Annual Progress Report (APR)

North Ayrshire Council
Comhairle Siorrachd Àir a Tuath

2016 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 2016

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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 2015. 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 were 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. These two areas have been identified and their details presented in previous reports which can be found here http://www.north-ayrshire.gov.uk/resident/pests-pollution-and-food-hygiene/pollution/air-quality-management.aspx.

2015 results show that a localised area of approximately 10 metres diameter on the High Street, Irvine continues to be the subject of elevated levels exceeding the NO_2 air quality annual mean objective of 40$\mu g/m^3$. Based on diffusion tube monitoring there has been only 1 exceedance, of 51$\mu g/m^3$, at one location. This is down on 2014 results where there were 2 exceedances, of 53$\mu g/m^3$ and 45$\mu g/m^3$, at two locations. PM_{10} was recorded at 14$\mu g/m^3$ for 2015 for High Street, Irvine. (Down from 16$\mu g/m^3$ for 2014.) The Scottish annual mean air quality objective for PM10 is 18$\mu g/m^3$.

NO_2 was also noted to be down in New Street, Dalry from 42$\mu g/m^3$ in 2014 to 36$\mu g/m^3$ in 2015 for the same corresponding diffusion tube of concern.

Overall, the monitoring results for 2015 have shown that levels of NO_2 and PM10 are down for the areas of interest in North Ayrshire.

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

With regard to elevated levels of NO_2 in High Street, Irvine, public realm works (streetscape improvements) are proposed. The principles of the proposed design solution to allow a detailed design to be developed and a programme of engagement with the community and businesses for the public realm works (streetscape improvements) were agreed by the Council Cabinet on 8th December 2015. In consultation with the bus operators, Strathclyde Passenger Transport and North Ayrshire Council's Road Transport Section the preferred design is to widen the pavement on the side where the elevated levels are being recorded and to relocate bus stops to further along the High Street and to nearby Bank Street whilst maintaining the existing frequency of service and convenient access to public transport. This will not only move the source of pollution away from the receptor, but will also allow better dilution and dispersion of pollutants. Time scales for the project are included in Appendix C, Figure 9.

It is anticipated that NO_2 levels will be reduced significantly in Dalry once the proposed A737 Dalry Bypass has been constructed as it will separate local and through traffic and reduce congestion. Funding has now been allocated by the Scottish Ministers and a notification published in the Official Journal of the European Union on Friday 18th March 2016 inviting prospective bidders to formally apply to participate in the procurement process for the construction of the new bypass. The successful bidders will be invited to tender for the project. Works are due to commence in the 2016/17 financial year. All the details pertaining to the project can be found here http://www.transport.gov.scot/project/a737-dalry-bypass

All relevant locations will continue to be monitored until there is confidence that the levels of pollutants will remain below the objective limits.

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 and supporting teams, all responsible for implementing the Council's Environmental Sustainability & Climate Change Strategy 2014-2017 which can be found here

http://naconnects.north-ayrshire.gov.uk/documents/strategies/environmental-sustainability-climate-change-strategy-procurement.pdf

In October 2015 North Ayrshire Council implemented a trial staff pool car share scheme as part of the Business Travel Plan. There are 11 cars, including 3 electric ones and to date (end of May 2016) approximately 56,000 miles have been covered with an estimated saving of 1.9 tonnes of carbon dioxide (CO_2).

North Ayrshire Council has invested £5M in a 5MW Renewable Energy Retrofit Programme for its properties. Twenty two properties have now been fitted with either biomass heating plant, solar panels or both.

North Ayrshire Council has a Renewables Strategy which has prompted investigation into a solar farm project and a district heating scheme; it has supported the ECO Schools programme, and has a programme of energy lessons planned for the new term; the council has reduced carbon emissions by 22% (from 2005/06 baseline) through the Carbon Management Plan; the 2015/16 External Wall Insulation Programme for both private and Council owned houses has saved over 2,340 tonnes of CO_2 and the council has undertaken an ambitious £4.25 million programme of lighting improvements to introduce LED white lighting and reduce our energy use and carbon emissions. The LUNAR (Lighting Up North Ayrshire Responsibly) project has already seen 6,000 LED lantern units installed throughout North Ayrshire as part of a major programme to replace up to 13,500 lights over two years. This “invest-to-save” project has already resulted in an annual reduction of 1.6 MWh of energy and a reduction in energy costs of approximately £211,000 per year.

In 2015, £1.8M was spent on facilitating and encouraging active travel. For example: walking/cycling path and signage improvements across the area; an iBike Officer to encourage/promote active travel on the school journey within the Garnock Valley; public bike pumps/tool kits located across Irvine and a Schools Active Travel Programme.

A feasibility study to install SCOOT (Split Cycle Offset Optimisation Technique), a tool for managing and controlling traffic signals in urban areas that responds automatically to fluctuations in traffic flow through the use of on-street detectors embedded in the road, has been undertaken for Irvine High Street and awaits appropriate funding to become available.

Local Priorities and Challenges

The priorities for North Ayrshire Council in addressing air quality for the coming year are a) to continue with monitoring and characterising air quality within its area, particularly in High Street, Irvine and New Street, Dalry, b) to progress the proposed public realm works in High Street, Irvine, c) to encourage a greater uptake of staff pool car participants and d) to implement the Actions in the Council's Environmental Sustainability & Climate Change Strategy 2014-2017.

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, b) any pre Public Realm works consultations are concluded on schedule and c) there are enough pool cars to satisfy demand and overall any set 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 http://www.north-ayrshire.gov.uk/resident/leisure-parks-and-events/outdoor-activities/outdoor-activities.aspx

Further information on our local air quality can 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 2015. 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) 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
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.

However, in addition to LAQM responsibilities the Council addresses action on air quality through its Environmental Sustainability & Climate Change Strategy 2014-2017. Key actions completed, in progress or planned since last year, and outcomes in terms of benefits for air quality can be found in Appendix 1 of the Strategy's Action Plan here http://naconnects.north-ayrshire.gov.uk/documents/strategies/environmental-sustainability-climate-change-strategy-procurement.pdf.

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

3.1 Summary of Monitoring Undertaken

A fixed ROMON unit is located in High Street, Irvine. It has contained a NO_2 analyser and a Beta Attenuation Monitor 1020 for PM_{10} (BAM 1020) particulate monitor since its installation in 2009. The BAM 1020 was replaced by a Fidas 200 fine dust and monitoring immission measurement system for the continuous and simultaneous measurement of PM_1, $PM_{2.5}$ as per EN 14907 and PM_{10} as per EN12341 on 14th April 2015. This monitoring station is also the site being used for the triplicate co-location of NO_2 diffusion tubes.

In May 2015 there was data loss from the NOx analyser due to remote connection issues resulting in a data capture of 81% for NO_2 and NOx.

Data capture was also lost in May for particulate matter (PM_{10}) due to the commissioning period of the new Fidas 200 analyser resulting in a data capture of 87%. Monitoring results from the Fidas 200 form part of this report.

Calibration checks are conducted every 2 weeks on site by Local Authority Officers and collected data is forwarded to Ricardo - EE who validate and ratify the data. The

unit is calibrated by Ricardo - EE every 6 months. Ricardo - EE reports are included in Appendix C, Figure 1.

Twenty two diffusion tubes monitoring NO_2 are also located at various locations in towns throughout North Ayrshire. 2015 results show that a localised area of approximately 10 meters diameter on the High Street, Irvine continues to be the subject of elevated levels exceeding the NO_2 air quality annual mean objective of 40μg/m^3. Based on diffusion tube monitoring this has been the only exceedance (51μg/m3). No other monitoring result 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 2015. Table A.1 in Appendix A shows the details of the site. Results are also available on the Scottish Air Quality website at http://www.scottishairquality.co.uk/latest/site-info?site_id=IRV&view=latest

Maps showing the location of the monitoring site are provided in Appendix D: Figure 9. Further details on how the monitors are calibrated and how the data has been adjusted are included in Appendix C, Figure 1.

3.1.2 Non-Automatic Monitoring Sites

North Ayrshire Council undertook non - automatic (passive) monitoring of NO_2 at twenty two sites during 2015. 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 Figure 10. Further details on Quality Assurance/Quality Control (QA/QC) and bias adjustment for the diffusion tubes are included in Appendix C, Figures 2 - 4.

3.2 Individual pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for annualisation and bias. Further details on adjustments are provided in Appendix C, Figures 1 – 4.

Trends in Annual Mean NO_2 Concentrations measured at Diffusion Tube Monitoring Sites at all locations throughout North Ayrshire and Annual Mean NO_2 and Annual Mean PM_{10} Concentrations measured at the automatic monitoring site in High Street, Irvine all show a downward trend since 2013. It is unclear if this is due to favourable climatic conditions as the trend appears to be widespread across local areas with different geographical locations. Graphs of the trends are included in Appendix C, Figures 5 - 7.

