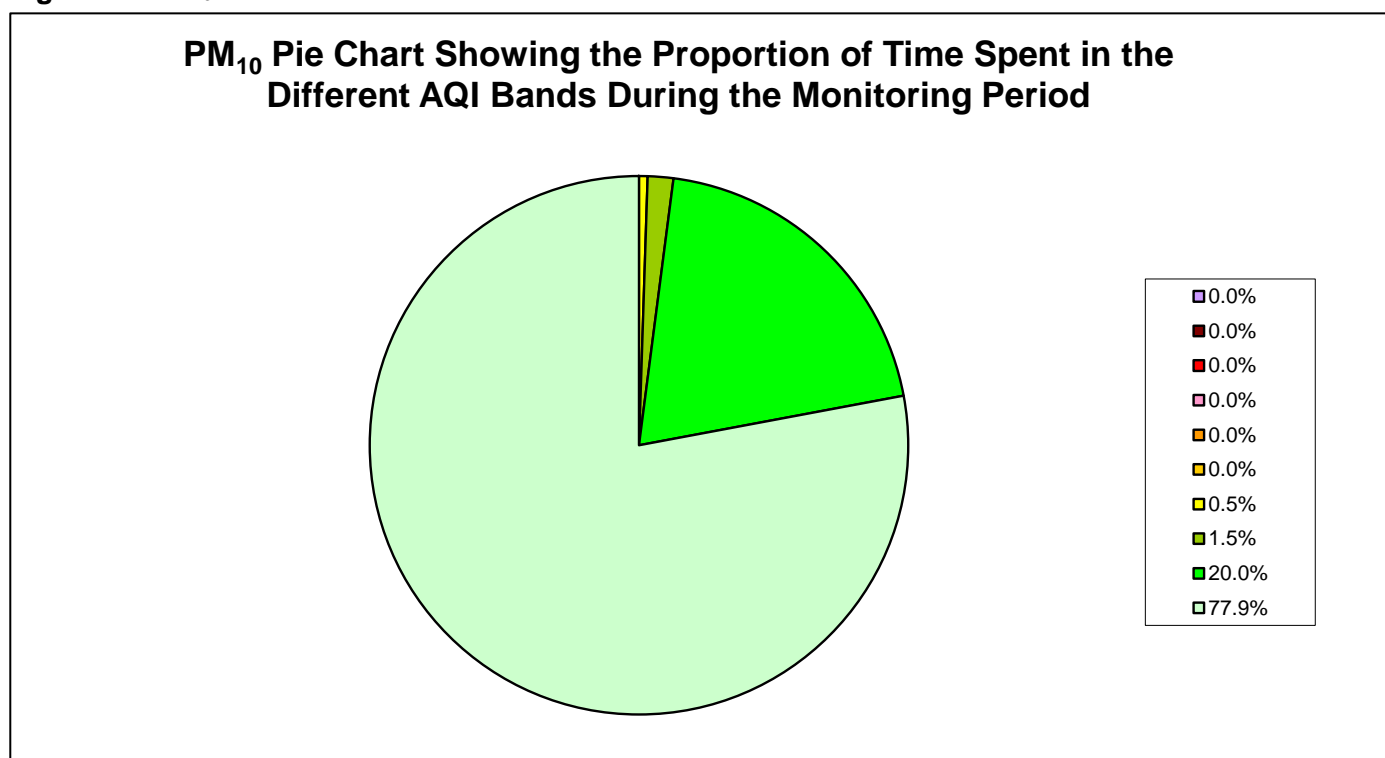
**Figure 4. Comparison of PM<sub>10</sub> and PM<sub>2.5</sub> event on the 5th-6th November 2017 with wind direction (degrees) and wind speed (m/s)**



In the United Kingdom a daily Air Quality Index has been developed. The system uses an index numbered 1-10 (low – high pollution), divided into four bands to provide more detail on a daily basis about air pollution levels to the general population and those at higher risk from air pollution.

Figure 5 looks retrospectively at the daily PM<sub>10</sub> concentrations at the monitoring site in relation to the Air Quality Index banding. The plot shows that PM<sub>10</sub> 24-hour concentrations were all in the low banding at the monitoring site, apart from one day in the moderate banding, which was associated with bonfire night.

