2020 Air Quality Annual Status Report (ASR)

In fulfilment of Part IV of the Environment Act 1995 Local Air Quality Management

November 2020

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Executive Summary: Air Quality in Our Area

Air Quality in Knowsley Council Area

Air pollution is associated with a number of adverse health impacts. It is recognised as a contributing factor in the onset of heart disease and cancer. Additionally, air pollution particularly affects the most vulnerable in society: children and older people, and those with heart and lung conditions. There is also often a strong correlation with equalities issues, because areas with poor air quality are also often the less affluent areas[1,2].

The annual health cost to society of the impacts of particulate matter alone in the UK is estimated to be around £16 billion[3].

Local monitoring data, the planning system, traffic information and control of industries by Environmental Permits have been utilised so that there is a continuing examination of the local air quality to ensure that all Air Quality Objectives (AQO) set by the Government are met.

The main sources of air pollution in Knowsley, as identified from previous air quality review and assessments and the work carried out in the Merseyside Atmospheric Emissions Inventory, are from road traffic vehicle emissions and from industrial sources. Knowsley is home to a wide range of industrial and commercial developments and is an important location for employment in the Liverpool City Region. The borough has large industrial bases concentrated mainly on Knowsley Business Park, situated in Kirkby and the Huyton, Kings and Prescot Business Parks situated in the centre of the borough, and Jaguar Land Rover car plant in Halewood. Neighbouring authorities also house large industries that can have an impact on the air quality in Knowsley. For example, Fiddlers Ferry power station in Warrington lies to the south of the borough, the Shell oil refinery and petro-chemical complex in Ellesmere Port lie to the south west of Knowsley as well as major glass manufacturing sites in St Helens.

Traffic movements within the borough also play a significant role when considering air quality. Knowsley has a variety of road communication links. The M57 is the 'backbone' of the Borough, running North West to South East. The M62 and A580

[1] Environmental equity, air quality, socioeconomic status and respiratory health, 2010
[2] Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006
[3] Defra. Abatement cost guidance for valuing changes in air quality, May 2013

(East Lancashire Road) link with the M57 and cut through the Borough East to West. The A5300 acts as the southerly extension of the M57. The motorway and main A-roads are connected via a network of smaller roads, which link towns and villages in the Borough.

The Council's background urban air quality monitoring site in Kirkby, which operated from 2008–2017, demonstrated long term compliance with the air quality objectives and so monitoring here was ceased in favour of monitoring at different locations.

In 2019, Knowsley Council installed an air quality monitoring station at the junction of County Road and Old Rough Lane in Kirkby, in addition to those already operating at Cronton Road, Huyton and Higher Road, Halewood. The new location was selected due to the volume of traffic using the road network. Sensitive receptors include the nearby residential dwellings and a high school. The junction is also an access point for people walking into the town centre.

For reporting purposes the Huyton and Halewood stations monitor nitrogen dioxide and particulate matter (PM_{10} and $PM_{2.5}$) levels, whilst the Kirkby station monitors nitrogen dioxide and PM_{10} levels.

The 2019 Huyton AQMS results, when compared to 2018, showed similar levels for NO_2 and $PM_{10,}$ and a slight increase in $PM_{2.5.}$ The area of concern in Huyton showed a slight reduction in nitrogen dioxide.

Halewood AQMS results, when compared to 2018, showed a decrease in nitrogen dioxide, whilst both PM10 and PM2.5 showed similar levels.

In 2019, Knowsley Council also extended their nitrogen dioxide diffusion tube programme and a further 20 sites are now monitored, bringing the total to 32 sites covering Huyton, Kirkby and Prescot.

Knowsley Council continues to work with other Liverpool City Region authorities, Merseytravel, Environment Agency and other partners to improve air quality within the borough. A Liverpool City Region Combined Authority Air Quality Group has been created to identify opportunities in the Liverpool City Region (LCR) to improve air quality, and achieve associated benefits to health and well-being, whilst supporting regional growth and development aspirations.

Actions to Improve Air Quality

Key completed measures in Knowsley are:

- Air Quality Steering Group meetings.
- The production of the Annual Status Report 2020.
- Diffusion tube monitoring began at 20 new sites (in Prescot and Kirkby), selected as part of the extension of the Knowsley air quality monitoring network.
- An air quality monitoring station is now operating in Kirkby (at a different site to that previously monitored).
- Worked within the planning system to help embed the role of air quality in sustainable development.
- Worked closely with neighbouring authorities and other partner agencies.
- City Region Air Quality website developed

  https://www.liverpoolcityregion-ca.gov.uk/tag/air-quality/
- Construction of cycle ways / walkways in the borough.
- Road junction improvements at Hall Lane and County Road, Kirkby and the M57 Junction 6

Conclusions and Priorities

From 2016, two continuous roadside monitors for nitrogen dioxide and particulate matter were installed in Huyton and Halewood.

From 2019, a continuous roadside monitor was installed in Kirkby to monitor nitrogen dioxide and particulate matter.

All three continuous monitoring sites demonstrated compliance with the air quality objectives, for both nitrogen dioxide and particulate matter in 2019.

Out of the 32 diffusion tube sites, following the bias adjustment of the data, there were 3 sites that exceeded the annual air quality objective (AQO) of 40 ug/m^3 for nitrogen dioxide. However, following the application of the Bureau Veritas nitrogen dioxide fall off with distance calculator to the 3 sites, they all demonstrated that the nitrogen dioxide level was below the AQO.

Priorities;

- Continue to monitor levels of nitrogen dioxide around the area of concern in Huyton.

- Look at ways the Whitefield Lane / Cronton Road junction can be improved as the level of nitrogen dioxide is very close to the annual AQO. Given the number of sites in the Huyton area that are significantly and consistently below the annual AQO we will look to relocate these tubes around the area of concern, in order to try and obtain a better understanding of the NO_2 levels in this specific area.
- Look at producing an AQ Strategy for Knowsley – looking at existing monitoring sites and equipment and evaluating their effectiveness whilst considering the specific monitoring objective required. In doing this, we will also look at incorporating current council policies and link with internal, and external partners who can assist with reducing AQ impact
- Plan to become involved with the National Air Quality Awareness Week in 2021
- Seek any external funding or support available such as grants
- Ensure that air quality is considered as part of ongoing major developments including:
    - **Beacon 62**, Cronton Road, Huyton – a commercial development including new food store, petrol station, drive thru restaurant and coffee shop.
    - **Halsnead Garden Village, off Tarbock Island, M62, Huyton** - the largest combined housing and employment sites in the Liverpool City Region delivering approximately 1,600 homes and at least 22.5ha of employment land.
    - **Land at Greensbridge Lane, Halewood** – Hybrid planning application for the erection of up to 730 dwellings.
    - **Land at Coopers Lane, Kirkby** – Installation of 11 No. 4.5MW gas engines with associated 33KV transformer.
    - **Moss Lane, Kirkby** – Outline planning permission for up to 74,322 m^2 of B1/B2/B8 floorspace.

Challenges;

- Both the Beacon 62 and Halsnead developments are challenging, as both developments are likely to have some impact on the Huyton air quality monitoring site as a result of the increase in traffic.

- Our particulate monitors in Huyton and Halewood are TEOMS, and as part of the data validation process the Volatile Correction Model is used. We have become aware that since early 2020 there are no reference sites we can use within the recommended distance. This therefore means our particulate matter data for 2020 could be invalid. This will be looked into further, advice sought from the LAQM helpdesk, and discussed in the 2021 ASR.
- Knowsley Council faces significant budget cuts from central government and continuing to provide projects and services related to monitoring and improving air quality will be a major challenge.

Local Engagement and How to get Involved

The public can help improve air quality in Knowsley by:

- Reducing the use of cars by, walking, cycling, car-sharing or using public transport instead.
- Considering electric or hybrid vehicles when buying a new car.
- Not leaving vehicles idling. Turn off the engine instead and use the stop start technology in newer vehicles where available.
- Not burning waste on bonfires and only using wood burners with the correct fuels. Dispose of household waste using the waste collection service, recycling centres, or compost garden waste instead.
- Use the Energy Savings Trust website (www.energysavingtrust.org.uk) for advice on saving energy in the home and business.
- Providing responses to planning applications that may impact on air quality, and in doing so this will challenge the applicants at a time when design can change and air quality impacts could be reduced as much as possible.

Further information and live air quality information from Knowsley Council's automatic monitoring site is available from our website:

http://www.knowsley.gov.uk/residents/bins-waste-and-environment/air-quality

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1 Local Air Quality Management

This report provides an overview of air quality in Knowsley during 2019. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents.

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where an exceedance is considered likely the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives. This Annual Status Report (ASR) is an annual requirement showing the strategies employed by Knowsley to improve air quality and any progress that has been made.

The statutory air quality objectives applicable to LAQM in England can be found in Table E.1 in Appendix E.

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority must prepare an Air Quality Action Plan (AQAP) within 12-18 months setting out measures it intends to put in place in pursuit of compliance with the objectives.

Knowsley currently does not have any AMQA's.

Knowsley's 2019 ASR 2nd Version identified an area off concern and discussed the possibility of having to declare an AQMA due to a marginal exceedance of the annual nitrogen dioxide limit of 40 ug/m^3. Our assessment predicted a level of 40.6 ug/m^3 at the receptor on Whitefield Lane. For reference, a map of Knowsley's monitoring locations is available in Appendix D. Map 5 shows the location of the Huyton air quality monitoring station and this is the area where we were looking at declaring an AQMA.

However, following the submission of the 2019 ASR Version 2, Knowsley began to arrange for a detailed assessment to be carried out, to identify if an AQMA was needed, and if it was, the extent of the AQMA. However, whilst obtaining quotes for the detailed assessment, our 2019 results were assessed and the value now seen at this location is 39.5ug/m^3, which is below the AQO. Given the value is now below the limit, the budgetary constraints of the Council and the fact that air quality across the borough has improved due to Covid (due to the reduced number of vehicles on the roads) we do not believe there is a need to declare an AQMA at present. Similarly, in considering the monitoring objectives, along with Box 1.1, and Tables 7.7 and 7.8 of TG16, further monitoring will be planned at additional representative locations nearby to assess the extent of this potential hotspot.

2.2 Progress and Impact of Measures to address Air Quality in Knowsley

Defra's appraisal of last year's ASR concluded

The report is well structured, detailed, and provides the information specified in the Guidance. The following comments are designed to help inform future reports:

1. Comments from last year's appraisal has been included, responded to and acted upon. This is welcomed and benefits the report.

2. The reports highlights areas where exceedances occur and continuation of monitoring is recommended to establish a long-term trend.

   Monitoring has continued in this area.

3. It is encouraging to see the measures put in place by the Council to tackle air quality. Future priorities are also clearly listed in the report.

4. Although, the Council currently has no AQMA and subsequently no AQAP, an action plan table of measures along with their status is recommended. Instruction for the completion of the action plan measures can be found in Table 2.2 in the latest report template.

   As discussed in this report we do not believe we need to declare an AQMA based on our recent results and the anticipated results of 2020 due to the impact of Covid 19. Our strategy is to continue to monitor the nitrogen dioxide levels in the area of concern and also discuss with our Highways team if there are any improvements that can be made to the junction.

5. The trend in NO_2 concentration levels has been presented for automatic stations. However, the report would benefit from a trend graph for the diffusion tube sites as well.

   This has been addressed in this report.

6. Currently, the Council undertakes monitoring around M62/M57 junction and plans to extend monitoring to towns such as Prescot and Kirby, and this decision is welcomed as it will help identify further possible hotspots.

Our monitoring network has been extended and the results are presented in this report.

Knowsley MBC has taken forward a number of direct measures during the current reporting year of 2019 in pursuit of improving local air quality. More detail on these measures can be found in the following documents;

Joint Strategic Needs Assessment (Environment)

This report has been prepared jointly by Knowsley Council and Knowsley Clinical Commissioning Group (CCG) and it is one of a series of reports that contributes to Knowsley's Joint Strategic Needs Assessment (JSNA). Its purpose is to provide an analysis of the environment and related issues in order to address questions such as:

- How much impact do these issues have on local people?
- Can this impact be reduced through local action?
- Can local action reduce health inequalities?
- Will local action on this help address other issues too?

This report, along with others produced as part of the JSNA, will be used to inform strategies and plans produced by the Council and its partners. In particular, the JSNA meets the statutory responsibility that the Council and CCG share to study the needs of local people in order to inform the development of a Joint Health and Wellbeing Strategy. The JSNA is also the main source of intelligence used to develop the Knowsley Partnership's 'Strategy for Knowsley'.

The Sustainable Transport Enhancements Package

The Sustainable Transport Enhancements Package (STEP) is a package of sustainable transport infrastructure measures integral to the Liverpool City Region (LCR) Growth Plan and Strategic Economic Plan (SEP). Although in its infancy, investment in STEP will be shaped around four interrelated strategic packages of works. These align with those set out in the SEP Investment Pipeline for the City Region and are as follows;

- Transport Investment for Growth;

- Sustainable Access to Employment and Opportunity;
- Transport and Low Carbon Opportunities; and
- Travel for the Visitor Economy.