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 2015 dataset of monthly mean values is provided in Appendix B, Table B.1.

As previously stated, based on diffusion tube monitoring there has been only 1 exceedance, of 51µg/m^3, at one roadside location in High Street, Irvine in 2015. This location is within a potential AQMA but not at a location of direct relevant exposure. In accordance with 7.77 to 7.79 of LAQM TG16 an estimate of the concentration at the nearest receptor has been calculated before and after proposals to widen the pavement at this location as part of public realm works. Following the procedure, results show that the predicted levels should currently be 39µg/m^3 at the relevant receptor and following the widening of the pavement should be 34µg/m^3. This would be 6µg/m^3 below the National Objective of 40µg/m^3. Results are shown in Appendix C, Figure 8.

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 only one exceedance over the 2011 to 2015 reporting period and that was in 2015. This one event resulted in a recording of a Maximum hourly mean of 218µg/m^3.

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.

There have been two exceedances over the 2011 to 2015 reporting period. One in 2011 and one 2015. The 2015 event resulted in a recording of a maximum daily mean of 59µg/m^3.

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.

The information presented in Table A.7 in Appendix A is for illustrative purposes only at this time as North Ayrshire Council has only been monitoring $PM_{2.5}$ since April 2015 therefore does not have a full set of data to report. An Annual Mean value of 10µg/m^3 has now been set for $PM_{2.5}$ for local authorities to achieve by the year 2020.

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 SO_2 monitoring can be found in North Ayrshire Council's previous Air Quality Reports which are available online at:

http://www.north-ayrshire.gov.uk/resident/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:

http://www.north-ayrshire.gov.uk/resident/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

One proposed housing development consisting of two hundred new homes was considered to have the potential to increase traffic numbers and flows in and around the town of Kilbirnie. The applicant was requested to undertake an Air Quality Assessment and submit a report to demonstrate whether the proposed development would have any detrimental effect on local air quality. In considering traffic counts, flows and existing air quality monitoring results in the town, the resultant report concluded that there would be no detrimental effect on local air quality. Details of the application are retained by the Planning Authority online at

https://www.eplanning.north-ayrshire.gov.uk/OnlinePlanning/applicationDetails.do?activeTab=map&keyVal=NC17QLLEFNK00

An application was also received during 2015 for a development of seventy houses in Ardrossan. This application was also assessed with regard to local air quality and a report concluded that there would be no detrimental effect on local air quality. The planning application details can access via the Planning Authority at:

https://www.eplanning.north-ayrshire.gov.uk/OnlinePlanning/applicationDetails.do?activeTab=summary&keyVal=NC17QLLEFNK00

Air Quality Assessment was also requested for an application for a 40MW Combined Heat and Power installation at a local pharmaceutical company. The assessment concluded that there would be no detrimental effect on local air quality. Full application details are retained by the Planning Authority online at

https://www.eplanning.north-ayrshire.gov.uk/OnlinePlanning/applicationDetails.do?activeTab=summary&keyVal=NC17QLLEFNK00

Thirteen Biomass boilers of various heat outputs have also been fitted retrospectively to various properties owned by North Ayrshire Council. All these installations were assessed and all reports and assessment tools used concluded that there would be no detrimental effect on local air quality. Details of the assessment for each installation are available by request to North Ayrshire Council's Environmental Health.

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; junctions; roads with significantly changed traffic flows and no relevant bus stations in the Local Authority area.

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

North Ayrshire Council confirms that there are no 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.

4.4 Commercial and Domestic Sources

A total of thirteen individual biomass combustion plants have been installed at various locations throughout the North Ayrshire Council area in 2015. Assessment has shown that no installation source exceeds the relevant threshold.

North Ayrshire Council has assessed the combined impacts of the biomass combustion plant, and concluded that it will not be necessary to proceed to a Detailed Assessment.

One application for a 40MW Combined Heat and Power installation at a local pharmaceutical company was received in 2015.

North Ayrshire Council confirms that there are no areas of significant domestic fuel use in the Local Authority area.

4.5 New Developments with Fugitive or Uncontrolled Sources

North Ayrshire Council confirms that there are no new potential sources of fugitive particulate matter emissions in the Local Authority area.

5. Planning Applications

Relevant new local developments are also discussed at Section 4 of this report. In 2015 there was an application for a proposed housing development consisting of two hundred new homes which was assessed for local air quality purposes. The resultant report concluded that there would be no detrimental effect on local air quality. Details of the application are retained by the Planning Authority online at

https://www.eplanning.north-ayrshire.gov.uk/OnlinePlanning/applicationDetails.do?activeTab=map&keyVal=NC17QLLEFNK00

There was also an application for a development of seventy houses in Ardrossan received which was assessed with regard to local air quality. The report concluded that there would be no detrimental effect on local air quality. The planning application details can access via the Planning Authority at:

https://www.eplanning.north-ayrshire.gov.uk/OnlinePlanning/applicationDetails.do?activeTab=summary&keyVal=NC17QLLEFNK00

An air quality assessment was also requested for an application for a 40MW Combined Heat and Power (CHP) plant installation at a local pharmaceutical company. The assessment concluded that there would be no detrimental effect on local air quality. Full application details are retained by the Planning Authority online at

https://www.eplanning.north-ayrshire.gov.uk/OnlinePlanning/applicationDetails.do?activeTab=summary&keyVal=NC17QLLEFNK00

Thirteen Biomass boilers of various heat outputs have also been fitted retrospectively to various properties owned by North Ayrshire Council. All these installations were assessed and all reports and assessment tools used concluded that there would be no detrimental effect on local air quality.

In addition to the above there has been, at the time of writing (June 2016), four planning applications for significant future housing developments received. These applications range from over one hundred to over three hundred new homes and have yet to be assessed for local air quality purposes. Details of any assessments arising from these applications will form part of the 2017 Annual Progress Report.

6. Conclusions and Proposed Actions

6.1 Conclusions from New Monitoring Data

NO_2 diffusion tube monitoring data for 2015 has shown one exceedence for High Street Irvine. All other NO_2 diffusion tube sites and automatic monitoring within North Ayrshire Council complied with the 40$\mu g/m^3$ NO_2 air quality objective set out in the directive.

The single tube that failed the objective, located in High Street, Irvine is adjacent to a major bus route through the town. As outlined earlier in this report, this street is the hub of the public transport (buses) serving North Ayrshire.

Diffusion tube monitoring has shown that the exceedence area is highly localised to an area approximately 10m wide. The two nearest tubes are approximately 10m away and both revealed compliant NO_2 annual mean concentrations of 31$\mu g/m^3$ and 37$\mu g/m^3$. All the remaining tubes in the vicinity ranged between 22$\mu g/m^3$ and 29$\mu g/m^3$, confirming that the street overall complies with the air quality objective and the exceedence is concentrated in one spot.

In addition, the "drop off with distance" calculator was used to more accurately quantify the NO_2 level at the receptors for 2015 results and also to predict the likely levels when the new widening of the pavement is in place at this location. The results are detailed in the Table below. It is anticipated that the amended pavement layout will have a significant impact on dispersion and dilution of the pollutants from buses and will result in significantly lower annual mean levels.

Drop-off with Distance for NO2 Tube Exceedence at High Street, Irvine

Location	Distance from Kerb		Annual Mean NO_2		Predicted NO2 at Receptor
	Site	Receptor	Background	Site	
79 High Street, Irvine *(Actual)*	1.5m	5m	6ug/m^3	51ug/m^3	39ug/m^3
NEW widened pavement (predicted)	*1.5m*	*8.2m*	*6*ug/m^3	*51*ug/m^3	34ug/m^3

The Scottish air quality objective of 18μg/m^3 for PM_{10}, was not exceeded with the annual mean measured at 14μg/m^3 in High Street, Irvine. The European Directive air quality directive (40μg/m^3) was not exceeded. Automated monitoring at this site will continue for 2016.

6.2 Conclusions relating to New Local Developments

Planning applications for two significant housing developments were received in 2015, one consisting of seventy new homes and the other for two hundred. Considered was given to these applications as they had potential to increase traffic numbers and flows in and around the towns of their location. The applicants were requested to undertake an Air Quality Assessments and submit a report to demonstrate whether their proposed development would have any detrimental effect on local air quality. The resultant reports concluded that there would be no detrimental effect on local air quality.

An Air Quality Assessment was also requested for an application for a 40MW Combined Heat and Power (CHP) plant installation at a local pharmaceutical company. The assessment concluded that there would be no detrimental effect on local air quality. The CHP plant has not been installed yet (June 2016).

Thirteen Biomass boilers of various heat outputs have also been fitted retrospectively to various properties owned by North Ayrshire Council. All these installations were assessed and all reports and assessment tools used concluded that there would be no detrimental effect on local air quality.

