Annual Progress Report (APR)

2020 Air Quality Annual Progress Report (APR) for
North Ayrshire Council

In fulfilment of Part IV of the
Environment Act 1995

Local Air Quality Management

June 2020

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Executive Summary: Air Quality in Our Area

Air Quality in North Ayrshire Council

This report was prepared in accordance with the Local Air Quality Management (LAQM) Technical Guidance 2016 (TG16) and sets out the air quality monitoring carried out in North Ayrshire, with results and conclusions of data collected for 2019. Monitoring is carried out in North Ayrshire for Nitrogen Dioxide (NO_2) and Particulate Matter (PM), particles of soot (carbon), metals or inorganic salts of sizes less than or equal to 10micrometers, PM_{10}; and less than or equal to 2.5micrometers, $PM_{2.5}$.

Monitoring in previous years identified that the main air quality issue in North Ayrshire was related to a) traffic congestion caused by a small section of High Street, Irvine being used as a bus terminus and b) queuing traffic in New Street, Dalry as a result of traffic lights on the main A737 passing through the town. The main pollutant of concern was NO_2 for both locations. The history of these two areas have been discussed in previous reports which can be found here https://www.north-ayrshire.gov.uk/pests-pollution-and-food- hygiene/pollution/air-quality-management.aspx. Public Realm (streetscape works) and the introduction of EURO VI engine buses in Irvine and the construction of bypass around the town of Dalry have alleviated these issues. Both these projects have now been completed successfully and monitoring results reflect the changes in ambient air quality accordingly.

NO_2 at the three diffusion tube monitors of previous years' concern adjacent to the bus stops, in High Street, Irvine, has continued to show a decrease. They decreased from 18,23, 22ug/m^3 in 2018 to 17, 20, 20ug/m^3 in 2019 respectively. The nearby automatic monitor station has also shown a decrease in NO_2 from 18ug/m^3 in 2018 to 16ug/m^3 for 2019.

The new Dalry Bypass opened on Thursday 30th May 2019, seven months ahead of schedule and traffic congestion through the town has been reduced significantly. In New Street, Dalry, NO_2 has been reduced from 34ug/m^3 in 2018 to 26 ug/m^3 in 2019 for the same corresponding diffusion tube of concern.

PM_{10} was recorded at 14ug/m^3 for 2019 in High Street, Irvine, this reflects no change from 2018. The Scottish annual mean air quality objective for PM_{10} is 18ug/m^3. In 2019 $PM_{2.5}$ monitoring in High Street, Irvine recorded a result of 8ug/m^3, again showing no change from 2018. The Scottish annual mean air quality objective for $PM_{2.5}$ is 10ug/m^3.

As part of the Public Realm works in High Street, Irvine the automatic monitoring station cabinet was also replaced. It was taken out of commission on 20th April 2019 and a new one was installed on 6th August 2019. This resulted in a loss of data and results were required to be annualised for NO_2, PM_{10} and $PM_{2.5}$ in accordance with recognised guidance.

Overall, monitoring results for 2019 have shown that levels of NO_2 have decreased in High Street whilst PM_{10} and $PM_{2.5}$ levels have remained steady. NO_2 levels in New Street, Dalry have also shown a decrease. Generally, NO_2 has shown a downward trend across the whole of North Ayrshire since 2015 whilst on average PM levels have remained steady.

North Ayrshire Council has one officer located within Environmental Health who implements the LAQM requirements: ensuring monitoring equipment is maintained correctly; dealing with any enquiries, planning permissions and complaints; report writing and liaising with relevant colleagues in other departments, and close consultation with our partners as required e.g. SEPA and Transport Scotland.

Actions to Improve Air Quality

Two significant projects were completed in North Ayrshire in 2019 as mentioned above, Public Realm works in High Street, Irvine and the opening of the Dalry A737 By-pass. Both these projects have been shown to improve the air quality through continued monitoring of the ambient air. Improvement in High Street, Irvine was achieved by widen the pavement on the side where the elevated levels were being recorded and relocating one of the bus stops further along the High Street and one to nearby Bank Street (Photograph 1 below).

Photograph 1: Public Realm Works: High Street & Bank Street, Irvine.

(North Ayrshire Council)

The new Dalry Bypass opened on Thursday 30th May 2019, seven months ahead of schedule and traffic congestion through the town has been reduced significantly. Monitoring has shown a significant decrease of NO_2 levels. The route of the bypass is shown in Photograph 2 below. All the details pertaining to the project can be found here https://www.transport.gov.scot/projects/a737-dalry-bypass/

Photograph 2: Dalry bypass route.

(Institution of Civil Engineers)

In addition to LAQM, North Ayrshire Council has Energy and Sustainability Officers, an Access Officer, a School Travel Plan Co-ordinator, Traffic and Transportation Managers, a Business Change Project Manager, Workplaces Engagement Officers and supporting teams.

North Ayrshire Council implemented a Sustainable Business Travel Plan Car Pool Scheme alongside Enterprise CarClub. Across January – December 2019, this car-share scheme had between 25 and 27 vehicles, with 261,375 miles being travelled on these. Of this, a total of 32,712 miles was travelled on 100% Electric Vehicles – around 12.5% of the total CarClub miles. There are now (at the time of writing) 1,173 members who have access to 29 vehicles (6 all-electric and 23 petrol/petrol-hybrid vehicles) across 12 council office locations. During 2020, the number of vehicles will increase again up to a contracted 33 cars, and we continue to scope out new locations for these. The next stage is to continue improving on charge-infrastructure so that we may further increase our use of electric vehicles across NAC.

North Ayrshire Council participated in National Clean Air Day on Thursday 20th June 2019 and encouraged staff to actively travel to work. Staff Pledged to do various activities throughout Clean Air Day, these ranged from Cycling to Work, participating in our Daily Step Count Challenge and Leaving the Car at Home. 37 Council employees pledged to walk to work/achieve up to 20,000 steps/Register for Enterprise Car Club Electric Vehicle/Trial our new e-bikes; 10 Council employees pledged to Complete the Clean Air Day Quiz; 15 Council Employees pledged to ditch the car and Walk/Cycle/Go Electric to get to work. 3 employees from Ayrshire Central Hospital Pledged to Cycle to Work and received an Active Travel Breakfast. Those who used an alternative mode of transport to the car also had the option to enter the Clean Air Day Quiz competition with a chance to win 1 weeks paid for Public Transport, a Sports Voucher and a Clean Air Day Water Bottle. Photographs of the staff with their pledges is shown below.

Photograph 3: Staff with their pledges.

(North Ayrshire Council)

The event was promoted to staff and schools via internal Newsletter, Facebook and Twitter. For information on how to become involved in air quality events around the UK and free promotional material please visit https://www.cleanairday.org.uk/. At the time of writing, Clean Air Day has been postponed to 8th October 2020 due to the Corona Virus pandemic.

Our Environmental Sustainability & Climate Change Strategy has been developed for 2018-20 and contains an ambition to achieve a 40% reduction in carbon emissions North Ayrshire wide by 2030, based on a 2005 baseline year.

This would equate to a reduction of 581,000 tonnes CO2 across North Ayrshire in total since 2005, and 27,088 tonnes within the Council estate.

During 2019 our Workplace Engagement Officers organised 102 events and visited 9 workplaces, engaging with 809 staff to help facilitate and encourage alternative active travel in the workplace.

The Council's Travel Smart behaviour change project continues to promote modal shift to active and sustainable travel. It has been recognised locally and nationally as good practice. This is funded by the Smarter Choices Smarter Places programme and delivered a wide range of activities including: bike maintenance training; two Workplace Engagement Officers are appointed to promote active and sustainable travel to/from work; and a Schools and Workplaces Active Travel Programme, but also to support and promote the number of infrastructure projects currently being worked on between Sustrans and North Ayrshire Council

This project worked with several local employers including NHS Ayrshire and Arran, KA Leisure, EDF Energy, J and D Pierce, GSK and Booth Welsh. Their work has included:

- Supporting 8 local businesses to become Cycle Friendly Employers
- Delivered 16 Information stalls, engaging with 164 employees from 4 various workplaces
- Delivered 18 Lunch Time LED walks, engaging with 64 employees from 2 workplaces
- Performed 41 Personal Travel Plans to provide Active Travel options to employees within workplaces.
- Since the purchase of the 3 ebikes in 2018 staff have clocked up approximately 650 miles within the council replacing a motor vehicle work related duties.
- 153 employees within North Ayrshire Council took part in Paths for All Step Count Challenge in Nov 2019 clocking up 49 million steps and walking approximately 22,000 miles.

The Irvine Active Travel Hub and Closed Loop Facility was officially opened on Tuesday 25th 2019 by Lee Craigie, the Active Nation Commissioner. This is funded through the EUROpean Regional Development Fund (ERDF) Low Carbon Travel and Transport Challenge Fund. This project has enabled a bike infrastructure to be

established and includes cycle parking; public cycle pumps; public cycle tools and an e- bike charging station. Furthermore, funding from both Sustrans and the Energy Saving Trust has allowed us to purchase nine e-bikes and one tandem.

Local Priorities and Challenges

The priorities for North Ayrshire Council in addressing air quality for the coming year are a) to continue with monitoring air quality within its area, particularly in High Street, Irvine and New Street, Dalry, to ensure concentrations remain below the relevant objective levels following the improvement works b) to continue improving on charge-infrastructure so that we may further increase our use of electric vehicles across NAC, c) continue to promote, support and help facilitate Active Travel and d) to implement the Actions in the Council's Environmental Sustainability & Climate Change Strategy 2018-20.

The challenges will be to ensure that a) any LAQM monitoring equipment malfunction is rectified timeously and the data capture rate is maintained at a high level and b) any targets with regard to improving air quality, directly or indirectly within North Ayrshire are achieved.

How to Get Involved

If you would like to become involved and participate in helping improving air quality in the area, details of alternative modes of travel, route options and projects can be found at https://www.north-ayrshire.gov.uk/leisure-parks-and-events/leisure-parks-and-events.aspx

North Ayrshire Council participated in the National Clean Air Day on Thursday 20th June 2019 and encouraged staff to actively travel to work. The event was promoted to staff and schools via internal Newsletters, Facebook and Twitter. North Ayrshire Council will continue to support and promote this event. For information on how to become involved in air quality events around the UK and free promotional material please visit https://www.cleanairday.org.uk/.

At the time of writing (June 2020) Clean Air Day has been postponed to 8th October 2020 due to the coronavirus pandemic (COVID-19).

Further information on our local air quality can also be found here http://www.scottishairquality.co.uk/latest/site-info?site_id=IRV on the National

website where information is updated every hour. A free service to subscribers in Scotland (that may be of benefit to people whose breathing gets worse when air pollution increases) is Know & Respond – Scotland. The service sends an alert message to registered members if air pollution in their area is forecast to be moderate, high or very high and this may be of benefit to pollution sensitive individuals who want to take steps to minimise the effects of any pollution incidents. To register for Know & Respond – Scotland please visit: http://www.scottishairquality.co.uk/know-and-respond/.

Know and Respond can also be accessed via an iPhone and Android app which is free to download at:

http://www.scottishairquality.co.uk/stay-informed/apps.

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1. Local Air Quality Management

This report provides an overview of air quality in North Ayrshire Council 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 Progress Report (APR) is summarises the work being undertaken by North Ayrshire Council to improve air quality and any progress that has been made.

Table 1.1 – Summary of Air Quality Objectives in Scotland

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Nitrogen dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 µg/m^3	Annual mean	31.12.2005
Particulate Matter (PM_{10})	50 µg/m^3, not to be exceeded more than 7 times a year	24-hour mean	31.12.2010
	18 µg/m^3	Annual mean	31.12.2010
Particulate Matter ($PM_{2.5}$)	10 µg/m^3	Annual mean	31.12.2020
Sulphur dioxide (SO_2)	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005
Benzene	3.25 µg/m^3	Running annual mean	31.12.2010
1,3 Butadiene	2.25 µg/m^3	Running annual mean	31.12.2003
Carbon Monoxide	10.0 mg/m^3	Running 8-Hour mean	31.12.2003

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Lead	0.25 µg/m^3	Annual Mean	31.12.2008

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 months, setting out measures it intends to put in place in pursuit of the objectives. North Ayrshire Council currently does not have any AQMAs.

As mentioned earlier, 2019 seen two significant projects completed in North Ayrshire. Public Realm works (streetscape improvements) in High Street, Irvine and the opening of the Dalry A737 By-pass. Both these projects have been shown to improve the air quality through continued monitoring of the ambient air. Improvement in High Street, Irvine was achieved by widen the pavement on the side where the elevated levels were being recorded and relocating one of the bus stops further along the High Street and one to nearby Bank Street. The new Dalry Bypass opened on Thursday 30th May 2019 seven months ahead of schedule and traffic congestion through the town has been reduced significantly. Monitoring has shown a significant decrease of NO_2 levels.

2.2 Cleaner Air for Scotland

Cleaner Air for Scotland – The Road to a Healthier Future (CAFS) is a national cross-government strategy that sets out how the Scottish Government and its partner organisations propose to reduce air pollution further to protect human health and fulfil Scotland's legal responsibilities as soon as possible. A series of actions across a range of policy areas are outlined, a summary of which is available at https://www.gov.scot/Publications/2015/11/5671/17. Progress by North Ayrshire Council against relevant actions within this strategy is demonstrated below.