Investment will be directed into seven Growth Zones, which align with the key areas for investment and development across the City Region, based on the growth sites identified in the SEP. The Environmental Impact Assessment concludes there is likely to be a slight beneficial impact on local and regional air quality as a result of the scheme.

As part of the Liverpool City Region, Knowsley will also contribute to regional initiatives to improve air quality. A preliminary options study of various air quality intervention has been prepared by AECOM in consultation with Merseytravel and the LCR Combined Authority and was published in March 2018.

Key completed measures in Knowsley are:

- Air Quality Steering Group meetings held.
- The production of the Annual Status Report 2020.
- Diffusion tube monitoring began at 20 new sites (in Prescot and Kirkby), selected as part of the extension of the Knowsley air quality monitoring network.
- An air quality monitoring station is now operating in Kirkby (at a different site to that previously monitored).
- Worked within the planning system to help embed the role of air quality in sustainable development.
- Worked closely with neighbouring authorities and other partner agencies.
- City Region Air Quality website developed https://www.liverpoolcityregion-ca.gov.uk/tag/air-quality/
- City Region Educational website developed https://letscleartheairlcr.co.uk/
- Construction of cycle ways / walkways in the borough.
- Road junction improvements at Hall Lane and County Road, Kirkby and the M57 Junction 6

Knowsley Council expects the following measures to be completed over the course of the next reporting year:

- Continue to monitor levels of nitrogen dioxide around the area of concern in Huyton. Look to relocate diffusion tubes from the Huyton area, that have shown consistent compliance, around the junction of concern to get a better understanding of the NO_2 levels in this area.
- Look at ways Whitefield Lane / Cronton Road junction can be improved.
- Further construction of cycle-way / walk-way schemes in the borough.

The principal challenges and barriers that Knowsley Council anticipates facing, regarding the implementation of projects and services relating to air quality, include significant budget cuts from central government. It is also evident that there will be a significant increase in the number of new housing and commercial developments within the borough. These include Sustainable Urban Extensions (SUE) which will increase the urban area of the borough at the cost of rural land. The associated increase in road traffic is likely to have a negative impact on air quality, however the extent of impact will need to be assessed via the planning system.

2.3 $PM_{2.5}$ – Local Authority Approach to Reducing Emissions and/or Concentrations

As detailed in Policy Guidance LAQM.PG16 (Chapter 7), local authorities are expected to work towards reducing emissions and/or concentrations of $PM_{2.5}$ (particulate matter with an aerodynamic diameter of 2.5µm or less). There is clear evidence that $PM_{2.5}$ has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases.

One of the biggest health burdens is understood to be from long-term exposure to particulate air pollution. Studies have shown that long-term exposure to air pollution reduces life expectancy by increasing deaths from cardiovascular and respiratory conditions and from lung cancer. The evidence suggests that exposure to fine particulate pollution may be the main cause. The Public Health Outcomes Framework (PHOF) for England reports on a range of indicators for local authorities, including an indicator for air pollution expressed as the fraction of adult mortality attributable to long-term exposure to human-made particulate air pollution. The PHOF allows for the assessment in the importance of air pollution locally, alongside other factors detrimental to public health.

Knowsley Council is taking the following measures to address $PM_{2.5}$:

- It is our intention to continue to monitor $PM_{2.5}$ however, as discussed in the summary of this report we have encountered an issue this year which could impact on the future reporting of our particulate data (both PM_{10} and $PM_{2.5}$) from Huyton and Halewood AQMS's. Our particulate monitors in Huyton and Halewood are TEOMS, and as part of the data validation process the Volatile Correction Model is used. We have become aware that since early 2020 there are no reference sites we can use within the recommended distance. This therefore means our particulate matter data for 2020 could be invalid. We will seek further advice on this from the LAQM Helpdesk and also look into whether or not funding is available to upgrade the equipment.
- Identify developments that could increase $PM_{2.5}$ levels through the planning regime and Environmental Permitting, and where necessary use conditions or enforcement to secure improvements. $PM_{2.5}$ will be a key focus for new planning applications and Environmental Permitting.

- Identify existing measures already in place that can help with reducing levels of $PM_{2.5}$
- The Public Health Outcome Framework for $PM_{2.5}$ is considered as part of Knowsley's JSNA Report. This outcome indicator is the percentage of all-cause death in adults over 30 attributed to small (<2.5 µm) particulate, man-made air pollution. It is a modelled estimate based on the relative risk incurred per 10 $\mu g/m^3$ increase above local average background levels. The attributable fraction in England is 5.4%, whilst for the North West as a whole this is lower, at 4.6%. In Knowsley the attributable fraction is 4.8%.

3 Air Quality Monitoring Data and Comparison with Air Quality Objectives and National Compliance

3.1 Summary of Monitoring Undertaken

Monitoring of the air quality in Knowsley, in 2019, has demonstrated that the results from the continuous monitors we have in Halewood, Huyton and Kirkby are below the AQO for both nitrogen dioxide and particulate matter (PM_{10}).

Diffusion Tubes

Out of the 32 diffusion tube sites there were two sites in Huyton (H2 and H3) and 1 site in Kirkby (K1) showing levels of nitrogen dioxide above the annual AQO, prior to the distance calculation being applied. Once the distance calculation was applied, all results were below the annual AQO (see Table B.1).

3.1.1 Automatic Monitoring Sites

This section sets out what monitoring has taken place and how it compares with objectives.

Knowsley Council undertook automatic (continuous) monitoring at 3 sites during 2019. Table A.1 in Appendix A shows the details of the sites. National monitoring results are available at https://uk-air.defra.gov.uk/

Maps showing the location of the monitoring sites are provided in Appendix D. Further details on how the monitors are calibrated and how the data has been adjusted are included in Appendix C.

3.1.2 Non-Automatic Monitoring Sites

Knowsley Council undertook non- automatic (passive) monitoring of NO_2 at 32 sites during 2019. Table A.2 in Appendix A shows the details of the sites.

Maps showing the location of the monitoring sites are provided in Appendix D. Further details on Quality Assurance/Quality Control (QA/QC) for the diffusion tubes, including bias adjustments and any other adjustments applied (e.g. “annualisation” and/or distance correction), are included in Appendix C.

3.2 Individual Pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for bias[4], "annualisation" (where the data capture falls below 75%), and distance correction[5]. Further details on adjustments are provided in Appendix C.

3.2.1 Nitrogen Dioxide (NO_2)

Table A.3 in Appendix A compares the ratified and adjusted monitored NO_2 annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3. Note that the concentration data presented in Table A.3 represents the concentration at the location of the monitoring site, following the application of bias adjustment and annualisation, as required (i.e. the values are exclusive of any consideration to fall-off with distance adjustment).

For diffusion tubes, the full 2019 dataset of monthly mean values is provided in Appendix B. Note that the concentration data presented in Table B.1 includes distance corrected values, only where relevant.

Table A.4 in Appendix A compares the ratified continuous monitored NO_2 hourly mean concentrations for the past 5 years with the air quality objective of 200µg/m^3, not to be exceeded more than 18 times per year.

No exceedances of the annual objective or hourly mean concentrations were recorded at any of the air quality monitoring stations.

No exceedances of the annual objective was seen in 2019 at the diffusion tube sites, following bias adjustment and after applying the distance calculation. Graphical representation of this can be seen in Figures B2, B3 and B4.

No trend can be determined for Kirkby AQMS given we only have limited data. For Huyton and Halewood the following AQMS trends can be seen:

Halewood – level fluctuates over the 4 years, always below the AQO. Lowest level seen this year.

Huyton – the level has been relatively steady over the 4-year period and below the AQO.

[4] https://laqm.defra.gov.uk/bias-adjustment-factors/bias-adjustment.html
[5] Fall-off with distance correction criteria is provided in paragraph 7.77, LAQM.TG(16)

Huyton diffusion tube trends (see fig A1(b)):

Note – all are below the AQO

Huyton Site Ref	Trend
H1	Steady
H2	Steady
H3	Steady
H4	Increasing
H5	Increasing
H6	Increasing
H7	Increasing
H8	Increasing
H9	Steady
H10	Increasing
H11	Steady
H12	Decreasing

The main change this year compared to last year was the level seen at site H3, Huyton. Last years ASR identified that the level at this site slightly exceeded the annual Air Quality Objective (40.6ug/m^3 compared to an AQO of 40ug/m^3), and we were looking to carry out a detailed assessment. However, after submitting the 2019 ASR, we began to look into carrying out a detailed assessment, to identify if an AQMA was needed, and if it was, the extent of the AQMA. However, whilst in the process of obtaining quotes for the detailed assessment, our latest results were assessed and the value at site H3 was seen to be 39.5ug/m^3, which is below the AQO. Given the value is currently below the limit, the budgetary constraints of the Council and the fact that air quality across the borough has improved due to Covid (due to the reduced number of vehicles on the roads) we do not believe there is a need to declare an AQMA at present. Our intention is to continue with diffusion tube monitoring in this location and look to increase the number of tubes in the area by relocating other tubes that have shown consistent compliance.

Given that we only have one years' worth of data for Prescot and Kirkby diffusion tubes, no trend can be established.

3.2.2 Particulate Matter (PM_{10})

Table A.5 in Appendix A compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3.

Table A.6 in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the past 5 years with the air quality objective of 50µg/m^3, not to be exceeded more than 35 times per year.

No exceedances of the air quality objectives were recorded.

The results from the PM_{10} monitor in Halewood, over the past 4 years, was decreasing for the first 3 years and then in 2019 a slight increase was seen. For all years the level was below the AQO.

The results for the PM_{10} level in Huyton, over the past 4 years has remained below the AQO and relatively steady.

The results for the PM_{10} in Kirkby are below the AQO but are quite high (37.6 ug/m^3 against an AQO of 40 ug/m^3), which is likely to reflect how busy the junction is. This too can be seen as the number of occasions the 24-hour mean was above 50 ug/m^3 was greater than our other two sites, although still significantly below the AQO. The Kirkby PM_{10} data capture was below 75% and therefore the result was annualised. The data capture next year should be much improved and will reflect more accurately the PM_{10} level in the area. This will be reported in the 2021 ASR. Improvements to this road junction have taken place this year and we will continue to monitor PM_{10} levels in this area.

3.2.3 Particulate Matter ($PM_{2.5}$)

Table A.7 in Appendix A presents the ratified and adjusted monitored $PM_{2.5}$ annual mean concentrations for the past 5 years.

Although there is no air quality objective for England, it is noted that the recorded levels are below the EU Air Quality standard (25 µg/m^3) for the two active sites, with both the Huyton and Halewood sites showing similar levels, with only a small variance, over the past 4 years.

Appendix A: Monitoring Results

Table A.1 - Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
Huyton	Cronton Road, Huyton	Roadside	345552	389413	NO2; PM2.5 PM10,	NO	Chemiluminescent, TEOMS	18	2	2
Halewood	Higher Road, Halewood	Roadside	345213	384691	NO2; PM2.5 PM10,	NO	Chemiluminescent, TEOMS	10	2	2
Kirkby (new)	Old Rough Lane, Kirkby	Roadside	341414	398991	NO2; PM2.5 PM10,	NO	BAMS	15	1	2.4
Kirkby (old, not operating)	Briery Hey Avenue, Northwood	Urban Background	345552	433175	PM2.5 PM10,	NO	BAMS	35	16	2.5

Notes:

(1) 0m if the monitoring site is at a location of exposure (e.g. installed on the façade of a residential property).