6.3 Proposed Actions

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

Irvine

Considering the monitoring data and planned alterations at High Street, Irvine, it is expected that the street layout and Public Realm changes will have the desired impact on reducing NO_2 levels at the localised hot spot. Full details can be found in Agenda Item 6 of the Cabinet meeting https://north-ayrshire.cmis.uk.com/North-Ayrshire/-ayrshire.cmis.uk.com/North-Ayrshire/-ayrshire.cmis.uk.com/north-ayrshire/CommitteesMeetings/MeetingsCalendar/tabid/70/ctl/ViewMeetingPublic/mid/397/Meeting/2651/Committee/5/Default.aspx

The time scale for this project is shown in Appendix, Figure 9. It is proposed that NO_2 sampling continues in this area with close supervision of future developments.

The BAM 1020 particulate monitor was replaced at the High Street by a Fidas 200 fine dust and monitoring immission measurement system for the continuous and simultaneous measurement of PM_1, $PM_{2.5}$ as per EN 14907 and PM_{10} as per EN12341 on 14th April 2015. Data will continue to be recorded and monitoring results from the Fidas 200 will form part of future Annual Progress Reports.

Three new AQ Mesh mobile air monitoring pods to measure NO_2 and PM_{10}, which can provide real time data over an online connection, were deployed in the High Street to monitor ambient air quality on 11th February 2016 and data collected will be presented in the 2017 Annual Progress Report. The AQ Mesh pods will allow more accurate data to be collected in the area of the identified hot spot and enable more informed decisions to be made.

Dalry

It is proposed that monitoring is continued in this area and, in addition to the existing NO_2 diffusion tubes, an AQ Mesh pod may also be deployed in this area which will allow more robust data to be collated on a real time basis.

The status of the A737 Dalry Bypass on Transport Scotland's website advises that it is currently being taken through the statutory process and we will continue to work with our partners Transport Scotland when required to support this project.

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)
GH	GroundHog	Roadside	232188	638861	NO_2; PM_{10}	Permanently replaced by ROMON beginning of 2009				
ROM	ROMON	Roadside	232188	638861	NO_2	N	Chemiluminescent	20	2.5	2.0
					PM_{10} & $PM_{2.5}$	N	Optical Light Scatter	20	2.5	2.0

(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	**232188**	**638861**	**NO_2**	**N**	4.7	1.7	Y
DT8	**65 High Street, Irvine, (ROMON)**	Roadside	**232188**	**638861**	**NO_2**	**N**	4.7	1.7	Y
DT9	**63 High Street, Irvine, (ROMON)**	Roadside	**232188**	**638861**	**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 2015 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)				
					2011	2012	2013	2014	2015
ROMON	Roadside	Automatic	94	94	31	31	31	29	28
DT1	Roadside	Diffusion Tube	100	100	23	27	27	23	22
DT2	Roadside	Diffusion Tube	100	100	26	28	28	25	22
DT3	Roadside	Diffusion Tube	100	100	30	31	31	34	24
DT4	Roadside	Diffusion Tube	100	100	34	34	36	32	31
DT5	Kerbside	Diffusion Tube	100	100	**54**	**59**	**59**	**53**	**51**
DT6	Roadside	Diffusion Tube	100	100	**46**	**46**	**48**	**45**	37
DT7	Roadside	Diffusion Tube	100	100	30	32	32	29	28
DT8	Roadside	Diffusion Tube	100	100	31	31	32	28	29
DT9	Roadside	Diffusion Tube	100	100	31	33	33	27	27
DT10	Urban Background	Diffusion Tube	100	100	14	14	13	11	8

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2015 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)				
					2011	2012	2013	2014	2015
DT11	Kerbside	Diffusion Tube	100	100	16	19	17	15	15
DT12	Urban Background	Diffusion Tube	91	91	12	13	12	11	10
DT13	Kerbside	Diffusion Tube	100	100	23	26	23	22	19
DT14	Kerbside	Diffusion Tube	100	100	11	14	14	11	9
DT15	Urban Background	Diffusion Tube	100	100	32	26	33	30	30
DT16	Kerbside	Diffusion Tube	100	100	**42**	**44**	**45**	**42**	36
DT17	Kerbside	Diffusion Tube	100	100	30	33	33	32	28
DT18	Roadside	Diffusion Tube	100	100	20	21	22	23	18
DT19	Urban Background	Diffusion Tube	100	100	19	24	25	19	18
DT20	Kerbside	Diffusion Tube	100	100	6	7	7	7	5
DT21	Rural	Diffusion Tube	100	100		19	23	18	18
DT22	Kerbside	Diffusion Tube	91	91		25	26	21	21

Notes: Exceedences of the NO_2 annual mean objective of 40µg/m3 are shown in **bold**.

NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedence 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 2015 (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3)				
					2011	2012(3)	2013	2014	2015
ROMON	Roadside	Automatic	93.9	93.9	**0**	0(117)	0	0	**1**

Notes: Exceedences 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 90%, 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 2015 (%) (2)	PM_{10} Annual Mean Concentration ($\mu g/m^3$) (3)				
				2011	2012	2013	2014	2015
ROMON	Roadside	93.9	93.9	**18**	17	**21**	16	14

Notes: Exceedences 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 2015 (%) (2)	PM_{10} 24-Hour Means > 50µg/m^3 (3)				
				2011	2012	2013	2014	2015
ROMON	Roadside	93.9	93.9	0	2	1	0	**1**

Notes: Exceedences 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 90%, the 90.4th 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 2015 (%) (2)	$PM_{2.5}$ Annual Mean Concentration (µg/m^3) (3)				
				2011	2012	2013	2014	2015
ROMON	Roadside	69.3	69.3	-	-	-	-	7*

Notes: Exceedences 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.

*This value is indicative for information only. The Fidas 200 fine dust monitor was installed in April 2015 and there are no other similar sites or reliable results with which to annualise data.

Appendix B: Full Monthly Diffusion Tube Results for 2015

Table B.1 – NO_2 Monthly Diffusion Tube Results for 2015

Site ID	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 (1)
DT1	28.00	29.90	24.50	20.50	19.80	23.70	19.20	21.50	18.60	25.40	21.40	14.00	22.2	22
DT2	28.70	34.70	21.20	18.10	14.80	20.30	18.70	18.00	23.50	29.20	29.60	18.30	22.9	22
DT3	33.00	30.50	18.30	22.50	14.10	21.10	21.20	24.00	23.00	31.50	33.50	25.00	24.8	24
DT4	37.20	44.60	26.60	20.40	31.60	36.10	28.70	30.20	29.50	40.20	42.90	18.00	32.2	31
DT5	68.20	80.20	51.60	59.60	28.00	68.70	48.60	52.30	43.10	50.80	54.20	26.56	**52.7**	51
DT6	51.70	60.80	34.60	27.40	24.80	48.60	37.90	49.90	30.50	40.60	21.10	35.90	38.7	37
DT7	33.10	40.70	26.60	25.90	26.40	31.40	28.40	23.10	28.50	39.90	25.00	19.30	29.0	28
DT8	41.30	38.00	23.60	30.30	23.60	30.10	26.20	25.90	29.00	41.10	26.00	19.70	29.6	29
DT9	45.00	40.40	18.00	27.50	18.40	28.60	30.50	28.90	31.30	34.60	16.10	13.10	27.7	27
DT10	15.10	12.10	7.50	9.50	2.80	7.00	5.00	6.00	8.50	13.70	6.10	9.80	8.6	8
DT11	21.00	22.10	10.30	13.70	7.10	12.80	10.80	12.50	15.10	19.20	22.90	12.40	15.0	15
DT12	12.60	11.90	9.40	6.00	3.00		9.00	9.50	9.70	13.20	14.40	11.20	10.0	10
DT13	24.10	28.90	26.80	11.20	9.70	18.00	15.10	19.50	16.70	19.90	28.10	17.50	19.6	19
DT14	12.80	8.80	6.20	8.20	3.10	6.10	5.60	4.70	5.30	14.40	15.20	19.00	9.1	9

Site ID	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 (1)
DT15	44.10	44.60	25.20	32.00	19.50	36.50	21.90	27.60	31.60	44.60	38.50	10.40	31.4	30
DT16	50.60	10.00	57.30	29.70	25.40	48.20	30.50	39.20	31.00	41.50	56.50	27.40	37.3	36
DT17	34.20	38.30	35.90	19.80	23.90	32.10	21.00	30.20	27.80	36.70	28.50	23.50	29.3	28
DT18	22.00	20.40	14.10	14.20	13.30	18.60	13.90	18.40	19.70	31.80	22.20	16.80	18.8	18
DT19	23.90	22.60	12.40	17.50	15.40	20.50	16.60	21.00	21.30	26.40	21.10	8.70	19.0	18
DT20	3.50	5.90	5.40	2.10	3.30	4.40	3.30	4.10	6.10	9.20	5.90	3.40	4.7	5
DT21	19.70	17.60	20.80	14.00	10.70	15.10	19.60	19.10	16.40	30.80	20.50	14.40	18.2	18
DT22		19.30	28.20	21.60	13.80	25.60	12.20	21.20	22.00	32.00	28.40	17.80	22.0	21