2.2.1 Transport – Avoiding travel – T1

North Ayrshire Council has a Travel Plan which can be accessed here:

https://www.north-ayrshire.gov.uk/council/strategies-plans-and-policies/transport-strategy.aspx

2.2.2 Climate Change – Effective co-ordination of climate change and air quality policies to deliver co-benefits – CC2

North Ayrshire Council has developed their Environmental Sustainability & Climate Change Strategy for 2017 – 2020. It contains an ambition to achieve a 40% reduction in carbon emissions North Ayrshire wide by 2030, based on a 2005 baseline year. This would equate to a reduction of 581,000 tonnes CO2 across North Ayrshire in total since 2005, and 27,088 tonnes within the Council estate.

Key actions completed, in progress or planned and outcomes in terms of benefits for air quality can be found in Appendix 1 of the Strategy's Action Plan here:

https://www.north-ayrshire.gov.uk/Documents/CorporateServices/Finance/environmental-sustainability-climate-change-strategy.pdf

2.2.3 Further Actions

North Ayrshire Council implemented a Sustainable Business Travel Plan Car Pool Scheme alongside Enterprise CarClub. Across January – December 2019, this car-share scheme had between 25 and 27 vehicles, with 261,375 miles being travelled on these. Of this, a total of 32,712 miles was travelled on 100% Electric Vehicles – around 12.5% of the total CarClub miles. At the time of writing there are now 1,173 members who have access to 29 vehicles (6 all-electric and 23 petrol / petrol- hybrid vehicles) across 12 council office locations. During 2020, the number of vehicles will increase again up to a contracted 33 cars, and we continue to scope out new locations for these. The next stage is to continue improving on charge-infrastructure so that we may further increase our use of electric vehicles across NAC.

2.3 National Low Emission Framework (NLEF) Stage 1 Screening Appraisal for North Ayrshire Council

North Ayrshire Council currently does not have any AQMAs, and therefore a Stage 1 Screening Appraisal has not been undertaken.

3. Air Quality Monitoring Data and Comparison with Air Quality Objectives

3.1 Summary of Monitoring Undertaken

A fixed automatic monitoring station is located in High Street, Irvine. It has contained a chemiluminescent NO_x analyser monitor since its installation in 2009 and a Fidas 200 fine dust and monitoring emission measurement system for the continuous and simultaneous measurement of PM1, $PM_{2.5}$ as per EN 14907 and PM_{10} as per EN12341 since 14th April 2015. This monitoring station is also the site being used for the triplicate co-location of NO_2 diffusion tubes.

Calibration checks are conducted every 2 weeks on site by Local Authority Officers and collected data is forwarded to Ricardo - AEA who validate and ratify the data. The unit is calibrated by Ricardo - AEA every 6 months. Ricardo - AEA reports are included in Appendix C: Figures 1 & 2.

Twenty-two diffusion tubes also monitor NO_2 at various locations in towns throughout North Ayrshire and data capture rate was 93%. 2019 results show that the localised area of approximately 10 meters diameter on the High Street, Irvine which was the subject of an elevated level exceeding the NO_2 air quality annual mean objective of 40ug/m^3 in previous years has now been resolved. Based on diffusion tube monitoring the level has reduced from 41ug/m^3 in 2017 to 20ug/m^3 in 2019 at the same tube of concern. No monitoring results for 2019 within North Ayrshire has exceeded any relevant EU Limit Value.

None of these changes have led to the declaration of an AQMA, decision to amend or revoke an AQMA, or appropriate local strategy.

3.1.1 Automatic Monitoring Sites

This section sets out what monitoring has taken place and how local concentrations of the main air pollutants compare with the objectives.

North Ayrshire Council undertook automatic (continuous) monitoring at one site during 2019. Table A.1 in Appendix A shows the details of the sites. National monitoring results are available at: http://www.scottishairquality.scot/

Maps showing the location of the monitoring sites are provided in Appendix D: Figure 14. 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

North Ayrshire Council undertook non-automatic (passive) monitoring of NO_2 at twenty-two sites during 2019. Table A.2 in Appendix A shows the details of the sites. National non-automatic monitoring sites and results are available at: http://www.scottishairquality.scot/latest/diffusion-sites

Maps showing the location of the monitoring sites are provided in Appendix D: Figure 15. Further details on Quality Assurance/Quality Control (QA/QC) and bias adjustment for the diffusion tubes are included in Appendix C.

3.2 Individual pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for bias. Further details on adjustments are provided in Appendix C. The data capture rate in 2019 for NO_x was 69% and 70% for PMs and therefore these parameters had to be annualised. Calculations are shown in Appendix C: Figure 5 below.

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.

For diffusion tubes, the full 2019 dataset of monthly mean values is provided in Appendix B.

Annual Mean NO_2 Concentrations measured at the Automatic monitoring site in High Street, Irvine and Diffusion Tube monitoring sites located throughout North Ayrshire have shown a downward trend since 2015. There has been a particularly noticeable decline in the NO_2 concentrations recorded around Irvine since 2017. This coincides with the introduction of the EURO VI engine buses and Public Realm streetscape works. A graph of this trends is included in Appendix C: Figure 10.

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. There has been no exceedance of over 18 times per year for the 2015 to 2019 reporting period.

In Dalry there was an area of concern due to congestion at traffic lights. NO_2 levels in New Street, Dalry have also shown a marked decrease since 2017. The opening

of the A737 bypass in May 2019 has contibuted significantly to this decline. A graph of this trend is included in Appendix C: Figure 11.

None of these changes have led to the declaration of an AQMA.

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 18µg/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 7 times per year.

PM_{10} levels have more of less remained steady during the 2015 – 2019 period at High Street, Irvine. A graph showing this trend is included in Appendix C: Figure 12.

There have been no exceedances of over 7 times per year for the 2015 to 2019 reporting period.

None of these changes have led to the declaration of an AQMA.

3.2.3 Particulate Matter ($PM_{2.5}$)

Table A.7 in Appendix A compares the ratified and adjusted monitored $PM_{2.5}$ annual mean concentrations for the past 5 years with the air quality objective of 10µg/m^3.

$PM_{2.5}$ levels increased slightly until 2018 to where they have remained steady at 8µg/m^3. A graph showing this trend is included in Appendix C: Figure 13.

None of these changes have led to the declaration of an AQMA.

3.2.4 Sulphur Dioxide (SO_2)

Monitoring for sulphur dioxide and smoke has been discontinued in North Ayrshire since 2004. Historical monitoring data is available for nearly every town in the area and there is no indication from these results that the air quality standard is likely to be breached even around local industrial sources.

Further details of historic SO2 monitoring can be found in North Ayrshire Council's previous Air Quality Reports which are available online at:

https://www.north-ayrshire.gov.uk/pests-pollution-and-food-hygiene/pollution/air-quality-management.aspx

There has been no evidence of any change to sulphur dioxide production or release in North Ayrshire. Similarly, there has been no development likely to result in any increase in sulphur dioxide levels at locations where there could be relevant public exposure.

3.2.5 Carbon Monoxide, Lead and 1,3-Butadiene

No recent monitoring of Carbon Monoxide, Lead and 1,3-Butadiene has been undertaken.

Further details of historic Carbon Monoxide, Lead and 1,3-Butadiene monitoring can be found in North Ayrshire Council's previous Air Quality Reports which are available online at:

https://www.north-ayrshire.gov.uk/pests-pollution-and-food-hygiene/pollution/air- quality-management.aspx

There has been no evidence of any change to Carbon Monoxide, Lead and 1,3-Butadiene production or release in North Ayrshire. Similarly, there has been no development likely to result in any increase in Carbon Monoxide, Lead and 1,3-Butadiene levels at locations where there could be relevant public exposure.

4. New Local Developments

There were several significant housing developments proposed during 2019 that was considered to have the potential to increase traffic numbers and flows in and around the relevant area. These are listed below:

19/00351/PPPM

https://www.eplanning.north-ayrshire.gov.uk/OnlinePlanning/simpleSearchResults.do?action=firstPage

No detailed air quality report was required as screening showed that it did not meet all the required criteria in accordance with the relevant guidance.

19/00787/MSCM

https://www.eplanning.north-ayrshire.gov.uk/OnlinePlanning/simpleSearchResults.do?action=firstPage

It was recommended, that an air quality assessment was undertaken for this planning application however this was not attached as a Condition in the permission granted.

19/00523/PPM

https://www.eplanning.north-ayrshire.gov.uk/OnlinePlanning/simpleSearchResults.do?action=firstPage

It was recommended, that an air quality assessment was undertaken for this planning application however this was not attached as a Condition in the permission granted.

19/00748/PPM

https://www.eplanning.north-ayrshire.gov.uk/OnlinePlanning/simpleSearchResults.do?action=firstPage

No detailed air quality report required as screening showed that it did not meet all the required criteria in accordance with the relevant guidance.

4.1 Road Traffic Sources

North Ayrshire Council confirms that there are no new/newly identified: narrow congested streets with a flow above 5,000 vehicles per day and residential properties close to the kerb; busy streets where people may spend 1 hour or more close to traffic; roads with high flows of buses/heavy delivery vehicles; busy junctions/busy roads; roads with significantly changed traffic flows and no relevant bus stations in the Local Authority area. The A737 Dalry Bypass is now fully complete and open.

All the details pertaining to the project can be found here:

https://www.transport.gov.scot/projects/a737-dalry-bypass/

The smaller road construction project, the A737 Den Realignment, has now also been completed and all the details pertaining to the project can be found here:

https://www.transport.gov.scot/projects/a737-the-den-realignment/

4.2 Other Transport Sources

North Ayrshire Council confirms that there are no: airports in the Local Authority area; locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m; locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m; or ports or shipping that meet the specified criteria within the Local Authority area.

4.3 Industrial Sources

There was one significant industrial installation, an energy from waste plant, proposed during 2019 that was considered to require air quality assessment carried out. This is listed below:

19/00539/PPM

https://www.eplanning.north-ayrshire.gov.uk/OnlinePlanning/simpleSearchResults.do?action=firstPage

A detailed Air Quality Assessment has been applied as a Condition to the planning permission granted. This installation will be regulated by the Scottish Environment Protection Agency and will require a Pollution Prevention and Control Licence to be issued by them.

North Ayrshire Council confirms that there are no other new or proposed industrial installations: for which an air quality assessment has been carried out; existing installations where emissions have increased substantially or new relevant exposure has been introduced; significantly changed installations with no previous air quality

assessment; major fuel storage depots storing petrol; petrol stations or poultry farms that we are aware of at this time.

4.4 Commercial and Domestic Sources

North Ayrshire Council is aware of the applications listed below for biomass boilers:

19/00545/PP

https://www.eplanning.north-ayrshire.gov.uk/OnlinePlanning/simpleSearchResults.do?action=firstPage

18/00882/PPM

https://www.eplanning.north-ayrshire.gov.uk/OnlinePlanning/simpleSearchResults.do?action=firstPage

Although this is dated as a 2018 application the chimney height for the biomass boiler was applied for it 2019.

Permitted Development: Community Heating Scheme: Sharon Street, Dalry by North Ayrshire Council.

Permitted Development: Heating Scheme: Flatt Road, Largs by North Ayrshire Council.

These installations were assessed and deemed suitable under the relevant Local Air Quality Management and Chimney Height Application guidance.

North Ayrshire Council confirms that there is no other areas of significant domestic fuel use or Combined Heat and Power CHP) plant in the Local Authority area that we are aware of at this time.

4.5 New Developments with Fugitive or Uncontrolled Sources

North Ayrshire Council is aware of the applications listed below for wood burning stoves:

19/00805/PP

https://www.eplanning.north-ayrshire.gov.uk/OnlinePlanning/simpleSearchResults.do?action=firstPage

Residential property, Irvine.

19/00807/PP

https://www.eplanning.north-ayrshire.gov.uk/OnlinePlanning/simpleSearchResults.do?action=firstPage

Residential property, Skelmorlie.

North Ayrshire Council is not aware of any other new developments with fugitive or uncontrolled sources within the Local Authority area in 2019 at this time

5. Planning Applications

Relevant new local developments are also discussed at Section 4 of this report.

6. Conclusions and Proposed Actions

6.1 Conclusions from New Monitoring Data

All NO_2, PM_{10} and $PM_{2.5}$ monitoring data within North Ayrshire Council for 2019 complied with the 40μg/m3, 18μg/m3 and 10μg/m3 respective Air Quality Objectives as set out in the Directive. Monitoring will continue at all the existing sites for 2020.

6.2 Conclusions relating to New Local Developments

Planning applications for several significant housing developments was received in 2019. Considered was given to the applications as they had the potential to increase traffic numbers and flows in and around the local area the location. The applicants were requested to undertake Air Quality Screening Assessments and submit a report to demonstrate whether their proposed development would have any detrimental effect on local air quality via the Planning process. The resultant screening reports provided were satisfactory.

6.3 Proposed Actions

The new monitoring data has not identified any new exceedances of the objectives for any pollutant or any need for additional monitoring or changes to the existing monitoring programme within North Ayrshire.

Irvine

As outlined earlier in this report, following the introduction of 27 EURO VI buses on Route 11 in January 2018 by the bus operator, Stagecoach, a significant reduction in NO_2 has been recorded in High Street, Irvine. Monitoring during 2019 has shown that levels have been reduced further following pavement widening on the completion of Public Realm works. It is proposed that NO_2 sampling continues in this area with close supervision of any future developments.

