2016 Air Quality Annual Status Report (ASR)

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

Date: June 2016

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Executive Summary: Air Quality in Our Area

Kirklees is the third largest Metropolitan District in area - it covers 157 square miles or 40,860 hectares and a population of ~404,000. Measured in population terms Kirklees is one of the larger local authorities in England and Wales ranking 11th out of 348 districts. Over one tenth of the district is in the Peak District National Park. The extremes of altitude in Kirklees range from 33m (108 ft) at Thornhill Lees to 582m (1903 ft) at Black Hill.

Manufacturing industry, textiles and engineering still form a proportion of the local economy, the majority of it situated in the Huddersfield and Dewsbury areas and northwards to the M62. The urban areas comprise nine towns including the two larger towns of Huddersfield and Dewsbury.

Air Quality in Kirklees

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

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

The air quality issues within Kirklees are focussed around the road network connecting the towns, and traffic which passes between the West Yorkshire conurbation along the M62 and Greater Manchester.

Kirklees Council have conducted monitoring across the district where these primary roads are in close proximity to relevant human activity. To date Kirklees has identified 2 primary pollutants of concern. They are Nitrogen Dioxide and Particulate Matter.

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

Current trends indicate that the levels of these pollutants have fallen over the last 5 years, but health related objectives are still exceeded within the district.

Actions to Improve Air Quality

Kirklees Council has taken forward a number of measures during the current reporting year of 2016 in pursuit of improving local air quality.

Key completed measures are:

- West Yorkshire Low Emission Strategy
- Deep Clean of Scout Hill
- ECO Stars Freight Recognition Scheme
- Local Plan Air Quality Officer input and associated study

The Deep Clean of Scouthill was an AQMA focused project conducted in 2014 and 2015 in an attempt to reduce the PM_{10} exceedances. The project targets the issue of re-suspension of particulates. Prior to conducting the cleaning PM_{10} levels exceeded the daily objective, which resulted in a declaration in 2007. Following the improvement actions, Kirklees Council have observed an 83% fall in number of daily exceedances by conducting deep cleans in the area. The lower levels have been observed in both 2014 and 2015. It is for that reason that Kirklees Council are proposing to revoke AQMA 2.

The majority of the other aforementioned improvement actions are districtwide and policy based action, of which the improvements are difficult to measure.

Local Priorities and Challenges

During the 2016/17 reporting year Kirklees Council priorities for air quality are listed below;

- Declare 7 AQMAs
- Construct new action plan for the district and AQMAs
- Integrate the West Yorkshire Low Emission Strategy into Council Policy
- Undertake impact assessment of the local plan

- Explore a regional EV charging network

How to Get Involved

If you wish to get information for air quality, please use the following websites:

http://www.kirklees.gov.uk/community/noisePollution/pollution.aspx

http://www.kirklees.gov.uk/involve/entry.aspx?id=821

https://uk-air.defra.gov.uk/

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1 Local Air Quality Management

This report provides an overview of air quality in Kirklees Council during 2016. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents.

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

The statutory air quality objectives applicable to LAQM in England can be found in Table E.2 in Appendix E.

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

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

A summary of AQMAs declared by Kirklees Council can be found in Table 2.1. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available online at https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=140 and http://www.kirklees.gov.uk/community/noisePollution/pollution.aspx

We propose to declare new AQMAs in 7 areas (Appendix F – Air Quality Management areas). The new AQMAs are as a result of exceedance of annual NO_2 objectives and the boundaries have been defined through the use of monitoring coupled with air quality modelling. These areas are a follows;

- Birchencliffe
- Birkenshaw
- Eastborough
- Edgerton
- Heckmondwike
- Huddersfield Town Centre
- Outlane

The AQMA 1 at Bradley continues to exceed the annual NO_2 objectives. Therefore, Kirklees Council has no intention to revoke or amend the boundaries

As agreed with DEFRA in our previous USA 2015, the levels of particulate in Scouthill have continued to be below the daily PM_{10} objective and we therefore propose to revoke AQMA2 (see monitoring section).

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Pollutants and Air Quality Objectives	City / Town	One Line Description	Action Plan
AQMA 1	NO_2 - Annual	Huddersfield	79 Residential dwellings in close proximity to junction for A62 / A6107 in Bradley	For progress see Table 2.2
AQMA 2	PM_{10} - Daily	Dewsbury	46 Residential dwellings in close proximity to A62 iin Scouthill	For progress see Table 2.2

2.2 Progress and Impact of Measures to address Air Quality in Kirklees Council

Kirklees Council has taken forward a number of measures during the current reporting year of 2016 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2. More detail on these measures within the district can be found in respective Action Plans and strategies. Key completed measures are:

- West Yorkshire Low Emission Strategy
- Deep Clean of Scout Hill
- ECO Stars Freight Recognition Scheme
- Local Plan Air Quality Officer input and associated study

Table 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
	Title	Select from the categories in blue box	Select from the subcategories in blue box		Date	Date				Date	
1	Install Split Cycle Offset Optimisation technique (SCOOT) Traffic Managements System within AQMA 1	Traffic Management	UTC, Congestion management, traffic reduction	Kirklees Council	2013	2013	Reduction in queuing time	NO2 / PM10	Installed	2013	
2	Alter SCOOT to incorporate actual Air Quality pollution levels	Traffic Management	UTC, Congestion management, traffic reduction	Kirklees Council	2015	2016	Reduction in NOx and PM10	NO2 / PM10	Planning stage	2017	
3	Bus priority at lights in AQMA 1	Traffic Management	UTC, Congestion management, traffic reduction	Kirklees Council	2013	2014	Reduction in queuing time for public transport	NO2 / PM10	Implemented scheme	2014	

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
4	Bradley Junction. Re-model one of the busiest Road Junction in Kirklees in AQMA 1	Transport Planning and Infrastructure	Strategic highway improvements, Re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority, high vehicle occupancy lane	Kirklees Council	2014	2019	Reduce congestion levels at AM/PM peaks	NO2 / PM10	Pre-design stage	2021	

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
5	Ravensthorpe Bypass. Complete by pass of AQMA 2.	Transport Planning and Infrastructure	Strategic highway improvements, Re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority, high vehicle occupancy lane	Kirklees Council	2012	2021	Divert traffic away from AQMA 2	NO2 / PM10	Feesibility Study carried out	2026	

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
6	Cooper Bridge Gyratory proposed in AQMA 1	Transport Planning and Infrastructure	Strategic highway improvements, Re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority, high vehicle occupancy lane	Kirklees Council	2014	2019	Reduction in queuing time	NO2 / PM10	Juction designed. Funding sought	2021	

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
7	Proposed New Junction 24a on M62	Transport Planning and Infrastructure	Strategic highway improvements, Re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority, high vehicle occupancy lane	Highways Agency	2013	2021	Reduction in traffic volume through AQMA 1	NO2 / PM10	Feesibility Study	2023	

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
8	Bus Lanes approaching AQMA 1	Traffic Management	Strategic highway improvements, Re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority, high vehicle occupancy lane	Kirklees Council	2010	2011	Reduction in delays to buses	NO2 / PM10	Bus lane installed		
9	Resource Smart Resource Corridor	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	Kirklees Council			Reduction of NO2 in AQMA	NO2 / PM10			

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
10	Internal Travel Plans	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	Kirklees Council	2008	2009	Uptake of sustainable options	NO2 / PM10	Adopted and implemented	Ongoing	
11	Transport Plans for Businesses required	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	Kirklees Council	Pre 2006	Pre 2006	Uptake of sustainable options	NO2 / PM10	Asking for plans through planning process	Ongoing	

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
12	School Travel Plan Framework	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	Kirklees Council	2005	2006	Uptake of sustainable options	NO2 / PM10	Schools were encouraged to produce travel plans and funding sought to fund infrastructure requirements	Ongoing	
13	Bikeability in schools. Council staff visited schools giving cycling safety training.	Public Information	Via other mechanisms	Kirklees Council	2009	2010	Increase in cycling	NO2 / PM10	Promoted cycling in schools via eductaion plrogrammes on road safety	2014	

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
14	Spen Valley Greenway (Traffic Free Cycleway on former railway line)	Transport Planning and Infrastructure	Cycle network	Kirklees Council	1998	2000	Increase in cycling	NO2 / PM10	Cycleway implemented	2000	
15	Calder Valley Cycleway (Traffic Free Cycleway on former railway line)	Transport Planning and Infrastructure	Cycle network	Kirklees Council	2004	2008	Increase in cycling	NO2 / PM10	Cycleway implemented	2008	
16	City Cycle Ambition Grant 2	Transport Planning and Infrastructure	Cycle network	Kirklees Council	2015	2015	Increase in cycling	NO2 / PM10	Bid submitted for cycleway improvements	2016	
17	Free Parking for Electric Vehicles and 50% discount on parking for other ULEV	Traffic Management	Emission based parking or permit charges	Kirklees Council	2007	2008	Uptake of low emission and Ultra Low Emission Vehicles	NO2 / PM10	Scheme is operational	On going	

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
18	City Car Club	Alternatives to private vehicle use	Car Clubs	Kirklees Council	2008	2009	Use of club cars	NO2 / PM10	Introduced car club to Kirklees District	Ongoing	
19	Car Sharing Scheme	Alternatives to private vehicle use	Car & lift sharing schemes	Kirklees Council	2006	2007	Use of website	NO2 / PM10	Contribute to license fee for car sharing website and private subsite for council staff	Ongoing	
20	Local Free Bus around Huddersfield Town Centre and Dewsbury Town Centre	Alternatives to private vehicle use	Other	Kirklees Council	2005	2006	Bus Patronage	NO2 / PM10	Bus runs in both Huddersfield and Dewsbury	Ongoing	

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
21	Conversion of Fleet to ULEV where appropriate	Promoting Low Emission Transport	Other	Kirklees Council	2008	2009	Number of fleet changed to EV	NO2 / PM10	We have used an electric transit type van for a number of years and have had the Energy Savings trust review our fleet to see if further swithes to Electric vehicles can be made	Ongoing	

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
22	Air Quality report to Newspaper	Public Information	Via other mechanisms	Kirklees Council	Pre 2006	Pre 2006	Awareness of Air Quality amongst the public	NO2 / PM10	Daily Reports sent to newspaper	Ongoing	
23	Bike to work scheme within Council, discount cycle purchase scheme	Alternatives to private vehicle use	Other	Kirklees Council	2008	2009	Uptake of bikes	NO2 / PM10	Implemented scheme and promoted to workforce	Ongoing	
24	Local sustainable transport fund project to promote modal shift in schools. Dedicated officer visiting schools promoting model shift	Public Information	Via other mechanisms	Kirklees Council	2011	2012	Monitor transport options at local schools	NO2 / PM10	Funded officer to go into schools and promote modal shift	Ongoing	

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
25	Air Quality Strategy	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	Kirklees Council	2005	2006	Local policy using Air Quality as a decision factor	NO2 / PM10	Document completed and adopted	2006	
26	Deep Clean in AQMA 2	Traffic Management	Other	Kirklees Council	2013	2014	Reduction in PM10 levels	PM10	First deep clean conducted. 2014 reduction in exceedances of daily PM10 in AQMA Planning to conduct clean in 2015	Ongoing	

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
27	Mote sensing real-time emissions	Public Information	Via other mechanisms	Kirklees Council	2010	2012	Results from research	NO2 / PM10	Analysed emissions of local traffic		
28	Electric Vehicle Charge point Installed in Council Depot	Promoting Low Emission Transport	Other	Kirklees Council	2013	2014	Number of fleet changed to EV	NO2 / PM10	Charge point installed in council depot	2014	
29	Trial of EV vehicles as pool car	Promoting Low Emission Transport	Other	Kirklees Council	2014	2014	Uptake of LEVs	NO2 / PM10	Car was used by various staff to conduct daily works	2014	

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
30	Smokey Vehicle hotline	Public Information	Via other mechanisms	Kirklees Council	Pre 2000	Pre 2000	Number of calls received	NO2 / PM10	Customers can call and report vehicles with smokey exhausts	Ongoing	
31	Planning conditions on all applications for sustainable transport	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	Kirklees Council	2014	2014	Number of conditions on approval	NO2 / PM10	Currently request EV charge points on all new developments	Ongoing	
32	Green Procurement Toolkit	Policy Guidance and Development Control	Sustainable Procurement Guidance	Kirklees Council	2005	2006	use of toolkit in procurment	NO2 / PM10	Green procurement toolkit created for Low carbon	2015	

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
33	West Yorkshire Low Emission Strategy	Policy Guidance and Development Control	Low Emissions Strategy	Bradford Council	2012	2013	Policy adpoted by Kirklees Council	NO2 / PM10	Strategy document completed in draft form. To go out for review	2015	
34	Hotel EV Charge Point Project. Electric Vehicle Charge points installed in a number of accommodation providers	Promoting Low Emission Transport	Other	Calderdale Council Kirklees Council Bradford Council	2014	2015	use of the charge points	NO2 / PM10	Applications from hotels. Number of sites installed	2015	
35	Install SCOOT within AQMA 2	Traffic Management	UTC, Congestion management, traffic reduction	Kirklees Council	2012	2013	Reduction in queuing time	NO2 / PM10	Installed	2013	

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
36	New links to Greenway (Cycle Path) added through planning	Transport Planning and Infrastructure	Cycle network	Kirklees Council	2000	2000	Increase cycle routes	NO2/PM10	Recommended conditions to planning	Ongoing	
36	Subsidised Metro Cards for Staff	Promoting Travel Alternatives	Other	Kirklees Council	Pre 2006	Pre 2006	Promote use of public transport	NO2/PM10	Scheme is operational	Ongoing	
37	Metro Cards Introduced for work journeys	Promoting Travel Alternatives	Other	Kirklees Council	2008	2009	Reduce use of cars for shorter jouneys	NO2/PM10	Metro Cards in use for public transport for council staff to undertake their daily work	Ongoing	

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
38	Installing EV Charge points into private car parks (three sites, 4 units installed)	Promoting Low Emission Transport	Other	Kirklees Council	2015	2015	Usage of charge points	NO2/PM10	Bid successful and sites identified	2015	
39	Congestions performance funding	Traffic Management	UTC, Congestion management, traffic reduction	Kirklees Council	2011	2012	Number of children going to schools using non private vehicles to access sites	NO2/PM10	Funded officer to go into schools and promote modal shift	2014	
40	Bus priority at lights in AQMA 1. Gives late buses priority through Air Quality Management Area 1	Traffic Management	UTC, Congestion management, traffic reduction	Kirklees Council	2013	2014	Reduction in queuing time for public transport	NO2 / PM10	Implemented scheme	2014	

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
41	Bluetooth journey monitoring	Public Information	Via other mechanisms	Kirklees Council	2013	2014	Inform smart traffic manangment	NO2/PM10	Ran trial of bluetooth data collection system	2016	
42	Retrofiting of School Buses with Pollution abatement equipment	Promoting Low Emission Transport	Vehicle Retrofitting programmes	West Yorkshire Combined Authority	2013	2013	All school buses now retrofitted and emissions reduced by 90%	NO2	All school buses now retrofitted and emissions reduced by 90%	2014	
44	Installation of Rapid Charge Network across West Yorkshire	Promoting Low Emission Transport	Other	West Yorkshire Combined Authority	2014	2015	Rapid charge network across West Yorkshire being installed	NO2/PM10	Sites indentified and installation due to begin in next few weeks	2015	

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
45	Ainley Top Junction improvements	Transport Planning and Infrastructure	Other	Kirklees Council	2012	2014	Reduction in traffic congestion	NO2/PM10	Extra Lanes installed on Roundabout	2015	Scoot to be installed 2015
46	A629 Corridor Improvement	Transport Planning and Infrastructure	Other	Kirklees Council	2013	2018	Reduction in traffic congestion	NO2/PM10	Bid for funding being prepared	2021	
47	A653 Corridor Improvement	Transport Planning and Infrastructure	Other	Kirklees Council	2013	2018	Reduction in traffic congestion	NO2/PM10	Bid for funding submitted	2018	
48	Bus priority at lights in AQMA 2	Traffic Management	UTC, Congestion management, traffic reduction	Kirklees Council	2012	2013	Reduction in queuing time for public transport	NO2 / PM10	Implemented scheme	2013	

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
49	West Yorkshire ECO-Stars Scheme	Vehicle Fleet Efficiency	Driver training and ECO driving aids	Kirklees Council	2015/16	2016	Improvement in HGV Fleets	NO2 / PM10	Scheme purchased, Implementation begun	Ongoing	

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

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

Kirklees Council is taking the following measures to address PM2.5:

- Collaborative working between Public Health, Environmental Health, Planning and Highways to conduct a 2015 baseline Air Quality Model for the whole Kirklees District for $PM_{2.5}$ as part of local plan works.
- Installation of $PM_{2.5}$ monitors at 2 location within the district
- Analyse pre-existing PM_{10} data and DEFRA $PM_{2.5}$ maps to inform Kirklees Council of potential issues within the district

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

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

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

Kirklees Council undertook automatic (continuous) monitoring at 7 sites during 2016. Table A.7 in Appendix A shows the details of the sites.