**Figure 5. PM<sub>10</sub> AQI Pie Chart.**

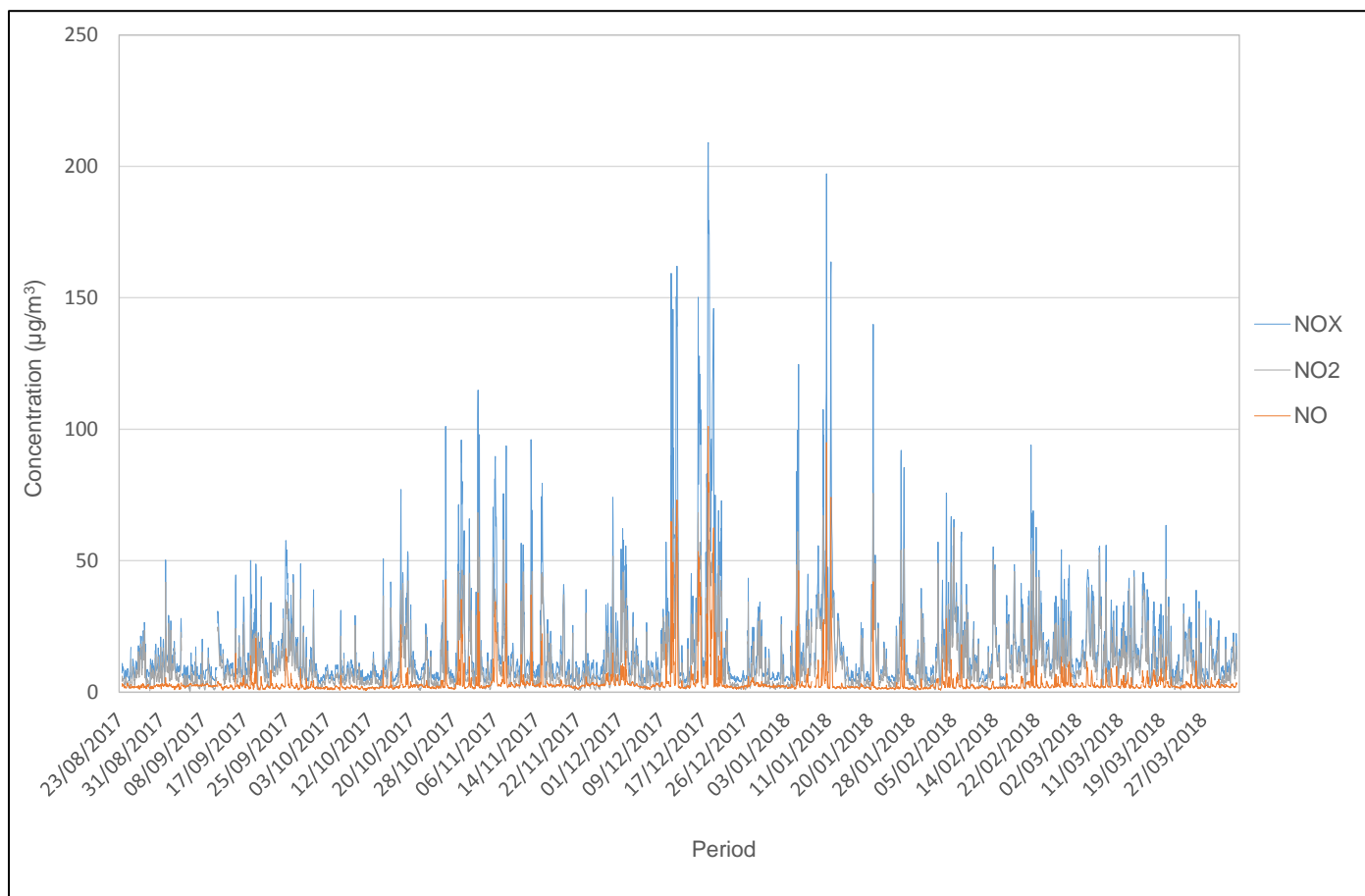


Index Band	10	9	8	7	6	5	4	3	2	1
	Very High	High	High	High	Moderate	Moderate	Moderate	Low	Low	Low
µg/m <sup>3</sup>	101+	92 - 100	84 - 91	76 - 83	67 - 75	59 - 66	51 - 58	34 - 50	17 - 33	0 - 16
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	1.5%	20.0%	77.9%

## Oxides of Nitrogen

Figure 6 shows that levels are relatively low at the monitoring site.