Dalry

Following the opening of the new Dalry Bypass on 30th May 2019, traffic congestion has reduced significantly through the town and this has been demonstrated by the 2019 monitoring results. It is proposed that monitoring is continued in this area.

Appendix A: Monitoring Results

Table A.1 – Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
ROM	ROMON	Roadside	232192	638827	NO_2; PM_{10}; $PM_{2.5}$	N	Chemiluminescent; Optical Light Scatter	20	4.88	2.15

(1) 0 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	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?
DT1	**35 East Road, Irvine**	Roadside	**232323**	**638892**	**NO_2**	**N**	1	2.5	N
DT2	**18 Bank St, Irvine**	Roadside	**232202**	**638952**	**NO_2**	**N**	2.5	1.6	N
DT3	**147 High Street, Irvine**	Roadside	**232077**	**638990**	**NO_2**	**N**	0	4	N
DT4	**85 High St, Irvine**	Roadside	**232158**	**638882**	**NO_2**	**N**	0	3.7	N
DT5	**79 High St, Irvine**	Roadside	**232169**	**638878**	**NO_2**	**N**	3.5	1.5	N
DT6	**75 High St, Irvine HIGH**	Roadside	**232170**	**638871**	**NO_2**	**N**	0	5	N
DT7	**65a High Street, Irvine, (ROMON)**	Roadside	**232192**	**638827**	**NO_2**	**N**	4.7	1.7	Y
DT8	**65 High Street, Irvine, (ROMON)**	Roadside	**232192**	**638827**	**NO_2**	**N**	4.7	1.7	Y
DT9	**63 High Street, Irvine, (ROMON)**	Roadside	**232192**	**638827**	**NO_2**	**N**	4.7	1.7	Y
DT10	**34 Kirkgate Irvine**	Urban Background	**232085**	**638774**	**NO_2**	**N**	10	0.5	N
DT11	**25 Main Rd, Springside**	Kerbside	**236813**	**638659**	**NO_2**	**N**	5	1	N
DT12	**Auchengate (Bridge)**	Urban Background	**233332**	**635558**	**NO_2**	**N**	N/A	32	N

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?
DT13	**Dalry Rd, Kilwinning**	Kerbside	**229928**	**643400**	**NO_2**	**N**	2	1	N
DT14	**Vernon St, Saltcoats**	Kerbside	**224697**	**641366**	**NO_2**	**N**	0	1	N
DT15	**12 Garnock St, Dalry**	Urban Background	**229326**	**649250**	**NO_2**	**N**	10	0.5	N
DT16	**67 New St, Dalry**	Kerbside	**229338**	**649337**	**NO_2**	**N**	0	0.5	N
DT17	**45 New St, Dalry**	Kerbside	**229286**	**649365**	**NO_2**	**N**	0	0.5	N
DT18	**2 Townhead St, Dalry**	Roadside	**229230**	**649338**	**NO_2**	**N**	0	3	N
DT19	**Highfield Hamlet, Dalry**	Urban Background	**230943**	**650280**	**NO_2**	**N**	10	1	N
DT20	**85 Main Street, Largs**	Kerbside	**220333**	**659322**	**NO_2**	**N**	1.5	0	N
DT21	**Hunterston Road**	Rural	**219582**	**650020**	**NO_2**	**N**	N/A	N/A	N
DT22	**Princess St/Glasgow St, Ardrossan**	Kerbside	**219582**	**650020**	**NO_2**	**N**	0	0.5	N

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

(2) N/A if not applicable.

Table A.3 – Annual Mean NO_2 Monitoring Results

Site ID	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)				
					2015	2016	2017	2018	2019
ROMON	Roadside	Automatic	-	69	28	25	21	18	16
DT1	Roadside	Diffusion Tube	-	100	22	22	22	21	20
DT2	Roadside	Diffusion Tube	-	92	22	23	22	25	19
DT3	Roadside	Diffusion Tube	-	92	24	25	21	23	16
DT4	Roadside	Diffusion Tube	-	100	31	29	27	18	17
DT5	Kerbside	Diffusion Tube	-	100	51	43	41	23	20
DT6	Roadside	Diffusion Tube	-	92	37	30	32	22	20
DT7	Roadside	Diffusion Tube	-	75	28	25	25	20	20
DT8	Roadside	Diffusion Tube	-	67	29	25	24	21	19
DT9	Roadside	Diffusion Tube	-	67	27	25	23	19	19
DT10	Urban Background	Diffusion Tube	-	100	8	9	8	11	9
DT11	Kerbside	Diffusion Tube	-	92	15	14	14	13	13

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)				
					2015	2016	2017	2018	2019
DT12	Urban Background	Diffusion Tube	-	100	10	12	12	12	11
DT13	Kerbside	Diffusion Tube	-	100	19	18	19	21	17
DT14	Kerbside	Diffusion Tube	-	100	9	11	9	10	9
DT15	Urban Background	Diffusion Tube	-	100	30	31	29	25	21
DT16	Kerbside	Diffusion Tube	-	92	36	39	38	34	26
DT17	Kerbside	Diffusion Tube	-	100	28	24	27	26	21
DT18	Roadside	Diffusion Tube	-	92	18	20	19	17	14
DT19	Urban Background	Diffusion Tube	-	100	18	19	17	18	16
DT20	Kerbside	Diffusion Tube	-	100	5	5	5	5	5
DT21	Rural	Diffusion Tube	-	100	18	17	15	16	15
DT22	Kerbside	Diffusion Tube	-	100	21	18	19	17	14

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 LAQM.TG(16) if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

Site ID	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
ROMON	Roadside	Automatic	-	69	**1**	0	0	0	0

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	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
ROMON	Roadside	-	70	14	15	13	14	14

Notes: Exceedances of the PM_{10} annual mean objective of 18$\mu g/m^3$ 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 LAQM.TG(16), valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

Site ID	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
ROMON	Roadside	-	70	0	0	0	0	0

Notes: Exceedances of the PM_{10} 24-hour mean objective (50µg/m^3 not to be exceeded more than 7 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 98.1st percentile of 24-hour means is provided in brackets.

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

Site ID	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
ROMON	Roadside	-	70	6	7	7	8	8

Notes: Exceedances of the PM_{10} annual mean objective of 10µg/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 LAQM.TG(16), valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Appendix B: Full Monthly Diffusion Tube Results for 2019

Table B.1 – NO_2 Monthly Diffusion Tube Results for 2019

Site ID	NO_2 Mean Concentrations (µg/m^3)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean	
													Raw Data	Bias Adjusted(1)
DT1	31.5	32.5	26.1	26.0	17.5	19.9	16.7	16.4	19.0	23.0	31.7	16.8	23.1	20
DT2	37.5	39.3	12.9	33.8	18.3	19.6	17.0	12.2	18.0	16.2		20.7	22.3	19
DT3	27.9	17.2	15.3	18.6		15.2	12.5	13.2	12.5	24.2	30.3	19.2	18.7	16
DT4	33.9	29.8	19.9	18.5	14.8	12.2	11.4	13.8	12.4	18.4	26.3	19.6	19.3	17
DT5	39.7	39.1	23.4	22.5	17.7	15.1	11.8	16.7	17.0	21.3	28.8	22.1	22.9	20
DT6	35.3	34.1	25.5	20.0	19.7	17.8		18.8	19.7	20.1	27.5	19.7	23.5	20
DT7	29.5	27.1	25.5	17.5				12.4	15.5	21.2	28.4	29.7	23.0	20
DT8	34.7	24.0	21.9	19.6				13.5	18.0	18.4	30.9		22.4	19
DT9	34.8	21.5	23.2	19.4				15.6	17.0	20.5	31.2		22.7	19
DT10	18.6	13.4	6.8	10.1	7.4	7.4	5.6	4.0	6.8	13.2	21.9	9.7	10.4	9
DT11	24.9	15.8	10.6	15.7	11.7	10.8		9.7	11.5	15.8	23.0	15.4	15.0	13
DT12	20.4	19.4	13.9	10.8	9.5	11.2	6.7	7.5	8.8	11.2	19.6	12.5	12.6	11
DT13	29.5	27.2	16.4	23.4	17.6	16.5	9.7	19.5	21.0	14.6	27.1	18.3	20.1	17
DT14	19.1	13.4	9.0	12.7	6.8	6.5	3.5	4.4	6.6	1.6	22.0	18.6	10.4	9
DT15	44.8	29.1	36.7	28.1	23.3	13.9	17.4	12.2	15.6	17.2	36.8	21.0	24.7	21
DT16	37.1	47.7	42.1	40.5	28.1	18.8		20.2	26.9	23.2	31.1	23.1	30.8	26
DT17	35.2	33.4	28.0	36.1	25.9	17.0	10.4	15.8	21.2	18.8	30.2	20.8	24.4	21
DT18	23.4	23.4	13.1	22.1	15.5	10.6	2.6		18.1	12.6	23.1	14.2	16.2	14
DT19	24.8	16.4	16.8	23.3	21.7	17.5	17.5	15.5	21.5	5.2	27.2	15.9	18.6	16
DT20	5.4	5.2	4.3	7.6	4.5	6.1	1.7	2.7	5.3	16.0	8.3	4.9	6.0	5
DT21	21.9	17.8	17.1	25.1	17.0	14.0	9.3	13.8	14.3	18.4	25.9	13.9	17.4	15
DT22	22.5	23.1	18.5	21.7	18.0	16.4	17.0	15.5	19.2	13.3	2.5	8.4	16.3	14

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

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

Figure 1: RICARDO - AEA Air Pollution Report

Air Pollution Report

Air Quality in Scotland

1st January to 31st December 2019

North Ayrshire Irvine High St (Site ID: IRV)

These data have been fully ratified

Only relevant statistics for LAQM are presented in the table. Cells with - indicate no data available or calculated.

Pollutant	NO µg/m³	NO_2 µg/m³	NO_x as NO_2 µg/m³	PM_{10} µg/m³	PM_{25} µg/m³
Number Days Low	-	253	-	253	253
Number Days Moderate	-	0	-	2	2
Number Days High	-	0	-	0	0
Number Days Very High	-	0	-	0	0
Max Daily Mean	60	56	148	70	40
Annual Max	291	112	553	918	119
Annual Mean	15	18	41	15	8
98th Percentile of daily mean	-	-	-	42	-
90th Percentile of daily mean	-	-	-	24	-
99.8th Percentile of hourly mean	-	87	-	-	-
98th Percentile of hourly mean	85	60	182	46	29
95th Percentile of hourly mean	60	49	141	33	20
50th Percentile of hourly mean	7	13	25	12	6
% Annual data capture	**68.79%**	**68.79%**	**68.79%**	**70.00%**	**70.00%**

Instruments: PM_{10}: FIDAS

PM_{25}: FIDAS

All gaseous pollutant mass units are at 20°C and 1013mb. Particulate matter concentrations are reported at ambient temperature and pressure. NO_X mass units are NO_X as NO_2 µg m-3

Note: For a strict comparison against the objectives there must be a data capture of 85% or greater throughout the calendar year.

1 / 3

Report produced by Ricardo Energy & Environment

Pollutant	Air Quality Standards (Scotland) Regulations 2010	Exceedances	Days
PM10 particulate matter (Hourly measured)	daily mean > 50 microgrammes per metre cubed	2	2
PM10 particulate matter (Hourly measured)	Annual mean > 18 microgrammes per metre cubed	0	-
PM2.5 particulate matter (Hourly measured)	Annual mean > 12 microgrammes per metre cubed	0	-
Nitrogen dioxide	Hourly Mean > 200 microgrammes per metre cubed	0	0
Nitrogen dioxide	Annual Mean > 40 microgrammes per metre cubed	0	-