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

In 2016 Kirklees Council have taken opportunity to review their automatic monitoring network. At the beginning of 2015 NO_2 & PM_{10} was monitored by a network of 7 continuous automatic. Kirklees Council also monitored O_3 and SO_2 at 1 location. NO_2 & PM_{10} monitors are based at 6 roadside and 1 urban background locations, while the O_3 & SO_2 are only at the Urban Background location.
In 2014 and 2015 only 2 automatic monitoring locations were found to exceed at the façade of properties for NO_2. Our PM_{10} AQMA has not exceeded since 2013 and particulate is not an issue at other locations. O_3 and SO_2 is not an issue within Kirklees. Kirklees Council has a limited monitoring budget, which means that we need to rationalise our monitoring network in order to ensure relevant cost affective data collection. With this in mind we have reviewed the automatic network and propose to remove 5 monitoring locations where AQO's are compliant.

Kirklees Council will also be adding 2 $PM_{2.5}$ monitors to the network at our 2 remaining roadside locations and will install diffusion tubes at locations where automatic monitors have been removed in order to ensure levels remain below the objective in these areas.

3.1.2 Non-Automatic Monitoring Sites

Kirklees Council undertook non- automatic (passive) monitoring of NO2 at 55 sites during 2016.

Table A.8 in Appendix A shows the details of the sites.

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

Kirklees Council currently have a diffusion tube monitoring network of 55 diffusion tubes across the whole district, which will be increased by 5 tubes when the automatic stations are decommissioned. These are constructed and analysed in the Kirklees Council laboratory, being of the composition 50%TEA solution to 50% Acetone.

Majority of diffusion tubes across the district are attached to street furniture such as lamp posts and sited at either in a kerbside or roadside location.

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.

3.2.1 Nitrogen Dioxide (NO_2)

Table A.9 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 2016 dataset of monthly mean values and façade calculations are provided in Appendix B.

Table A.10 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.

In 2016 no Kirklees Council automatic monitoring sites have reported levels exceeding the NO_2 hourly objective more than 18 times and only 1 diffusion in Eastborough exceeds 60µg/m^3 indicator.

In 2016 2 Kirklees Council automatic monitoring sites exceeded the annual AQO for NO_2 at Birchencliffe and Birkenshaw. Within the same period 7 diffusion tube locations exceeded the annual AQO for NO_2 at the façades of properties within the localities of Eastborough, Edgerton, Heckmondwike, Huddersfield Town Centre, Outlane and Thornton Lodge

Figure 3.1 Automatic monitoring - Annual NO_2 concentration trends

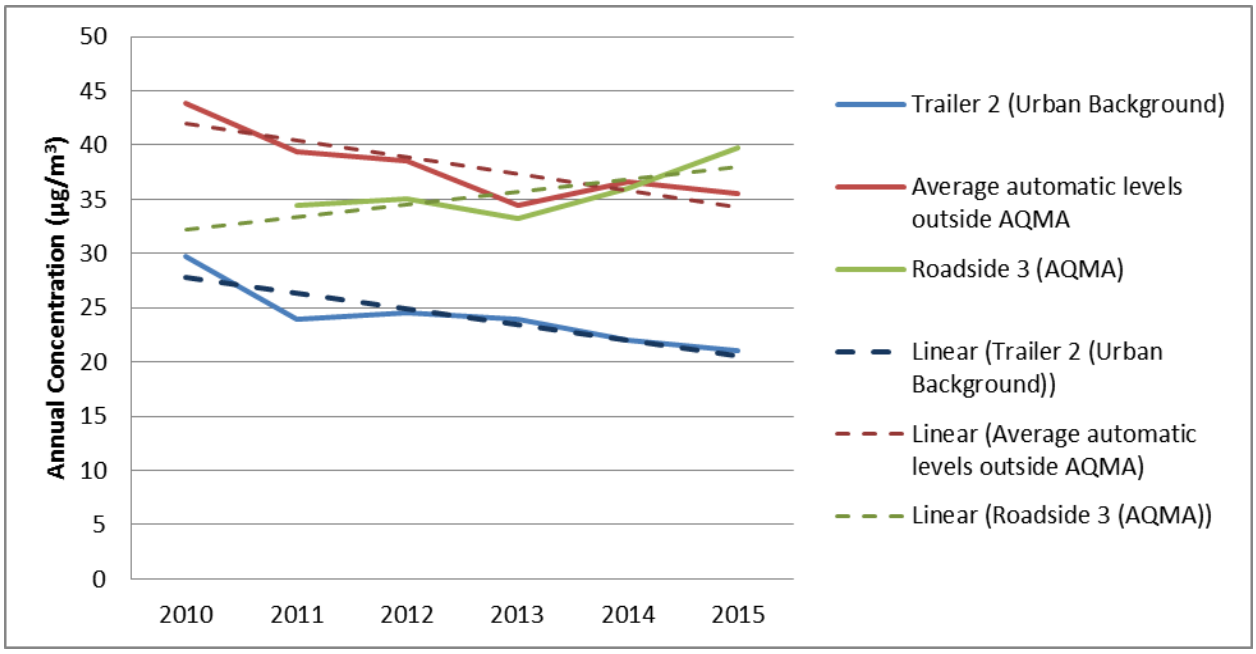
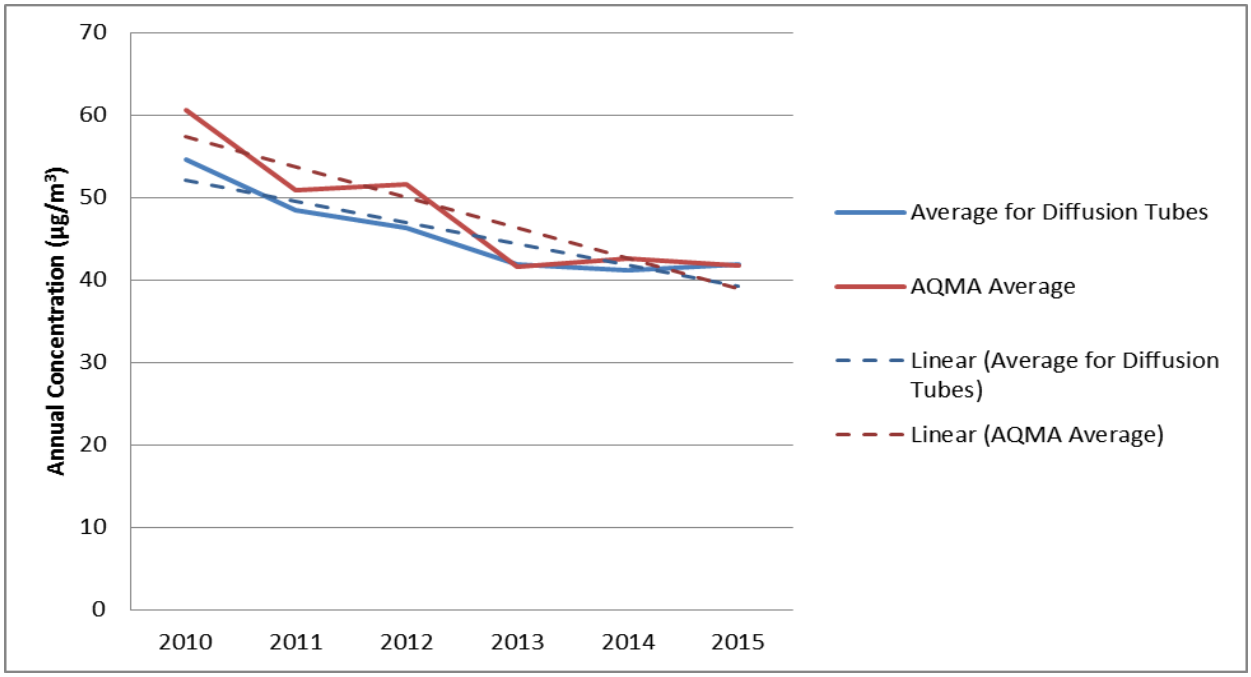


Figure 3.2 Diffusion tube monitoring - Annual NO_2 concentration trends



Figures 3.1 and 3.2 shows that trends for Annual NO_2 levels within the district have continued to show falls year on year since 2010 for average diffusion tube levels, average automatic monitor locations outside AQMAs and the urban background location.

Levels within the AQMA have conflicting trends between automatic and diffusion tube monitoring. Trends from the diffusion tube data mirrors that of other monitors within the district, that of a continous fall since 2010. The automatic monitor level has always been lower than that observed using diffusion tubes. Over the last 2 years the levels have crept up. In 2015 the levels are closer to that of the diffusion tubes, but still not above the AQO. Variabilty between the levels could be accounted for due to the affect of street canyoning and gaps within the canyon. Therefore, because levels continue to fall and the automatic monitoring being below objectives, we have decided to carry out modelling to redefine the boundaries of the AQMA.

Kirklees Council have conducted detailed assessments at 7 of the 8 locations and have run models to determine the extent of the exceedance. These areas are;

- Birchencliffe
- Birkenshaw
- Eastborough
- Edgerton
- Heckmondwike
- Huddersfield Town Centre
- Outlane

Details regarding the models and output maps are included in Appendix F.

In order to determine the issues within Thornton Lodge, Kirklees council proposes to install further passive monitoring sites to determine the full extent of the exceedance,

3.2.2 Particulate Matter (PM_{10})

Kirklees Council have 3 types of monitoring equipment installed in our monitoring station Trailer 2 monitors using a tapered element oscillating microbalance (TEOM) and data collected at this station has been corrected using the Volatile Correction Model (VCM).

Discussion regarding PM_{10} correction factors can be found in Appendix C

Table A.11 in Appendix A compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3.

Table A.12 in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the past 5 years with the air quality objective of 50µg/m^3, not to be exceeded more than 35 times per year.

In 2016 no Kirklees Council automatic monitoring sites have reported levels exceeding the Annual or Daily PM_{10} objective more than 35 times.

Figure 3.3 Automatic monitoring - Annual PM_{10} concentration trends

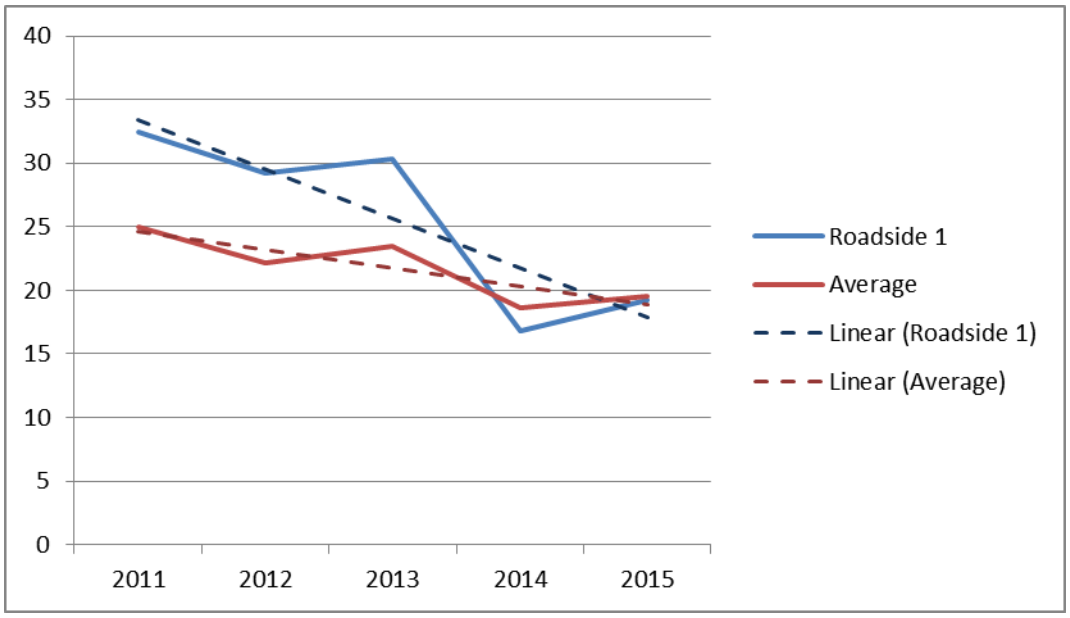
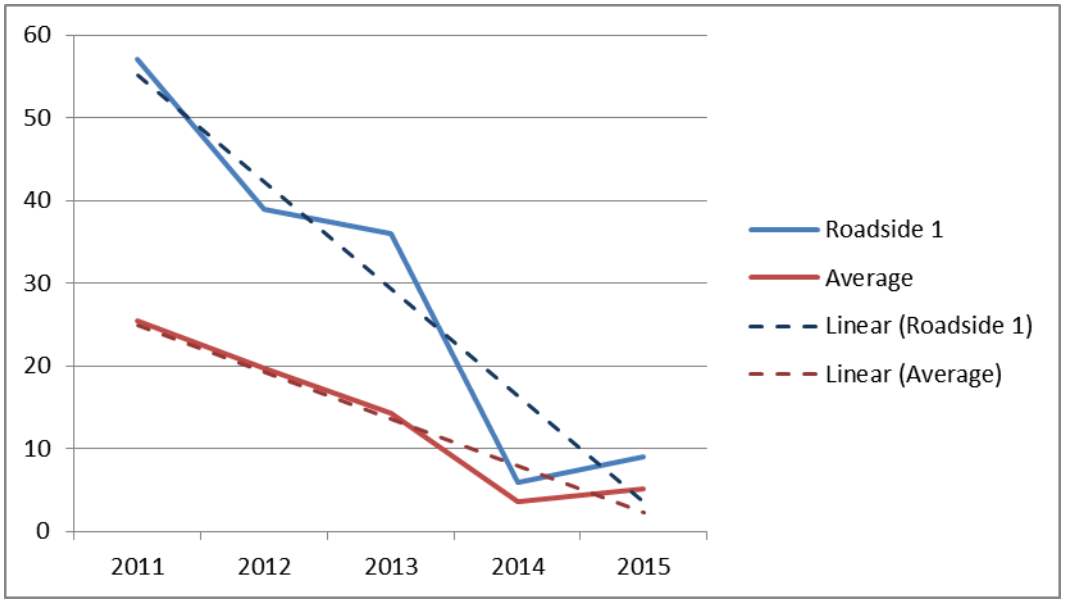


Figure 3.4 Automatic monitoring - Daily PM_{10} exceedance trends



Figures 3.3 and 3.4 shows that trends for Annual PM_{10} levels within the district have continued to show falls year on year outside and within the AQMA since 2011 for both annual and daily levels.