(2) N/A if not applicable

Table A.2 – Details of Non-Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
H1	Station co-location	Roadside	345552	389413	NO2	NO	3.6	2.2	YES	2.5
H2	Outside 2 Whitefield Lane	Roadside	345537	389407	NO2	NO	1.5	1.2	NO	2.4
H3	Outside1 Whitefield Lane	Kerbside	345563	389399	NO2	NO	2.8	0.8	NO	2.3
H4	Opp Smithford Walk	Roadside	345517	389329	NO2	NO	3.8	1.3	NO	2.4
H5	Sevenoak Grove	Roadside	345676	389366	NO2	NO	1.4	1.5	NO	2.3
H6	Wilson Rd Jct	Roadside	345878	389437	NO2	NO	N/A	2.3	NO	2.4
H7	Tarbock Island	Roadside	345996	389471	NO2	NO	21.0	2.2	NO	2.4
H8	Natruscot	Roadside	345301	389479	NO2	NO	2.5	1.0	NO	2.3
H9	Outside 29 Southford Walk	Suburban	345598	389183	NO2	NO	4.0	0.9	NO	2.3
H10	Outside 9 Ribchester Way	Suburban	345424	389325	NO2	NO	4.9	1.6	NO	2.2
H11	Outside 12 Windy Arbor Brow	Suburban	346329	389782	NO2	NO	3.1	1.9	NO	2.2
H12	Halsnead development	Roadside	346425	389669	NO2	NO	N/A	2.4	NO	2.5
K1	LC056A Junction of M57 and Valley Road.	Roadside	340355	397795	NO2	NO	15.9	1.6	NO	2.4

K2	LC006 Outside Kirkby C of E School, Hall Lane	Roadside	341165	398953	NO2	NO	13.5	6.4	NO	2.4
K3	LC005 outside 12 Hall Drive	Roadside	341317	399000	NO2	NO	8.1	1.6	NO	2.4
K4	LC021 to rear of 12 Brakenhurst Grove	Roadside	341464	398998	NO2	NO	10.1	3.0	NO	2.39
K5	LC091 Junction of Old Rough Lane and County Road	Roadside	341407	398988	NO2	NO	20.3	3.2	NO	2.37
K6	LC085 On County Road near 18 Kelday Close	Roadside	341426	398922	NO2	NO	8.9	1.1	NO	2.4
K7	LC067 Corner of County Road and Webster	Roadside	341581	398650	NO2	NO	6.6	1.4	NO	2.23
K8	LC002 Outside Webster Drive	Roadside	341386	398560	NO2	NO	10.6	1.3	NO	2.24
K9	LC 017 on Cherryfield Drive	Roadside	341387	398504	NO2	NO	5.4	0.9	NO	2.4
K10	Outside 19 Moorgate Road (A5207)	Roadside	342421	397755	NO2	NO	1.4	6.9	NO	2.36
P1	LC227 Near Liverpool Road	Roadside	345796	392654	NO2	NO	6.9	3.5	NO	2.3
P2	LC003 Outside 50 Derby Street	Roadside	346165	392801	NO2	NO	0.6	2.0	NO	2.4
P3	LC014 Adjacent 2 Stanley Crescent	Roadside	346389	392884	NO2	NO	5.6	3.0	NO	2.4
P4	Stop sign on Leyland St	Roadside	346668	392876	NO2	NO	0.6	2.2	NO	2.4

	junction with High St									
P5	LC010 Outside 49 High Street	Roadside	346765	392918	NO2	NO	0.4	1.9	NO	2.4
P6	LC 004 Outside 31 St Helens Road	Roadside	346831	393006	NO2	NO	4.6	1.6	NO	2.4
P7	LC005 Oliver Lyme Road near Tinling Close	Roadside	347115	392724	NO2	NO	4.5	2.7	NO	2.4
P8	LC070 Outside 81 Warrington Road	Roadside	347092	392569	NO2	NO	6.6	1.8	NO	2.4
P9	Traffic signal Outside 53 Kemble Street	Roadside	346788	392648	NO2	NO	0.6	1.3	NO	2.4
P10	LC008 Outside Greenall Court, Sewell Street	Roadside	346583	392611	NO2	NO	2.6	2.8	NO	2.4

Notes:

(1) 0m if the monitoring site is at a location of exposure (e.g. installed on the façade of a residential property).

(2) N/A if not applicable.

Table A.3 – Annual Mean NO_2 Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO_2 Annual Mean Concentration (µg/m^3) (3) (4)				
							2015	2016	2017	2018	2019
Huyton	345552	389413	Roadside	Automatic	94.7	94.7	N/A	38.8	36.2	37.4	37.6
Halewood	345213	384691	Roadside	Automatic	99.4	99.4	N/A	32.3	27.8	30.3	24.3
Kirkby (new)	341414	398991	Roadside	Automatic	82.7	82.7	N/A	N/A	N/A	N/A	24.8
Kirkby (old)	345552	433175	Urban Background	Automatic	0	0	18.7	17.7	N/A	N/A	N/A
H1	345552	389413	Roadside	Diffusion Tube	100	100	N/A	N/A	40	37.5	37.4
H2	345537	389407	Roadside	Diffusion Tube	100	100	N/A	N/A	39.9	**41**	**40.8**
H3	345563	389399	Kerbside	Diffusion Tube	91.7	91.7	N/A	N/A	**47.7**	**49.3**	**48.0**
H4	345517	389329	Roadside	Diffusion Tube	91.7	91.7	N/A	N/A	26.7	29.8	31.4
H5	345676	389366	Roadside	Diffusion Tube	91.7	91.7	N/A	N/A	25.1	26.8	27.4
H6	345878	389437	Roadside	Diffusion Tube	100	100	N/A	N/A	29.2	30	32.1
H7	345996	389471	Roadside	Diffusion Tube	95.8	95.8	N/A	N/A	36.2	36.8	37.2
H8	345301	389479	Roadside	Diffusion Tube	91.7	91.7	N/A	N/A	26.7	26.6	29.3
H9	345598	389183	Suburban	Diffusion Tube	100	100	N/A	N/A	26.3	25	26.4
H10	345424	389325	Suburban	Diffusion Tube	100	100	N/A	N/A	22.9	23.3	23.9
H11	346329	389782	Suburban	Diffusion Tube	100	100	N/A	N/A	28.6	26.4	28.9

H12	346425	389669	Roadside	Diffusion Tube	100	100	N/A	N/A	35.5	33.5	32.8
K1	340355	397795	Roadside	Diffusion Tube	100	100	N/A	N/A	N/A	N/A	**45.4**
K2	341165	398953	Roadside	Diffusion Tube	100	100	N/A	N/A	N/A	N/A	26.9
K3	341317	399000	Roadside	Diffusion Tube	100	100	N/A	N/A	N/A	N/A	25.3
K4	341464	398998	Roadside	Diffusion Tube	75	75	N/A	N/A	N/A	N/A	27.1
K5	341407	398988	Roadside	Diffusion Tube	91.7	91.7	N/A	N/A	N/A	N/A	32.1
K6	341426	398922	Roadside	Diffusion Tube	100	100	N/A	N/A	N/A	N/A	35.3
K7	341581	398650	Roadside	Diffusion Tube	95.8	95.8	N/A	N/A	N/A	N/A	29.6
K8	341386	398560	Roadside	Diffusion Tube	100	100	N/A	N/A	N/A	N/A	32.4
K9	341387	398504	Roadside	Diffusion Tube	79.2	79.2	N/A	N/A	N/A	N/A	29.4
K10	342421	397755	Roadside	Diffusion Tube	100	100	N/A	N/A	N/A	N/A	29.4
P1	345796	392654	Roadside	Diffusion Tube	95.8	95.8	N/A	N/A	N/A	N/A	26.8
P2	346165	392801	Roadside	Diffusion Tube	100	100	N/A	N/A	N/A	N/A	26.9
P3	346389	392884	Roadside	Diffusion Tube	100	100	N/A	N/A	N/A	N/A	29.6
P4	346668	392876	Roadside	Diffusion Tube	100	100	N/A	N/A	N/A	N/A	29.7
P5	346765	392918	Roadside	Diffusion Tube	95.8	95.8	N/A	N/A	N/A	N/A	35.8
P6	346831	393006	Roadside	Diffusion Tube	100	100	N/A	N/A	N/A	N/A	24.7
P7	347115	392724	Roadside	Diffusion Tube	100	100	N/A	N/A	N/A	N/A	24.2

P8	347092	392569	Roadside	Diffusion Tube	100	100	N/A	N/A	N/A	N/A	27.4
P9	346788	392648	Roadside	Diffusion Tube	100	100	N/A	N/A	N/A	N/A	23.5
P10	346583	392611	Roadside	Diffusion Tube	100	100	N/A	N/A	N/A	N/A	24.9

N/A = Not Applicable

☒ **Diffusion tube data has been bias corrected**

☐ **Annualisation has been conducted where data capture is <75%**

☒ **Reported concentrations are those at the location of the monitoring site (bias adjusted and annualised, as required), i.e. prior to any fall-off with distance adjustment**

Notes:

Exceedances of the NO_2 annual mean objective of 40µg/m^3 are shown in **bold**.

NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO_2 1-hour mean objective are shown in **bold and underlined.**

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per Boxes 7.9 and 7.10 in LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

(4) Concentrations are those at the location of monitoring and not those following any fall-off with distance adjustment.

Figure A.1 (a) – Trends in Annual Mean NO_2 Concentrations (continuous monitors)

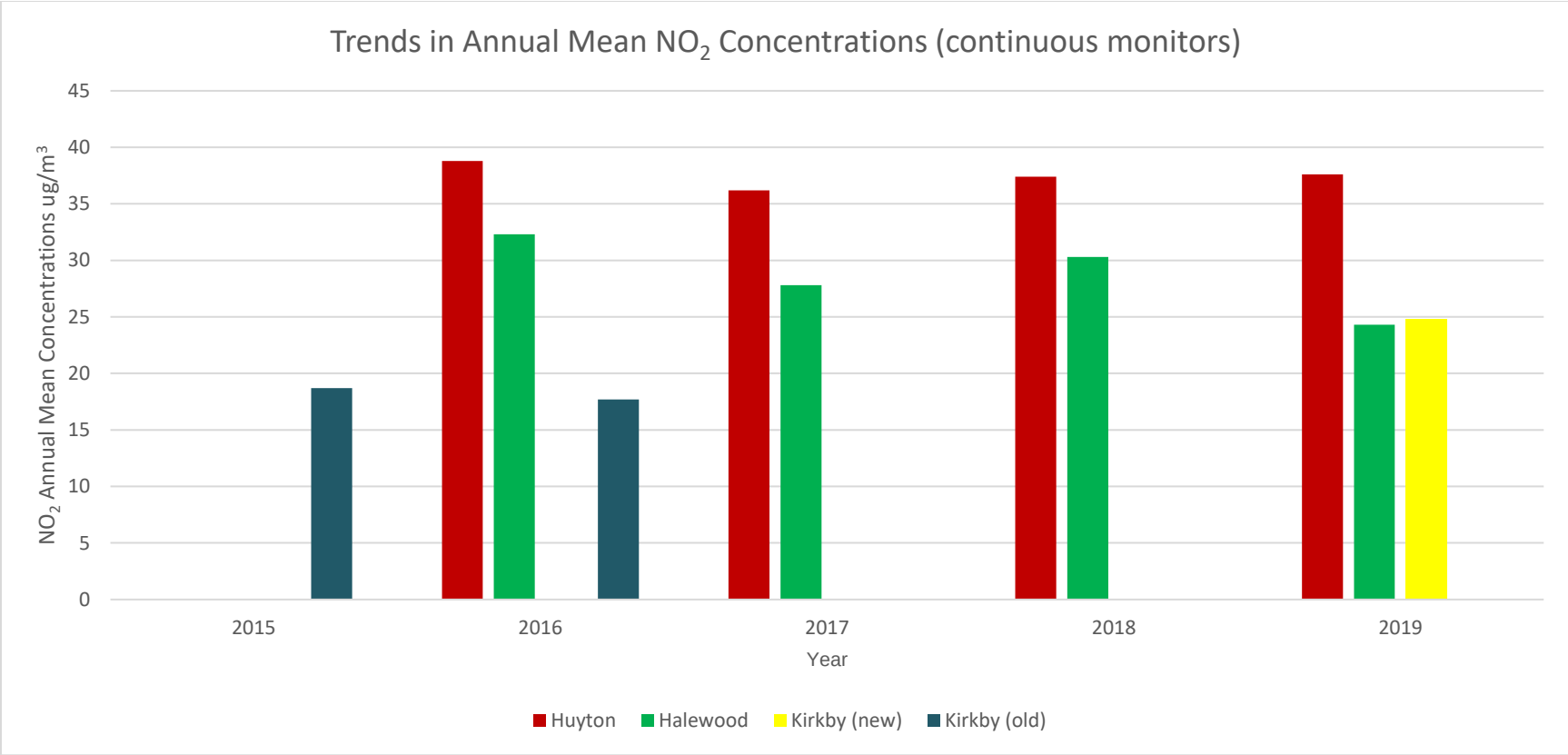


Figure A1 (b). Trends in Annual Mean NO_2 Concentrations (Huyton's diffusion tubes)