**Figure 6. Time series plot of the oxides of nitrogen 1-Hour Mean Concentrations ( $\mu\text{g}/\text{m}^3$ ).**



While consideration of  $\text{NO}_x$  levels can be more informative when determining the source of pollution, the level of  $\text{NO}_2$  concentration is more important from a human health stand point.  $\text{NO}_2$  is the constituent of  $\text{NO}_x$  that is harmful to health and consequently a National Air Quality Strategy Objective exists for  $\text{NO}_2$  levels.  $\text{NO}_2$  has therefore been considered, in addition to  $\text{NO}_x$ , as it is a pollutant in its own right.

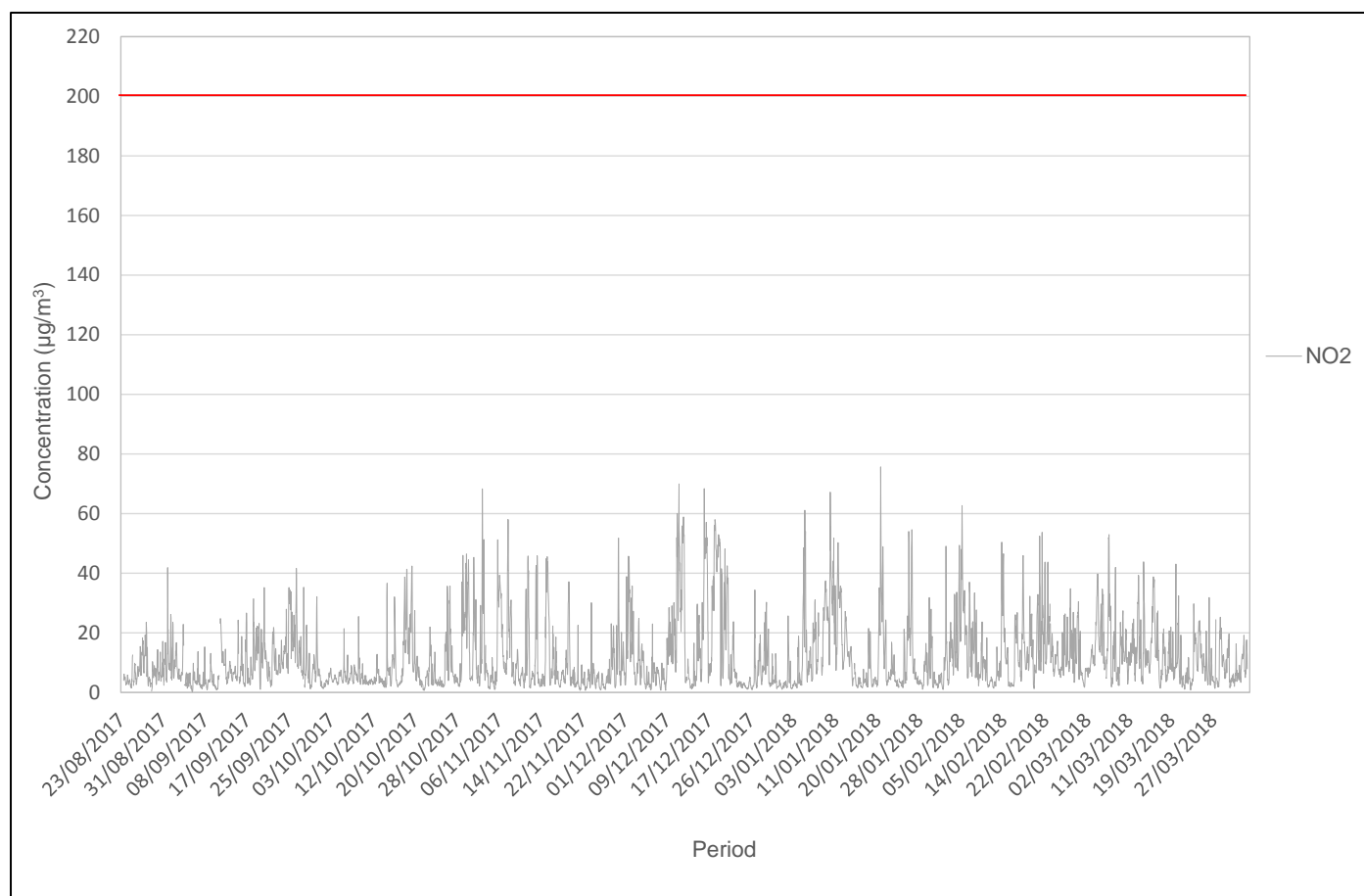
The AQS has objectives for 1-hour mean and annual mean  $\text{NO}_2$  concentrations. The AQS objectives for the 1-hour mean concentrations states that a value of  $200\mu\text{g}/\text{m}^3$  must not be exceeded on more than 18 occasions during one year. A time series plot of 1-hour concentrations of  $\text{NO}_2$  measured at the monitoring site is shown in Figure 7.