3.2.3 Sulphur Dioxide (SO_2)

Table A. in Appendix A compares the ratified continuous monitored SO_2 concentrations for year 2015 with the air quality objectives for SO_2.

The SO_2 monitor is at a background location within the district. Kirklees Council has previously monitored at industrial locations, but have not recoded an exceedance during any monitoring period. Kirklees Council has therefore decided to remove SO_2 monitoring from our network.

Appendix A: Monitoring Results

Table A.7 – Details of Automatic Monitoring Sites

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)
Trailer 2	Industrial	423185	420612	NO_2, O_3, PM_{10}, SO_2	Adjacent	Chemiluminescence method. Ultraviolet Absorptiometry. TEOM. Ultraviolet luminescence	N (42m)	6m	3.0
Roadside 1	Roadside	423247	420761	NO_2, PM_{10},	Y	Chemiluminescence method. FH 62 I-R	Y (3m)	3m	1.5
Roadside 2	Roadside	418240	426553	NO_2, PM_{10},	N	Chemiluminescence method. FH 62 I-R	Y (50m)	2m	1.5
Roadside 3	Roadside	417255	420358	NO_2, PM_{10},	Y	Chemiluminescence method. FH 62 I-R	Y (3m)	3m	1.5
Roadside 4	Roadside	420441	427353	NO_2, PM_{10},	N	Chemiluminescence method. FH 62 I-R	N (29m)	3m	1.5
Roadside 5	Roadside	422430	420399	NO_2, PM_{10},	N	Chemiluminescence method. FH 62 I-R	Y (3m)	3m	1.5

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)
Roadside 6	Roadside	411739	419007	NO_2, PM_{10},	N	Chemiluminescence method. Met-One BAM	Y (8m)	5m	1.5

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

(2) N/A if not applicable.

Table A.8 – Details of Non-Automatic Monitoring Sites

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?	Height (m)
1	Other	424506	421535	NO_2	N	N	0.8	N	2.0
2	Other	414214	416504	NO_2	N	N	4.1	N	2.0
3	Roadside	413504	417439	NO_2	N	Y (2.0)	2.4	N	2.0
4	Roadside	424464	424395	NO_2	N	Y (4.3)	1.8	N	2.0
5	Roadside	422443	420380	NO_2	N	Y (1.6)	1.9	N	2.0
6	Roadside	417872	421050	NO_2	Y	Y (5.2)	6.0	N	2.0
7	Urban Centre	414434	416744	NO_2	N	Y (0.5)	0.5	N	2.0
8	Roadside	414496	417795	NO_2	N	Y (2.5)	2.5	N	2.0
9	Kerbside	417280	420482	NO_2	Y	Y (13.4)	0.7	N	2.0
10	Roadside	417227	420337	NO_2	Y	Y (3.2)	2.0	N	2.0

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?	Height (m)
11	Roadside	414389	416262	NO_2	N	Y (0.1)	5.5	N	2.0
12	Roadside	417335	420412	NO_2	Y	Y (3.7)	1.8	N	2.0
13	Roadside	420377	427871	NO_2	N	Y (2.1)	2.6	N	2.0
14	Urban Background	413669	416463	NO_2	N	N	1.7	N	2.0
15	Co-location Study	420441	427353	NO_2	N	N	3.0	Y	2.0
16	Co-location Study	420441	427353	NO_2	N	N	3.0	Y	2.0
17	Co-location Study	420441	427353	NO_2	N	N	3.0	Y	2.0
18	Roadside	422686	426229	NO_2	N	Y (4.2)	1.9	N	2.0
19	Roadside	423563	421014	NO_2	N	Y (6.5)	2.7	N	2.0
20	Roadside	424853	421828	NO_2	N	Y (9.5)	1.5	N	2.0
21	Roadside	414149	416686	NO_2	N	Y (6.9)	2.1	N	2.0

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?	Height (m)
22	Roadside	417418	420479	NO_2	Y	Y (3.2)	1.5	N	2.0
23	Roadside	418483	420978	NO_2	N	Y (14.1)	1.6	N	2.0
24	Roadside	409941	418471	NO_2	N	Y (15.4)	2.0	N	2.0
25	Co-location	423185	420612	NO_2	N	N	6.0	Y	2.0
26	Co-location	423185	420612	NO_2	N	N	6.0	Y	2.0
27	Co-location	423185	420612	NO_2	N	N	6.0	Y	2.0
28	Roadside	414745	416710	NO_2	N	Y (0.1)	3.3	N	2.0
29	Co-location	429960	434240	NO_2	N	N	30	Y	2.0
30	Co-location	432680	406174	NO_2	N	N	3.5	Y	2.0
31	Roadside	413400	417495	NO_2	N	Y (8.3)	2.7	N	2.0
32	Roadside	413513	417481	NO_2	N	Y (5.0)	2.6	N	2.0

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?	Height (m)
33	Roadside	420727	423668	NO_2	N	Y (4.3)	2.4	N	2.0
34	Roadside	420845	423770	NO_2	N	Y (0.3)	1.9	N	2.0
35	Roadside	420853	423866	NO_2	N	Y (9.4)	1.9	N	2.0
36	Kerbside	420304	419766	NO_2	N	Y (2.9)	0.9	N	2.0
37	Roadside	420356	427810	NO_2	N	Y (2.5)	2.2	N	2.0
38	Roadside	420222	427764	NO_2	N	Y (18.3)	1.0	N	2.0
39	Roadside	424526	424326	NO_2	N	Y (1.7)	2.1	N	2.0
40	Roadside	424871	421921	NO_2	N	Y (1.2)	1.6	N	2.0
41	Roadside	418285	426630	NO_2	N	Y (12.5)	3.4	N	2.0
42	Roadside	424969	422002	NO_2	N	Y (5.6)	1.9	N	2.0
43	Roadside	425083	422022	NO_2	N	Y (6.0)	1.9	N	2.0

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?	Height (m)
44	Roadside	425179	422114	NO_2	N	Y (-7.2)	1.7	N	2.0
45	Roadside	414480	417720	NO_2	N	Y (0.5)	7.2	N	2.0
46	Roadside	414546	417759	NO_2	N	Y (0)	2.2	N	2.0
47	Other	407942	417261	NO_2	N	Y (0)	14.4	N	2.0
48	Roadside	421039	423673	NO_2	N	Y (0)	2.6	N	2.0
49	Roadside	413659	416182	NO_2	N	Y (3.5)	3.7	N	2.0
50	Roadside	413414	415981	NO_2	N	Y (1.6)	2.5	N	2.0
51	Roadside	421904	423580	NO_2	N	Y (4.9)	1.0	N	2.0
52	Roadside	417627	416472	NO_2	N	Y (7.8)	2.4	N	2.0
53	Roadside	411564	415902	NO_2	N	Y (1.6)	1.7	N	2.0
54	Roadside	425196	421566	NO_2	N	Y (2.7)	3.2	N	2.0

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?	Height (m)
55	Roadside	414187	408264	NO_2	N	Y (3.2)	1.7	N	2.0
56	Planning	415009	416420	NO_2	N	N	2.8	N	2.0
57	Planning	414291	417281	NO_2	N	N	2.2	N	2.0
58	Planning	414350	417270	NO_2	N	N	2.6	N	2.0

(1) 0m 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.9 – 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 (µg/m^3) (3)				
					2011	2012	2013	2014	2015
Trailer 2	Urban Background	Continuous	77	77	24.0	24.6	23.9	22.0	21.0
Roadside 1	Roadside	Continuous	83	83	39.5	**41.0**	35.9	37.2	32.0
Roadside 2	Roadside	Continuous	75	75	37.7	37.4	32.4	33.1	35.7
Roadside 3	Roadside	Continuous	75	75	34.5	35.0	33.2	36.0	39.8
Roadside 4	Roadside	Continuous	74	74	**46.3**	**42.9**	36.9	**43.6**	**44.6**
Roadside 5	Roadside	Continuous	77	77	33.9	33.1	32.8	32.7	29.7
Roadside 6	Roadside	Continuous	91	91	N/A	N/A	**42.3**	**41.7**	**44.4**

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 Technical Guidance LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Table A.10 – 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	2013	2014	2015
Trailer 2	Urban Background	Continuous	77	77	0	0	0 (64.23)	0 (79.85)	0 (71.17)
Roadside 1	Roadside	Continuous	83	83	0	5	1	0 (126.15)	0 (107.03)
Roadside 2	Roadside	Continuous	75	75	0	0	0(88.91)	0 (135.03)	0 (121.47)
Roadside 3	Roadside	Continuous	75	75	0	0	0	2 (139.91)	7 (171.37)
Roadside 4	Roadside	Continuous	74	74	7	5	0 (96.68)	1 (136.96)	0 (131.91)
Roadside 5	Roadside	Continuous	77	77	0	0	0	0 (98.96)	0 (89.28)
Roadside 6	Roadside	Continuous	91	91	N/A	N/A	0 (102.04)	0 (128.0)	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 90%, the 99.8th percentile of 1-hour means is provided in brackets.

Table A.11 – 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
Trailer 2	Urban Background	Continuous	77	22.81	22.46	21.54	17.22	18.52
Roadside 1	Roadside	Continuous	64	32.47	29.21	30.34	16.78	19.28
Roadside 2	Roadside	Continuous	0	18.61	19.13	19.11	15.92	N/A
Roadside 3	Roadside	Continuous	67	23.30[c]	19.21	22.08	20.12	18.72
Roadside 4	Roadside	Continuous	70	23.29	19.87	22.29	20.84	19.14
Roadside 5	Roadside	Continuous	66	29.29	22.79	25.48	22.41	15.58
Roadside 6	Roadside	Continuous	45	N/A	N/A	N/A	17.13	25.95

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

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

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

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

Table A.12 – 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
Trailer 2	Urban Background	77	77	19	28	5 (33.31)[c]	2 (29.44)	4 (30.05)
Roadside 1	Roadside	64	64	**57**	**39**	**36 (50.32)[c]**	6 (28.02)	9 (42.40)
Roadside 2	Roadside	0	0	4	9	4 (35.69)[c]	0 (24.81)	N/A
Roadside 3	Roadside	67	67	7 *(29.68)[c]*	12	13	8 (32.36)	3 (32.48)
Roadside 4	Roadside	70	70	22	13	13 (40.57)[c]	8 (33.77)	3 (25.38)
Roadside 5	Roadside	66	66	**44**	17	15	6 (35.96)	0 (20.26)
Roadside 6	Roadside	45	45	N/A	N/A	N/A	0 (24.79)	10 (40.11)

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

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

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

(3) If the period of valid data is less than 90%, the 90.4th percentile of 24-hour means is provided in brackets.

Table A.7 – SO_2 Monitoring Results

Site ID	Site Type	Valid Data Capture for monitoring Period (%) (1)	Valid Data Capture 2015 (%) (2)	Number of Exceedances (percentile in bracket) (3)		
				15-minute Objective (266 µg/m^3)	1-hour Objective (350 µg/m^3)	24-hour Objective (125 µg/m^3)
Trailer 2	Urban Background	59	59	0 (7.81)	0 (7.72)	0 (7.48)

Notes: Exceedances of the SO_2 objectives are shown in **bold** (15-min mean = 35 allowed a year, 1-hour mean = 24 allowed a year, 24-hour mean = 3 allowed a year)

(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 relevant percentiles are provided in brackets.

Appendix B: Full Monthly Diffusion Tube Results for 2015

Table B.2 – NO_2 Monthly Diffusion Tube Results - 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 (2)	Bias Adjusted (1)(2)
1	64.22	66.49	57.28	48.12	50.10	53.32	62.23	65.98	52.55	67.54	75.78	61.79	60.45	45.34
2	74.40	73.32	69.93	58.99	59.92	47.08	43.79	57.60	55.13	77.10	76.31	54.19	62.31	46.74
3	73.17	79.30	65.92	66.01	61.95	64.45	68.23	75.67	73.95	79.17	80.55	70.86	71.60	53.70
4	53.23	39.42	53.02	55.42	51.60	41.34	33.46	40.72	54.64	-	55.99	36.91	46.89	35.16
5	63.84	48.77	65.33	49.50	56.29	48.17	46.14	49.57	56.42	56.84	69.64	53.43	55.33	41.50
6	-	84.03	48.93	43.35	39.94	43.54	38.85	46.72	50.17	70.63	55.06	49.84	51.92	38.94
7	64.33	63.11	49.96	54.99	57.97	55.59	44.08	63.34	69.01	82.81	63.29	48.53	59.75	44.81
8	64.07	-	53.74	41.75	33.08	48.45	37.49	49.25	50.99	69.03	66.45	47.42	51.06	38.30
9	-	61.58	51.68	37.63	40.00	45.37	36.17	45.13	53.91	63.29	75.02	65.30	52.28	39.21
10	-	62.72	48.00	43.36	44.92	54.28	45.88	53.05	61.82	76.19	73.57	53.84	56.15	42.11
11	62.16	66.47	59.01	46.03	50.81	48.07	38.98	-	52.67	70.75	73.19	53.72	56.53	42.40
12	-	64.05	-	46.29	49.20	51.52	-	55.78	57.02	61.23	66.10	59.61	56.76	42.57
13	51.72	78.13	48.66	52.34	45.06	49.51	40.92	46.82	54.57	56.48	67.24	54.58	53.83	40.38
14	28.91	26.05	24.02	20.26	14.06	12.88	13.52	15.39	23.09	33.05	24.54	25.73	21.79	16.34
15	59.92	64.21	51.69	42.61	42.93	56.74	45.91	48.23	42.07	45.80	56.69	58.75	51.29	38.47
16	58.49	65.16	55.27	47.84	50.35	55.61	48.11	45.52	48.08	50.38	61.22	55.47	53.46	40.09
17	54.10	56.89	48.22	49.92	52.28	55.22	44.82	46.61	49.42	53.40	55.67	49.70	51.35	38.51
18	60.61	64.75	69.43	60.48	59.80	56.37	44.96	59.36	61.35	62.62	68.42	58.23	60.53	45.40
19	52.26	48.65	65.71	55.13	42.00	50.77	48.68	57.80	56.37	64.82	-	42.09	53.12	39.84
20	59.28	68.44	-	-	51.66	49.07	44.40	49.15	57.82	43.10	62.37	57.09	54.24	40.68
21	57.48	-	64.97	57.06	54.43	49.31	43.43	-	55.16	87.00	68.17	61.93	59.89	44.92