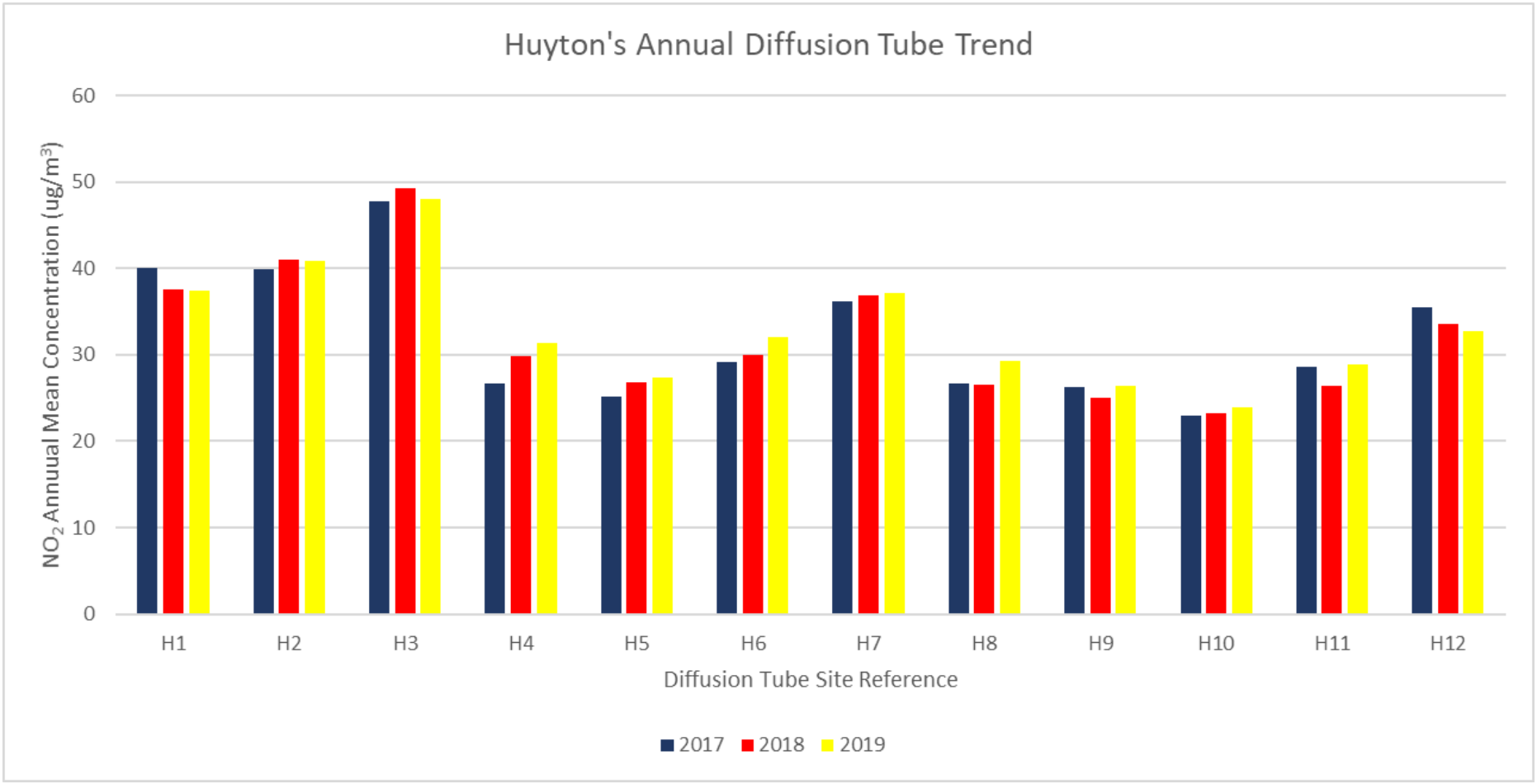


Table A.4 – 1-Hour Mean NO_2 Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3)				
							2015	2016	2017	2018	2019
Huyton	345552	389413	Roadside	Automatic	94.7	94.7	N/A	0(130.4)	0	0	0
Halewood	345213	384691	Roadside	Automatic	99.4	99.4	N/A	0 (117.0)	0	0	0
Kirkby (new)	341414	398991	Roadside	Automatic	98.2	98.2	N/A	N/A	N/A	N/A	0
Kirkby (old)	345552	433175	Urban Background	Automatic	N/A	N/A	0	0 (87.8)	N/A	N/A	N/A

N/A = Not Applicable

Notes:

Exceedances of the NO_2 1-hour mean objective (200µg/m^3 not to be exceeded more than 18 times/year) are shown in **bold.**

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) If the period of valid data is less than 85%, the 99.8th percentile of 1-hour means is provided in brackets.

Table A.5 – Annual Mean PM_{10} Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	PM_{10} Annual Mean Concentration ($\mu g/m^3$) (3)				
						2015	2016	2017	2018	2019
Huyton	345552	389413	Roadside	87.3	87.3	N/A	20	22.5	21.8	22.9
Halewood	345213	384691	Roadside	90.7	90.7	N/A	24.8	20.8	16.8	19.9
Kirkby (new)	341414	398991	Roadside	71.9	71.9	N/A	N/A	N/A	N/A	37.6
Kirkby (old)	345552	433175	Urban Background	N/A	N/A	16.5	17.9	19.6	N/A	N/A

N/A = Not Applicable

☒ **Annualisation, for the new Kirkby station, has been conducted as data capture was <75%**

Notes:

Exceedances of the PM_{10} annual mean objective of $40\mu g/m^3$ are shown in **bold.**

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) All means have been "annualised" as per Boxes 7.9 and 7.10 in LAQM.TG16, valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Figure A.2 – Trends in Annual Mean PM_{10} Concentrations

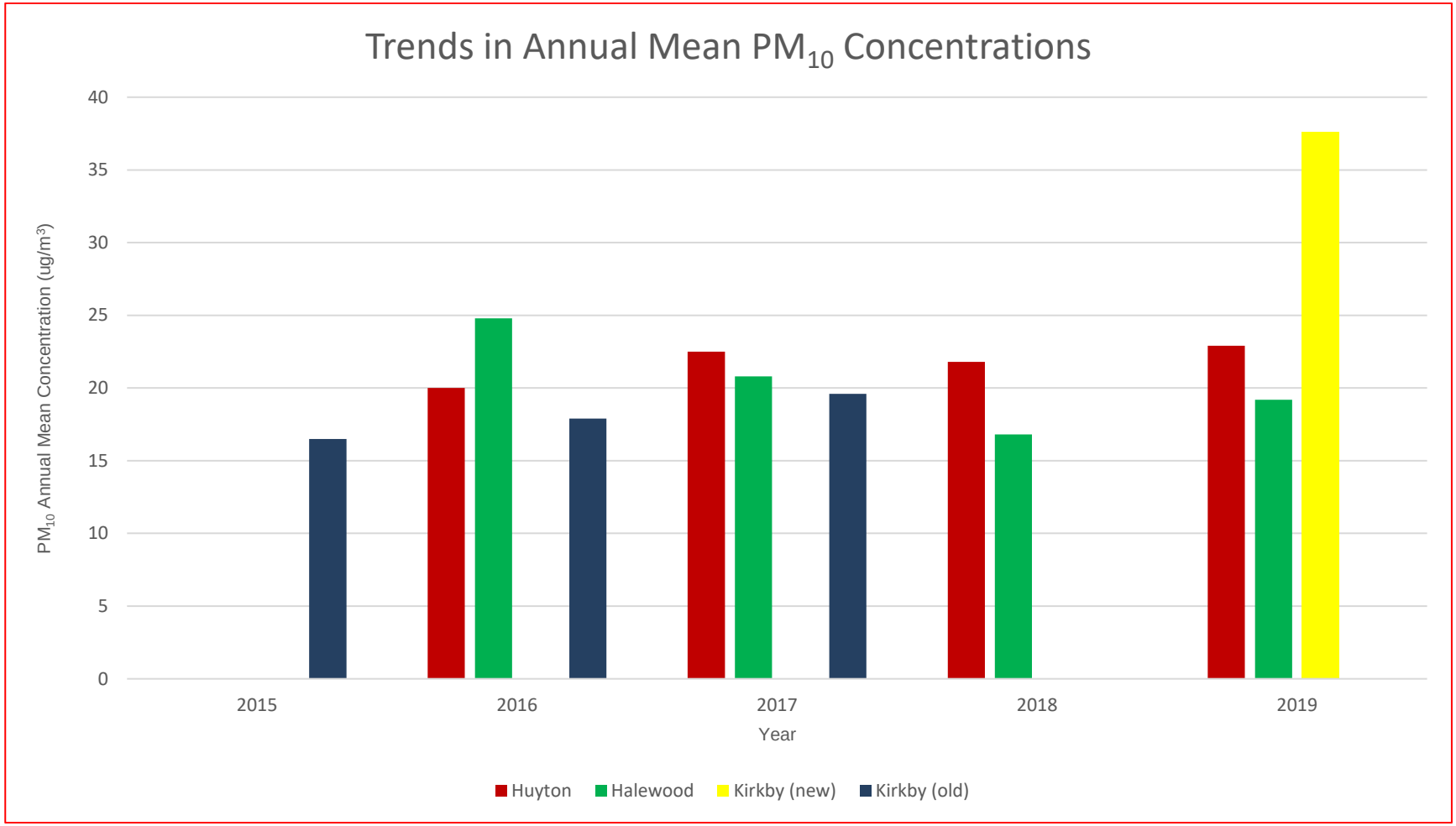


Table A.6 – 24-Hour Mean PM_{10} Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	PM_{10} 24-Hour Means > 50µg/m^3 (3)				
						2015	2016	2017	2018	2019
Huyton	345552	389413	Roadside	94.6	94.6	N/A	2 (32.9)	5	1	2
Halewood	345213	384691	Roadside	90.7	90.7	N/A	8 (43)	5	3	2
Kirkby (new)	341414	398991	Roadside	87.7	87.7	N/A	N/A	N/A	N/A	9
Kirkby (old)	345552	433175	Urban Background	N/A	N/A	4 (30.8)	0	0 (27.5)	N/A	N/A

N/A = Not Applicable

Notes:

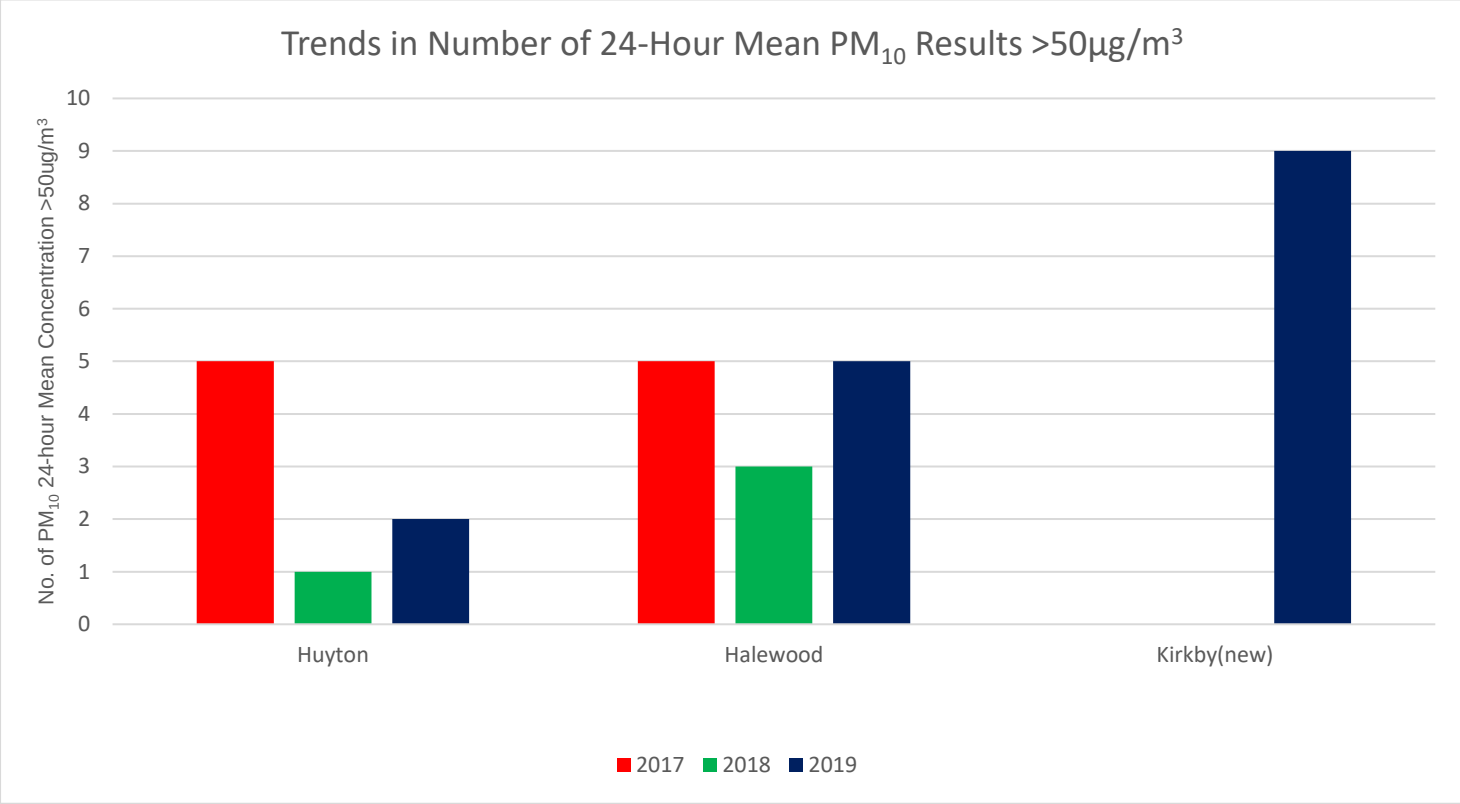
Exceedances of the PM_{10} 24-hour mean objective (50µg/m^3 not to be exceeded more than 35 times/year) are shown in **bold.**

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) If the period of valid data is less than 85%, the 90.4th percentile of 24-hour means is provided in brackets.