(1) See Appendix C for details on bias adjustment

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

Figure 1: RICARDO-EE Air Pollution Report

Produced by Ricardo Energy and Environment on behalf of the Scottish Government

NORTH AYRSHIRE IRVINE HIGH ST
01 January to 31 December 2015

These data have been fully ratified by Ricardo Energy and Environment

POLLUTANT	PM_{10}*+	PM_{25}~	NO_2	NO_X
Maximum hourly mean	143 µg m^{-3}	-	218 µg m^{-3}	511 µg m^{-3}
Maximum daily mean	59 µg m^{-3}	25 µg m^{-3}	87 µg m^{-3}	188 µg m^{-3}
98.08th percentile of daily means	-	17 µg m^{-3}	-	-
Average	14 µg m^{-3}	7 µg m^{-3}	28 µg m^{-3}	67 µg m^{-3}
Data capture	97.1 %	69.3 %	93.9 %	93.9 %

*PM_{10} Indicative Gravimetric Equivalent µg m^{-3}
+ PM_{10} instruments:
BAM using a gravimetric factor of 1 from 1 January 2015
FIDAS from 16 April 2015
~ PM_{25} instruments:
FIDAS from 16 April 2015
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}

Pollutant	Air Quality Regulations (2000) and Air Quality (Scotland) Amendment Regulations 2002	Exceedences	Days
PM_{10} Particulate Matter (Gravimetric)	Daily mean > 50 µg m^{-3}	1	1
PM_{10} Particulate Matter (Gravimetric)	Annual mean > 18 µg m^{-3}	0	-
Nitrogen Dioxide	Annual mean > 40 µg m^{-3}	0	-
Nitrogen Dioxide	Hourly mean > 200 µg m^{-3}	1	1

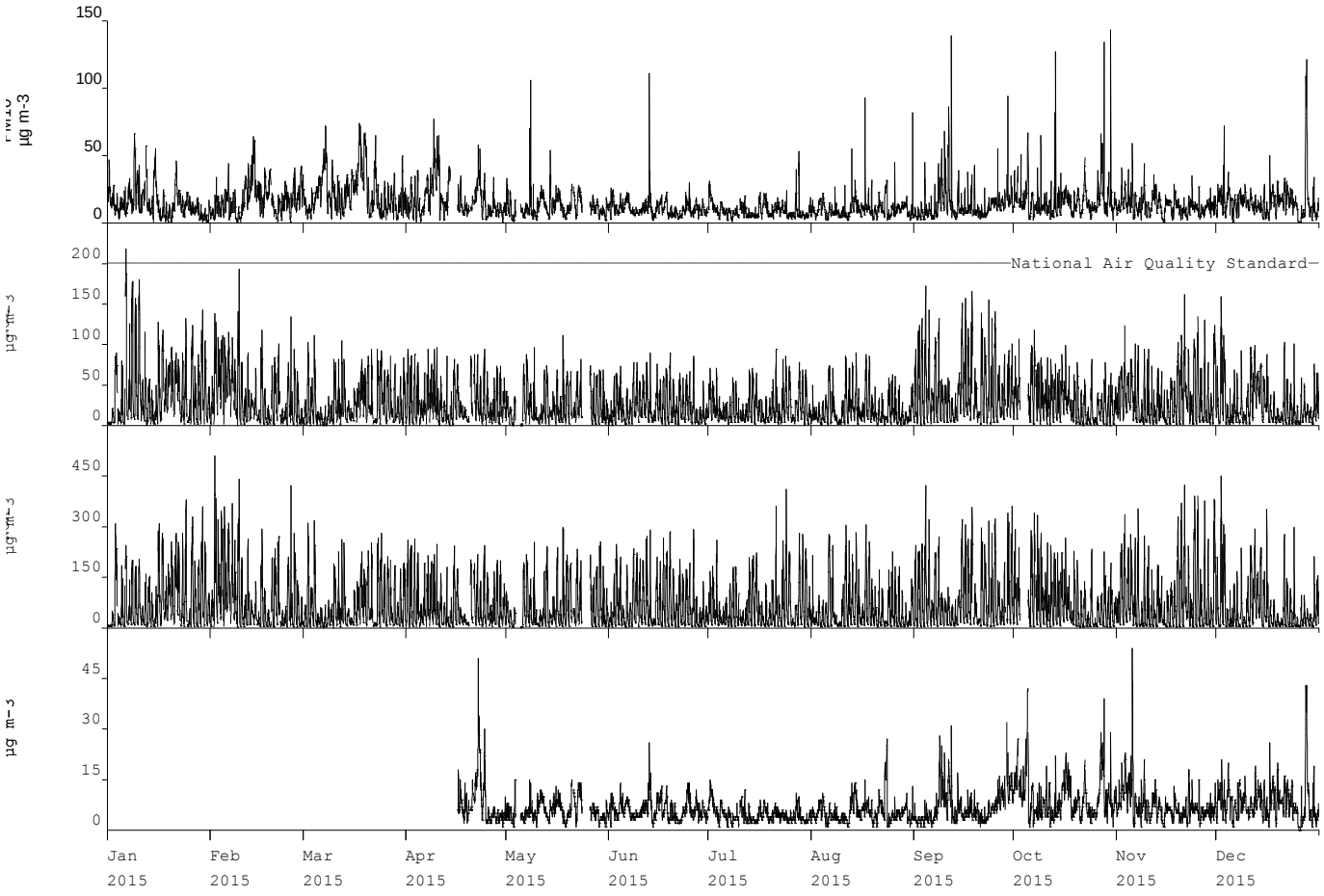
Note: For a strict comparison against the objectives there must be a data capture of >90% throughout the calendar year

Figure 1: RICARDO-EE Air Pollution Report Cont'd

Air Pollution Report

Produced by Ricardo Energy and Environment on behalf of the Scottish Government

North Ayrshire Irvine High St
Hourly Mean Data for 01 January to 31 December 2015



Date Created: 10/05/2016

RICARDO-AEA

0401

CERTIFICATE OF CALIBRATION

18 Blythswood Square, Glasgow, G2 4AD
Telephone 01235 753642

Approved Signatories: D. Hector S. Stratton

Signed:

Date of Issue: 1st April 2015

Certificate Number: 3106

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 at North Ayrshire Irvine High Street.

Site / Date Test Carried Out	Species	Analyser Serial No.	Zero Response[1]	Uncertainties ppb	Calibration Factor[2]	Uncertainties %	Converter eff. (%)[3]
Irvine High St 6th January 2015	NO_x	2981873	0.0	2.7	1.0208	3.5	100.4
	NO		0.0	2.7	1.0209	3.5	

Site / Date Test Carried Out	Species	Analyser Serial No.	Parameter	Specified Value	Measured Value	Deviation %	Uncertainty %
Irvine High St 6th January 2015	BAM PM10	H3190	Total Flow[4]	16.67	11.36	-31.9	±2.2

The reported expanded uncertainty is 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 recognised national standards, and to units of measurement realised at the National Physical Laboratory or other recognised national standards laboratories. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

CERTIFICATE OF CALIBRATION

Ricardo Energy & Environment, 18 Blythswood Square, Glasgow, G2 4AD
Telephone 01235 753642

0401

Authorised Signatories: D Hector
S Stratton

Signed: Date of Issue: 13th June 2016

Certificate Number: 03316

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 North Ayrshire Councils Irvine North High Street air monitoring station.

Ricardo Energy and Environment Calibration ID Number: ED57729/April 2016

Site / Date Test Carried Out	Species	Analyser Serial No.	Zero Response[1]	Uncertainties ppb	Calibration Factor[2]	Uncertainties %	Converter eff. (%)[3]
Irvine North High Street 10th July 2015	NO_x	2981873	0.0	2.7	1.0166	3.5	100.8
	NO		0.0	2.5	1.0041	3.5	

The reported expanded uncertainty is 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.

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QA/QC Data

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 - EE. The unit is audited every 6 months by Ricardo - EE and is serviced every 6 months under contract to another company. Corresponding data was entered in the "Checking Precision and Accuracy of Triplicate Tubes" spreadsheet provided by Ricardo - EE Energy & Environment (Figure 4 below). The resulting Bias factor for 2015 data is **0.97**.

Diffusion Tube Bias Adjustment Factors

Diffusion tubes (20% TEA/Water) used in the sampling period for 2015 were supplied and analysed by Glasgow Scientific Services (GSS). Diffusion Tube Bias Adjustment Factors for tubes provided by GSS are listed in Figure 2 below. The resultant bias for GSS is **0.98** based on 2 studies with 2 poor precision.