Annual Graph

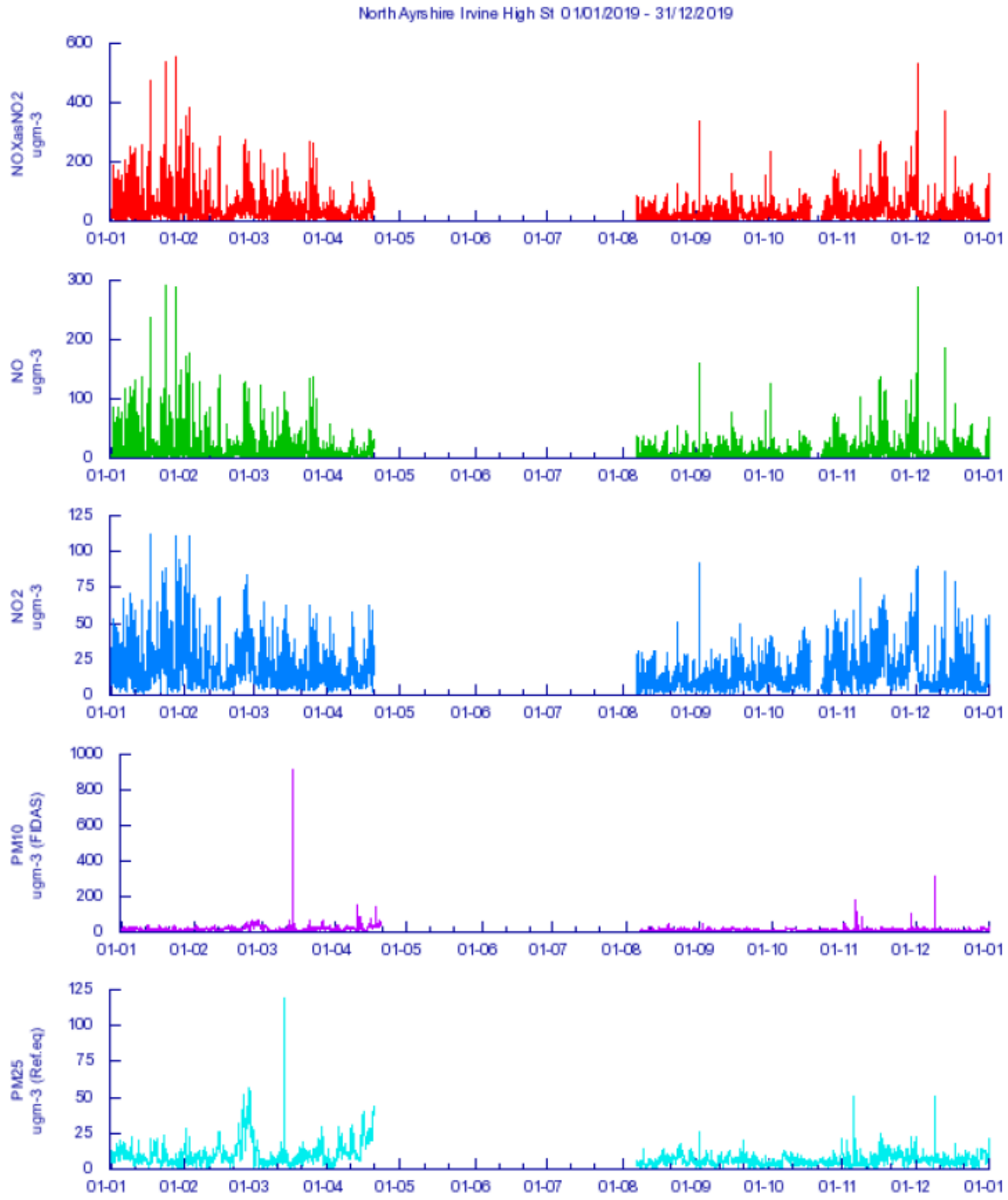

Figure 2: Ricardo - AEA Certificates of Calibration.

0401

CERTIFICATE OF CALIBRATION

Ricardo Energy and Environment, Gemini Building, Fermi Avenue Harwell, Didcot, Oxfordshire OX11 0QR. Telephone 01235 753692

RICARDO

Page 1 of 3

Approved Signatories:

- ☐ S. Eaton
- ☐ D Hector
- ☐ N Rand
- ☐ B Davies
- ☐ B Stacey
- ☐ S Stratton
- ☑ S Telfer
- ☐ S Gray

Signed:

Date of issue: 20 May 20

Certificate Number: 4955

Customer Name and Address:

Scottish Government
Water, Air, Soils and Flooding Division
Environmental Quality Directorate
Scottish Government
Victoria Quay
Edinburgh
EH6 6QQ

Description: Calibration factors for the air monitoring station(s) at North Ayrshire Council

Ricardo Energy & Environment ID: ED11194 / 4955

The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95% The uncertainty evaluation has been carried out in accordance with UKAS requirements.

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory

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0401

CERTIFICATE OF CALIBRATION

Date of issue: 20 May 20

Certificate Number: 4955

Ricardo Energy & Environment ID: ED11194 / 4955

North Ayrshire Council

NOx analysers

Station	Date of Audit	Species	Analyser Serial no	Zero Response[1]	Zero uncertainty ppb	Calibration Factor[2]	Factor uncertainty %	Converter eff. (%)[3]
North Ayrshire Irvine High Street	09-Aug	NOx	2981873	0.0	2.5	1.0211	3.50	94.5
		NO		-1.0	2.5	1.0147	3.50	

PM10 analysers

Station	Date of audit	Analyser Serial no	Calculated ko	Uncertainty %	Total flow	Uncertainty %	Main flow	Uncertainty %
North Ayrshire Irvine High Street	09-Aug	6251			4.65	2.2		2.2

PM2.5 analysers

Station	Date of audit	Analyser Serial no	Calculated ko	Uncertainty %	Total flow	Uncertainty %	Main flow	Uncertainty %
North Ayrshire Irvine High Street	09-Aug	6251			4.65	2.2		2.2

0401

CERTIFICATE OF CALIBRATION

Date of issue:	20 May 20
Certificate Number:	4955
Ricardo Energy & Environment ID:	ED11194 / 4955

The gaseous ambient analysers listed above have been tested for zero response, calibration factor, linearity and converter efficiency (NOx analysers) by documented methods. The factors have been calculated using certified gas standards. The particulate analysers listed above have been tested for sample flow rates and ko(where appropriate) by documented methods. Note that the test results are valid on the day of test only, as analyser drift over time cannot be quantified. All results for gaseous species are given in ppb (parts per billion) mole fractions or ppm (parts per million) mole fractions.

[1] The zero response is the zero reading on the data logging system of the analyser when audit zero gas was introduced to the analysers under test.

[2] The calibration factor is the multiplying factor required to scale the reading on the data logging system of the analyser into reported concentration units (ppb for NO, NOx, SO_2, O_3 and ppm for CO. Where 1ppm = 1000ppb). It should be used in conjunction with the zero response. A corrected concentration is calculated using the following equation:

Concentration = F(Output - Zero Response)

Where F = Calibration Factor provided on this certificate

Output = Reading on the data logging system of the analyser

Zero Response = Zero Response provided on this certificate

[3] Converter eff. is the measured efficiency of the NO_2 to NO converter within the oxides of nitrogen analyser under test.

[4] The measured main flow rate (where this is applicable) is the flow rate through the sensor unit of the TEOM particulate analyser under test. The measured total flow rate is the total flow rate through the particulate analyser under test. Units of flow are $l.min^{-1}$, reported at prevailing ambient conditions unless otherwise specified. Where flow rates are highlighted in bold, it indicates that measurements were not made at the analyser sample inlet. These measurements therefore may not accurately reflect analyser performance in normal operation.

[5] The calculated ko value (specifically for TEOM analysers) is the calculated ko spring constant based on tests undertaken with filters of known weight. The % deviation indicates the closeness of the calculated result to the manufacturer's specified value of ko.

The calibration results shaded are those that fall within our scope of accreditation, all other results on this certificate are not UKAS accredited, but have been included for completeness.

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CERTIFICATE OF CALIBRATION

Ricardo Energy and Environment, Gemini Building, Fermi Avenue Harwell, Didcot, Oxfordshire OX11 0QR. Telephone 01235 753692

RICARDO

Approved Signatories:

☐ S. Eaton	☐ B Stacey
☐ D Hector	☐ S Stratton
☐ N Rand	☑ S Telfer
☐ B Davies	☐ S Gray

Signed: STelfer

Date of issue: 27 May 20

Certificate Number: 4985

Customer Name and Address:

Scottish Government
Water, Air, Soils and Flooding Division
Environmental Quality Directorate
Scottish Government
Victoria Quay
Edinburgh
EH6 6QQ

Description: Calibration factors for the air monitoring station(s) at North Ayrshire Council

Ricardo Energy & Environment ID: ED11194 / 4985

The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95% The uncertainty evaluation has been carried out in accordance with UKAS requirements.

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory

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CERTIFICATE OF CALIBRATION

Date of issue: 27 May 20

Certificate Number: 4985

Ricardo Energy & Environment ID: ED11194 / 4985

North Ayrshire Council

PM10 analysers

Station	Date of audit	Analyser Serial no	Calculated ko	Uncertainty %	Total flow	Uncertainty %	Main flow	Uncertainty %
North Ayrshire Irvine High Street	13-Dec	6251			4.67	2.2		2.2

PM2.5 analysers

Station	Date of audit	Analyser Serial no	Calculated ko	Uncertainty %	Total flow	Uncertainty %	Main flow	Uncertainty %
North Ayrshire Irvine High Street	13-Dec	6251			4.67	2.2		2.2

0401

CERTIFICATE OF CALIBRATION

Date of issue:	27 May 20
Certificate Number:	4985
Ricardo Energy & Environment ID:	ED11194 / 4985

The gaseous ambient analysers listed above have been tested for zero response, calibration factor, linearity and converter efficiency (NOx analysers) by documented methods. The factors have been calculated using certified gas standards. The particulate analysers listed above have been tested for sample flow rates and ko(where appropriate) by documented methods. Note that the test results are valid on the day of test only, as analyser drift over time cannot be quantified. All results for gaseous species are given in ppb (parts per billion) mole fractions or ppm (parts per million) mole fractions.

[1] The zero response is the zero reading on the data logging system of the analyser when audit zero gas was introduced to the analysers under test.

[2] The calibration factor is the multiplying factor required to scale the reading on the data logging system of the analyser into reported concentration units (ppb for NO, NOx, SO_2, O_3 and ppm for CO. Where 1ppm = 1000ppb). It should be used in conjunction with the zero response. A corrected concentration is calculated using the following equation:

Concentration = F(Output - Zero Response)

Where F = Calibration Factor provided on this certificate

Output = Reading on the data logging system of the analyser

Zero Response = Zero Response provided on this certificate

[3] Converter eff. is the measured efficiency of the NO_2 to NO converter within the oxides of nitrogen analyser under test.

[4] The measured main flow rate (where this is applicable) is the flow rate through the sensor unit of the TEOM particulate analyser under test. The measured total flow rate is the total flow rate through the particulate analyser under test. Units of flow are $l.min^{-1}$, reported at prevailing ambient conditions unless otherwise specified. Where flow rates are highlighted in bold, it indicates that measurements were not made at the analyser sample inlet. These measurements therefore may not accurately reflect analyser performance in normal operation.

[5] The calculated ko value (specifically for TEOM analysers) is the calculated ko spring constant based on tests undertaken with filters of known weight. The % deviation indicates the closeness of the calculated result to the manufacturer's specified value of ko.

The calibration results shaded are those that fall within our scope of accreditation, all other results on this certificate are not UKAS accredited, but have been included for completeness.

Figure 3: NOx & PM Fidas Service Report

SERVICE REPORT

AirMonitors.co.uk
Quality - Service - Innovation

Customer :	North Ayrshire	Job No:	KDSN060819_I	Start Date	06/08/19
				Start Time	08:30
Site Name:	Irvine High Street			End Date	07/08/19
				End Time	14:50

Reason for visit: Install

Additional Reason for visit: Please select

Action Taken: AML7988

Secured new PT5 cabinet to plinth. Fitted shelves and sample inlets to roof of cabinet. Applied weather proof sealant. Installed existing instruments to new cabinet.

NOx Pump vacuum good at 26". Carried out zero and span. Gas analyser sample inlet checked.

FIDAS Carried out flow and leak checks.
Replaced SIM card (M2M - IMEI 89340 76179 00728 579 7) in Gen II Web Logger and configured.
Vodafone SIM card; IMEI 8944 1000 3010 8509 9796 C484 removed.
Comms tested ok.

Parts Used

Model Used on:	Part No: (Must be completed)	Description:	Qty	Invoice
		Installation Materials		
	M2M	SIM Card	1	
		Consumables		

Engineer: Kris Dalziel, Stephen Nicol

Visit Type: Installation

Complete site inventory

For Office Use Only:

TTS 4.5

VDT A

Air Monitors Ltd - Units 2/3 Miller Court - Severn Drive – Tewkesbury – Glos - GL20 8DN
Tel: 01684 857530 Fax 01684 857538 Email: service@airmonitors.co.uk Web: www.airmonitors.co.uk

Figure 4: QA/QC Data

Diffusion Tube Bias Adjustment

Factors National Adjustment Factors

Diffusion tubes (20% TEA/Water) used in the sampling period for 2019 were supplied and analysed by Glasgow Scientific Services (GSS). Diffusion Tube Bias Adjustment Factors for tubes provided by GSS are listed in the National Diffusion Tube Bias Adjustment Factor Spreadsheet in Figure 7 below. The Tube Precision and AIR results for the laboratory are shown in Figure 8 below. The resultant bias for GSS is **0.86** based on 4 studies with 2 of poor precision.

Factor from Local Co-location Studies

The automatic monitoring station (ROMON) has been operational since early 2009 and is the site being used for three co-location tubes. The unit is permanently located here and allows for full "calendar year" data to be collected. The ROMON has fortnightly checks carried out in accordance with the prescribed methodology as issued by Ricardo - AEA. The unit is audited every 6 months by Ricardo - AEA and is serviced every 6 months under contract to a specialist company. Corresponding data was entered in the "Checking Precision and Accuracy of Triplicate Tubes" spreadsheet (Figure 9 below). The resulting Bias factor for 2019 data is **0.76** using all 12 periods.

Discussion of Choice of Factor to Use

Due to the loss of data during 2019 the data set isn't as comprehensive as to meet with good statistical rules. The diffusion tube co-location study for North Ayrshire Council shows this has "Poor" precision and corresponding "Poor" overall Data Capture from the ROMON and it is felt that the local derived bias factor of 0.78 – 0.81 is significantly lower than that of other years. Records show that previously local derived bias factors ranged from 0.91 – 1 between 2009 and 2018 and the National Bias Adjustment Factor from GSS is closer to these values and when applied reflects this more accurately on the true values of air quality when considered over the entire district. Using the national bias factor of **0.86** reflects a more realistic trend for NO_2 pollution levels within North Ayrshire Council.