Figure A.3 – Trends in Number of 24-Hour Mean PM_{10} Results >50µg/m^3



Please note, the data shown in Figure A.4 is only for the occasions were 50µg/m^3 was exceeded.

Table A.7 – $PM_{2.5}$ Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	$PM_{2.5}$ Annual Mean Concentration (µg/m^3) (3)				
						2015	2016	2017	2018	2019
Huyton	345552	389413	Roadside	98.4	98.4	N/A	10.1	9.5	9.1	10.8
Halewood	345213	384691	Roadside	97.8	97.8	N/A	11.1	8.6	9.2	9.2
Kirkby (old)	345552	433175	Urban Background	N/A	N/A	6.8	10.9	8.4	N/A	N/A

N/A = Not Applicable

☐ **Annualisation has been conducted where data capture is <75%**

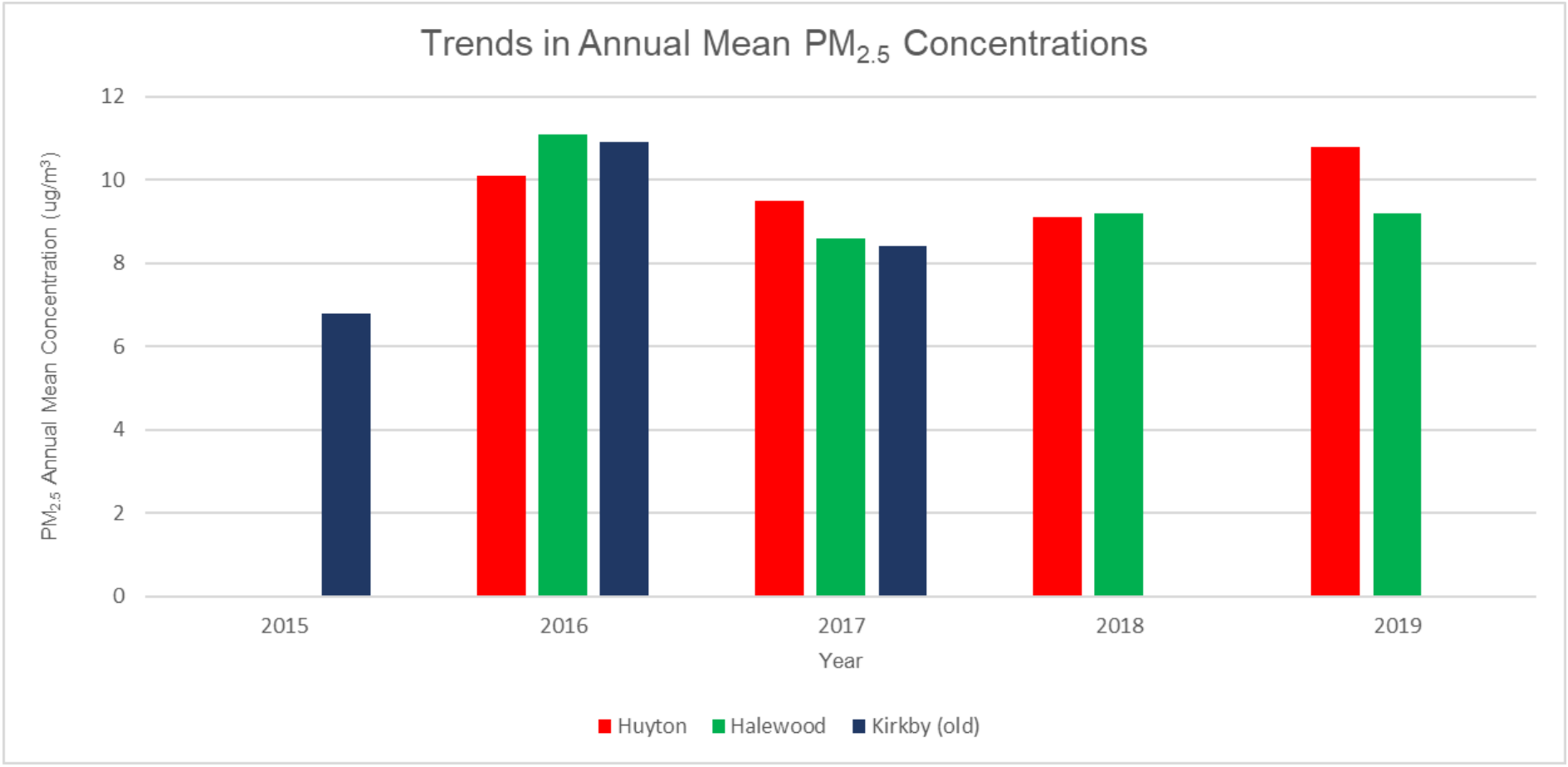
Notes:

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) All means have been "annualised" as per Boxes 7.9 and 7.10 in LAQM.TG16, valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Figure A.4 – Trends in Annual Mean $PM_{2.5}$ Concentrations



Appendix B: Full Monthly Diffusion Tube Results for 2019

Table B.1 - NO_2 Monthly Diffusion Tube Results - 2019

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	NO_2 Mean Concentrations ($\mu g/m^3$)														
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
															Raw Data	Bias Adjusted (0.81) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
H1	345552	389413	57.0	59.7	43.8	52.4	39.9	39.0	38.5	36.1	40.2	45.4	53.5	49.5	46.2	37.4	N/A
H2	345537	389407	55.5	60.6	42.5	59.9	42.5	47.6	38.6	36.3	46.7	53.7	69.8	50.7	50.3	**40.8**	37.0
H3	345563	389399	63.5	66.1	52.5	69.1	54.6	58.9	46.8	ND	50.8	57.9	72.8	59.3	59.3	**48.0**	39.5
H4	345517	389329	42.4	48.8	30.3	47.7	30.6	28.6	ND	24.9	34.6	40.5	57.2	40.5	38.7	31.4	N/A
H5	345676	389366	43.1	37.3	27.8	36.9	29.6	29.5	26.0	ND	32.3	32.9	45.6	31.2	33.8	27.4	N/A
H6	345878	389437	45.4	47.4	28.3	51.1	32.5	32.2	26.2	26.7	37.1	45.8	62.3	40.5	39.6	32.1	N/A
H7	345996	389471	52.0	57.2	38.1	54.9	38.4	38.6	35.8	27.2	43.9	52.8	56.3	56.1	45.9	37.2	N/A
H8	345301	389479	46.9	40.5	29.6	42.3	28.0	26.2	ND	22.1	30.3	38.4	56.8	37.9	36.2	29.3	N/A
H9	345598	389183	42.2	43.4	26.1	35.0	24.1	26.3	22.6	24.5	29.3	36.4	45.7	36.3	32.6	26.4	N/A
H10	345424	389325	39.3	39.3	24.2	32.2	21.6	22.7	18.5	20.0	24.9	32.9	44.1	34.7	29.5	23.9	N/A
H11	346329	389782	51.3	47.4	46.3	30.7	28.9	24.9	26.0	29.5	28.6	33.6	40.3	41.6	35.7	28.9	N/A
H12	346425	389669	48.4	50.1	41.4	32.9	38.4	33.8	36.5	36.0	36.5	38.6	48.6	44.5	40.5	32.8	N/A
K1	340355	397795	63.5	74.6	56.0	48.9	51.0	48.0	47.8	49.1	50.9	58.6	59.0	65.3	56.0	**45.4**	30.3
K2	341165	398953	40.1	47.6	23.5	40.3	23.8	24.0	21.0	22.3	29.6	40.3	45.3	41.4	33.2	26.9	N/A

K3	341317	399000	38.1	43.0	21.1	35.4	21.5	22.5	20.1	21.6	28.7	38.0	43.7	42.1	31.3	25.3	N/A
K4	341464	398998	53.1	49.1	34.5	38.2	ND	33.1	ND	30.1	36.5	43.2	51.0	33.1	40.2	32.5	N/A
K5	341407	398988	53.3	41.7	ND	39.6	38.9	37.4	37.8	35.4	43.0	49.3	48.2	52.1	43.3	35.1	N/A
K6	341426	398922	52.3	53.3	39.8	35.9	39.5	35.1	35.5	33.1	44.7	47.8	58.2	47.9	43.6	35.3	N/A
K7	341581	398650	50.8	45.7	28.5	36.9	25.7	29.7	24.7	23.9	34.2	41.4	53.7	43.3	36.5	29.6	N/A
K8	341386	398560	49.0	57.8	33.4	39.0	22.8	33.1	29.9	31.1	38.9	46.0	53.1	45.9	40.0	32.4	N/A
K9	341387	398504	52.0	ND	43.0	39.5	38.5	40.5	38.3	35.0	44.0	48.3	56.6	ND	43.5	35.3	N/A
K10	342421	397755	46.9	48.7	26.4	44.0	28.9	28.1	24.0	22.2	33.4	40.5	50.8	41.3	36.2	29.4	N/A
P1	345796	392654	39.4	41.0	37.3	32.8	27.8	28.9	26.3	27.0	32.4	35.4	47.1	21.3	33.0	26.8	N/A
P2	346165	392801	44.1	38.6	31.1	31.4	27.9	27.9	25.0	23.9	30.3	36.0	47.0	36.1	33.3	26.9	N/A
P3	346389	392884	43.5	46.5	31.6	39.2	27.7	27.3	27.6	29.7	34.1	41.8	43.3	45.9	36.5	29.6	N/A
P4	346668	392876	43.4	41.2	36.5	35.9	32.8	32.6	31.9	30.6	35.6	34.4	48.5	37.1	36.7	29.7	N/A
P5	346765	392918	51.8	47.1	44.3	42.6	38.1	40.0	36.9	35.1	44.8	48.3	55.0	47.0	44.2	35.8	N/A
P6	346831	393006	39.4	40.1	26.2	26.2	22.0	23.9	20.7	19.6	29.5	33.5	46.6	38.4	30.5	24.7	N/A
P7	347115	392724	37.9	37.1	23.8	32.8	22.4	23.0	20.2	20.4	27.4	33.6	43.6	36.7	29.9	24.2	N/A
P8	347092	392569	42.8	43.1	29.8	29.0	27.0	27.3	26.4	26.2	30.9	38.9	44.5	40.8	33.9	27.4	N/A
P9	346788	392648	39.1	33.0	26.1	28.9	23.1	24.3	20.6	19.3	28.2	32.0	41.4	31.7	29.0	23.5	N/A
P10	346583	392611	38.7	38.3	27.1	28.6	22.0	25.3	22.0	21.8	32.2	34.3	42.6	36.3	30.7	24.9	N/A

***** Distance to relevant exposure is not applicable. ND = No Data N/A = Not Applicable

☒ **Local bias adjustment factor used** ☐ **National bias adjustment factor used** ☐ **Annualisation has been conducted where data capture is <75%**

☒ **Where applicable, data has been distance corrected for relevant exposure in the final column**

Notes: Exceedances of the NO_2 annual mean objective of 40µg/m^3 are shown in **bold**.

NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO_2 1-hour mean objective are shown in **bold and underlined.**

(1) See Appendix C for details on bias adjustment and annualisation.

(2) Distance corrected to nearest relevant public exposure.