Discussion of Choice of Factor to Use

The co-location study for North Ayrshire Council has "good" precision and high quality results from the ROMON, although there has been poor data capture for 2 months of the year due to technical breakdowns on site. Use of the local co-location bias factor reflects more accurately on the true values of air quality when considered over the entire district. This is particularly noticeable for the long term background results where there are no significant sources of pollution; using the local bias factor reflects a more realistic trend for NO_2 pollution levels.

PM Monitoring Adjustment

The automatic monitoring station (ROMON – Fidas 200) is visually checked every 2 weeks during the NOx calibration check. The PM_{10} data collected by the ROMON is processed and ratified by Ricardo - EE. The Air Pollution Report for North Ayrshire, Irvine High Street for 1st January to 31st December 2015 is included above.

QA/QC of automatic monitoring

The automatic monitoring station (ROMON – NOx) has an onsite calibration check conducted every 2 weeks by Local Authority Officers. All checks are carried out in accordance with procedures laid out by Ricardo - EE and calibration check sheets are forwarded to them after each visit. The site is visited by Ricardo - EE engineers every 6 months to carry out calibration tests and the unit is serviced twice yearly. Reports from these visits are included above.

QA/QC of diffusion tube monitoring

Workplace Analysis Scheme for Proficiency (WASP) for the diffusion tube provider, Glasgow Scientific Services is provided below.

Figure 2: Bias Factor Spreadsheet (Glasgow Scientific)

National Diffusion Tube Bias Adjustment Factor Spreadsheet

Spreadsheet Version Number: 03/16

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 2016

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	2015	R	East Dunbartonshire Council	12	34	34	-2.1%	G	**1.02**
Glasgow Scientific Services	20% TEA in water	2015	R	East Dunbartonshire Council	12	28	28	-1.7%	P	**1.02**
Glasgow Scientific Services	20% TEA in water	2015	R	East Dunbartonshire Council	11	29	33	-12.5%	P	**1.14**
Glasgow Scientific Services	20% TEA in water	2015	R	East Dunbartonshire Council	11	23	22	4.0%	P	**0.96**
Glasgow Scientific Services	20% TEA in water	2015		**Overall Factor[3] (6 studies)**				**Use**		**0.98**

Figure 3: Tube Precision & WASP Results

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	AR001	AR003	AR004	AR006	AR007	AR009	AR010	AR012
Round conducted in the period	April – May 2014	July – August 2014	October – November 2014	January – February 2015	April – May 2015	July – August 2015	October – November 2015	January – February 2016
Aberdeen Scientific Services	100 %	100 %	100 %	100 %	100 %	75 %	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 %	75 %	100 %	100 %	100 %	100 %
Environmental Services Group, Didcot [1]	100 %	100 %	100 %	87.5 %	100 %	100 %	100 %	100 %
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 %	100 %	100 %	100 %	100 %	100 %	75 %
Gradko International [1]	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Kent Scientific Services	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Kirklees MBC	100 %	100 %	100 %	75 %	100 %	100 %	100 %	100 %
Lambeth Scientific Services	50 %	100 %	100 %	25 %	100 %	100 %	100 %	100 %
Milton Keynes Council	100 %	100 %	75 %	100 %	100 %	100 %	100 %	50 %
Northampton Borough Council	100 %	0 %	0 %	100 %	100 %	100 %	100 %	50 %
Somerset Scientific Services	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
South Yorkshire Air Quality Samplers	100 %	100 %	100 %	100 %	100 %	100 %	75 %	100 %
Staffordshire County Council	100 %	25 %	100%	100 %	100 %	75 %	75 %	75 %
Tayside Scientific Services (formerly Dundee CC)	NR [2]	100 %	100 %	100 %	NR [2]	NR [2]	NR [2]	100 %
West Yorkshire Analytical Services	75 %	100 %	75 %	100 %	75 %	75 %	75 %	75 %

[1] Participant subscribed to two sets of test samples (2 x 4 test samples) in each AIR PT round.
[2] NR No results reported
[3] Kent Scientific Services, Cardiff Scientific Services and Exova (formerly Clyde Analytical) no longer carry out NO_2 diffusion tube monitoring and therefore did not submit results.

Figure 4: 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	06/01/2015	04/02/2015	33.10	41.30	45.00	40	6.1	15	15.1	45	90.7	Good	Good
2	04/02/2016	04/03/2015	40.70	38.00	40.40	40	1.5	4	3.7	33	90.9	Good	Good
3	04/03/2015	01/04/2015	26.60	23.60	18.00	23	4.4	19	10.8	27	91.4	Good	Good
4	01/04/2015	29/04/2015	25.90	30.30	27.50	28	2.2	8	5.5	27	89.5	Good	Good
5	29/04/2015	27/05/2015	26.40	23.60	18.40	23	4.1	18	10.1	24	78.5	Good	Good
6	27/05/2015	03/07/2015	31.40	30.10	28.60	30	1.4	5	3.5	23	99	Good	Good
7	03/07/2015	29/07/2015	28.40	26.20	30.50	28	2.2	8	5.3	21	98.7	Good	Good
8	29/07/2015	26/08/2015	23.10	25.90	28.90	26	2.9	11	7.2	20	99.6	Good	Good
9	26/08/2015	30/09/2015	28.50	29.00	31.30	30	1.5	5	3.7	36	96.9	Good	Good
10	30/09/2015	28/10/2015	39.90	41.10	34.60	39	3.5	9	8.6	29	89.6	Good	Good
11	28/10/2015	02/12/2015	25.00	26.00		26	0.7	3	6.4	31	98.6	Good	Good
12	02/12/2015	06/01/2016	19.30	19.70		20	0.3	1	2.5	23	99.4	Good	Good
13													
												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

Overall survey -->

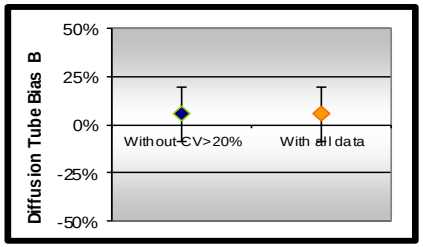
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:	High Street, Irvine

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	0.97 (0.85 - 1.12)
Bias B	3% (-11% - 18%)
Diffusion Tubes Mean:	29 µgm^{-3}
Mean CV (Precision):	9
Automatic Mean:	28 µgm^{-3}
Data Capture for periods used:	94%
Adjusted Tubes Mean:	28 (25 - 33) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 12 periods of data	
Bias factor A	0.97 (0.85 - 1.12)
Bias B	3% (-11% - 18%)
Diffusion Tubes Mean:	29 µgm^{-3}
Mean CV (Precision):	9
Automatic Mean:	28 µgm^{-3}
Data Capture for periods used:	94%
Adjusted Tubes Mean:	28 (25 - 33) 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

Diffusion Tube Measurements

Site Name/ID	Periods													Raw Mean	Valid periods
	1	2	3	4	5	6	7	8	9	10	11	12	13		
1. 35 East Road Irvine	28.0	29.9	24.5	20.5	19.8	23.7	19.2	21.5	18.6	25.4	21.4	14.0		22.2	12
2. 18 Bank St, Irvine (Pitchers)	28.7	34.7	21.2	18.1	14.8	20.3	18.7	18.0	23.5	29.2	29.6	18.3		22.9	12
3. 147 High Street, Irvine	33.0	30.5	18.3	22.5	14.1	21.1	21.2	24.0	23.0	31.5	33.5	25.0		24.8	12
4. 85 High St, Irvine	37.2	44.6	26.6	20.4	31.6	36.1	28.7	30.2	29.5	40.2	42.9	18.0		32.2	12
5. 79 High St, Irvine	68.2	80.2	51.6	59.6	28.0	68.7	48.6	52.3	43.1	50.8	54.2	26.6		52.7	12
6. 75 High St, Irvine (HIGH)	51.7	60.8	34.6	27.4	24.8	48.6	37.9	49.9	30.5	40.6	21.1	35.9		38.7	12
7. 65a High Street, Irvine	33.1	40.7	26.6	25.9	26.4	31.4	28.4	23.1	28.5	39.9	25.0	19.3		29.0	12
8. 65 High Street, Irvine	41.3	38.0	23.6	30.3	23.6	30.1	26.2	25.9	29.0	41.1	26.0	19.7		29.6	12
9. 63 High Street, Irvine	45.0	40.4	18.0	27.5	18.4	28.6	30.5	28.9	31.3	34.6	16.1	13.1		27.7	12
10. 34 Kirkgate Irvine	15.1	12.1	7.5	9.5	2.8	7.0	5.0	6.0	8.5	13.7	6.1	9.8		8.6	12
11. 25 Main Rd, Springside	21.0	22.1	10.3	13.7	7.1	12.8	10.8	12.5	15.1	19.2	22.9	12.4		15.0	12
12. Auchengate (Bridge)	12.6	11.9	9.4	6.0	3.0		9.0	9.5	9.7	13.2	14.4	11.2		10.0	11
13. Dalry Rd , Kilwinning	24.1	28.9	26.8	11.2	9.7	18.0	15.1	19.5	16.7	19.9	28.1	17.5		19.6	12
14. Vernon St, Saltcoats		19.3	28.2	21.6	13.8	25.6	12.2	21.2	22.0	32.0	28.4	17.8		22.0	11
15. Princes St/Glasgow St	19.7	17.6	20.8	14.0	10.7	15.1	19.6	19.1	16.4	30.8	20.5	14.4		18.2	12
16. 12 Garnock St, Dalry	12.8	8.8	6.2	8.2	3.1	6.1	5.6	4.7	5.3	14.4	15.2	19.0		9.1	12
17. 67 New St Dalry	44.1	44.6	25.2	32.0	19.5	36.5	21.9	27.6	31.6	44.6	38.5	10.4		31.4	12
18. 45 New St, Dalry	50.6	10.0	57.3	29.7	25.4	48.2	30.5	39.2	31.0	41.5	56.5	27.4		37.3	12
19. 2 Townhead St, Dalry	34.2	38.3	35.9	19.8	23.9	32.1	21.0	30.2	27.8	36.7	28.5	23.5		29.3	12
20. Highfield Hamlet	22.0	20.4	14.1	14.2	13.3	18.6	13.9	18.4	19.7	31.8	22.2	16.8		18.8	12
21. 85 Main St, Largs	23.9	22.6	12.4	17.5	15.4	20.5	16.6	21.0	21.3	26.4	21.1	8.7		19.0	12
22. HunterstonRd/Cycle track	3.5	5.9	5.4	2.1	3.3	4.4	3.3	4.1	6.1	9.2	5.9	3.4		4.7	12