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 (2)	Bias Adjusted (1)(2)
22	65.19	-	57.02	62.72	56.18	-	-	-	-	74.13	52.48	67.40	**57.81**	**43.36**
23	53.32	51.65	60.28	55.59	46.14	48.75	56.80	56.79	56.37	71.59	70.21	54.65	**56.84**	**42.63**
24	82.03	90.01	61.25	67.89	59.04	55.97	55.96	46.20	70.58	90.54	74.94	53.33	**67.31**	**50.48**
25	29.26	28.47	34.49	21.69	18.54	21.34	22.15	25.80	28.81	35.04	32.25	28.31	**27.18**	**20.39**
26	36.26	24.28	36.90	23.68	18.66	24.89	21.13	24.85	31.67	29.18	29.43	28.86	**27.48**	**20.61**
27	34.06	27.22	32.05	20.87	17.33	21.88	22.34	26.00	30.74	25.00	33.28	28.76	**26.63**	**19.97**
28	72.79	87.47	72.93	68.97	67.17	62.33	51.11	73.69	64.77	88.60	84.41	80.60	**72.90**	**54.68**
29	49.97	56.55	39.38	42.04	38.36	30.47	32.58	36.39	38.33	57.21	55.84	50.42	**43.96**	**32.97**
30	55.38	63.11	49.98	45.97	37.98	39.08	39.54	43.11	59.83	60.40	59.98	56.71	**50.92**	**38.19**
31	47.34	49.48	44.73	48.79	42.54	36.35	38.75	45.08	51.51	55.53	49.90	49.31	**46.61**	**34.96**
32	73.16	64.46	63.09	54.66	54.84	53.40	55.94	57.51	65.34	76.74	71.13	68.39	**63.22**	**47.42**
33	48.44	44.10	42.77	44.84	37.33	31.46	39.81	44.18	54.58	53.54	54.30	44.64	**45.00**	**33.75**
34	42.31	45.66	47.61	48.19	42.21	-	-	33.65	42.71	52.98	43.01	44.47	**44.28**	**33.21**
35	56.23	52.82	53.02	55.76	36.35	30.94	57.94	55.30	51.27	59.08	52.32	60.75	**51.82**	**38.86**
36	58.25	-	-	53.58	49.28	51.78	54.33	63.59	57.21	63.19	62.30	53.03	**56.65**	**42.49**
37	46.22	55.06	48.87	51.29	42.71	47.34	38.38	45.00	55.66	51.10	58.64	41.43	**48.48**	**36.36**
38	47.80	57.59	51.47	54.32	43.28	55.56	42.20	51.00	48.03	54.20	62.65	50.41	**51.54**	**38.66**
39	58.36	56.77	63.45	68.27	51.03	50.55	38.74	51.15	50.73	59.37	58.88	39.03	**53.86**	**40.40**
40	55.34	61.70	82.48	55.15	60.09	92.33	72.44	107.78	110.87	77.44	99.93	90.62	**80.51**	**60.39**
41	60.83	-	53.83	66.37	51.82	59.98	55.39	57.00	62.44	61.70	80.44	53.78	**60.33**	**45.25**
42	61.07	59.58	52.92	51.28	50.34	-	35.92	49.87	72.32	53.30	70.26	73.63	**57.32**	**42.99**
43	58.96	57.10	61.22	49.45	41.84	51.86	45.24	62.99	74.66	57.48	73.16	69.55	**58.63**	**43.97**
44	50.97	52.05	53.72	41.79	41.97	45.03	39.93	47.91	55.84	42.22	60.61	54.88	**48.91**	**36.68**
45	53.75	53.30	51.29	44.73	39.11	43.28	36.55	49.98	52.65	67.90	54.28	52.35	**49.93**	**37.45**
46	48.18	46.64	48.00	50.33	40.13	46.78	35.80	-	51.05	69.90	64.86	53.83	**50.50**	**37.87**

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 (2)	Bias Adjusted (1)(2)
47	87.68	87.85	67.46	66.45	65.45	58.78	69.10	64.10	72.45	72.84	86.87	67.52	**72.21**	**54.16**
48	60.97	52.68	54.35	53.47	56.56	56.47	45.83	65.66	61.99	63.59	73.71	55.78	**58.42**	**43.82**
49	59.76	-	42.54	66.05	40.27	-	45.92	51.56	54.12	81.38	64.23	63.59	**56.94**	**42.71**
50	63.62	-	51.83	71.35	52.12	49.70	53.06	60.64	63.58	76.25	47.87	77.11	**60.65**	**45.49**
51	52.82	62.84	-	58.18	50.74	47.73	41.36	46.96	58.23	71.10	62.59	34.75	**53.39**	**40.04**
52	52.50	45.29	51.05	48.42	42.61	47.60	35.84	48.03	47.06	63.95	51.14	46.26	**48.31**	**36.23**
53	45.87	49.88	48.43	48.87	37.97	34.67	35.85	41.60	46.68	57.16	72.95	41.16	**46.76**	**35.07**
54	56.29	49.69	46.75	60.99	44.87	53.61	44.49	50.29	50.91	66.78	56.38	52.51	**52.80**	**39.60**
55	68.50	69.63	48.42	45.47	-	-	30.44	-	47.03	66.55	47.16	45.39	**52.06**	**39.05**
56	35.12	35.51	57.66	50.88	-	-	-	36.18	56.75	85.84	65.76	55.51	**53.25**	**39.93**
57	78.59	-	33.88	59.93	56.87	16.73	49.21	61.83	56.94	76.60	76.42	42.50	**55.41**	**41.56**
58	85.58	52.24	35.62	34.82	22.79	-	36.75	-	41.20	41.30	36.66	44.41	**43.14**	**32.35**

(1) See Appendix C for details on bias adjustment

(2) In accordance with paragraph 7.177 of TG(16) sites with less than 75% data capture have been annualised in using the procedure set out in box 7.9 of TG(16)

Table B.2 – Façade Corrected NO_2 Annual Diffusion Tube Results - 2015

Site ID	Site Name	Site Type	Bias Adjusted Annual Concentration (µg/m^3)	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Background NO_2 (µg/m^3)	NO_2 at Façade of nearest receptor (µg/m^3)
1	Dewsbury Bus Station (Dewsbury)	Other	45.34	N	0.8	30.62	N/A
2	Huddersfield Bus Station (Huddersfield Town Centre)	Other	46.74	N	4.1	25.29	N/A
3	Edgerton Rd / Blacker Rd, Lamp post No 26 (Edgerton)	Roadside	53.70	Y (2.0)	2.4	18.35	48.5
5	Queens St (Ravensthorpe)	Roadside	41.50	Y (1.6)	1.9	19.98	38.5
7	Byram Arcade, Westgate (Huddersfield Town Centre)	Urban Centre	44.81	Y (0.5)	0.5	25.29	N/A
10	Leeds Rd (Bradley)	Roadside	42.11	Y (3.2)	2.0	19.98	37.2
11	Chapel Hill (Huddersfield Ring Road)	Roadside	42.40	Y (0.1)	5.5	25.29	42.3
12	Leeds Rd (Bradley)	Roadside	42.57	Y (3.7)	1.8	19.98	36.8
13	Whitehall Rd (Birkenshaw)	Roadside	40.38	Y (2.1)	2.6	26.69	38.4
16	Roadside 4 (co location)	Co-location Study	40.09	N	3.0	26.69	N/A

Site ID	Site Name	Site Type	Bias Adjusted Annual Concentration (µg/m^3)	Distance to Relevant Exposure (m) [1]	Distance to kerb of nearest road (m) [2]	Background NO_2 (µg/m^3)	NO_2 at Façade of nearest receptor (µg/m^3)
18	Huddersfield Rd (Birstall)	Roadside	**45.40**	Y (4.2)	1.9	20.68	38.7
20	Leeds Rd (Eastborough)	Roadside	**40.68**	Y (9.5)	1.5	30.62	36.3
21	Castlegate Appartments (Huddersfield Ring Road)	Roadside	**44.92**	Y (6.9)	2.1	25.29	38.2
22	Colne Bridge Rd / Leeds Rd / Bradley Rd (Bradley)	Roadside	**43.36**	Y (3.2)	1.5	19.98	37.5
23	Huddersfield Rd (Mirfield)	Roadside	**42.63**	Y (14.1)	1.6	16.94	29.6
24	Lindley Moor Rd (Lindley)	Roadside	**50.48**	Y (15.4)	2.0	19.54	34.8
28	Southgate (Huddersfield Ring Road)	Roadside	**54.68**	Y (0.1)	3.3	25.29	**54.4**
32	Blacker Rd (Edgerton)	Roadside	**47.42**	Y (5.0)	2.6	18.34	39.6
36	Huddersfield Rd (Mirfield)	Kerbside	**42.49**	Y (2.9)	0.9	16.94	35.2
39	Bradford Rd (Batley)	Roadside	**40.40**	Y (1.7)	2.1	21.66	37.8
40	Leeds Rd (Eastborough)	Roadside	**60.39**	Y (1.2)	1.6	30.62	**56.7**
41	Chain Bar Roundabout	Roadside	**45.25**	Y (12.5)	3.4	26.44	37.5
42	Leeds Rd (Eastborough)	Roadside	**42.99**	Y (5.6)	1.9	22.01	36.3
43	Leeds Rd / John St (Eastborough)	Roadside	**43.97**	Y (6.0)	1.9	22.01	36.7
47	Round Ings Road (Outlane)	Other	**54.16**	Y (0)	14.4	15.53	**54.2**
48	Flush (Heckmondwike)	Roadside	**43.82**	Y (0)	2.6	21.78	**43.8**

Site ID	Site Name	Site Type	Bias Adjusted Annual Concentration (µg/m^3)	Distance to Relevant Exposure (m) [1]	Distance to kerb of nearest road (m) [2]	Background NO_2 (µg/m^3)	NO_2 at Façade of nearest receptor (µg/m^3)
49	Manchester Rd (Thornton Lodge)	Roadside	**42.71**	Y (3.5)	3.7	19.51	38.5
50	Manchester Rd (Thornton Lodge)	Roadside	**45.49**	Y (1.6)	2.5	19.88	**42.4**
51	High St (Heckmondwike)	Roadside	**40.04**	Y (4.9)	1.0	21.78	33.5
57	Cambridge Rd (Huddersfield Town Centre)	Planning	**41.56**	N	2.2	24.95	N/A

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

Kirklees operates its own laboratory for the analysis of Palmes NO_2 diffusion tubes. The laboratory operates following the protocols set out in the AEAT document "Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance".
The tubes are prepared using 50% tea: 50% acetone mix.

C.1.1 Factor from Local Co-location Studies

Kirklees Council currently conduct 2 co-location studies with neighbouring authorities and participates in the Intercomparison scheme locating tubes at Marylebone Road

The bias adjustment factor derived from Kirklees participation in the Intercomparison scheme for 2015 is 0.75, with the precision being rated as good

C.1.2 Diffusion Tube Bias Adjustment Factors

In addition to the Intercomparison scheme 3 Co-location studies are conducted at Kirklees Monitoring stations and with neighbouring authorities, but due to station failures, Roadside 4 did not have a data capture >75% and not valid.

Trailer 2 Co –location study generated a bias adjustment figure of 0.79 with a good precision between the 3 tubes.

Barnsley Council Co-location study generated a bias adjustment figure of 0.75, but does not have a precision because the study is carried out with a singular tube.

Bias adjustment data is fed into the national bias adjustment spreadsheet and available below;

http://laqm.defra.gov.uk/documents/Database_Diffusion_Tube_Bias_Factors_v06_16-Final.xls

C.1.3 Discussion of Choice of Factor to Use

Of the 3 Co-location studies are conducted by Kirklees Council, 2 have generated the same value and the other is close to that. Therefore, Kirklees Council have used the Barnsley Council and Intercomparison scheme derived correction factor of 0.75

C.2 PM Monitoring Adjustment

Kirklees Council currently have 3 types of PM_{10} monitors across the 7 sites.

Trailers 2 collects data using a TEOM, therefore all data presented in this report have been corrected using the Volatile Correction Model using FDMS sites Leeds Centre AURN, Liverpool Speke AURN and an average of other nearby FDMS Sites

Roadsides 1 to 5 have FH 62 I-R PM_{10} monitors which are not equivalence tested. Kirklees Council has sought advice on this issue with the LAQM Helpline who provided Kirklees Council with studies from Europe in which the FH 62 I-R were included. The conclusions of these studies found that the heated element affected volatiles and as a result under-predicted. The recommendation of the studies was that a 1.3 correction factor is applied to data collected. In accordance with advice from the LAQM Helpdesk and the guidance in TG(09)para1.56.

Roadside 6 is a Met-One BAM which is an equivalence tested monitor. Therefore the applicable correction factor of /1.2 has been applied to the data.

C.3 QA/QC of Automatic Monitoring

Data ratification is carried out internally by one person (Senior Technical Officer) periodically, normally at monthly intervals. After ratification it is stored on an Excel files in the Kirklees air quality archive.

Data verification is carried out by two staff who have had their competency verified after internal training. Verification takes place twice per day on weekdays, and the of Friday p.m. to Monday a.m. on Monday morning.

Trailer 2 – Back Ravens Street, Scout Hill

Station	**Trailer 2 – Back Ravens Street, Scout Hill**
Analyser Model	Horiba: APNA-360CE, APSA-360ACE, APOA-360, TEOM 1400AB
Logging system	Datalogger used for collecting and storing data from 5 analysers and the data routinely retrieved via modem communication twice per day.
Calibration Gas	NO, SO_2, Scrubbed zero air.
Routine Calibration	Automatic calibration carried out every 72 hours
Daily zero and span Check	No
Air Conditioning	Yes
Service Contract	Horiba: 2 x 6 monthly service and breakdown/repair call out.

Roadside 1 – Dewsbury

Station	Roadside 1 – Dewsbury
Analyser Model	Horiba: APNA-360CE, FH 62 I-R
Logging system	Each analyser has a data distribution board and communicates directly via modem for data download twice per day
Calibration Gas	NO, zero air.
Routine Calibration	Automatic calibration carried out every 72 hours
Daily zero and span Check	No
Air Conditioning	Yes
Service Contract	Horiba: 2 x 6 monthly service and breakdown/repair call out.

Roadside 2 – Bradford Rd/Chain Bar

Station	Roadside 2 – Bradford Rd/Chain Bar
Analyser Model	Horiba: APNA-360CE, FH 62 I-R
Logging system	Each analyser has a data distribution board and communicates directly via modem for data download twice per day.
Calibration Gas	NO, zero air.
Routine Calibration	Automatic calibration carried out every 72 hours
Daily zero and span Check	No
Air Conditioning	Yes
Service Contract	Horiba: 2 x 6 monthly service and breakdown/repair call out.

Roadside 3 – Hunsworth Lane

Station	Roadside 3 – Hunsworth Lane
Analyser Model	Horiba: APNA-360CE, FH 62 I-R
Logging system	Each analyser has a data distribution board and communicates directly via modem for data download twice per day
Calibration Gas	NO, zero air.
Routine Calibration	Automatic calibration carried out every 72 hours
Daily zero and span Check	No
Air Conditioning	Yes
Service Contract	Horiba: 2 x 6 monthly service and breakdown/repair call out.

Roadside 4 – M62 road bridge, Birkenshaw

Station	Roadside 4 – M62 road bridge, Birkenshaw
Analyser Model	Horiba: APNA-360CE, FH 62 I-R
Logging system	Each analyser has a data distribution board and communicates directly via modem for data download twice per day.
Calibration Gas	NO, zero air.
Routine Calibration	Automatic calibration carried out every 72 hours
Daily zero and span Check	No
Air Conditioning	Yes
Service Contract	Horiba: 2 x 6 monthly service and breakdown/repair call out.

Roadside 5 – Ravensthorpe Gyratory

Station	Roadside 5 – Ravensthorpe Gyratory
Analyser Model	Horiba: APNA-360CE, FH 62 I-R
Logging system	Each analyser has a data distribution board and communicates directly via modem for data download twice per day
Calibration Gas	NO, zero air.
Routine Calibration	Automatic calibration carried out every 72 hours
Daily zero and span Check	No
Air Conditioning	Yes
Service Contract	Horiba: 2 x 6 monthly service and breakdown/repair call out.