Figure B.1: Bureau Veritas NO2 fall off with distance calculator

Enter data into the pink cells

Site Name/ID	Distance (m)		NO_2 Annual Mean Concentration ($\mu g/m^3$)			Comment
	Monitoring Site to Kerb	Receptor to Kerb	Background	Monitored at Site	Predicted at Receptor	
H2	1.2	2.7	18.7	40.8	*37.0*	Predicted concentration at Receptor within 10% the AQS objective.
H3	0.8	3.6	18.7	48.0	*39.5*	Predicted concentration at Receptor within 10% the AQS objective.
K1	1.6	17.5	17.0	45.4	30.3	

Table B.2: Huyton's annual nitrogen dioxide diffusion tube data – following annualisation (where required), bias adjustment and distance calculation

Note: Only sites with 2 or more years data have been included

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Annual NO_2 Mean Concentrations ($\mu g/m^3$)		
			2017[1]	2018	2019
H1	345552	389413	40	37.5	37.4
H2	345537	389407	39.9	38.4[2]	37.0[2]
H3	345563	389399	40.2[2]	41.7[2]	39.5[2]
H4	345517	389329	26.7	29.8	31.4
H5	345676	389366	25.1	26.8	27.4
H6	345878	389437	29.2	30.0	32.1
H7	345996	389471	36.2	36.8	37.2
H8	345301	389479	26.7	26.6	29.3
H9	345598	389183	26.3	25	26.4
H10	345424	389325	22.9	23.3	23.9
H11	346329	389782	28.6	26.4	28.9
H12	346425	389669	35.5	33.5	32.8

[1] = data has been annualised
[2] = distance correction applied

Figure B.2: Trend in Huyton's annual mean nitrogen dioxide diffusion tube data – following annualisation (where required), bias adjustment and distance calculation

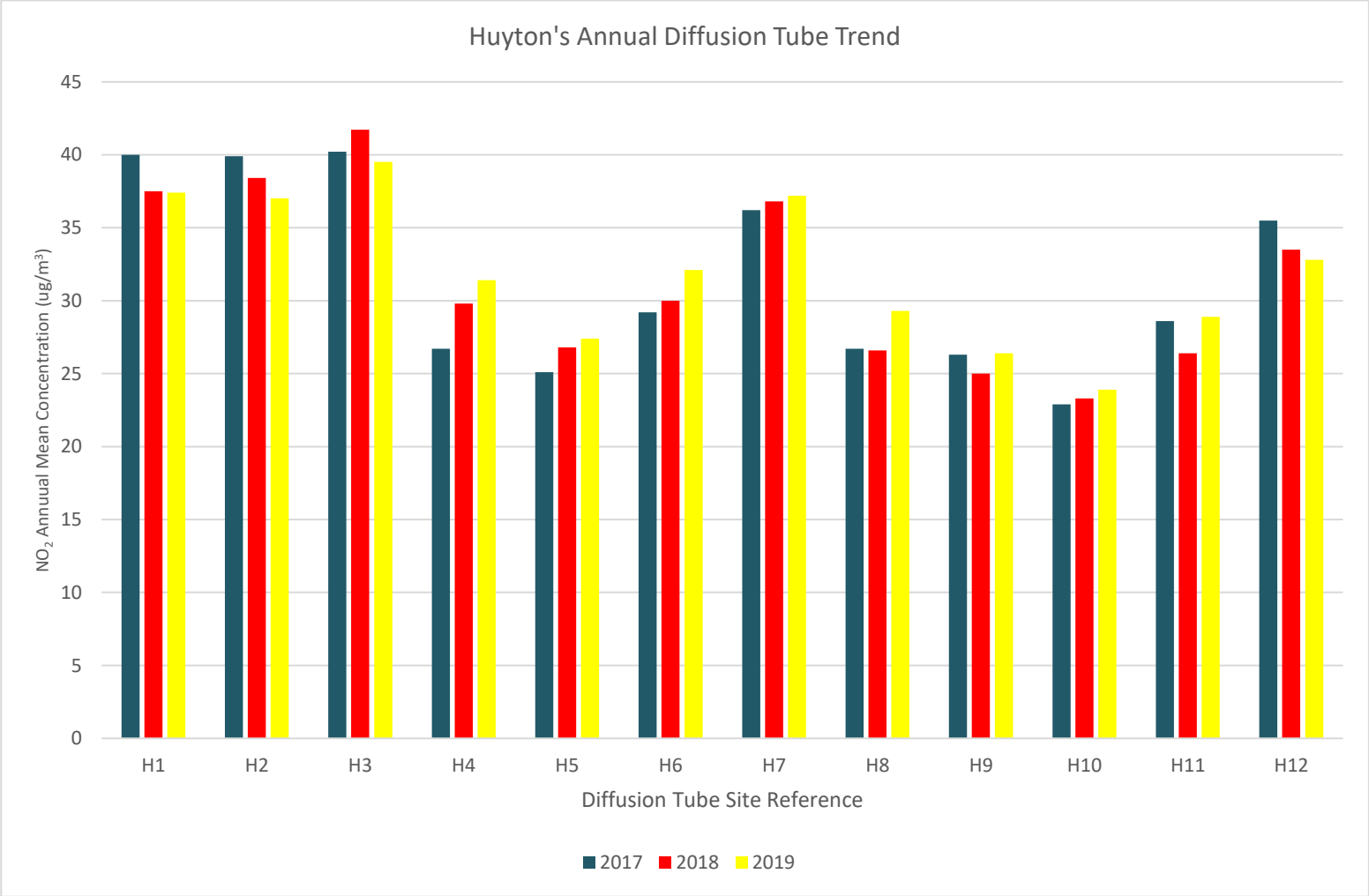


Figure B.3: Kirkby's annual mean nitrogen dioxide diffusion tube data

Note: All data has been bias adjusted and distance corrected were required.

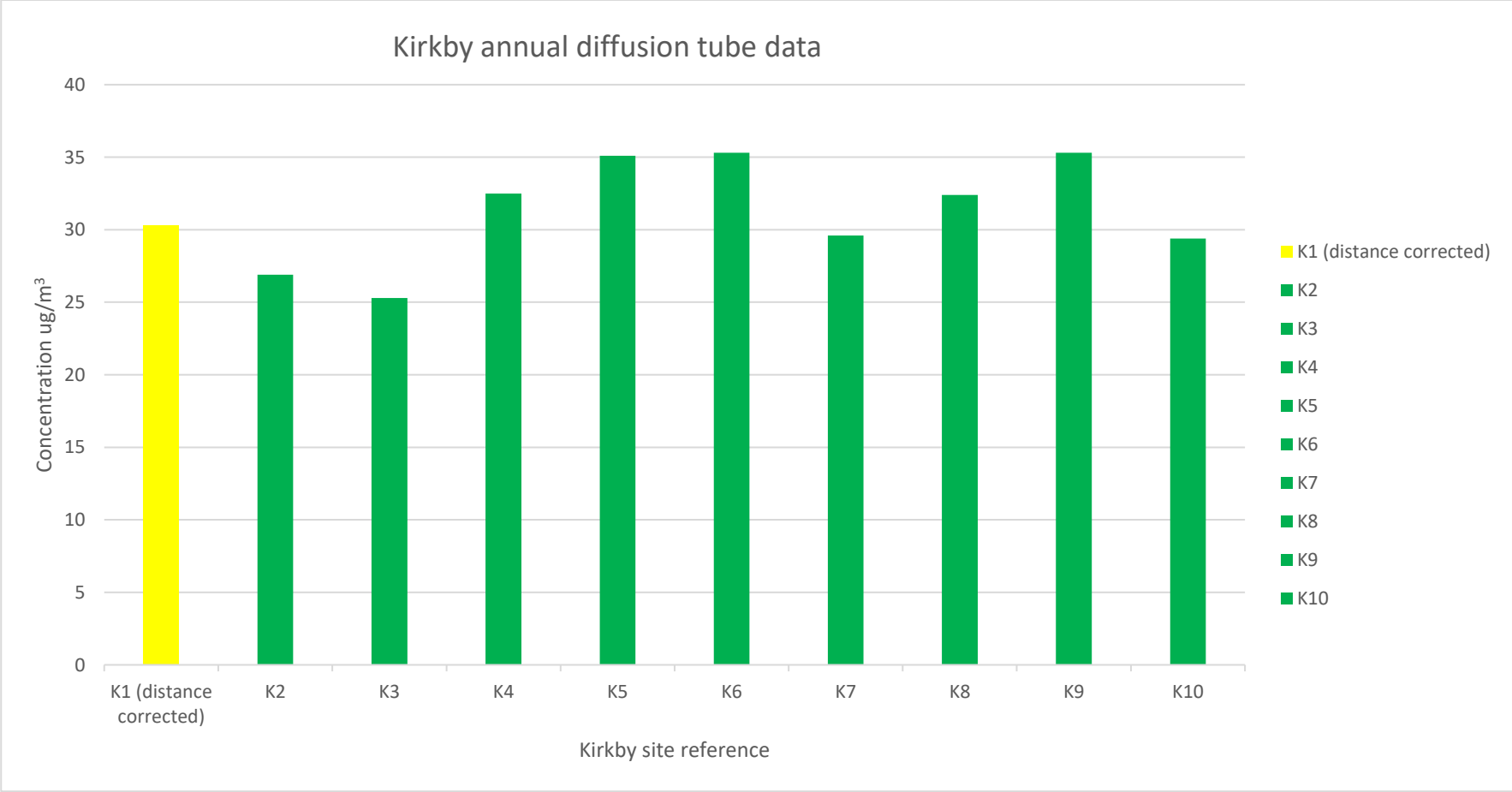
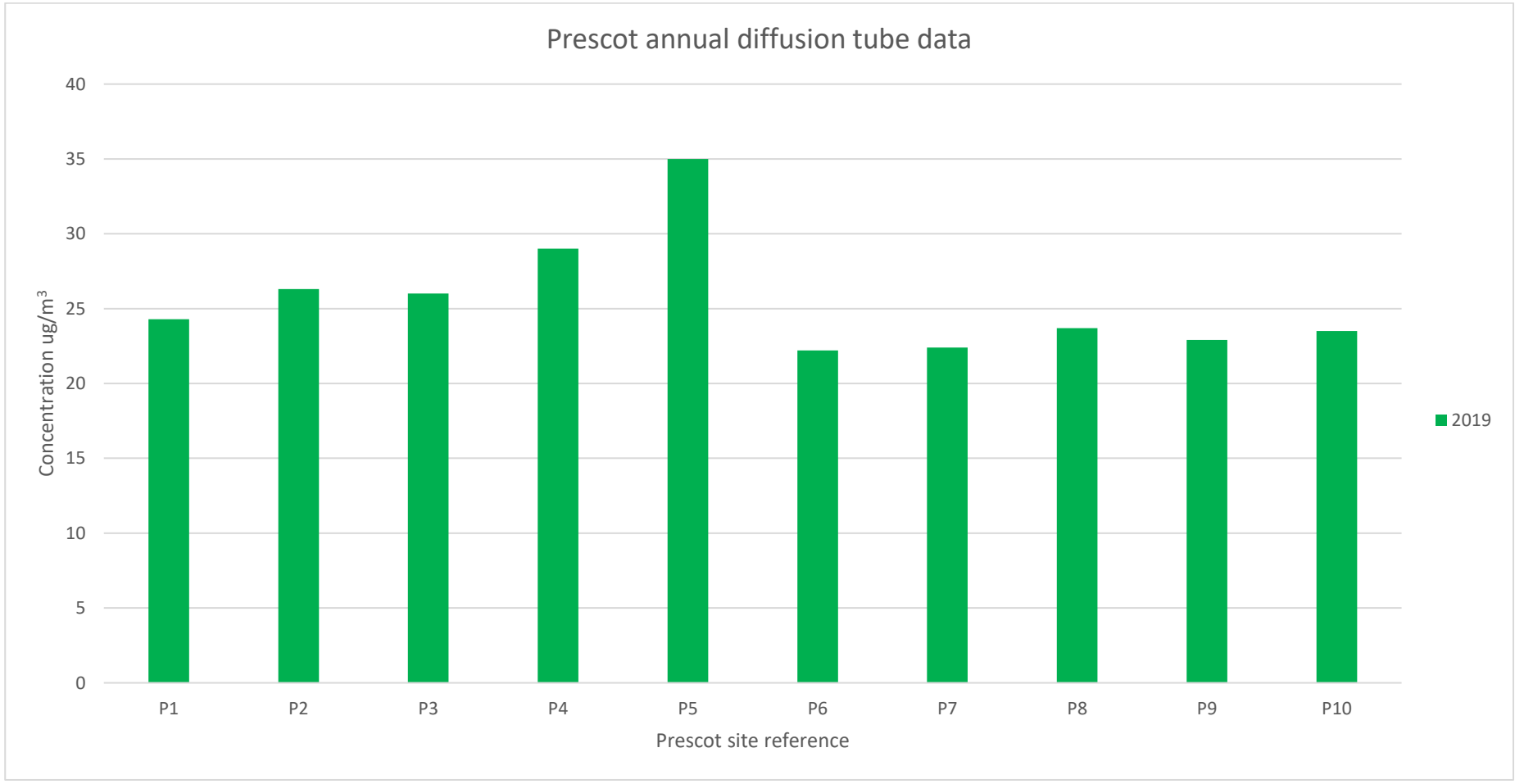


Figure B.4: Prescot's annual mean nitrogen dioxide diffusion tube data

Note: All data has been bias adjusted, no distance correction required.



Appendix C: Supporting Technical Information / Air Quality Monitoring Data QA/QC

C.1 Significant changes to sources

The following sources have been identified as part of the planning regime as being new sources of pollution in 2019

Planning Reference: 17/00301/HYB, Granted 20 January 2019

Proposal: hybrid application comprising a full planning application for 1800m^2 gross external area food store (use class A1), 1161m^2 gross external area B1/B2 use (business use / general industrial use) with associated car parking, landscaping, highway works, pumping station, substation and associated works including bund and noise attenuation boundary treatment to top of bund along western boundary of the site; outline planning application for up to 6,000m^2 use class B1 and B2 floor space, petrol filling station (sui generis use) with up to 400m^2 floor space associated use class A1 unit, up to 1000m^2 use class A3 and A4 floor space (pub / restaurant), with associated car parking, servicing areas, highway works, and other associated works, with all matters reserved for future approval

Location: Land between Cronton Road and M62 Motorway

Notes: An air quality assessment was submitted with the application and reviewed prior to determination of the planning application. Environmental Health expressed their concerns with regards to the potential impact this development could have on the Junction of Whitefield Lane / Cronton Road.