Adjusted measurement (95% confidence interval)
with all the data
12 periods used in this calcuations

Bias Factor A 0.97 (0.85 - 1.12)
Bias B 3% (-11% - 18%)
Tube Precision: 9 Automatic DC: 94%

Adjusted with 95% CI	**22 (19 - 25)**
Adjusted with 95% CI	**22 (19 - 26)**
Adjusted with 95% CI	**24 (21 - 28)**
Adjusted with 95% CI	**31 (27 - 36)**
Adjusted with 95% CI	**51 (45 - 59)**
Adjusted with 95% CI	**37 (33 - 43)**
Adjusted with 95% CI	**28 (25 - 33)**
Adjusted with 95% CI	**29 (25 - 33)**
Adjusted with 95% CI	**27 (24 - 31)**
Adjusted with 95% CI	**8 (7 - 10)**
Adjusted with 95% CI	**15 (13 - 17)**
Adjusted with 95% CI	**10 (8 - 11)**
Adjusted with 95% CI	**19 (17 - 22)**
Adjusted with 95% CI	**21 (19 - 25)**
Adjusted with 95% CI	**18 (15 - 20)**
Adjusted with 95% CI	**9 (8 - 10)**
Adjusted with 95% CI	**30 (27 - 35)**
Adjusted with 95% CI	**36 (32 - 42)**
Adjusted with 95% CI	**28 (25 - 33)**
Adjusted with 95% CI	**18 (16 - 21)**
Adjusted with 95% CI	**18 (16 - 21)**
Adjusted with 95% CI	**5 (4 - 5)**

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	06/01/2015	04/02/2015	33.1	41.3	45.0	39.8	6.09	15.30	15.13	Good
2	04/02/2016	04/03/2015	40.7	38.0	40.4	39.7	1.48	3.73	3.68	Good
3	04/03/2015	01/04/2015	26.6	23.6	18.0	22.7	4.37	19.20	10.84	Good
4	01/04/2015	29/04/2015	25.9	30.3	27.5	27.9	2.23	7.98	5.53	Good
5	29/04/2015	27/05/2015	26.4	23.6	18.4	22.8	4.06	17.81	10.08	Good
6	27/05/2015	03/07/2015	31.4	30.1	28.6	30.0	1.40	4.67	3.48	Good
7	03/07/2015	29/07/2015	28.4	26.2	30.5	28.4	2.15	7.58	5.34	Good
8	29/07/2015	26/08/2015	23.1	25.9	28.9	26.0	2.90	11.17	7.21	Good
9	26/08/2015	30/09/2015	28.5	29.0	31.3	29.6	1.49	5.04	3.71	Good
10	30/09/2015	28/10/2015	39.9	41.1	34.6	38.5	3.46	8.98	8.59	Good
11	28/10/2015	02/12/2015	25.0	26.0	16.1	22.4	5.45	24.37	13.54	Poor Precision
12	02/12/2015	06/01/2016	19.3	19.7	13.1	17.4	3.70	21.31	9.19	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

Version 04 - February 2011

Site Name/ ID: High Street, Irvine

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

Bias calculated using 12 periods of data
Tube Precision: 9 Automatic DC: 94%
Bias factor A: 0.97 (0.85 - 1.12)
Bias B: 3% (-11% - 18%)

Information about tubes to be adjusted
Diffusion Tube average: 31 μgm^{-3}
Average Precision (CV): 10
Adjusted Tube average: 30 +/- 4 μgm^{-3}

Adjusted measurement (95% confidence level)
with all data

Bias calculated using 12 periods of data
Tube Precision: 9 Automatic DC: 94%
Bias factor A: 0.97 (0.85 - 1.12)
Bias B: 3% (-11% - 18%)

Information about tubes to be adjusted
Diffusion Tube average: 29 μgm^{-3}
Average Precision (CV): 12
Adjusted Tube average: 28 +/- 4 μgm^{-3}

Figure 5: Trends in Annual Mean Nitrogen Dioxide Concentrations measured at Diffusion Tube Monitoring Sites in Irvine 2011 - 2015.

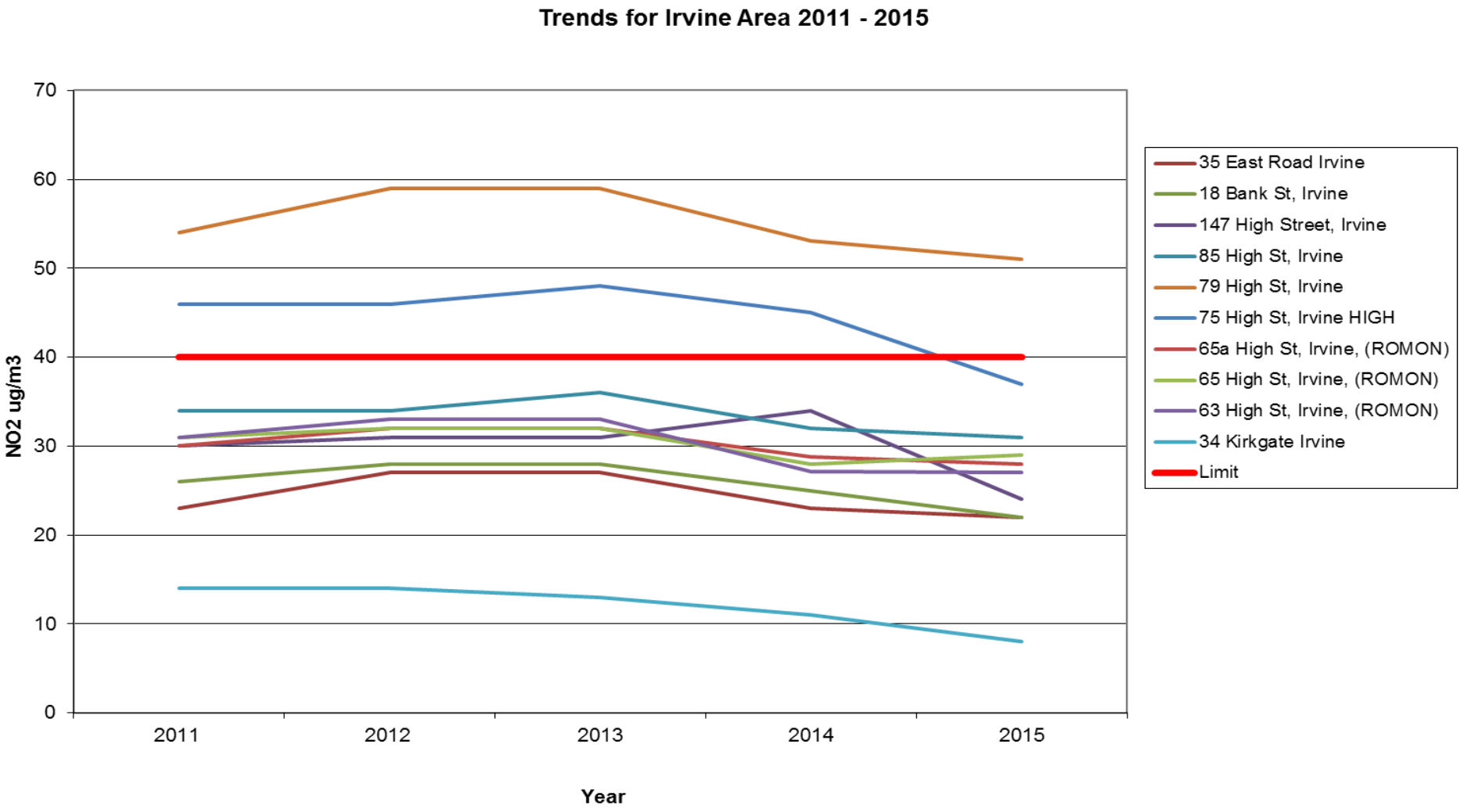


Figure 6: Trends in Annual Mean Nitrogen Dioxide Concentrations measured at Diffusion Tube Monitoring Sites in Dalry 2011 - 2015.