Roadside 6– Ainley Top

Station	Roadside 6 – Ainley Top
Analyser Model	Horiba: APNA-360CE, MET-One BAM
Logging system	Each analyser has a data distribution board and communicates directly via modem for data download twice per day
Calibration Gas	NO,
Routine Calibration	Automatic calibration carried out every 72 hours
Daily zero and span Check	No
Air Conditioning	Yes
Service Contract	Horiba: 2 x 6 monthly service and breakdown/repair call out.

C.4 QA/QC of Diffusion Tube Monitoring

Kirklees operates its own laboratory for the analysis of Palmes NO_2 diffusion tubes. The laboratory operates following the protocols set out in the AEAT document "Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance".
The tubes are prepared using 50% tea:50% acetone mix.

Kirklees participates in the following QC/QA schemes
- AIR-PT (Formerly WASP)
-Intercomparison Scheme.

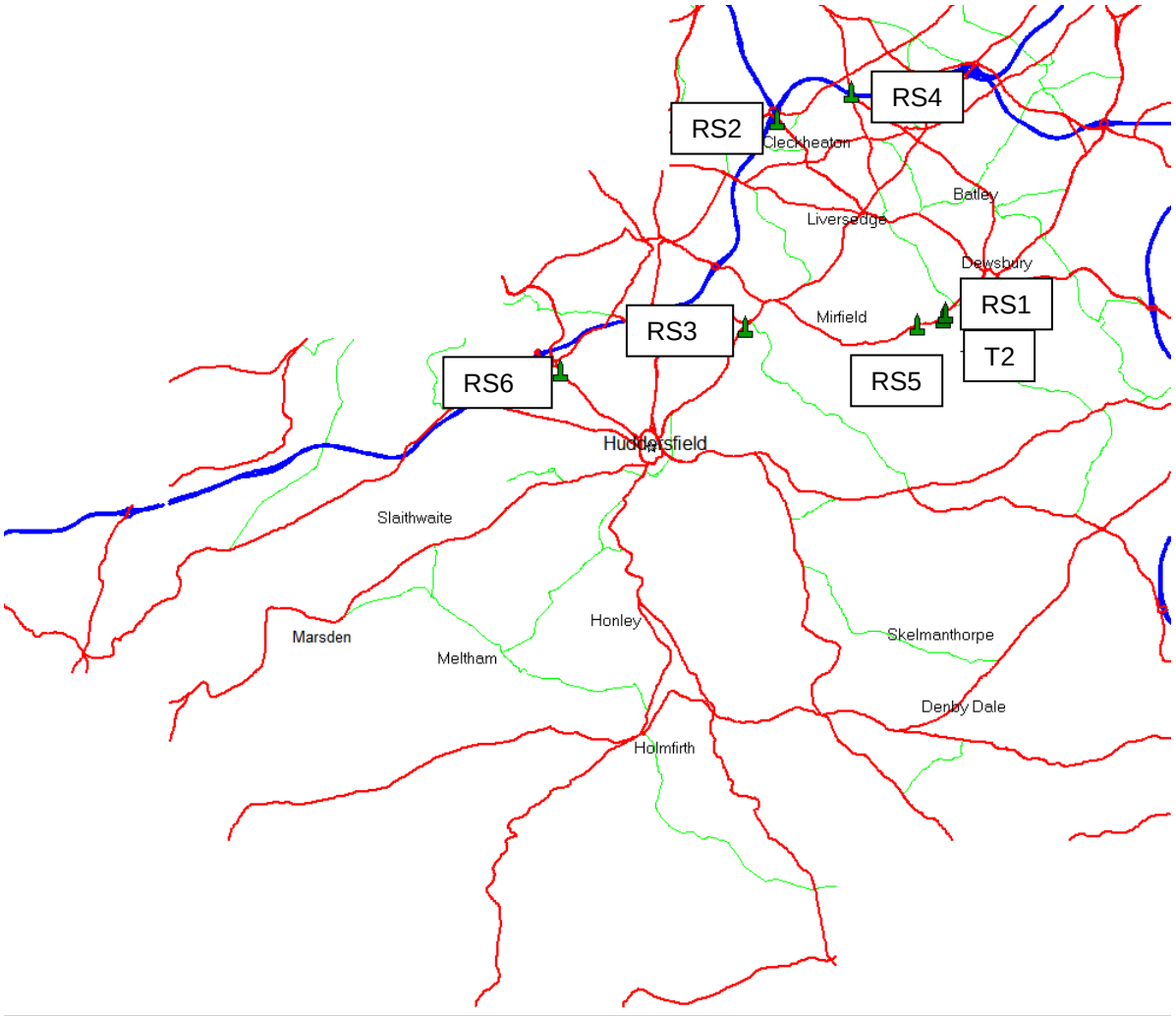
LAQM-AIR-PT-Rounds-1-12: for April 2014 to February 2016 Kirklees performance on the following web link-

http://laqm.defra.gov.uk/documents/LAQM-AIR-PT-Rounds-1-12-(April-2014-February-2016)-NO2-report.pdf

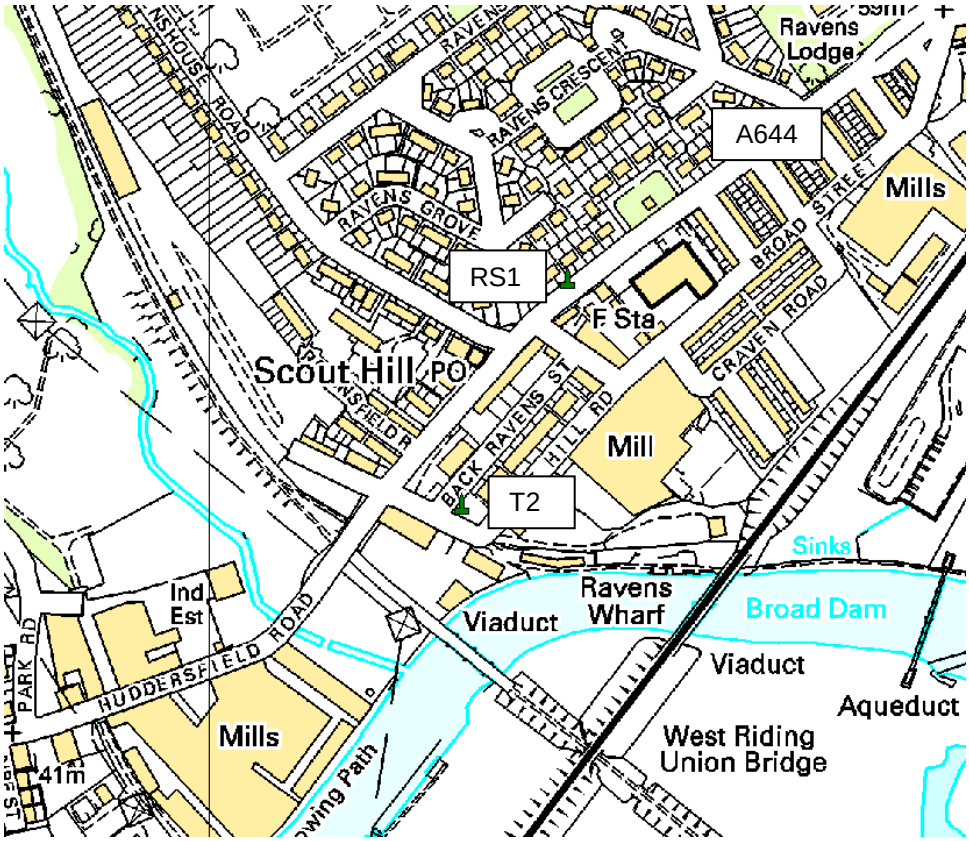
Appendix D: Map(s) of Monitoring Locations

D.1 Continuous Monitor Sites

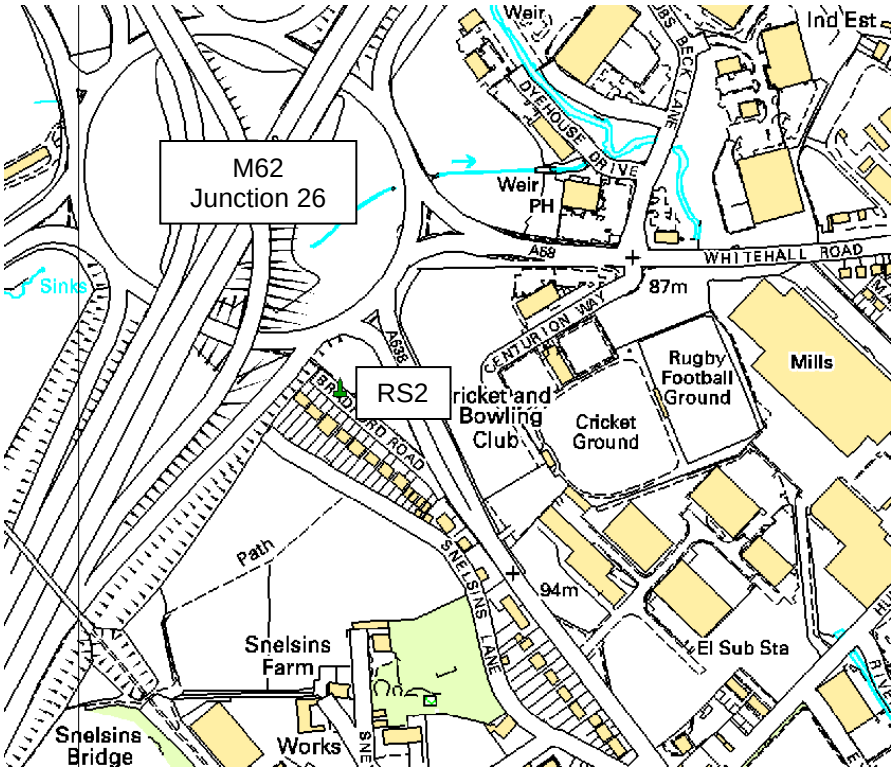
Map 1.1 Automatic Monitoring Sites across district



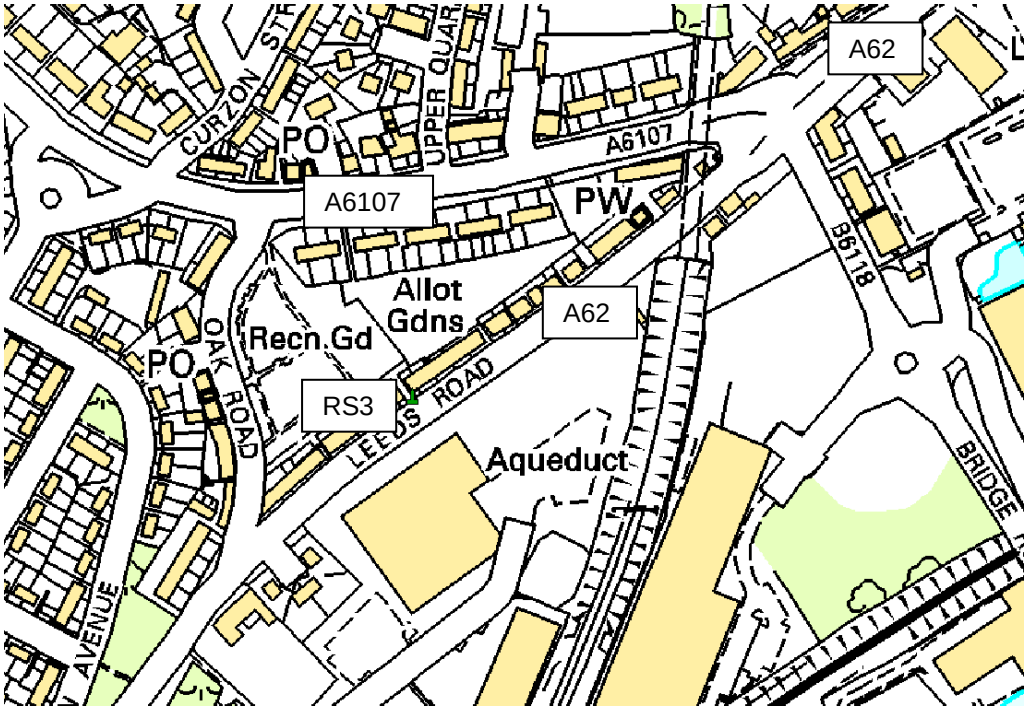
Map 1.2 Automatic Monitoring Site Trailer 2 Back Ravens Avenue & Roadside 1 Huddersfield Road



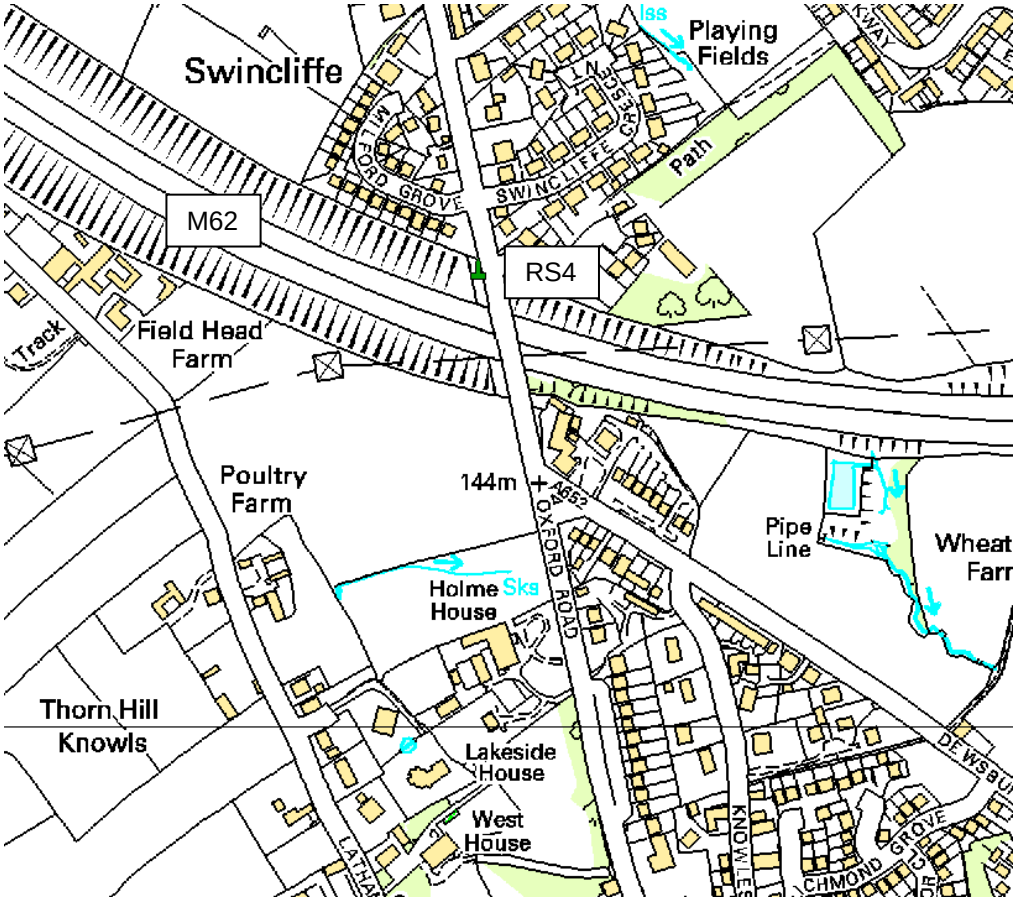
Map 1.3 Automatic Monitoring Site Roadside 2