Planning Reference: 19/00147/FUL, Granted 10 October 2019

Proposal: Installation of 11 no. 4.4mw gas engines with associated 33kv transformer, 11kv transformer, switchgear housing, lubrication tanks, site office, metering and gas kiosks and associated cctv, car parking, hardstanding and fencing

Location: Land Adjacent To National Grid Substation, Cooper's Lane, Kirkby, Knowsley, L33 7TT

Notes: An air quality assessment was submitted with the application and reviewed prior to determination of the planning application. The report concludes that the development was not significant with regards to air quality and predicts that the

relevant air quality objectives will not be exceeded. The report was approved by the Local Planning Authority and planning permission was granted.

Planning Reference: 18/00776/HYB, Granted 27 March 2019

Proposal: Hybrid planning application for the following development: (i) full planning permission for the provision of a new access to Moss Lane; and (ii) outline planning permission (access to be considered - all other matters reserved for future approval) for up to 74,322m^2 of B1/B2/B8 floorspace.

Location: Former Site Of Sonae , Moss Lane, Kirkby, Knowsley, L33 7XQ.

Notes: An air quality assessment was submitted with the application and reviewed prior to determination of the planning application. The report concludes that the development was not significant with regards to air quality and predicts that the relevant air quality objectives will not be exceeded. The report was approved by the Local Planning Authority and planning permission was granted.

C.2 QA/QC of monitoring data

The Kirkby station (no longer operational at Briery Hey Avenue) used Beta Attenuation Mass (BAM) monitors to monitor particulate matter and a nitrogen dioxide analyser. As per TG16 the BAM meets the equivalence criteria for monitoring providing the results are corrected for slope. The data in this report has had the correction factor applied so it can be compared to the National Air Quality Objectives.

The new Kirkby station uses a BAM to monitor the PM_{10} levels, whilst the Huyton and Halewood sites monitor PM_{10} and $PM_{2.5}$ using TEOMS.

All 3 sites have nitrogen dioxide monitors installed. Data from an analyser is stored on the logger as ‘raw’ or ‘uncorrected’ data, therefore data needs to be corrected or ‘validated’. To validate data, the NO_2 analyser needs to be checked against a referenced standard of ‘zero’ air and ‘span’ gas.

There are two methods available to correct data by using calibration checks to verify that the analyser is corrected for any response change:

- Daily automatic calibration checks
- Monthly manual calibration checks

The air quality monitoring stations use manual calibration checks

A regular manual calibration is performed at all of the AQMS's, on all analysers. For the nitrogen dioxide analyser the check is performed to verify the response of the analyser in reference to the 'zero' and 'span' by introducing a high concentration of NO gas. These results are also used to validate the data for the NOx analyser.

All of the calibration results are then used to create a calibration factor, which is used to correct the data.

Conversion factors for ppb to µg/m3

Conversion rates at 20°C and 101.3kPa:

- NO_2

1.91 x ppb = µg/m^3

Bias adjustment

For this Annual Status Report the local bias adjustment factor was used instead of using the national bias adjustment factor given that we had 12 months' worth of co-location diffusion tube data with the Huyton automatic monitoring site. The local bias adjustment figure is slightly higher than the national figure and therefore will give the worst-case scenario. The laboratory was ESG Didcot using 50% TEA in Acetone for the year 2019.

National bias adjustment figure = 0.75

Local bias adjustment figure used = 0.81

National bias adjustment figure

National Diffusion Tube Bias Adjustment Factor Spreadsheet — Spreadsheet Version Number: 09/20

Follow the steps below **in the correct order** to show the results of **relevant** co-location studies
Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods
Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet
This spreadsheet will be updated every few months: the factors may therefore be subject to change. This should not discourage their immediate use.

This spreadsheet will be updated at the end of March 2021
LAQM Helpdesk Website

The LAQM Helpdesk is operated on behalf of Defra and the Devolved Administrations by Bureau Veritas, in conjunction with contract partners AECOM and the National Physical Laboratory.

Spreadsheet maintained by the National Physical Laboratory. Original compiled by Air Quality Consultants Ltd.

Step 1:	Step 2:	Step 3:	Step 4:							
Select the Laboratory that Analyses Your Tubes from the Drop-Down List	Select a Preparation Method from the Drop-Down List	Select a Year from the Drop-Down List	Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor[3] shown in blue at the foot of the final column.							
If a laboratory is not shown, we have no data for this laboratory.	If a preparation method is not shown, we have no data for this method at this laboratory.	If a year is not shown, we have no data[2]	If you have your own co-location study then see footnote[4]. If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@bureauveritas.com or 0800 0327953							
Analysed By[1]	Method To make your selection, choose [All] from the pop-up list	Year[2] To make your selection, choose [All]	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m^3)	Automatic Monitor Mean Conc. (Cm) (µg/m^3)	Bias (B)	Tube Precision[4]	Bias Adjustment Factor (A) (Cm/Dm)
Milton Keynes Council	20% TEA in water	2019		Overall Factor[3] (2 studies)					Use	0.84
SOCOTEC Didcot	20% TEA in water	2019		Overall Factor[3] (12 studies)					Use	0.77
SOCOTEC Didcot	50% TEA in acetone	2019		Overall Factor[3] (42 studies)					Use	0.75

Local bias adjustment figure

National Diffusion Tube Bias Adjustment Factor Spreadsheet — Spreadsheet Version Number: 09/20

Follow the steps below in the correct order to show the results of relevant co-location studies
Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods
Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet
This spreadsheet will be updated every few months: the factors may therefore be subject to change. This should not discourage their immediate use.

This spreadsheet will be updated at the end of March 2021
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Spreadsheet maintained by the National Physical Laboratory. Original compiled by Air Quality Consultants Ltd.

Step 1: Select the Laboratory that Analyses Your Tubes from the Drop-Down List

Step 2: Select a Preparation Method from the Drop-Down List

Step 3: Select a Year from the Drop-Down List

Step 4: **Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor[3] shown in blue at the foot of the final column.**

If you have your own co-location study then see footnote[4]. If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@bureauveritas.com or 0800 0327953

Analysed By[1]	Method	Year[2]	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m^3)	Automatic Monitor Mean Conc. (Cm) (µg/m^3)	Bias (B)	Tube Precision[4]	Bias Adjustment Factor (A) (Cm/Dm)
Socotec Didcot	50% TEA in acetone	2019	R	Knowsley MBC	12	46	37	23.5%	G	**0.81**

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements

Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm^{-3}	Tube 2 µgm^{-3}	Tube 3 µgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	08/01/2019	06/02/2019	57.1	56.8		57	0.2	0	1.9
2	06/02/2019	06/03/2019	56.3	63		60	4.7	8	42.6
3	06/03/2019	03/04/2019	46.3	41.3		44	3.5	8	31.8
4	03/04/2019	01/05/2019	52.2	52.5		52	0.2	0	1.9
5	01/05/2019	06/06/2019	39.8	40		40	0.1	0	1.3
6	06/06/2019	03/07/2019	42.1	35.8		39	4.5	11	40.0
7	03/07/2019	07/08/2019	40.3	36.7		39	2.5	7	22.9
8	07/08/2019	06/09/2019	36.8	35.3		36	1.1	3	9.5
9	06/09/2019	02/10/2019	40.4	39.9		40	0.4	1	3.2
10	02/10/2019	06/11/2019	45.5	45.2		45	0.2	0	1.9
11	06/11/2019	04/12/2019	54.4	52.5		53	1.3	3	12.1
12	04/12/2019	08/01/2020	52.8	46.2		50	4.7	9	41.9
13									

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
48.6	85.6	Good	Good
53.6	99.1	Good	Good
41.9	99.7	Good	Good
46.5	99.6	Good	Good
34.5	99.5	Good	Good
29.8	99.5	Good	Good
25.6	93.2	Good	Good
27.1	88.4	Good	Good
28.7	83.6	Good	Good
34.6	96.2	Good	Good
36.4	98.8	Good	Good
41.7	85.2	Good	Good
	Overall survey -->	Good precision	Good Overall

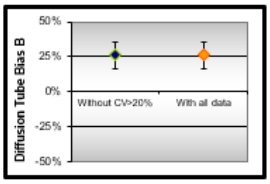
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:

Precision 12 out of 12 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval) without periods with CV larger than 20%
Bias calculated using 12 periods of data
Bias factor A 0.81 (0.75 - 0.88)
Bias B 24% (14% - 33%)
Diffusion Tubes Mean: 46 µgm^{-3}
Mean CV (Precision): 4
Automatic Mean: 37 µgm^{-3}
Data Capture for periods used: 94%
Adjusted Tubes Mean: 37 (35 - 41) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA
Bias calculated using 12 periods of data
Bias factor A 0.81 (0.75 - 0.88)
Bias B 24% (14% - 33%)
Diffusion Tubes Mean: 46 µgm^{-3}
Mean CV (Precision): 4
Automatic Mean: 37 µgm^{-3}
Data Capture for periods used: 94%
Adjusted Tubes Mean: 37 (35 - 41) µgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Background levels

Below is the excel pivot table produced from the values obtained from the background mapped data for those sites that required the drop off with distance calculator to be used (H2, H3 and K1). The relevant value can be extrapolated from the table using the relevant coordinates.

Pivot Table

Sum of Total_NO2_19	Column Labels												
Row Labels	339500	340500	341500	342500	343500	344500	345500	346500	347500	348500	349500	350500	Grand Total
384500						17.44026	16.29917						33.73943
385500					15.78717	15.82488	14.57784	13.15946	14.85429				74.20364
386500					14.59456	14.07276	13.3788	12.52431	14.6107				69.18113
387500							13.08094	13.7899	13.71456	12.97829			53.56369
388500							13.47435	15.61071	13.54244	13.13229	13.25016		69.00995
389500				15.03383	16.68765	17.89815	18.66517	21.55298	18.42941	17.35943	17.10889	17.61799	160.3535
390500			20.01277	19.16929	16.77872	16.88194	16.76497	16.23232	15.25692				121.09693
391500				17.79278	17.18635	16.35308	16.61475	17.44806	18.89657				104.29159
392500				15.98525	17.02064	18.85439	18.50607	16.46036	17.02425				103.85096
393500				14.8943	17.88106	14.34964	13.5256	13.73822					74.38882
394500				14.62416	15.99262	13.13835	12.08247	11.79335					67.63095
395500				16.30355	15.0936	12.81426	11.67547	11.21801					67.10489
396500			19.35445	19.30803	17.93266	13.89272	12.39205	11.23909					94.119
397500	16.36549	17.32795	16.39889	18.13602	16.1774	13.1769	11.91359						109.49624
398500	16.85378	16.971	16.06248	15.84832	16.85203	12.82347	11.29862						106.7097
399500		14.57485	14.67174	14.08376	14.08245								57.4128
400500			12.67334										12.67334
Grand Total	33.21927	48.8738	99.17367	181.17929	212.06691	197.5208	214.24986	174.76677	126.32914	43.47001	30.35905	17.61799	1378.82656

Huyton H1 to H10 (18.7)

Kirkby K1 (17.0)

Bureau Veritas NO2 fall off with distance calculator

Enter data into the pink cells

Site Name/ID	Distance (m)		NO_2 Annual Mean Concentration ($\mu g/m^3$)			Comment
	Monitoring Site to Kerb	Receptor to Kerb	Background	Monitored at Site	Predicted at Receptor	
H1	2.2	3.6	18.7	37.4	35.2	
H2	1.2	2.7	18.7	40.8	*37.0*	Predicted concentration at Receptor within 10% the AQS objective.
H3	0.8	3.6	18.7	48.0	*39.5*	Predicted concentration at Receptor within 10% the AQS objective.
K1	1.6	17.5	17.0	45.4	30.3	

Annualisation

Given that data capture for PM_{10} at Kirkby was less than 75%, the data required annualising.

In accordance with TG16, it recommends that background sites are used in the first instance for annualisation. Where there are no adequate background sites then similarly sited nearby automatic monitoring sites may be used. Unfortunately, there was only one background site available for us to use (Salford Eccles). Advice was sought from the Local Authority Help Desk and we were advised to look at 3 scenarios using the Salford Eccles site together with our own other two sites in Halewood and Huyton. The table below compares the different annualisation factor calculated for each of the three scenarios, when using valid 24 hour data, i.e. a valid 24 hr period equates to 75% of available data per 24 hrs (72 instances per 24hrs for 15 min intervals and 18 instance per 24 hrs for 1 hr intervals) – as per para 7.161 TG16.

Scenario 1: All 3 sites, Salford Eccles, Huyton and Halewood – Average Annualisation factor of 1.11

Scenario 2: Salford Eccles only (Background sites) – Annualisation factor of 1.13

Scenario 3 Our own 2 sites, Huyton and Halewood – Average Annualisation factor of 1.10

For this report we have chosen to use scenario 2 as it produces the most conservative factor, 1.13, resulting in a predicted annual mean value, at the Kirkby AQMS site, of 37.6 ug/m^3.