The 1-hour  $\text{NO}_2$  concentrations were never greater than  $200\mu\text{g}/\text{m}^3$  during the monitoring period, the maximum concentration being  $75.6\mu\text{g}/\text{m}^3$ . If the assumption is made that the conditions during the monitoring period were representative of a typical year then the AQS for 1-Hour mean  $\text{NO}_2$  concentrations would not be exceeded at the monitoring site.

The annual objective states that an average concentration value of  $40\mu\text{g}/\text{m}^3$  must not be exceeded in one year.

The average  $\text{NO}_2$  concentration over the monitoring period was  $11.4\mu\text{g}/\text{m}^3$ . If the assumption is made that conditions during the monitoring period were representative of a typical year, then the results would indicate that the annual AQS objective for  $\text{NO}_2$  would not be exceeded with the concentrations that existed during the monitoring period.

**Figure 7. Time series plot of nitrogen dioxide ( $\text{NO}_2$ ) 1-Hour Mean Concentrations ( $\mu\text{g}/\text{m}^3$ )**



The AQS objective has an annual standard for  $\text{NO}_x$  of  $30\mu\text{g}/\text{m}^3$ , for the protection of vegetation and ecosystems. The mean  $\text{NO}_x$  concentration during the monitoring period was  $16.8\mu\text{g}/\text{m}^3$ .

In the United Kingdom a daily Air Quality Index has been developed. The system uses an index numbered 1-10 (low – high pollution), divided into four bands to provide more detail on a daily basis about air pollution levels to the general population and those at higher risk from air pollution.

Figure 8 looks retrospectively at the daily  $\text{NO}_2$  concentrations at the monitoring site in relation to the Air Quality Index banding. The figure shows that during the monitoring period the  $\text{NO}_2$  1-hour concentrations remained in the low banding of the Air Quality Index.