Map 1.4 Automatic Monitoring Site New Roadside 3

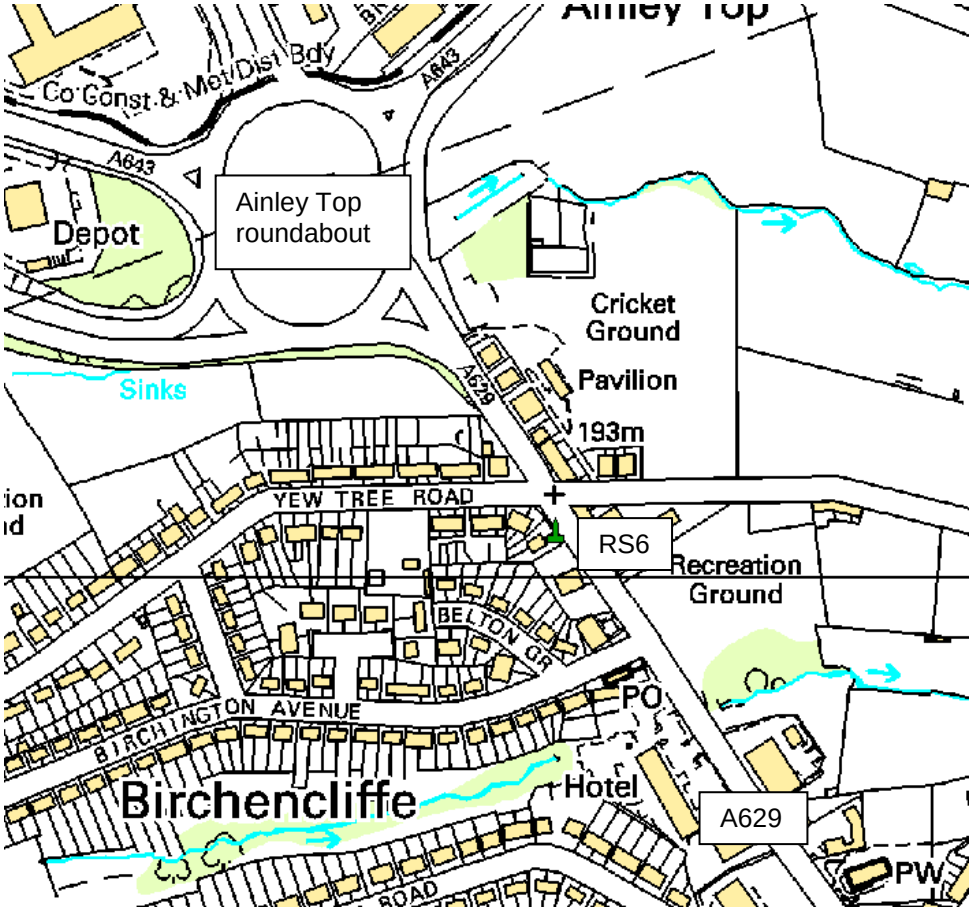


Map 1.5 Automatic Monitoring Site Roadside 4



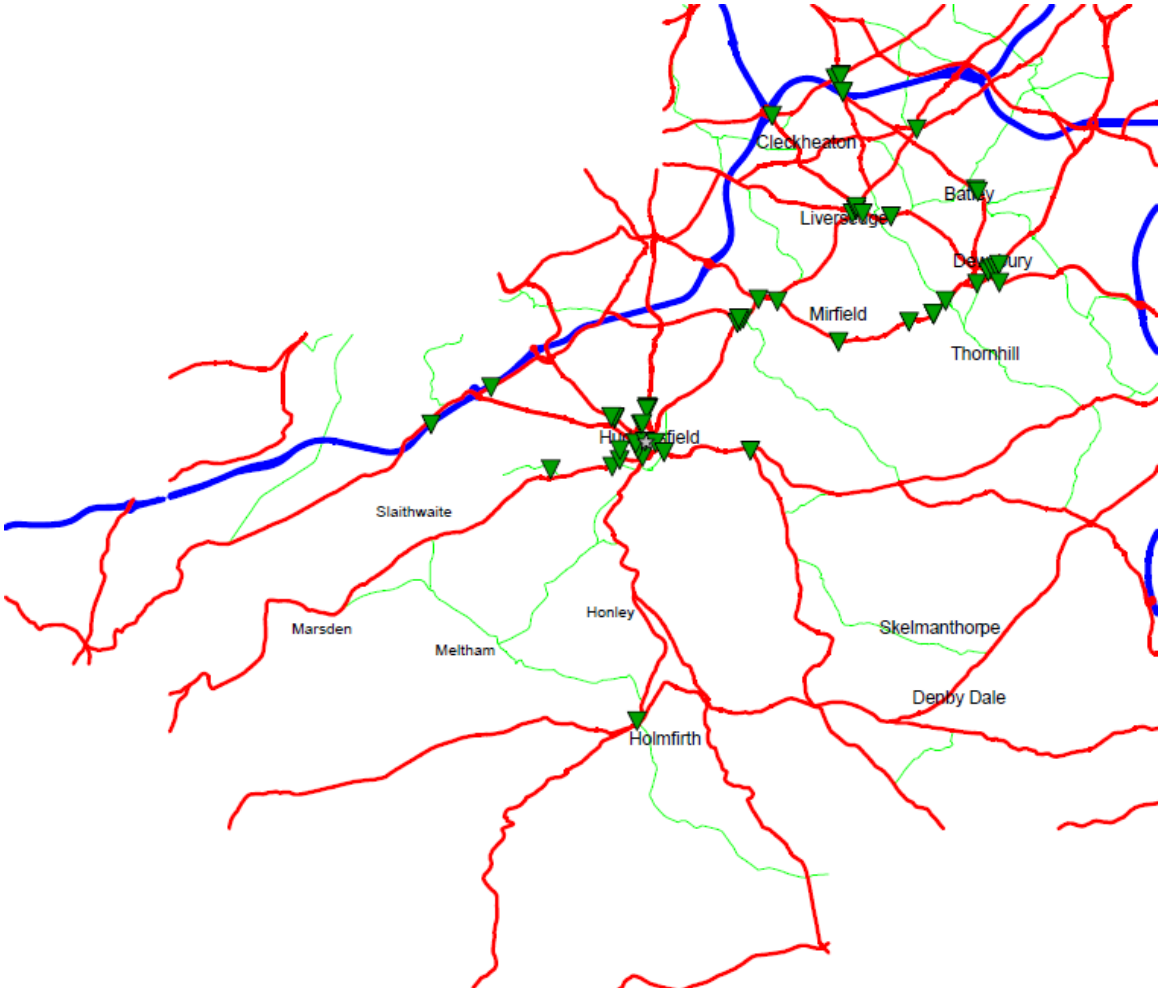
Map 1.6 Automatic Monitoring Site Roadside 5

Map 1.7 Automatic Monitoring Site Roadside 6

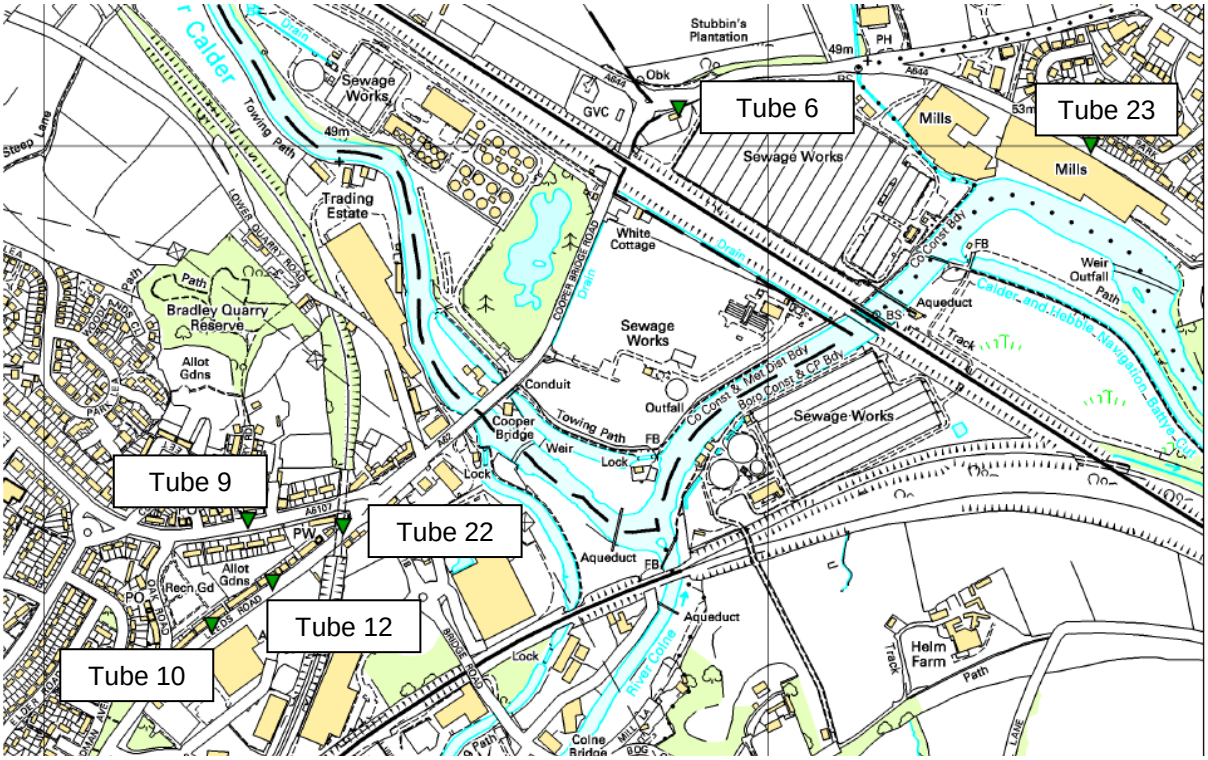


D.2 Passive Monitor Sites

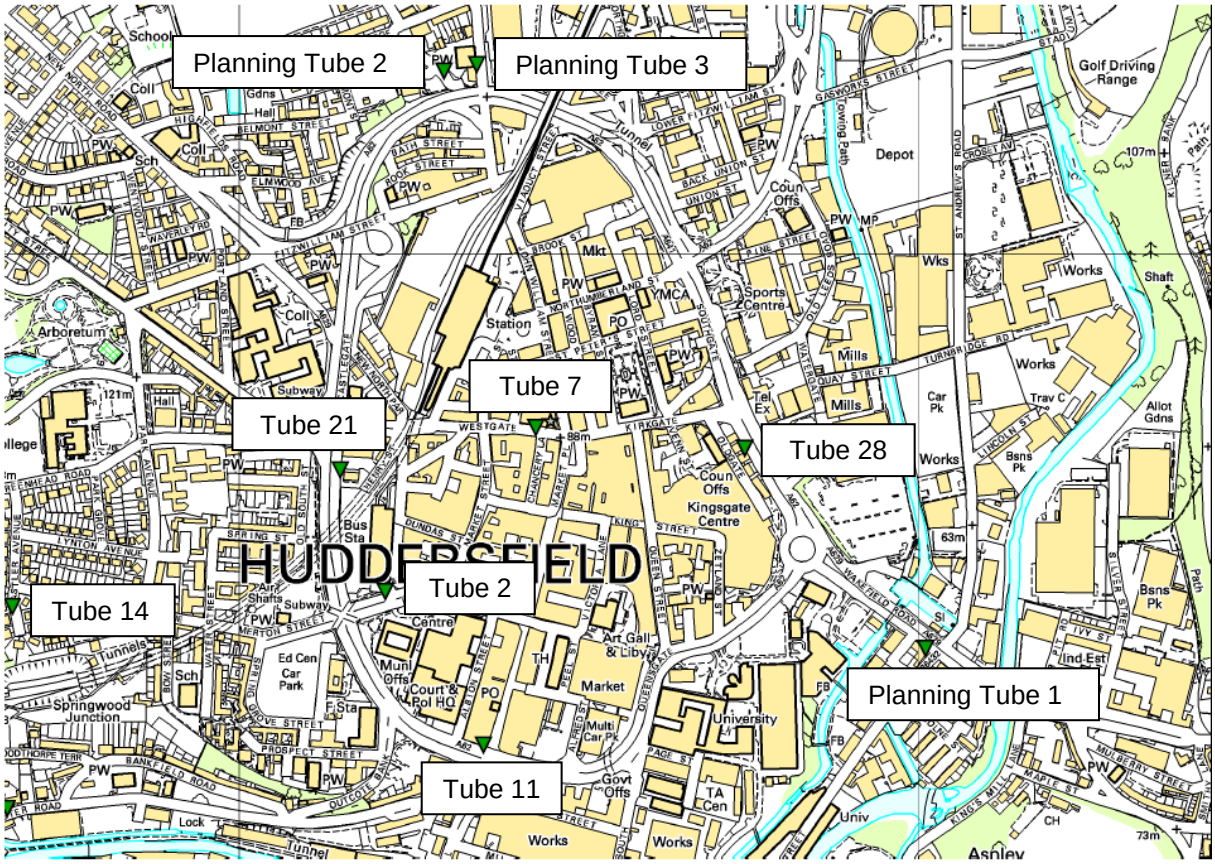
Map 2.1 Non-Automatic Monitoring Sites across district