Annualisation Table

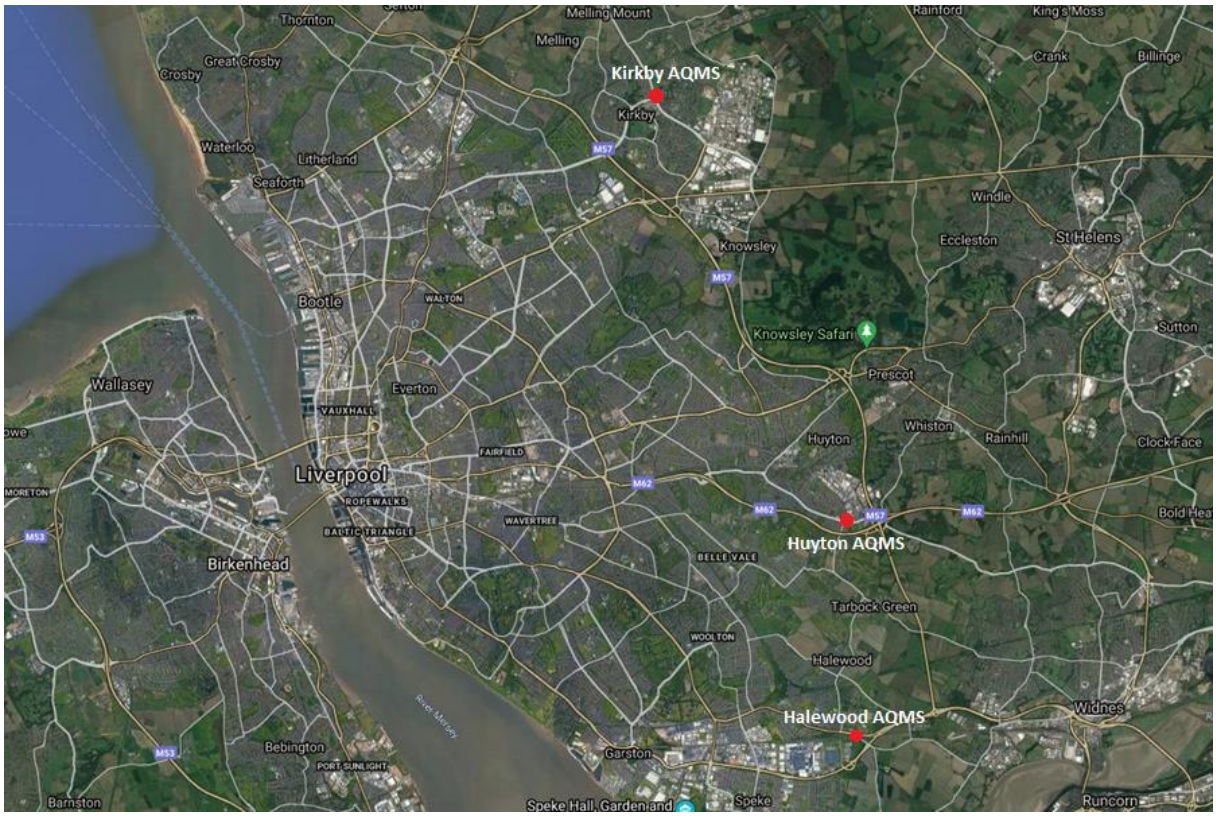
	Average		Background 1 (Salford Eccles)	Background 2 (Halewood)	Background 3 (Huyton)
Mean of site to be annualised / ug m-3	33.2	Background Annual Mean / ug m-3	15.33	20.79	22.67
Data Capture / %	71.9%	Background Data Capture / %	99.9%	87.3%	84.5%
Average Annualisation Factor	1.11	Background Period Mean / ug m-3	13.55	18.29	21.26
Annualised Mean / ug m-3	36.9	Mean of site to be annualised / ug m-3	33.22	33.22	33.22
		Annualisation Factor	1.13	1.14	1.07
Most conservative annualisation factor	**1.13**	Annualised Mean / ug m-3	37.60	37.76	35.42
Most conservative annualised mean	**37.6**				

Kirkby Unadjusted PM10 Annual Mean (µg/m3)	AF AURN Salford Eccles	AF Halewood	AF Huyton	Average AF	Kirkby Annualised PM10 Concentration (µg/m3)
33.2	1.13	1.14	1.07	1.11	36.9
	1.13	-	-	1.13	37.60
	-	1.14	1.07	1.10	36.6

AF = Annualisation Factor

Appendix D: Map(s) of Monitoring Locations and AQMAs

Map 1 – Active continuous air quality monitors in the borough of Knowsley.



Map 2 – Huyton automatic monitoring site (Cronton Road)

Map 3 – Halewood automatic monitoring site (Higher Road)

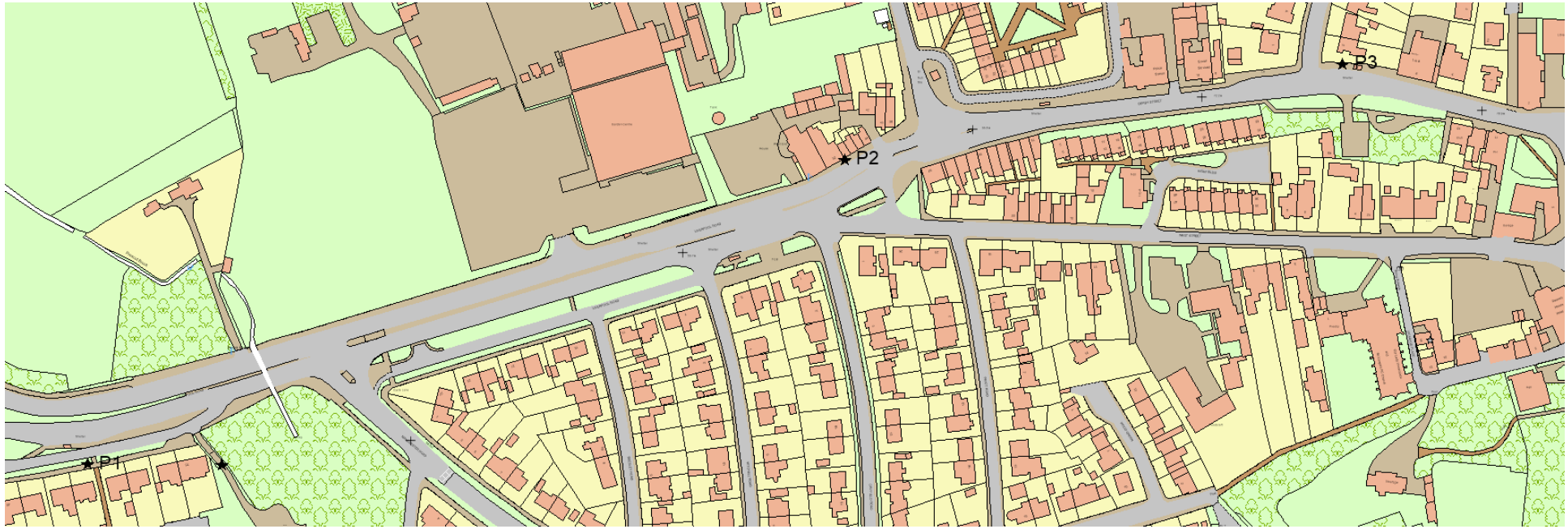
Map 4 – Kirkby automatic monitoring site (Old Rough Lane / County Road)

Map 5 – Kirkby automatic monitoring site (Briery Hey Avenue) – No longer active

Map 6 – Huyton passive (NO_2 diffusion tube) monitoring sites (H1-H10) near M62/M57 motorway junction(west)

Map 7 – Huyton NO_2 diffusion tube monitoring sites (H11-H12) near M62/M57 motorway junction (north)

Map 8 – Prescot NO2 diffusion tubes sites (Warrington Road) – P1 to P3

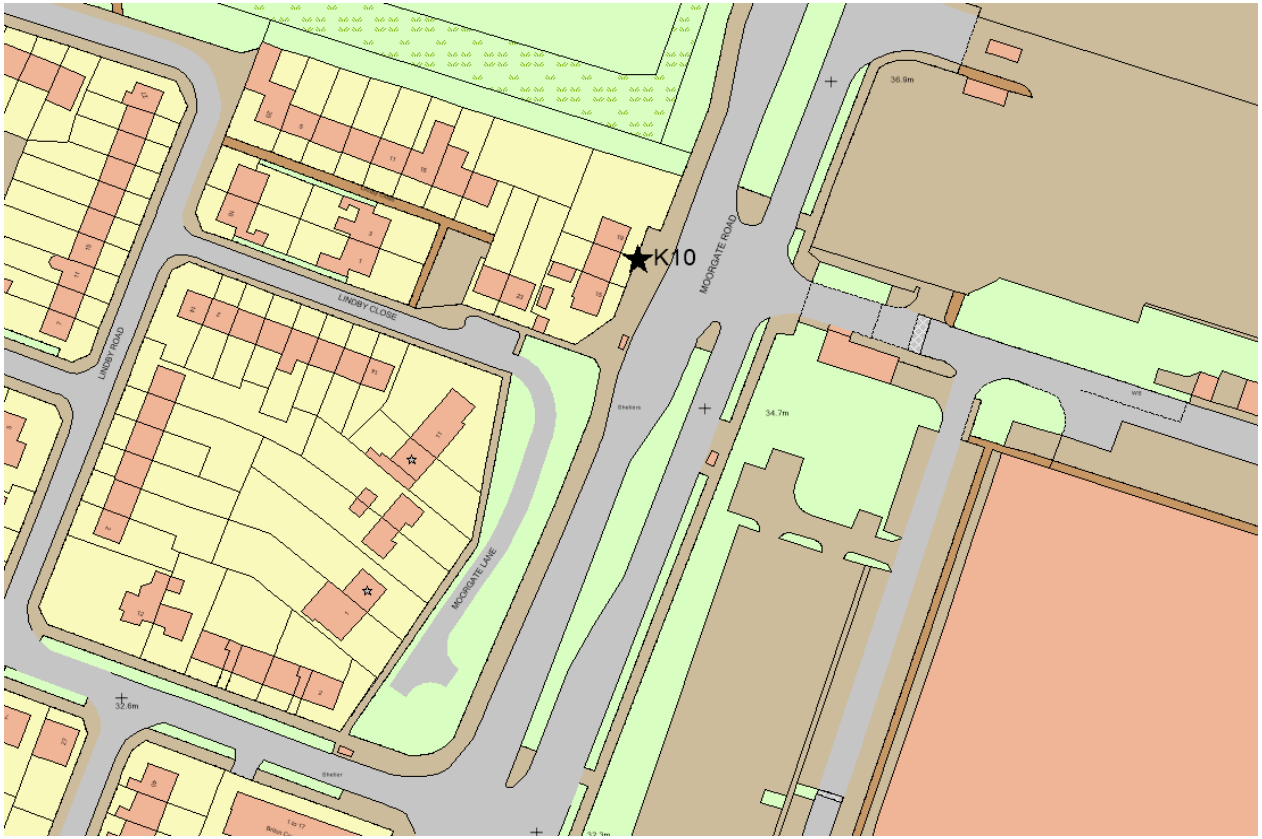


Map 9 – Prescot town centre NO_2 diffusion tube sites (Prescot Town Centre) P3 – P10

Map 10 - Kirkby NO_2 diffusion tube monitoring site (K1) – M57 Junction 6

Map 11 - Kirkby NO_2 diffusion tube monitoring sites (K2-K9) – Kirkby Town Centre

Map 12 - Kirkby NO_2 diffusion tube monitoring site (K10) – Moorgate Road



Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

Pollutant	Air Quality Objective[6]	
	Concentration	Measured as
Nitrogen Dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean
	40 µg/m^3	Annual mean
Particulate Matter (PM_{10})	50 µg/m^3, not to be exceeded more than 35 times a year	24-hour mean
	40 µg/m^3	Annual mean
Sulphur Dioxide (SO_2)	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean
	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean

[6] The units are in microgrammes of pollutant per cubic metre of air (µg/m^3).

Glossary of Terms

Abbreviation	Description
AECOM	Architecture, Engineering, Construction, Operations, and Management
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values'
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
AQMS	Air Quality Monitoring Station
AQO	Air Quality Objective
ASR	Air quality Annual Status Report
BAM	Beta Attenuation Mass
CCG	Clinical Commissioning Group
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
EU	European Union
FDMS	Filter Dynamics Measurement System
JSNA	Joint Strategic Needs Assessment
LAQM	Local Air Quality Management
LCR	Liverpool City Region
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm (micrometres or microns) or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less

QA/QC	Quality Assurance and Quality Control
SEP	Strategic Economic Plan
SO_2	Sulphur Dioxide
STEP	Sustainable Transport Enhancement Package
TEOM	Tapered Element Oscillating Microbalance
…	…

References

- AECOM (2018) Liverpool City Region Preliminary Air Quality Options Study
- DEFRA (2016) Local Air Quality Management, Technical Guidance LAQM. TG(16)
- Knowsley Council (2016) Joint Strategic Needs Assessment Report (Environment)
- Liverpool City Region Combined Authority (2015) Sustainable Transport Enhancements Package (STEP).
- Public Health England, Public Health Outcomes Framework (PHOF)