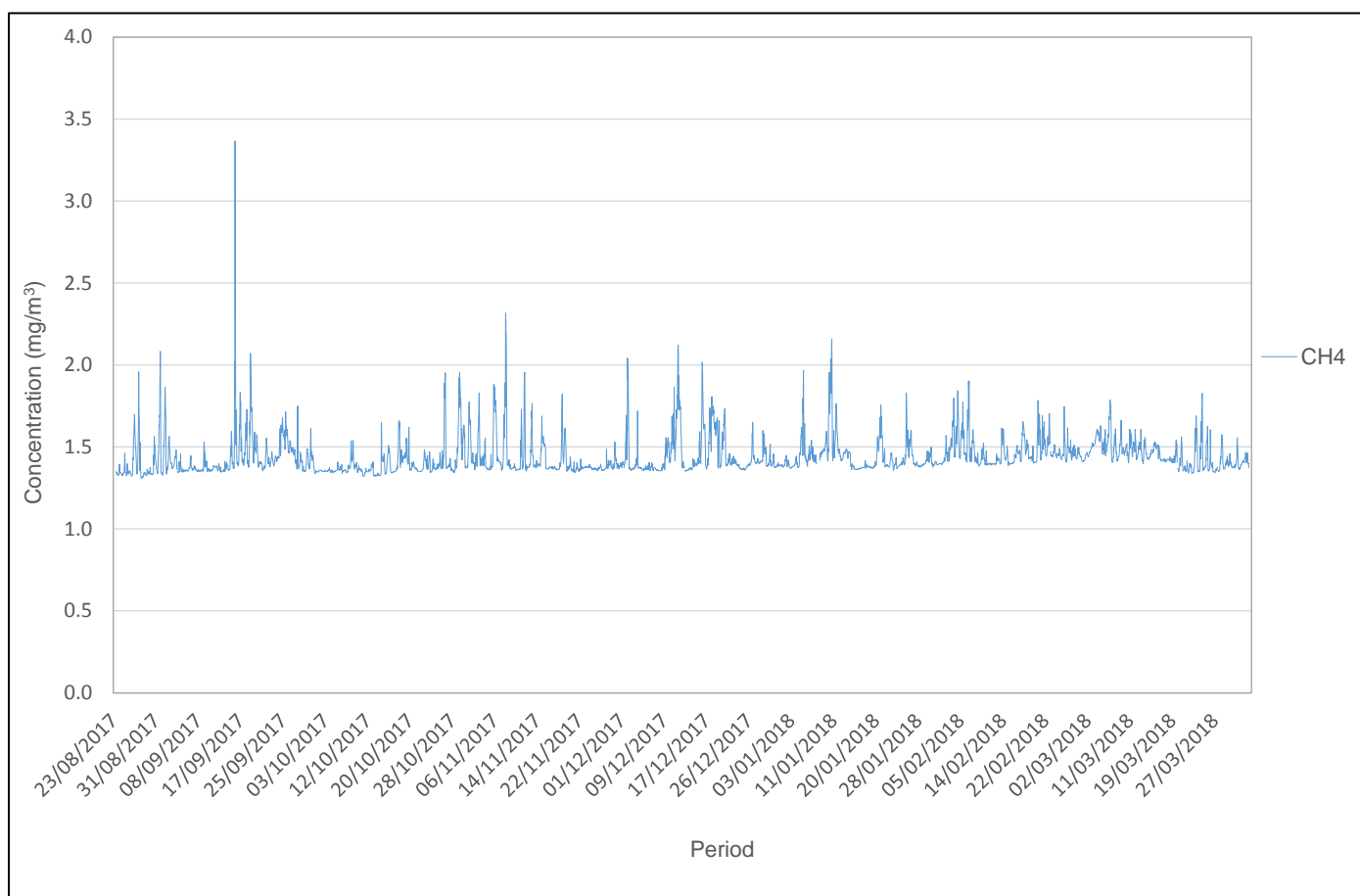




## Methane

Figure 9 shows that the CH<sub>4</sub> levels are relatively low at the monitoring site. The average CH<sub>4</sub> concentration during this period was 1.44mg/m<sup>3</sup>.

**Figure 9. Time series plot of the methane (CH<sub>4</sub>) 1-Hour Mean Concentrations (mg/m<sup>3</sup>).**



## BTEX

Figure 10 shows that the BTEX levels are relatively low at the monitoring site. Table 1 shows the average concentration of each of the BTEX during the monitoring period. The build-up of emissions from bonfire night is also evident in the BTEX data, especially in the benzene data, where the hourly average benzene concentration was 7.83µg/m<sup>3</sup> at 05:00 on the 6th November. This corresponds with the peak in particulate concentrations.

Benzene is the only BTEX recorded at the monitoring site that has an AQS. The AQS objective for benzene is expressed as an annual mean and is currently set at 5ug/m<sup>3</sup>. The mean benzene concentration over the monitoring period was at 0.39ug/m<sup>3</sup>. If the assumption is made that conditions during the monitoring period were representative of a typical year, then the results would indicate that the annual AQS objective for benzene would not be exceeded with the concentrations that existed during the monitoring period.

**Table 1. Average BTEX concentrations ( $\mu\text{g}/\text{m}^3$ )**

VOC	Average ( $\mu\text{g}/\text{m}^3$ )
Benzene	0.39
Toluene	0.72
Ethylbenzene	0.26
m&p-Xylene	0.97

**Figure 10. Time series plot of the BTEX 1-Hour Mean Concentrations ( $\mu\text{g}/\text{m}^3$ ).**