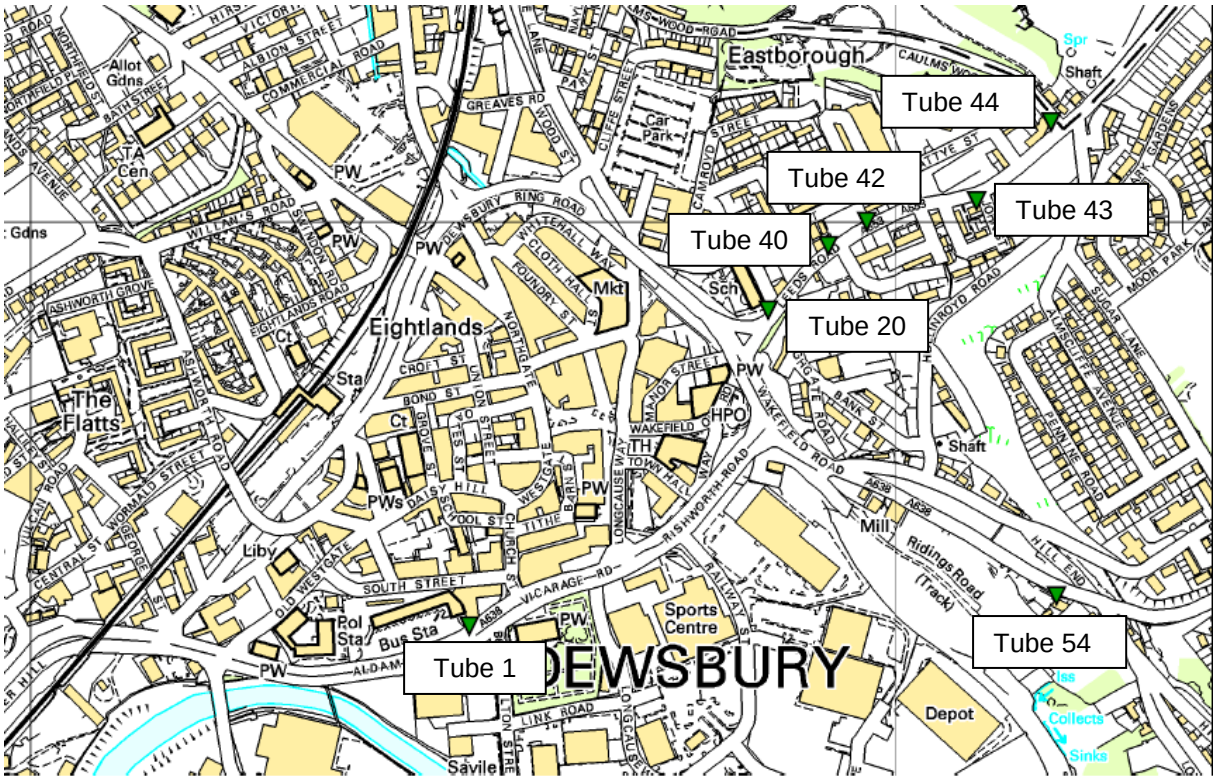
Map 2.2 AQMA 1 Bradley diffusion tubes



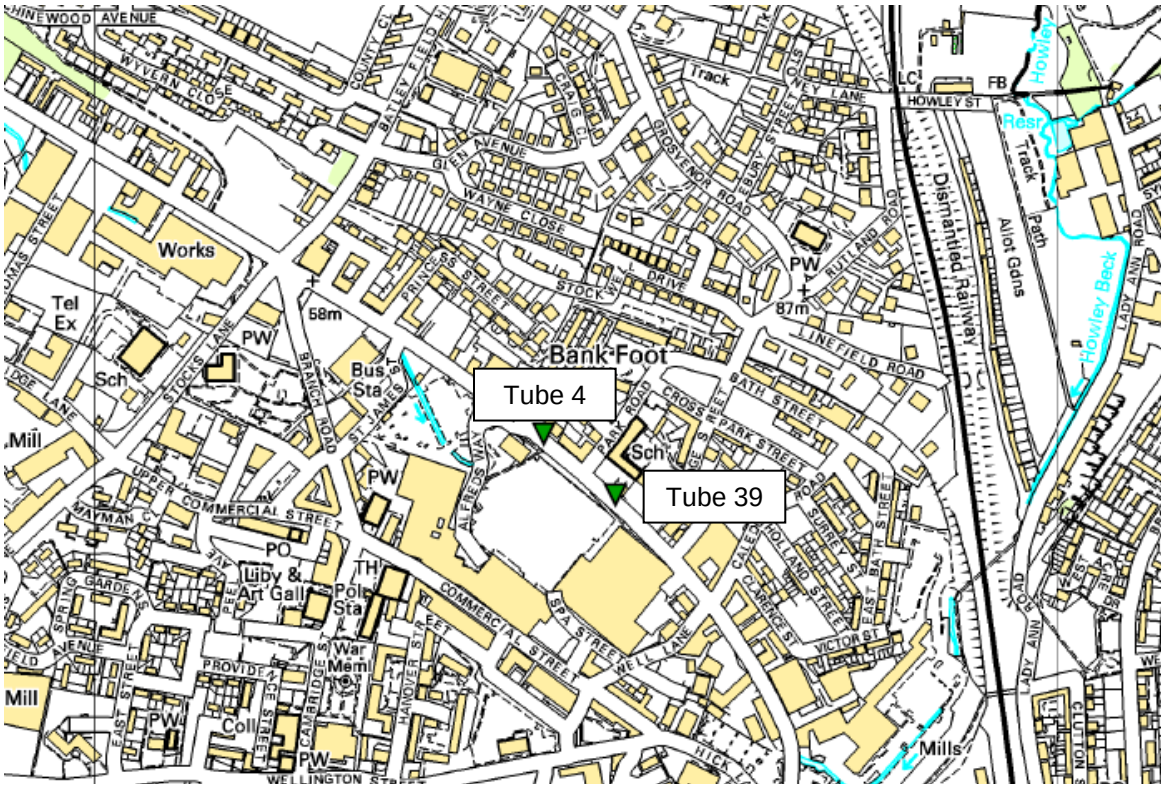
Map 2.3 Huddersfield town centre diffusion tubes



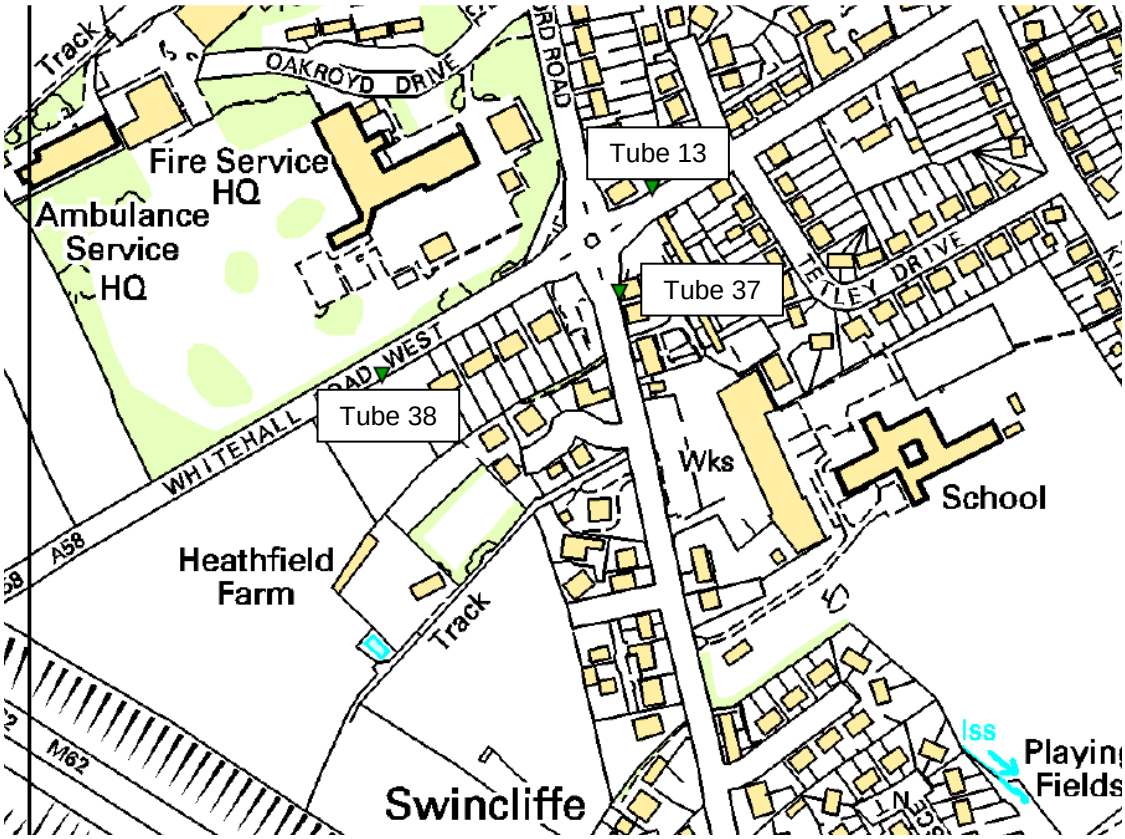
Map 2.4 Dewsbury town centre & Eastborough diffusion tubes



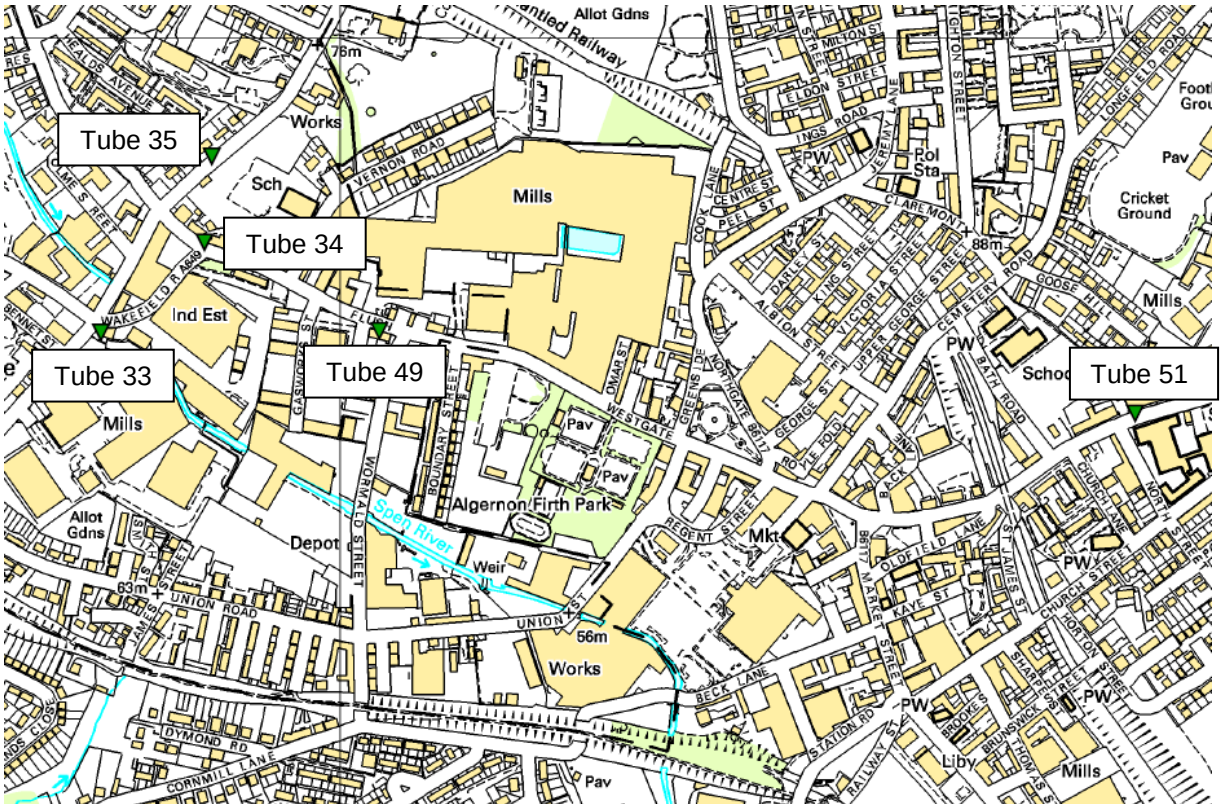
Map 2.5 Batley diffusion tubes



Map 2.6 Birkenshaw diffusion tubes

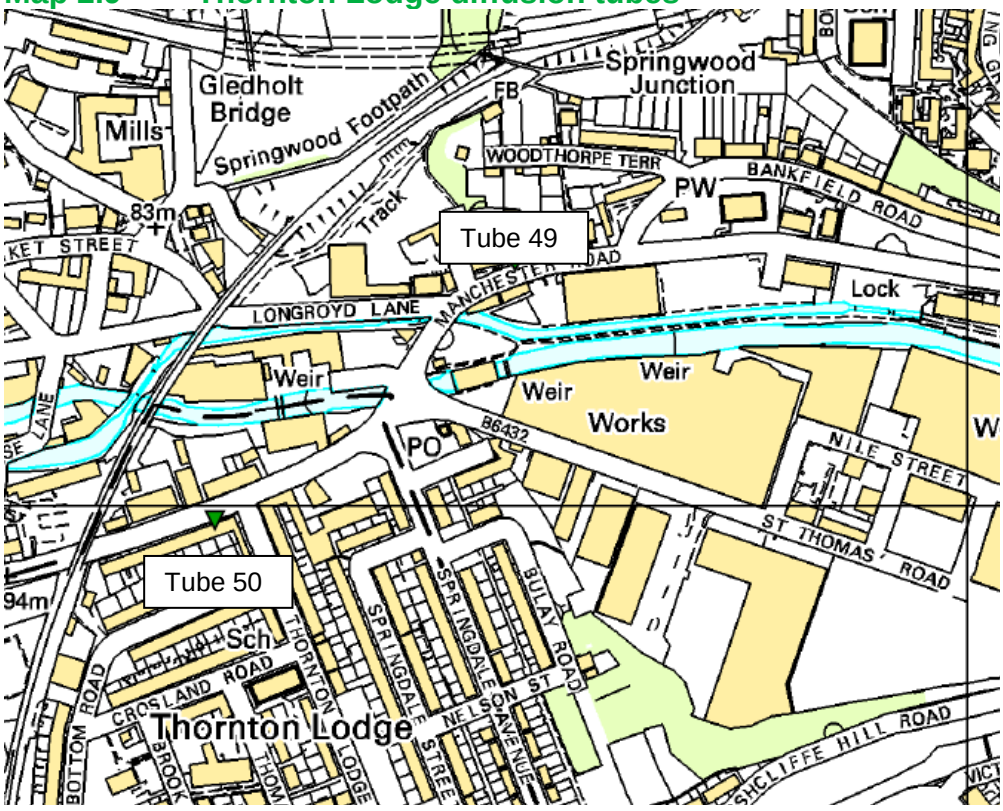


Map 2.7 Heckmondwike and Liversedge diffusion tubes



Map 2.8 Edgerton diffusion tubes

Map 2.9 Thornton Lodge diffusion tubes



Appendix E: Summary of Air Quality Objectives in England

Table E.2 – Air Quality Objectives in England

Pollutant	Air Quality Objective[4]	
	Concentration	Measured as
Nitrogen Dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean
	40 µg/m^3	Annual mean
Particulate Matter (PM_{10})	50 µg/m^3, not to be exceeded more than 35 times a year	24-hour mean
	40 µg/m^3	Annual mean
Sulphur Dioxide (SO_2)	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean
	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean

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

Appendix F: Air Quality Management Areas 2016

F.1 Ainley Top Detailed Assessment

Kirklees Council has modelled the annual mean NOx for 2014 in the area around Ainley Top Roundabout. This modelling was conducted to determine the boundaries of the AQMA.

Kirklees Council has used Atmospheric Dispersion Modelling System for Urban areas (ADMS Urban) to create this model and validated it against the 2014 automatic monitoring data.

Meteorological Data for the model has been taken from Huddersfield Civic 3 Weather Station. The weather data for 2004 has been selected as the weather patterns in that year are representative of the usual weather conditions in the district.

The Traffic Figures have been obtained from the Department of Transport for 2013 count points in close proximity to the assessment areas.
Traffic counts and average speeds were entered into the Emission Factor Toolkit 2014

Background figures for the model have been taken from the *2014 based background maps* (DEFRA).

The topography and road layout was obtained from Kirklees Council GIS data and ordinance survey records.

Kirklees conducted a statistical procedure as set out in TG(09) to determine the model uncertainty and performance. Table F.1.1 indicates the results at diffusion tube sites and the results of the statistical analysis are contained within Table F.1.2 and Figure F.1.1.