PM Monitoring Adjustment

Readings from the Fidas 200 automatic particulate analyser are recorded for monitoring purposes every 2 weeks during the NO_x calibration check. The PM_{10} and $PM_{2.5}$ data collected by the ROMON is processed and ratified by Ricardo - AEA. The Air Pollution Report for North Ayrshire, Irvine High Street for 1st January to 31st December 2019 is included in Figure 1 above.

QA/QC of automatic monitoring

The automatic monitoring instruments housed within the roadside cabinet has onsite calibration checks conducted every 2 weeks by Local Authority Officers. All checks are carried out in accordance with procedures laid out by Ricardo - AEA and calibration check sheets are forwarded to them after each visit. The site is visited by Ricardo - AEA engineers every 6 months to carry out calibration audit tests and reports from these visits are included in Figure 2 above. The instruments units are also serviced twice yearly by a specialist company and reports from these visits are included in Figure 3 above.

Figure 5: Annualisation Calculations for Automatic Monitor
(The data that is missing from NAC is May, June & July)

NO_2

Background Site	Annual Mean 2019 (A_m)	Period Mean 2019 (P_M)	Ratio (A_m/P_m)
Glasgow Waulkmillglen	9	10.9	0.826
Glasgow Townhead	24	28.11	0.854
Glasgow Anderston	25	27.26	0.917
	Average (R_a)		0.866

M x R_a = 18 x 0.866 = 16ug/m^3

PM_{10}

Background Site	Annual Mean 2019 (A_m)	Period Mean 2019 (P_M)	Ratio (A_m/P_m)
Glasgow Waulkmillglen	9	9	1
Glasgow Townhead	11	12.26	0.897
Glasgow Anderston	12	12.61	0.951
	Average (R_a)		0.949

M x R_a = 15 x 0.949 = 14ug/m^3

$PM_{2.5}$

Background Site	Annual Mean 2019 (A_m)	Period Mean 2019 (P_M)	Ratio (A_m/P_m)
Glasgow Waulkmillglen	6	6	1
Glasgow Townhead	7	7.21	0.970
Glasgow Anderston	7	7.3	0.959
	Average (R_a)		0.976

M x R_a = 8 x 0.976 = 8ug/m^3

Figure 6: Annualisation Summary for Diffusion Tubes

Diffusion Tube Raw Data Inputs

Enter data into the pink cells

Step 2	Bias Adjustment Factor	1.0	

Step 3	Raw Diffusion Tube Data

				NO_2 Monthly Concentration Data ($\mu g/m^3$)												
Diffusion Tube ID	Duplicate/Triplicate ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Requires Annualisation?
DT 1	35 East Road Irvine	232323	638892	31.5	32.5	26.1	26.0	17.5	19.9	16.7	16.4	19.0	23.0	31.7	16.8	NO
DT 2	18 Bank St, Irvine (Pitchers)	232202	638952	37.5	39.3	12.9	33.8	18.3	19.6	17.0	12.2	18.0	16.2		20.7	NO
DT 3	147 High Street, Irvine (Browings)	232077	638990	27.9	17.2	15.3	18.6		15.2	12.5	13.2	12.5	24.2	30.3	19.2	NO
DT 4	h St, Irvine (Shoe Repair/Indian F	232158	638882	33.9	29.8	19.9	18.5	14.8	12.2	11.4	13.8	12.4	18.4	26.3	19.6	NO
DT 5	79 High St, Irvine (Fishmongers)	232160	638885	39.7	39.1	23.4	22.5	17.7	15.1	11.8	16.7	17.0	21.3	28.8	22.1	NO
DT 6	St, Irvine (Yoohoo/The Meridian	232170	638871	35.3	34.1	25.5	20.0	19.7	17.8		18.8	19.7	20.1	27.5	19.7	NO
DT 7 Tri Set 1	Street, Irvine, (AUTO MONITOR	232182	638867	29.5	27.1	25.5	17.5				12.4	15.5	21.2	28.4	29.7	NO
DT 8 Tri Set 1	Street, Irvine, (AUTO MONITOR S	232182	638867	34.7	24.0	21.9	19.6				13.5	18.0	18.4	30.9		YES
DT 9 Tri Set 1	Street, Irvine, (AUTO MONITOR S	232182	638867	34.8	21.5	23.2	19.4				15.6	17.0	20.5	31.2		YES
DT 10	34 Kirkgate Irvine	232085	638774	18.6	13.4	6.8	10.1	7.4	7.4	5.6	4.0	6.8	13.2	21.9	9.7	NO
DT 11	25 Main Rd, Springside	236813	638659	24.9	15.8	10.6	15.7	11.7	10.8		9.7	11.5	15.8	23.0	15.4	NO
DT 12	Auchengate (Bridge)	233350	635578	20.4	19.4	13.9	10.8	9.5	11.2	6.7	7.5	8.8	11.2	19.6	12.5	NO
DT 13	Dalry Rd , Kilwinning	229928	643400	29.5	27.2	16.4	23.4	17.6	16.5	9.7	19.5	21.0	14.6	27.1	18.3	NO
DT 14	12 Garnock St, Dalry	229326	649250	19.1	13.4	9.0	12.7	6.8	6.5	3.5	4.4	6.6	1.6	22.0	18.6	NO
DT 15	67 New St, Dalry (Royal Hotel)	229338	649337	44.8	29.1	36.7	28.1	23.3	13.9	17.4	12.2	15.6	17.2	36.8	21.0	NO
DT 16	New St Dalry (Zain's Curry Hous	229286	649365	37.1	47.7	42.1	40.5	28.1	18.8		20.2	26.9	23.2	31.1	23.1	NO
DT 17	ownhead, St, Dalry (Housing Offi	229230	649365	35.2	33.4	28.0	36.1	25.9	17.0	10.4	15.8	21.2	18.8	30.2	20.8	NO
DT 18	Highfield Hamlet , Dalry	230943	650280	23.4	23.4	13.1	22.1	15.5	10.6	2.6		18.1	12.6	23.1	14.2	NO
DT 19	5 Main Street , Largs (Key Centr	220333	659322	24.8	16.4	16.8	23.3	21.7	17.5	17.5	15.5	21.5	5.2	27.2	15.9	NO
DT 20	Hunterston Road/Cycle Track	219582	650020	5.4	5.2	4.3	7.6	4.5	6.1	1.7	2.7	5.3	16.0	8.3	4.9	NO
DT 21	41-43 Princes St, Ardrossan	222942	642101	21.9	17.8	17.1	25.1	17.0	14.0	9.3	13.8	14.3	18.4	25.9	13.9	NO
DT 22	21 Vernon St, Saltcoats	224697	641366	22.5	23.1	18.5	21.7	18.0	16.4	17.0	15.5	19.2	13.3	2.5	8.4	NO
DT 23																

Annualisation Summary for Diffusion Tubes (Cont'd)

Annualisation Summary

Diffusion Tube ID	Annualisation Factor Glasgow Townhead	Annualisation Factor Glasgow Anderston	Annualisation Factor Gl	Annualisation Factor Site 4 Name	Average Annualisation Factor	Raw Data Time Weighted Annual Mean (µg/m3)	Annualised Data Time Weighted Annual Mean (µg/m3)	Comments
DT 8 Tri Set	0.8822	0.9360			0.9091	-	-	Duplicate/Triplicate site - Annual data provided for other tube
DT 9 Tri Set	0.8822	0.9360			0.9091	22.9	20.8	
						-	-	

Figure 7: Bias Factor Spreadsheet (Glasgow Scientific)

National Diffusion Tube Bias Adjustment Factor Spreadsheet

Spreadsheet Version Number: 03/20

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 spreadhseet 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 June 2020

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@uk.bureauveritas.com or 0800 0327953

Analysed By[1]	Method (To undo your selection, choose (All) from the pop-up list)	Year[5] (To undo 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[6]	Bias Adjustment Factor (A) (Cm/Dm)
Glasgow Scientific Services	20% TEA in water	2019	R	East Dunbartonshire Council	12	36	32	12.7%	P	**0.89**
Glasgow Scientific Services	20% TEA in water	2019	R	East Dunbartonshire Council	12	23	21	10.6%	P	**0.90**
Glasgow Scientific Services	20% TEA in water	2019	R	East Dunbartonshire Council	12	33	26	23.7%	G	**0.81**
Glasgow Scientific Services	20% TEA in water	2019	KS	Marylebone Road Intercomparison	12	79	65	21.0%	G	**0.83**
Glasgow Scientific Services	20% TEA in water	2019		**Overall Factor[3] (4 studies)**				**Use**		**0.86**

Figure 8: Tube Precision & AIR Results

Table 1: Laboratory summary performance for AIR NO_2 PT rounds AR0024, 25, 27, 28, 30, 31, 33 and 34

The following table lists those UK laboratories undertaking LAQM activities that have participated in recent AIR NO_2 PT rounds and the percentage (%) of results submitted which were subsequently determined to be **satisfactory** based upon a **z**-score of ≤ ± 2 as defined above.

AIR PT Round	AIR PT AR024	AIR PT AR025	AIR PT AR027	AIR PT AR028	AIR PT AR030	AIR PT AR031	AIR PT AR033	AIR PT AR034
Round conducted in the period	January – February 2018	April – May 2018	July – August 2018	September – October 2018	January – February 2019	April – May 2019	July – August 2019	September – November 2019
Aberdeen Scientific Services	100 %	100 %	100 %	100 %	75 %	100 %	100 %	100 %
Cardiff Scientific Services	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Edinburgh Scientific Services	100 %	100 %	100 %	100 %	100 %	NR [2]	100 %	25 %
SOCOTEC	100 % [1]	100 % [1]	100 % [1]	100 % [1]	87.5 % [1]	100 % [1]	100 % [1]	100 % [1]
Exova (formerly Clyde Analytical)	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Glasgow Scientific Services	100 %	100 %	50 %	100 %	100 %	100 %	100 %	50 %
Gradko International [1]	100 % [1]	100 %	100 %	100 %	75 %	100 %	100 %	100 %
Kent Scientific Services	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Kirklees MBC	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Lambeth Scientific Services	NR [2]	NR [2]	NR [2]	25 %	50 %	100 %	50 %	100 %
Milton Keynes Council	100 %	75 %	100 %	100 %	100 %	100 %	50 %	100 %
Northampton Borough Council	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Somerset Scientific Services	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
South Yorkshire Air Quality Samplers	100 %	100 %	100 %	100 %	100 %	100 %	100 %	75 %
Staffordshire County Council	50 %	100 %	100 %	100 %	100 %	75 %	75 %	75 %
Tayside Scientific Services (formerly Dundee CC)	100 %	NR [2]	100 %	NR [2]	100 %	NR [2]	100 %	NR [2]
West Yorkshire Analytical Services	50 %	75 %	100 %	100 %	100 %	100 %	100 %	50 %

[1] Participant subscribed to two sets of test results (2 x 4 test samples) in each AIR PT round.
[2] NR No results reported
[3] Northampton Borough Council, Kent Scientific Services, Cardiff Scientific Services, Kirklees MBC and Exova (formerly Clyde Analytical) no longer carry out NO2 diffusion tube monitoring and therefore did not submit results.

Figure 9: Diffusion Tube Accuracy

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements										Automatic Method		Data Quality Check	
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	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	07/01/2019	05/02/2019	29.5	34.7	34.8	33	3.0	9	7.5	26	100	Good	Good
2	05/02/2019	04/03/2019	27.1	24.0	21.5	24	2.8	12	7.0	23	100	Good	Good
3	04/03/2019	03/04/2019	25.5	21.9	23.2	24	1.8	8	4.5	17	100	Good	Good
4	03/04/2019	01/05/2019	17.5	19.6	19.4	19	1.2	6	2.9	15	65	Good	or Data Capture
5	01/05/2019	12/06/2019											
6	12/06/2019	03/07/2019											
7	03/07/2019	06/08/2019											
8	06/08/2019	04/09/2019	12.4	13.5	15.6	14	1.6	12	4.0	10	78	Good	Good
9	04/09/2019	02/10/2019	15.5	18.0	17.0	17	1.3	7	3.1	11	100	Good	Good
10	02/10/2019	06/11/2019	21.2	18.4	20.5	20	1.5	7	3.6	15	85	Good	Good
11	06/11/2019	11/12/2019	28.4	30.9	31.2	30	1.5	5	3.8	23	100	Good	Good
12	11/12/2019	08/01/2020	29.7	20.8	20.8	24	5.1	22	12.8	16	100	Poor Precision	Good
13													
										Overall survey -->		Good precision	Good Overall DC

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

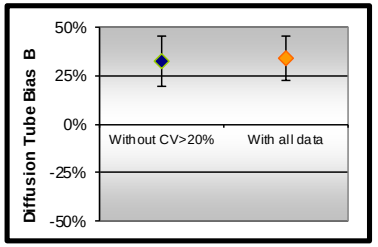
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:	High Street, Irvine

Precision: 8 out of 9 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 7 periods of data	
Bias factor A	0.77 (0.7 - 0.86)
Bias B	29% (16% - 42%)
Diffusion Tubes Mean:	23 µgm^{-3}
Mean CV (Precision):	9
Automatic Mean:	18 µgm^{-3}
Data Capture for periods used:	95%
Adjusted Tubes Mean:	18 (16 - 20) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 8 periods of data	
Bias factor A	0.76 (0.7 - 0.83)
Bias B	31% (20% - 43%)
Diffusion Tubes Mean:	23 µgm^{-3}
Mean CV (Precision):	10 caution
Automatic Mean:	18 µgm^{-3}
Data Capture for periods used:	95%
Adjusted Tubes Mean:	18 (16 - 19) µgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