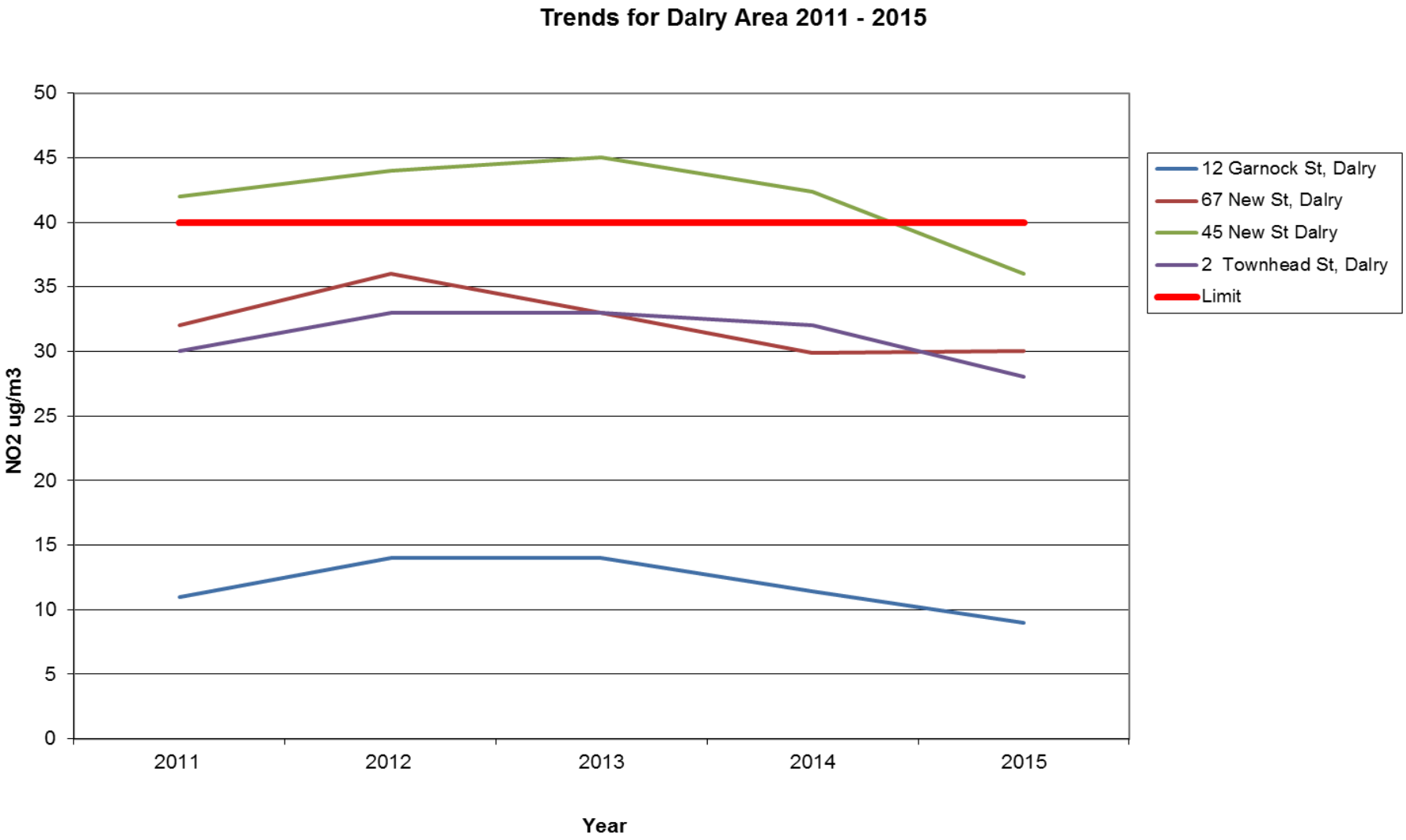


Figure 7: Trends in Annual Mean PM10 Concentrations measured at Automatic Station (ROMON) in High Street, Irvine 2011 - 2015.

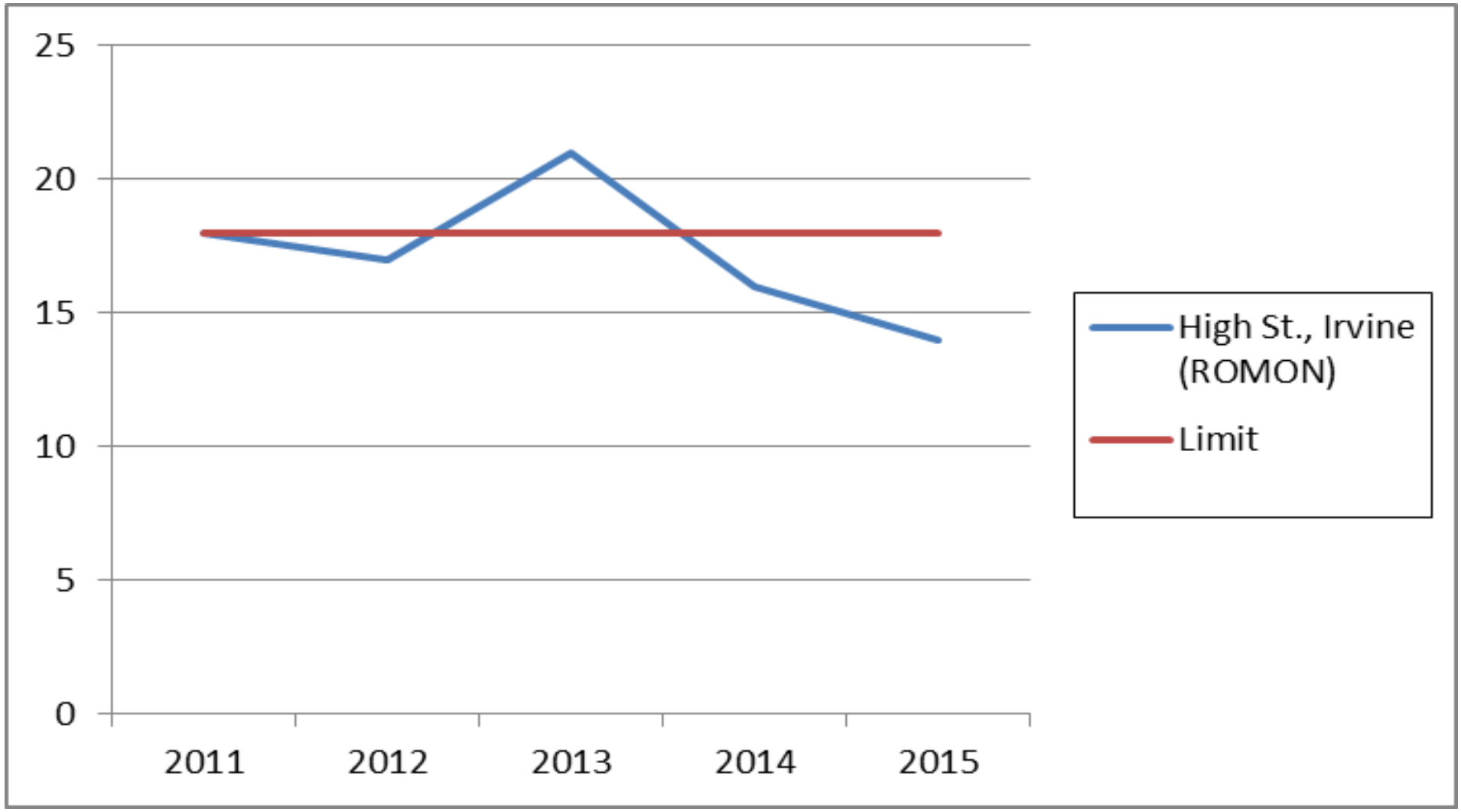


Figure 8: Drop-off with Distance for NO2 Tube Exceedences

Location	Distance from Kerb		Annual Mean NO_2		Predicted NO2 at Receptor
	Site	Receptor	Background	Site	
79 High Street, Irvine *(Actual)*	1.5m	5m	6ug/m^3	51ug/m^3	39ug/m^3
NEW widened pavement (predicted)	*1.5m*	*8.2m*	*6*ug/m^3	*51*ug/m^3	34ug/m^3