If you have any enquiries about this spreadsheet please contact the LAQM Helpdesk at: LAQMHelpdesk@uk.bureauveritas.com

Diffusion Tube Accuracy NAC (cont'd)

Adjustment of SINGLE Tubes

AEA Energy & Environment
From the AEA group

Site Name/ID	Periods													Raw Mean	Valid periods	Adjusted measurement (95% confidence interval) with all the data 8 periods used in this calcuations
	1	2	3	4	5	6	7	8	9	10	11	12	13			Bias Factor A 0.76 (0.7 - 0.83) Bias B 31% (20% - 43%) Tube Precision: 10 Automatic DC: 95%
35 East Road Irvine/DT1	31.5	32.5	26.1	26.0	17.5	19.9	16.7	16.4	19.0	23.0	31.7	16.8		23.1	12	Adjusted with 95% CI 18 (16 - 19)
18 Bank St, Irvine (Pitchers)/DT2	37.5	39.3	12.9	33.8	18.3	19.6	17.0	12.2	18.0	16.2		20.7		22.3	11	Adjusted with 95% CI 17 (16 - 19)
147 High Street, Irvine (Browings)/DT3	27.9	17.2	15.3	18.6		15.2	12.5	13.2	12.5	24.2	30.3	19.2		18.7	11	Adjusted with 95% CI 14 (13 - 16)
85 High St, Irvine (Shoe Repair/Indian Palace)/DT4	33.9	29.8	19.9	18.5	14.8	12.2	11.4	13.8	12.4	18.4	26.3	19.6		19.3	12	Adjusted with 95% CI 15 (13 - 16)
79 High St, Irvine (Fishmongers)/DT5	39.7	39.1	23.4	22.5	17.7	15.1	11.8	16.7	17.0	21.3	28.8	22.1		22.9	12	Adjusted with 95% CI 17 (16 - 19)
75 High St, Irvine (Yoohoo/The Meridian Room)/DT6	35.3	34.1	25.5	20.0	19.7	17.8		18.8	19.7	20.1	27.5	19.7		23.5	11	Adjusted with 95% CI 18 (16 - 19)
65a High Street, Irvine, (AUTO MONITOR STATION)/DT7	29.5	27.1	25.5	17.5				12.4	15.5	21.2	28.4	29.7		23.0	9	Adjusted with 95% CI 17 (16 - 19)
65 High Street, Irvine, (AUTO MONITOR STATION)/DT8	34.7	24.0	21.9	19.6				13.5	18.0	18.4	30.9	20.8		22.4	9	Adjusted with 95% CI 17 (16 - 19)
65 High Street, Irvine, (AUTO MONITOR STATION)/DT9	34.8	21.5	23.2	19.4				15.6	17.0	20.5	31.2	20.8		22.7	9	Adjusted with 95% CI 17 (16 - 19)
34 Kirkgate Irvine/DT10	18.6	13.4	6.8	10.1	7.4	7.4	5.6	4.0	6.8	13.2	21.9	9.7		10.4	12	Adjusted with 95% CI 8 (7 - 9)
25 Main Rd, Springside/DT11	24.9	15.8	10.6	15.7	11.7	10.8		9.7	11.5	15.8	23.0	15.4		15.0	11	Adjusted with 95% CI 11 (10 - 12)
Auchengate (Bridge)/DT12	20.4	19.4	13.9	10.8	9.5	11.2	6.7	7.5	8.8	11.2	19.6	12.5		12.6	12	Adjusted with 95% CI 10 (9 - 10)
Dalry Rd , Kilwinning/DT13	29.5	27.2	16.4	23.4	17.6	16.5	9.7	19.5	21.0	14.6	27.1	18.3		20.1	12	Adjusted with 95% CI 15 (14 - 17)
12 Garnock St, Dalry/Dt14	19.1	13.4	9.0	12.7	6.8	6.5	3.5	4.4	6.6	1.6	22.0	18.6		10.4	12	Adjusted with 95% CI 8 (7 - 9)
67 New St, Dalry (Royal Hotel)/DT15	44.8	29.1	36.7	28.1	23.3	13.9	17.4	12.2	15.6	17.2	36.8	21.0		24.7	12	Adjusted with 95% CI 19 (17 - 20)
45 New St Dalry (Zain's Curry House)/DT16	37.1	47.7	42.1	40.5	28.1	18.8		20.2	26.9	23.2	31.1	23.1		30.8	11	Adjusted with 95% CI 23 (22 - 26)
2 Townhead, St, Dalry (Housing Office)/DT17	35.2	33.4	28.0	36.1	25.9	17.0	10.4	15.8	21.2	18.8	30.2	20.8		24.4	12	Adjusted with 95% CI 19 (17 - 20)
Highfield Hamlet , Dalry/DT18	23.4	23.4	13.1	22.1	15.5	10.6	2.6		18.1	12.6	23.1	14.2		16.2	11	Adjusted with 95% CI 12 (11 - 13)
85 Main Street , Largs (Key Centre)/DT19	24.8	16.4	16.8	23.3	21.7	17.5	17.5	15.5	21.5	5.2	27.2	15.9		18.6	12	Adjusted with 95% CI 14 (13 - 15)
Hunterston Road/Cycle Track/DT20	5.4	5.2	4.3	7.6	4.5	6.1	1.7	2.7	5.3	16.0	8.3	4.9		6.0	12	Adjusted with 95% CI 5 (4 - 5)
41-43 Princes St, Ardrossan/DT21	21.9	17.8	17.1	25.1	17.0	14.0	9.3	13.8	14.3	18.4	25.9	13.9		17.4	12	Adjusted with 95% CI 13 (12 - 14)
21 Vernon St, Saltcoats/DT22	22.5	23.1	18.5	21.7	18.0	16.4	17.0	15.5	19.2	13.3	2.5	8.4		16.3	12	Adjusted with 95% CI 12 (11 - 14)

The bias adjustment factor used in these calculations include all the data and no screening of data due to poor precision has been applied.

Diffusion Tube Accuracy NAC (cont'd)

Adjustment of DUPLICATE or TRIPLICATE Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements										Data Quality Check
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Average	Standard Deviation	CV	95% CI mean	Diffusion Tubes Precision Check
1	07/01/2019	05/02/2019	29.5	34.7	34.8	33.0	3.03	9.19	7.53	Good
2	05/02/2019	04/03/2019	27.1	24.0	21.5	24.2	2.81	11.59	6.97	Good
3	04/03/2019	03/04/2019	25.5	21.9	23.2	23.5	1.82	7.75	4.53	Good
4	03/04/2019	01/05/2019	17.5	19.6	19.4	18.8	1.16	6.15	2.88	Good
5	01/05/2019	12/06/2019								
6	12/06/2019	03/07/2019								
7	03/07/2019	06/08/2019								
8	06/08/2019	04/09/2019	12.4	13.5	15.6	13.8	1.63	11.75	4.04	Good
9	04/09/2019	02/10/2019	15.5	18.0	17.0	16.8	1.26	7.48	3.13	Good
10	02/10/2019	06/11/2019	21.2	18.4	20.5	20.0	1.46	7.27	3.62	Good
11	06/11/2019	11/12/2019	28.4	30.9	31.2	30.2	1.54	5.10	3.82	Good
12	11/12/2019	08/01/2020	29.7	20.8	20.8	23.8	5.14	21.62	12.76	Poor Precision
13										

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

Jaume Targa, for AEA

Site Name/ ID:	High Street, Irvine

Version 04 - February 2011

Adjusted measurement (95% confidence level)
Without periods with CV larger than 20%

Bias calculated using 7 periods of data
Tube Precision: 9 Automatic DC: 95%
Bias factor A: 0.77 (0.7 - 0.86)
Bias B: 29% (16% - 42%)

Information about tubes to be adjusted
Diffusion Tube average: 23 μgm^{-3}
Average Precision (CV): 8
Adjusted Tube average: 17 +/- 2 μgm^{-3}

Adjusted measurement (95% confidence level)
with all data

Bias calculated using 8 periods of data
Tube Precision: 10 Automatic DC: 95%
Bias factor A: 0.76 (0.7 - 0.83)
Bias B: 31% (20% - 43%)

Information about tubes to be adjusted
Diffusion Tube average: 23 μgm^{-3}
Average Precision (CV): 10
Adjusted Tube average: 17 +/- 2 μgm^{-3}

Figure 10: Trends in Annual Mean Nitrogen Dioxide Concentrations measured at Diffusion Tube Monitoring Sites in Irvine 2015 - 2019.

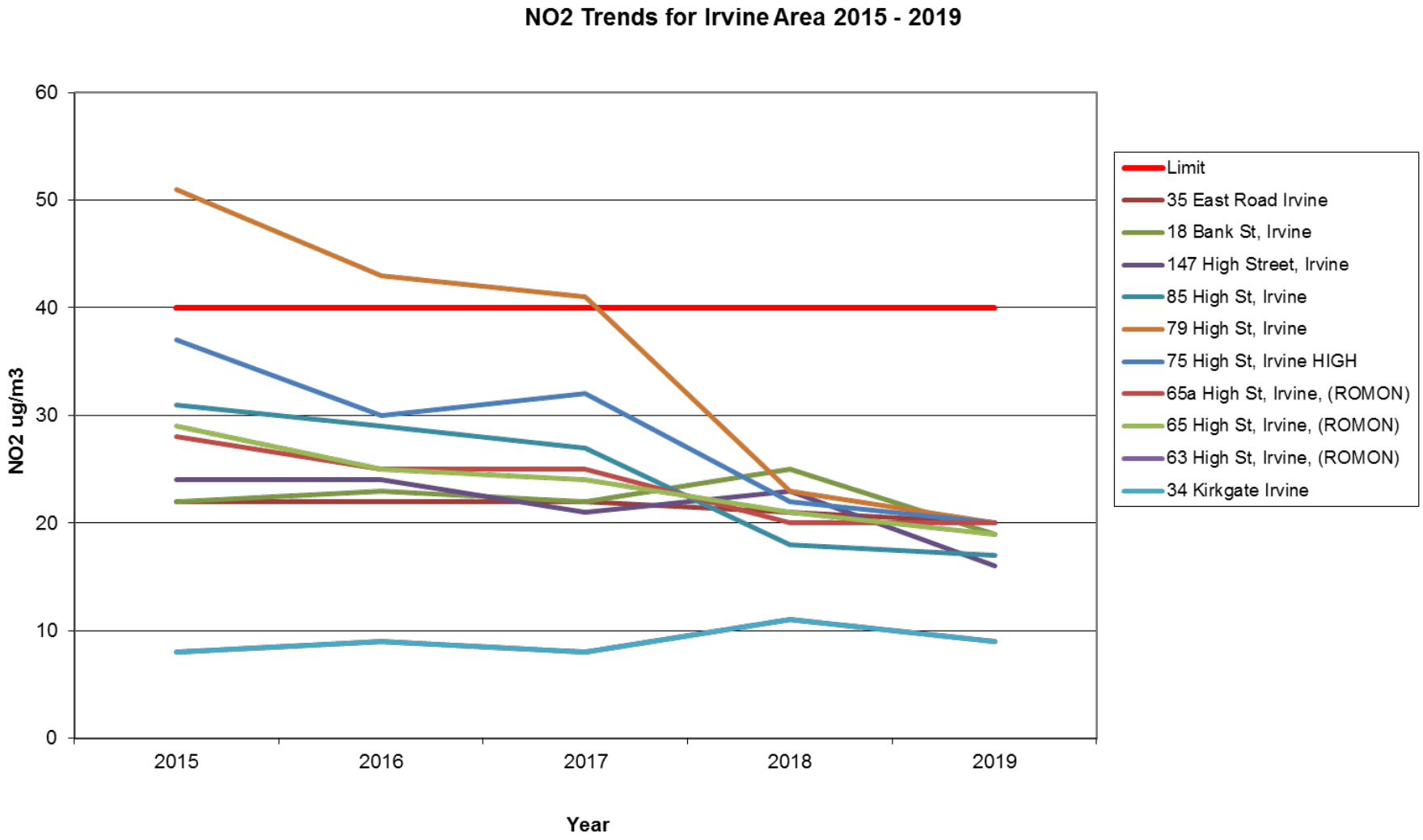


Figure 11: Trends in Annual Mean Nitrogen Dioxide Concentrations measured at Diffusion Tube Monitoring Sites in Dalry 2015 - 2019.

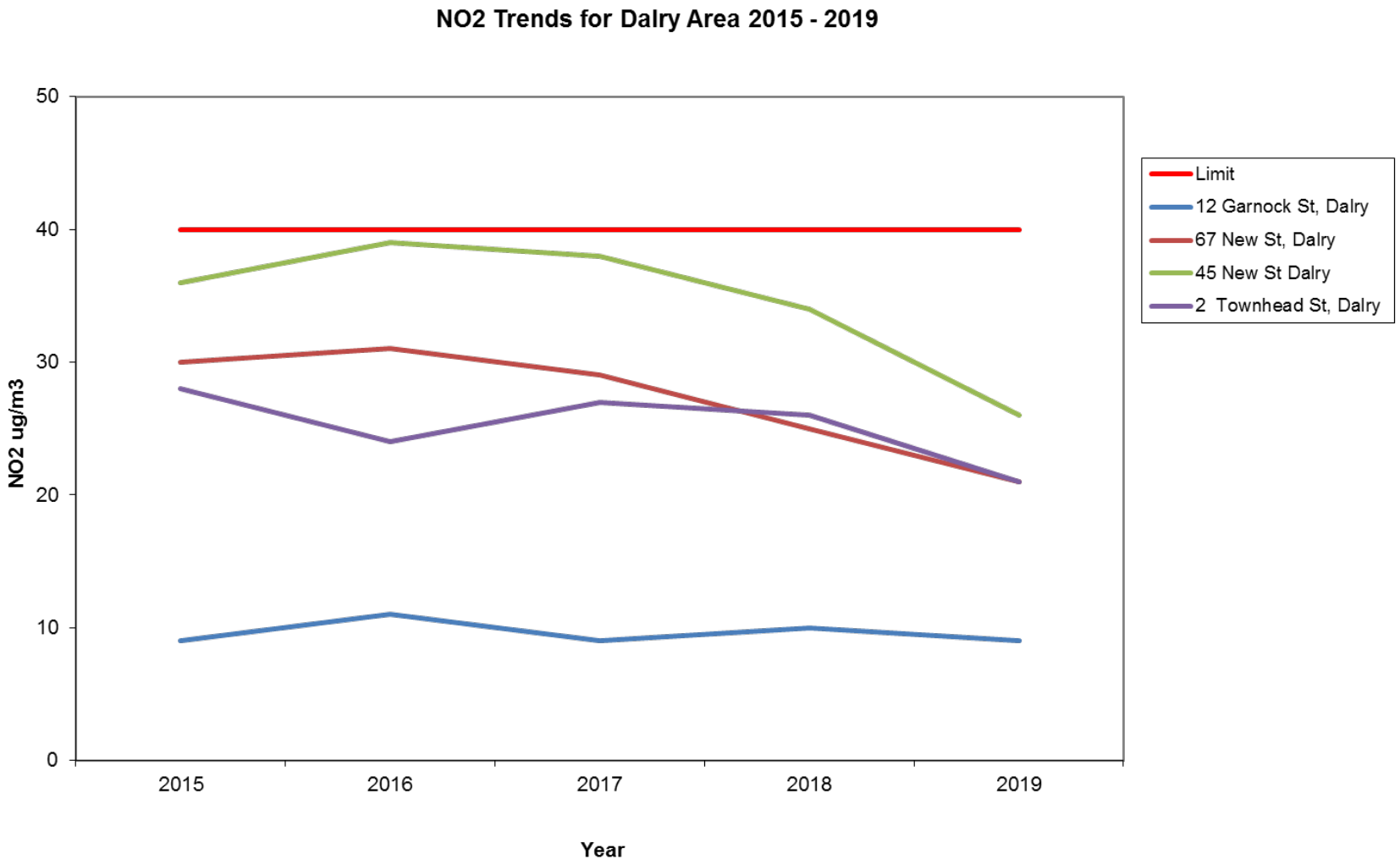


Figure 12: Trends in Annual Mean PM10 Concentrations measured at Automatic Station (ROMON) in High Street, Irvine 2015 - 2019.

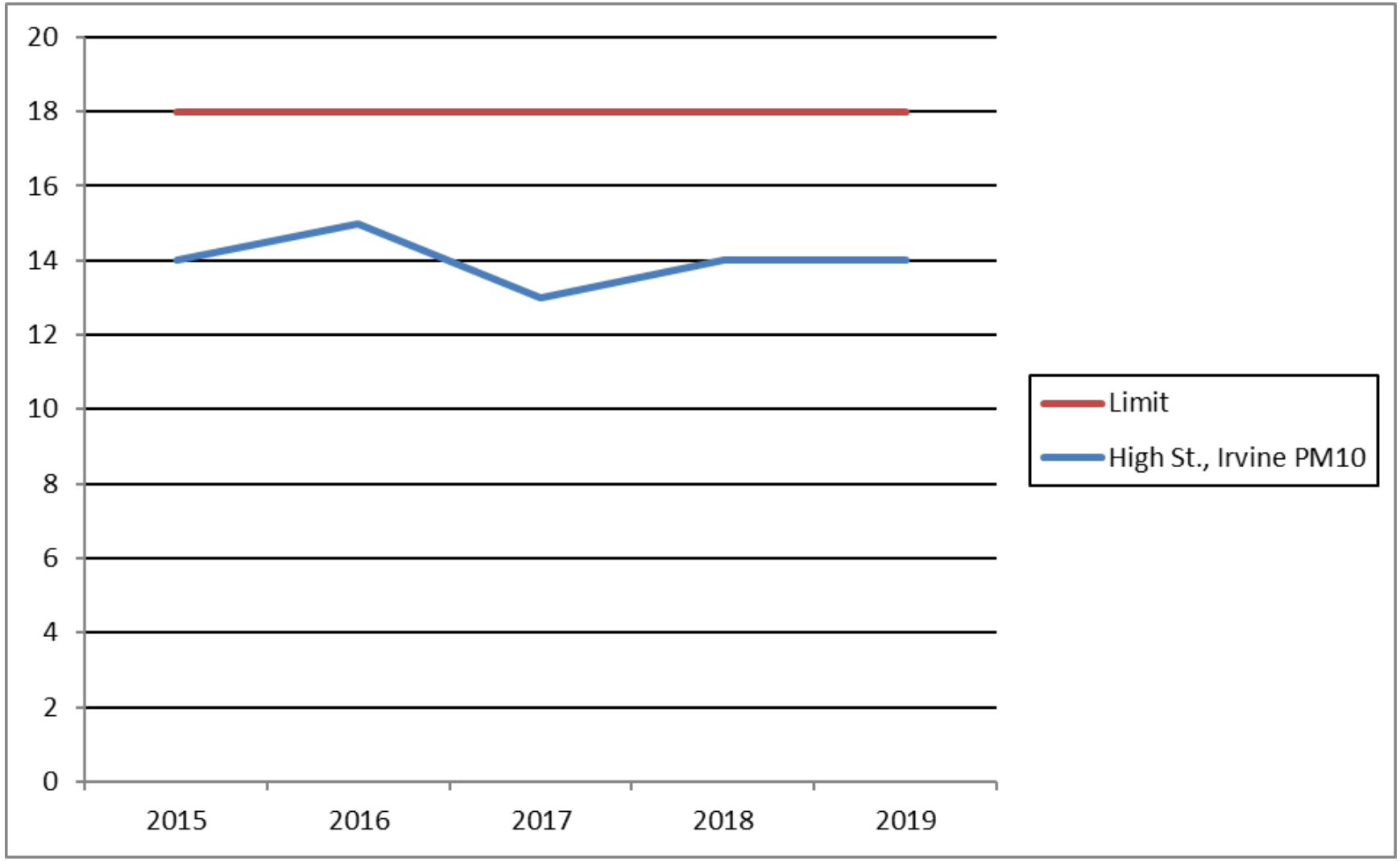
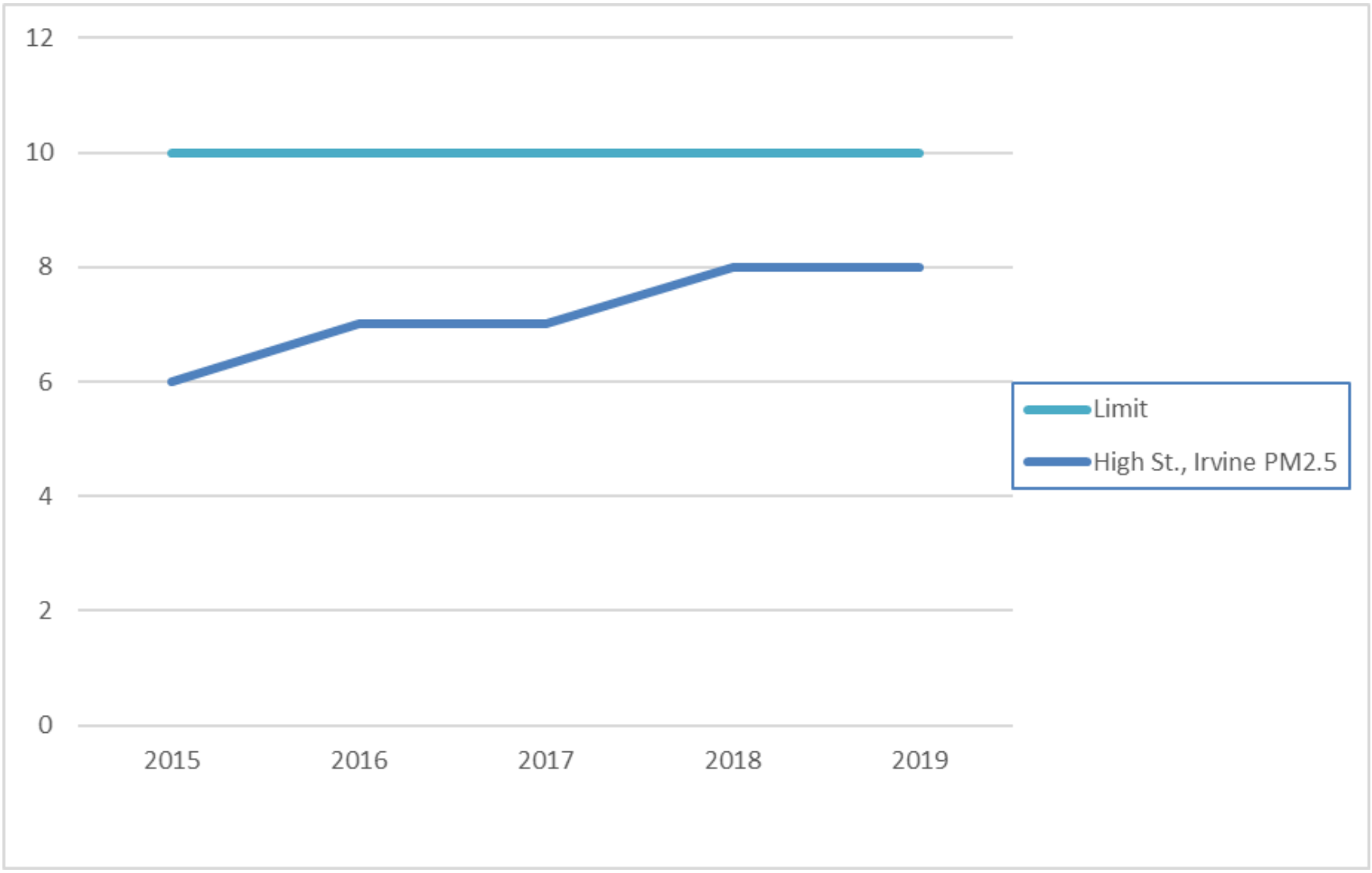


Figure 13: Trends in Annual Mean PM2.5 Concentrations measured at Automatic Station (ROMON) in High Street, Irvine 2015 - 2019.