Figure 9: Public Realm Proposed Works Timetable

Task Name	Duration	Start	Finish	Predecessors
Tender	30 days	Mon 29/04/16	Fri 08/06/16	1
Evaluation & Appointment	14 days	Mon 11/06/16	Thu 28/06/16	2
Develop Design	90 days	Mon 02/07/16	Fri 02/11/16	3
Public Consultation	35 days	Mon 05/09/16	Fri 21/10/16	4
Employer Approval	0 days	Fri 21/10/16	Fri 21/10/16	5
Stat Consents	100 days	Mon 24/10/16	Fri 10/03/17	6
Design Development & Procurement	110 days	Mon 09/01/17	Fri 09/06/17	
Construction	505 days	Mon 12/06/17	Fri 17/05/19	8

Appendix D: Supporting Figures

Figure 10: Automatic Monitoring Site Location

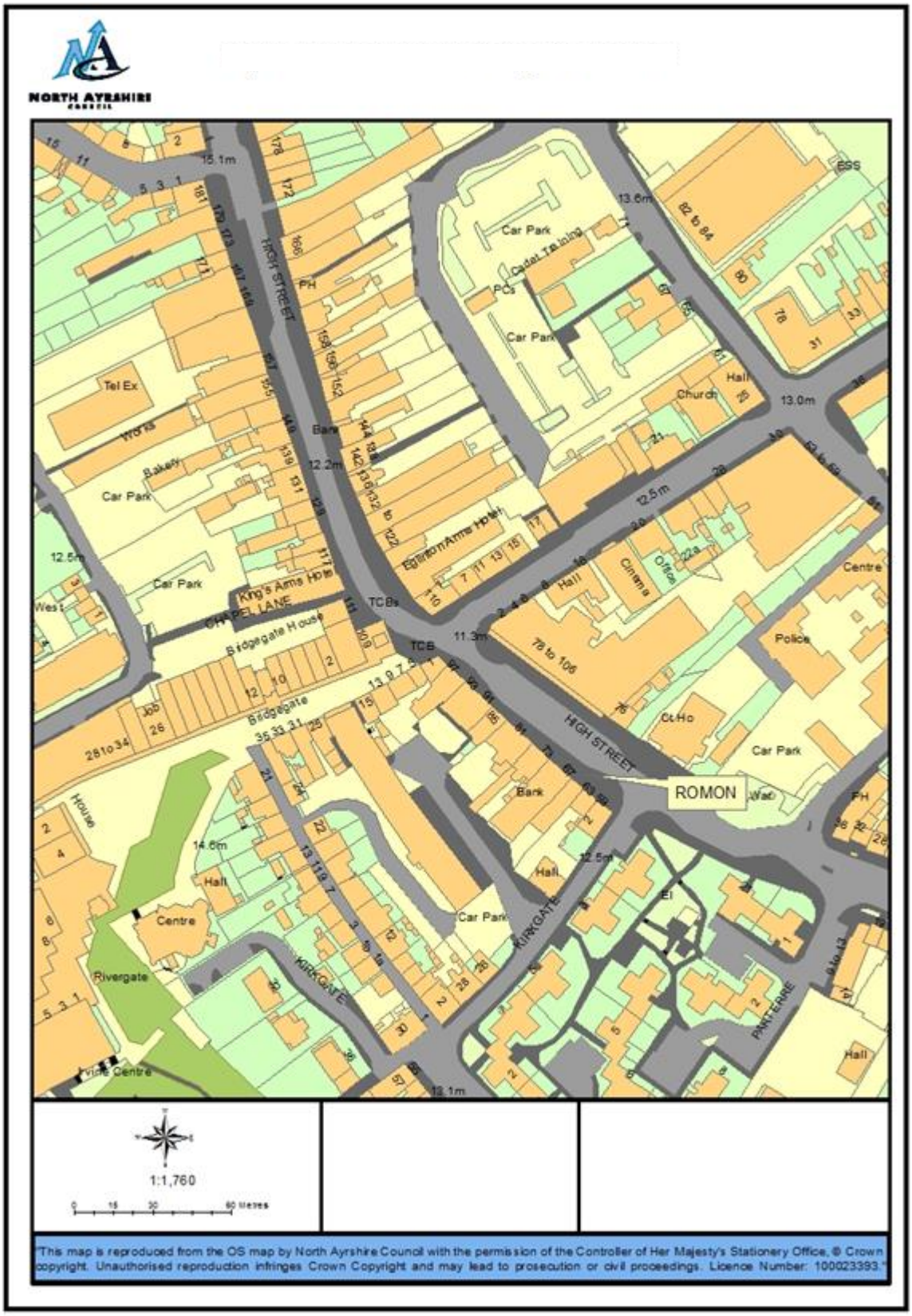
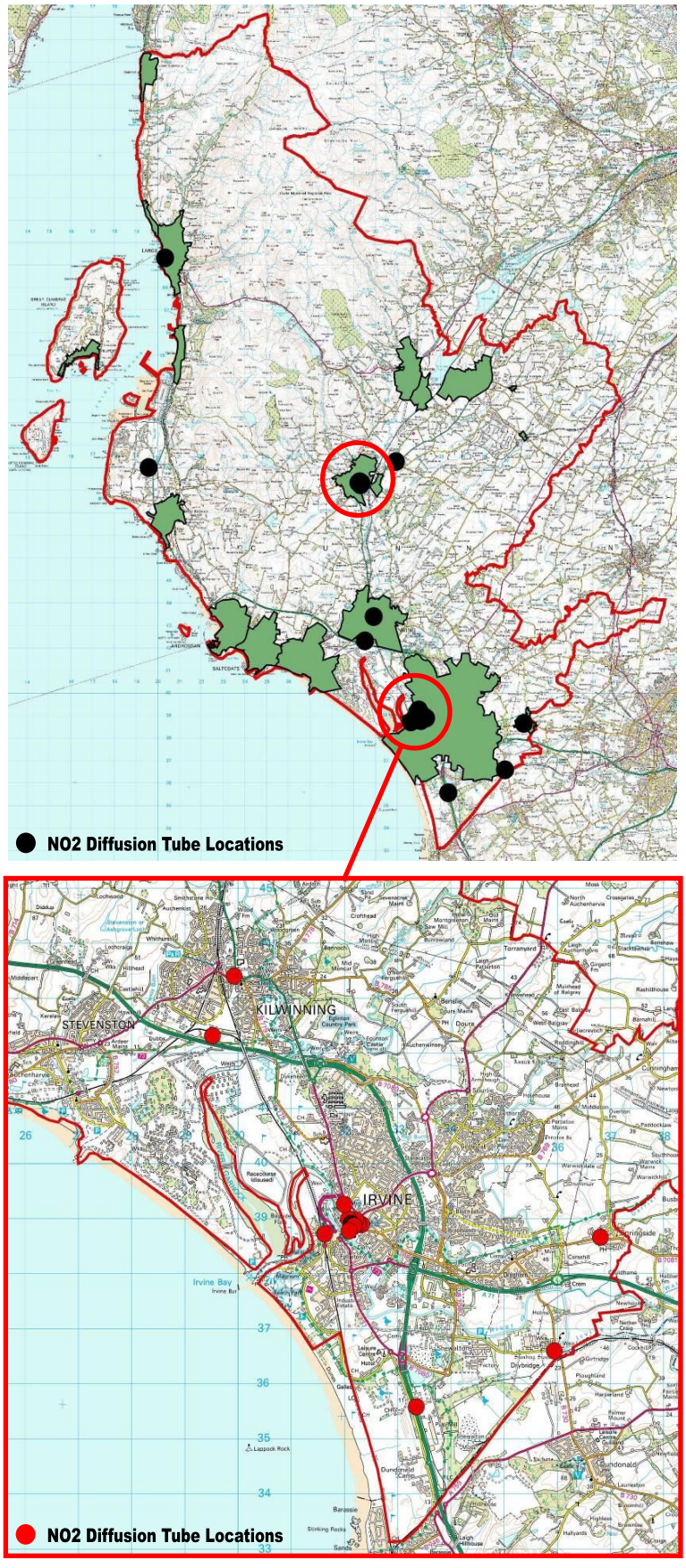


Figure 11: Non-Automatic Monitoring Site Locations



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. Air Quality Assessment Site to East of West Bankside Farm, Kilbirnie, North Ayrshire by Air Quality Consultants Febuary 2016 Report Reference J2483/1/F1.
2. Checking Precision and Accuracy of Triplicate Tubes (Version 05 - Feb 2012).
3. Distance from Roads Calculator www.laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html
4. Environmental Sustainability & Climate Change Strategy 2014-2017 http://naconnects.north-ayrshire.gov.uk/documents/strategies/environmental-sustainability-climate-change-strategy-procurement.pdf
5. Local Air Quality Management, Technical Guidance LAQM.TG (16), April 2016.