Appendix D: Supporting Figures

Figure 14: Automatic Monitoring Site Location

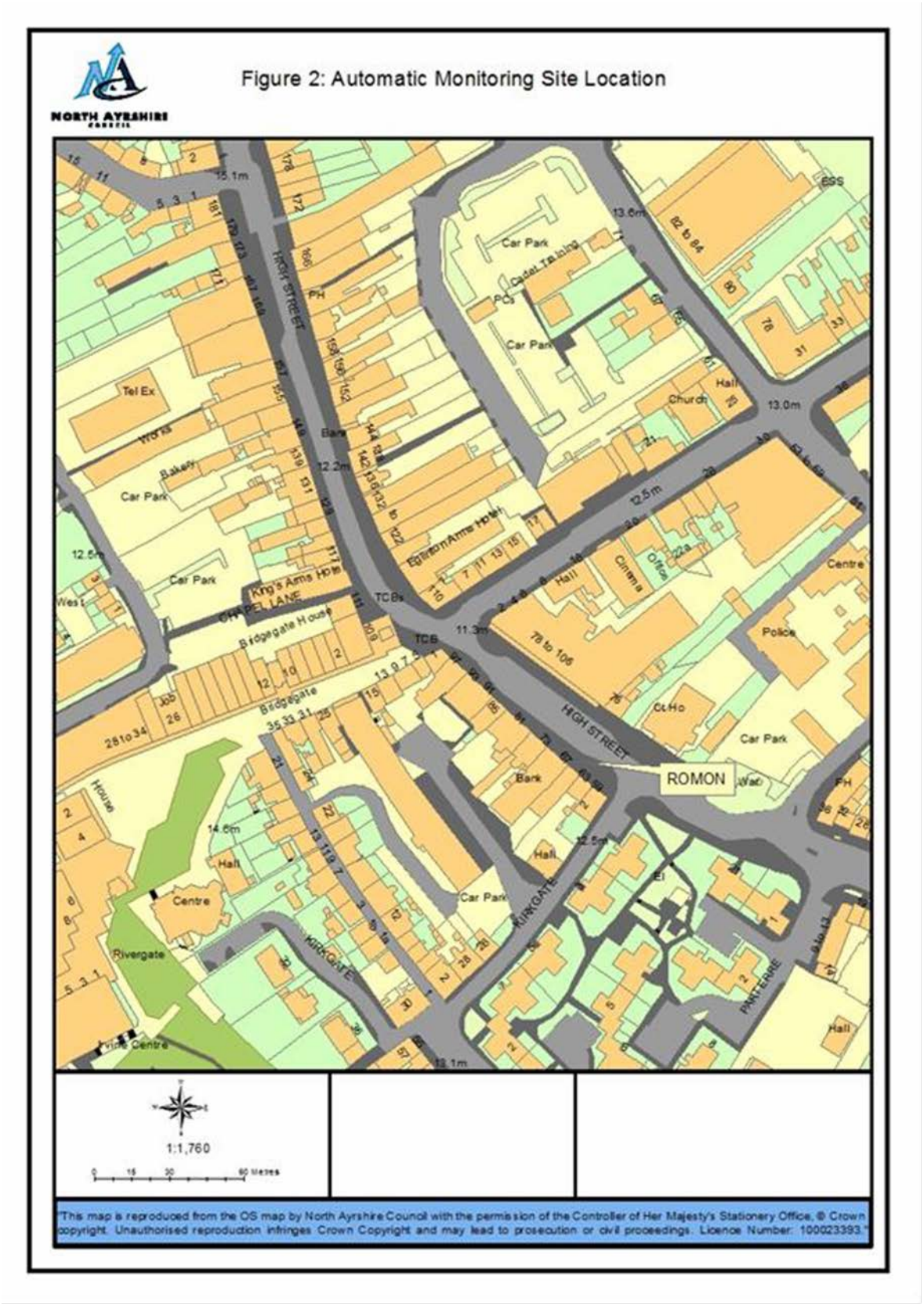


Figure 15: Non-Automatic Monitoring Site Locations

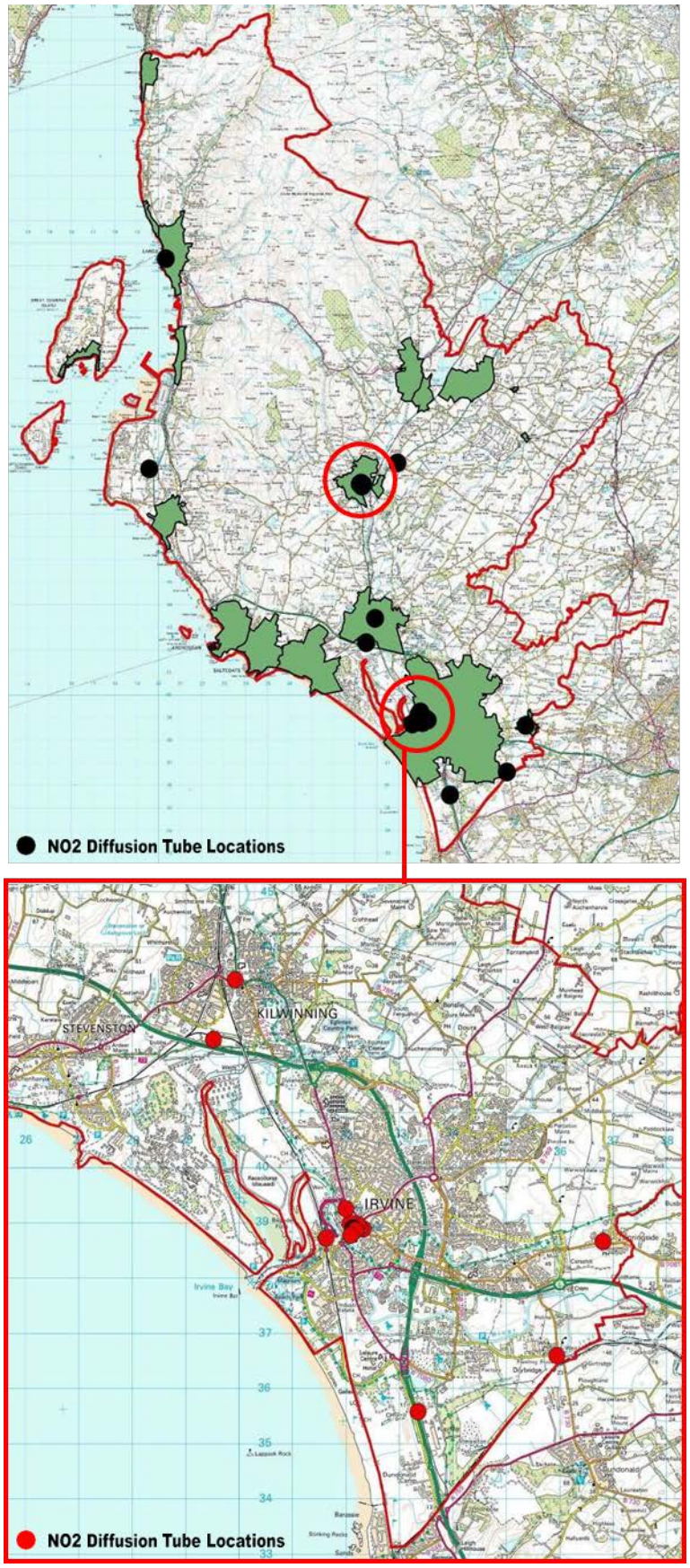


Figure 16: High Street, Irvine Diffusion Tube Site Location

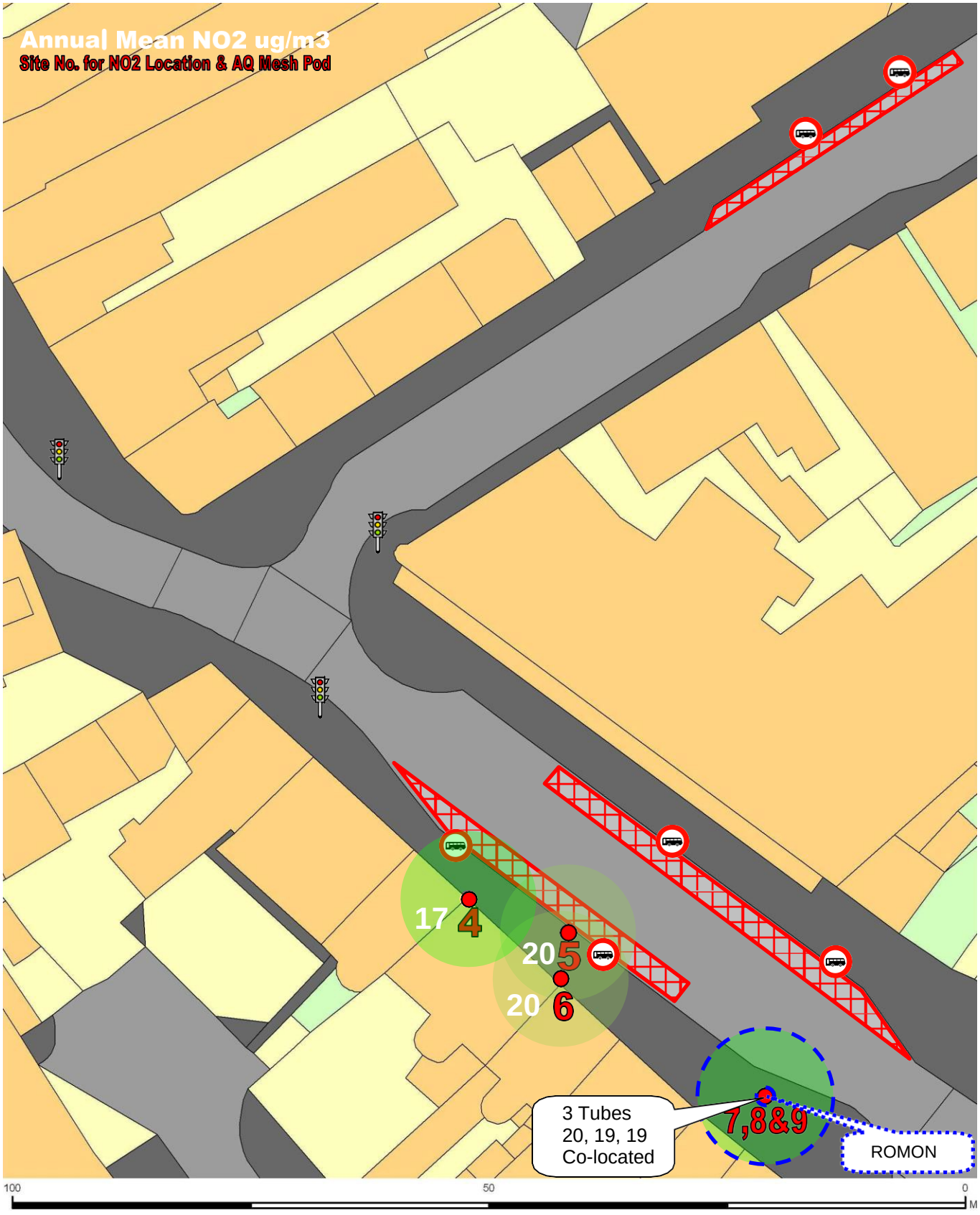
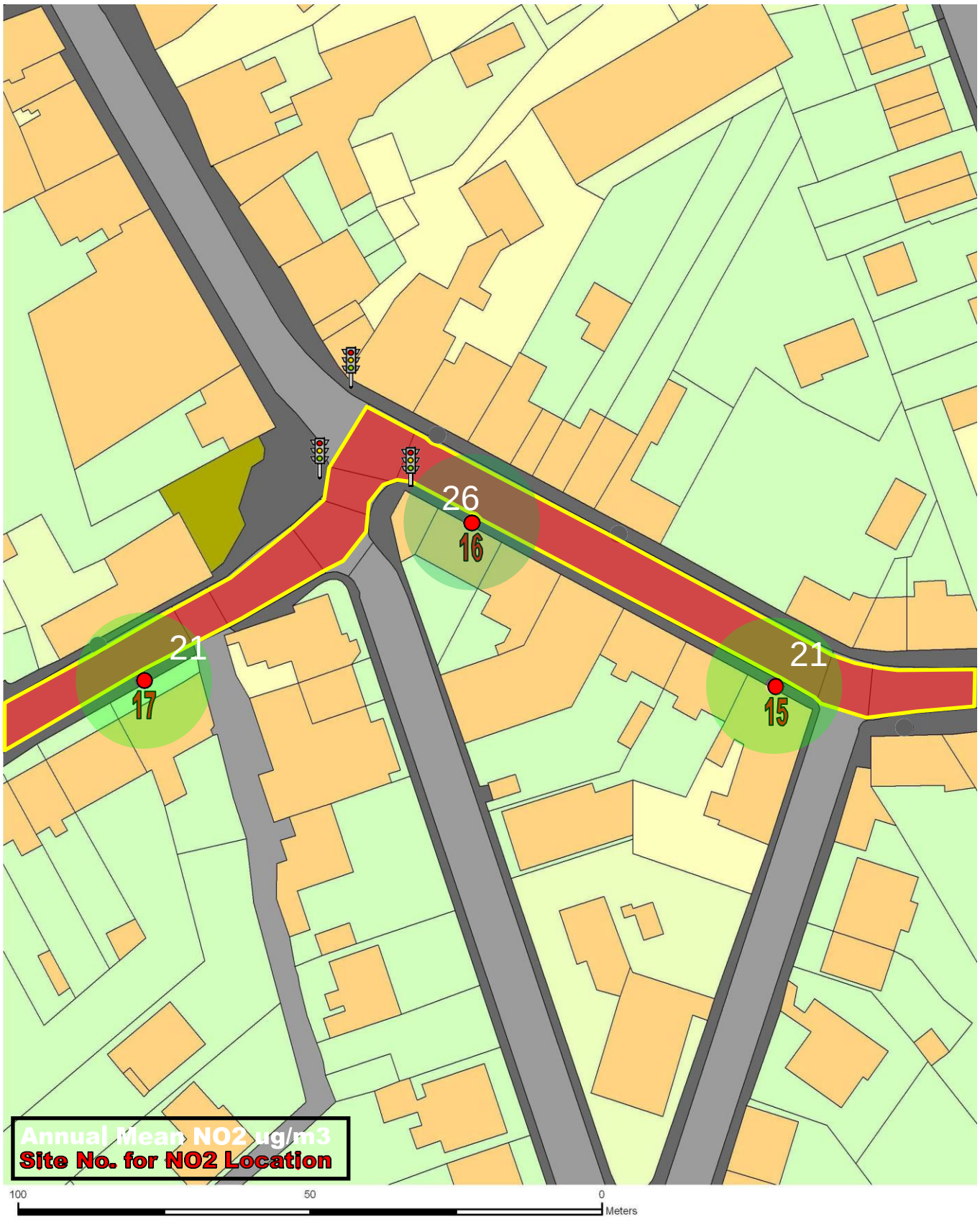


Figure 17: Dalry Diffusion Tube Site Locations



Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the LA 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
APR	Air quality Annual Progress Report
AURN	Automatic Urban and Rural Network (UK air quality monitoring network)
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
FDMS	Filter Dynamics Measurement System
LAQM	Local Air Quality Management
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
SO_2	Sulphur Dioxide

References

1. Checking Precision and Accuracy of Triplicate Tubes (Version 05 - Feb 2012).
2. Environmental Sustainability & Climate Change Strategy 2017-2020

   https://www.north-ayrshire.gov.uk/Documents/CorporateServices/Finance/environmental-sustainability-climate-change-strategy.pdf

3. Local Air Quality Management, Technical Guidance LAQM.TG (16), April 2016.