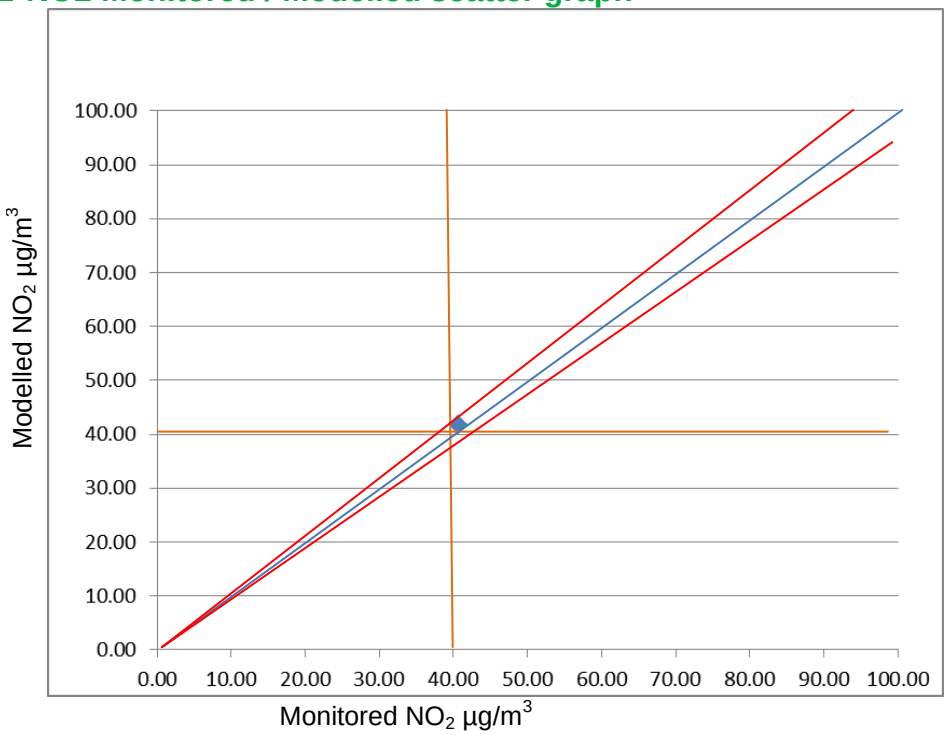
Table F.1.1 Results of Run at diffusion tube sites and statistical analysis of model

	Tube result ($\mu g/m^3$)	Modelled increment NO_x ($\mu g/m^3$)	Calculated NO_2 from NO_x ($\mu g/m^3$)	% Difference	Correction Factor
Roadside 6	**41.70**	29.99	40.61	-3	0.97

Table F.1.2 Statistical analysis of the corrected data

Ainley Top Run 2 - 2014	
RMSE	**1.09**
Fractional Bias	**0.03**

Figure F.1.1 NO2 Monitored / Modelled scatter graph



The statistical analysis carried out at the validation stage shows that the model accuracy is good and the fractional bias indicates that the model is only slightly underestimating

Figure F.1.1 graphs the correlation between the monitored and modelled data. It is clear to see that trend line is close to the mid-point and all points fall well within the +/- 5% region

Map 3.1 was constructed using the correction factor of 0.97. The yellow and red areas indicate the areas of exceedance and how NO_2 diffuses around the Ainley Top Roundabout assessment area

Map 3.1 Ainley Top AQMA

F.2 Birkenshaw Detailed Assessment

Kirklees Council has modelled the annual mean NOx for 2015 in the area of Birkenshaw. This modelling was conducted to determine the boundaries of the AQMA.

Kirklees Council has used Atmospheric Dispersion Modelling System for Urban areas (ADMS Urban) to create this model and validated it against the 2015 automatic monitoring data.

Meteorological Data for the model has been taken from Huddersfield Civic 3 Weather Station. The weather data for 2004 has been selected as the weather patterns in that year are representative of the usual weather conditions in the district.

The Traffic Figures have been obtained from the Department of Transport for 2015 count points in close proximity to the assessment areas.
Traffic counts and average speeds were entered into the Emission Factor Toolkit 2014

Background figures for the model have been taken from the *2015 based background maps* (DEFRA).

The topography and road layout was obtained from Kirklees Council GIS data and ordinance survey records.

Kirklees conducted a statistical procedure as set out in TG(09) to determine the model uncertainty and performance. Table F.2.1 indicates the results at diffusion tube sites and the results of the statistical analysis are contained within Table F.2.2 and Figure F.2.1.

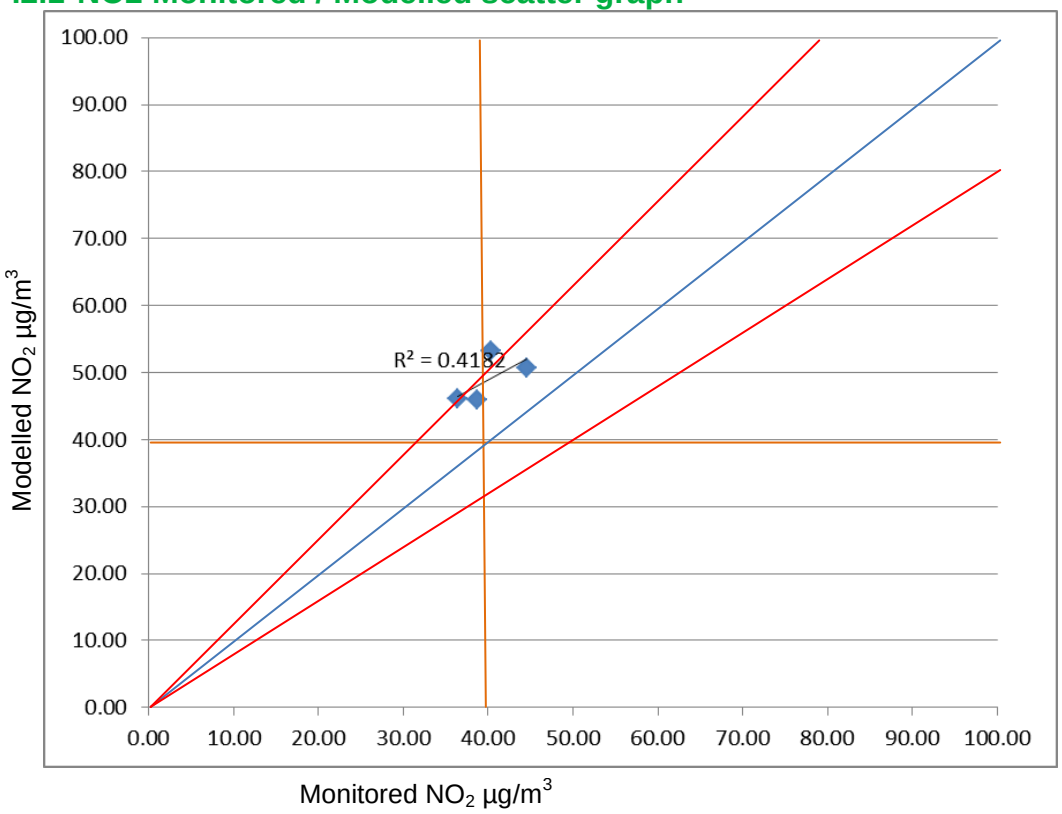
Table F.2.1 Results of Run at diffusion tube sites and statistical analysis of model

	Tube result ($\mu g/m^3$)	Modelled increment NO_x ($\mu g/m^3$)	Calculated NO_2 from NO_x ($\mu g/m^3$)	% Difference	Correction Factor
RS4	44.60	70.09	50.71	14	0.88
Tube 13	40.38	77.69	53.22	32	0.76
Tube 37	36.36	56.64	46.04	27	0.79
Tube 38	38.66	56.17	45.87	19	0.84

Table F.2.2 Statistical analysis of the corrected data

Birkenshaw Run - 2015	
RMSE	**7.05**
Fractional Bias	**-0.20**

Figure F.2.1 NO2 Monitored / Modelled scatter graph

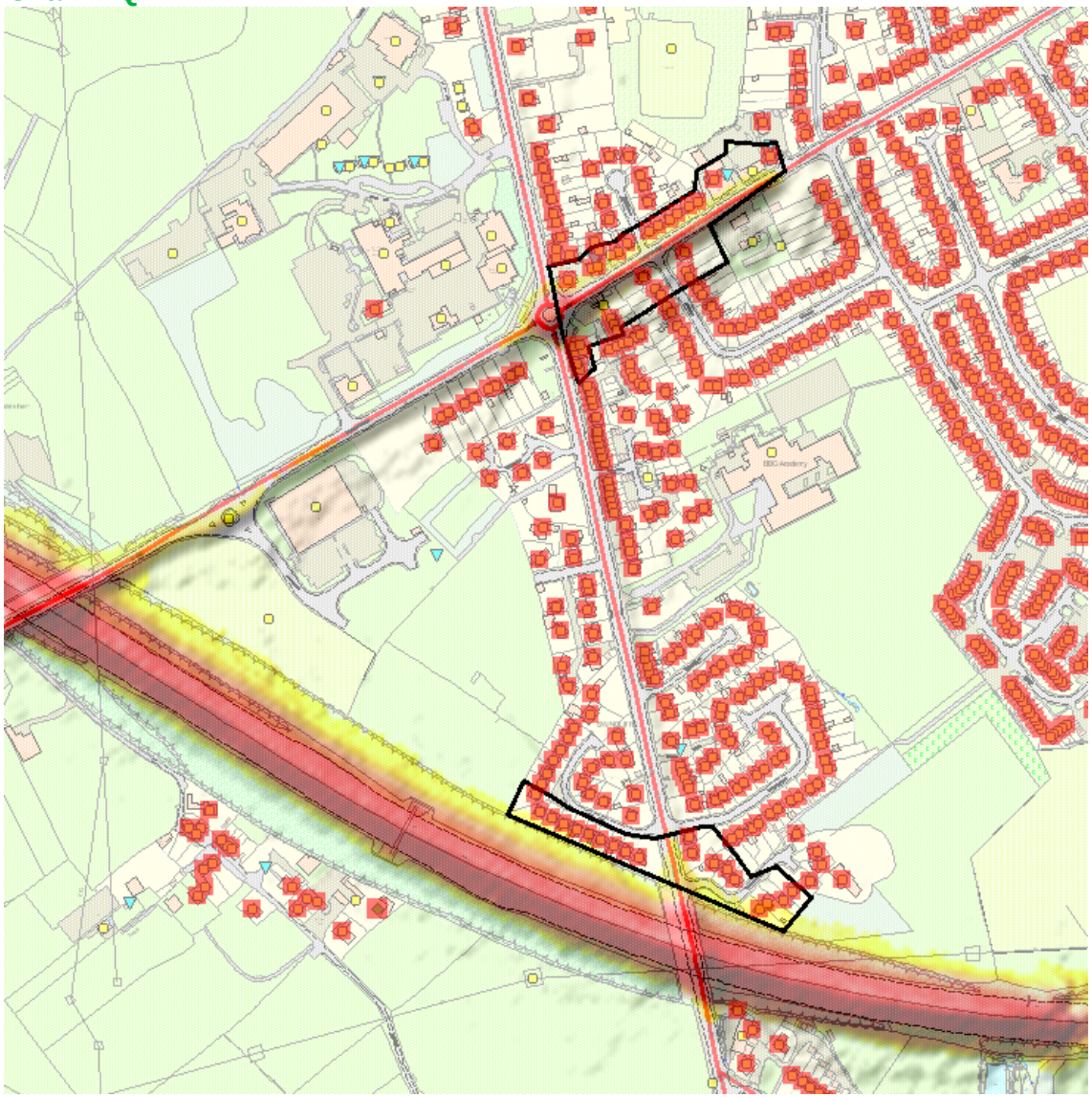


The statistical analysis carried out at the validation stage shows that the model accuracy is average and the fractional bias indicates that the model is over estimating

Figure F.2.1 graphs the correlation between the monitored and modelled data. It is clear to see that trend line falls within the +/- 20% region

Map 3.1 was constructed using the correction factor of 0.88. The yellow and red areas indicate the areas of exceedance and how NO_2 diffuses around the Ainley Top Roundabout assessment area

Map 3.2 Birkenshaw AQMA



F.3 Eastborough Detailed Assessment

Kirklees Council has modelled the annual mean NOx for 2015 in the area of Eastborough. This modelling was conducted to determine the boundaries of the AQMA.

Kirklees Council has used Atmospheric Dispersion Modelling System for Urban areas (ADMS Urban) to create this model and validated it against the 2015 automatic monitoring data.

Meteorological Data for the model has been taken from Huddersfield Civic 3 Weather Station. The weather data for 2004 has been selected as the weather patterns in that year are representative of the usual weather conditions in the district.

The Traffic Figures have been obtained from the Department of Transport for 2015 count points in close proximity to the assessment areas.
Traffic counts and average speeds were entered into the Emission Factor Toolkit 2014

Background figures for the model have been taken from the *2015 based background maps* (DEFRA).

The topography and road layout was obtained from Kirklees Council GIS data and ordinance survey records.

Kirklees conducted a statistical procedure as set out in TG(09) to determine the model uncertainty and performance. Table F.3.1 indicates the results at diffusion tube sites and the results of the statistical analysis are contained within Table F.3.2 and Figure F.3.1.

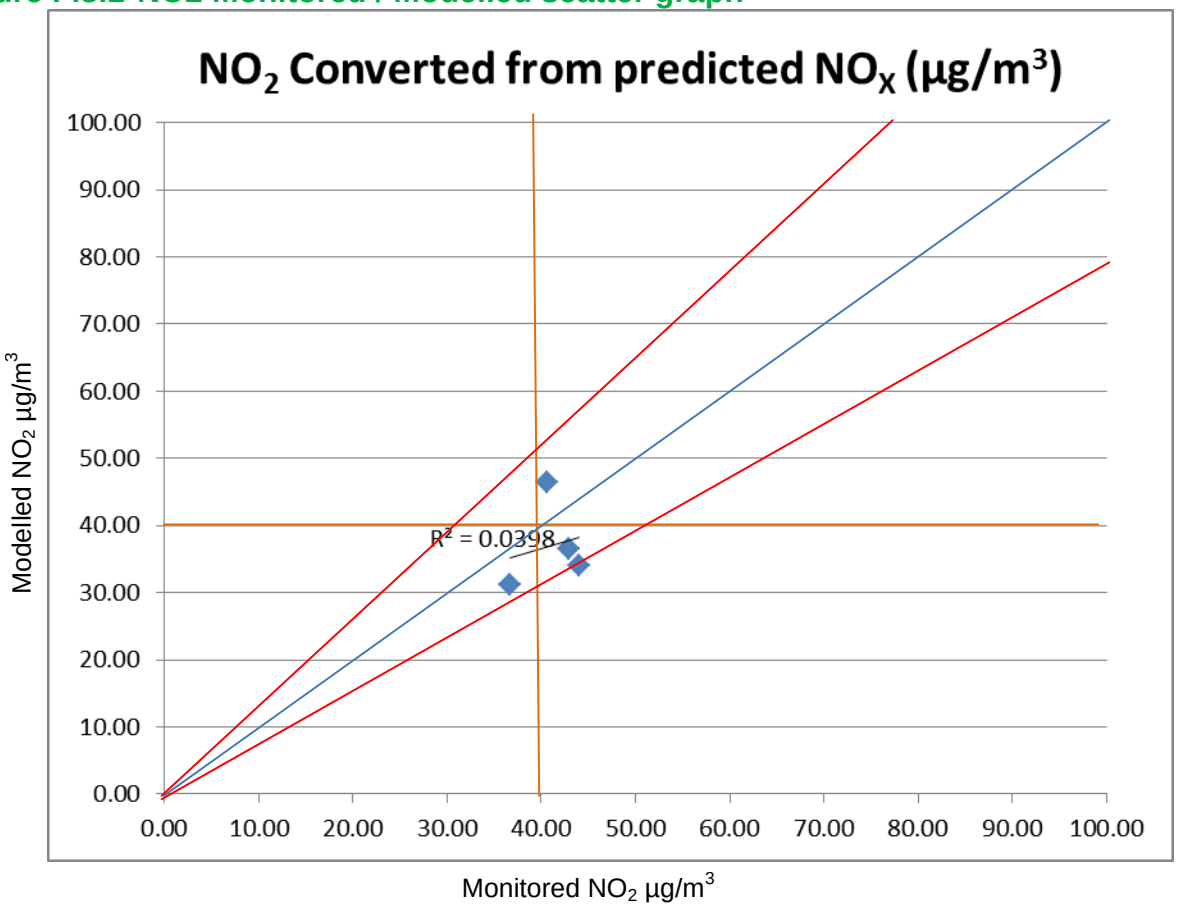
Table F.3.1 Results of Run at diffusion tube sites and statistical analysis of model

	Tube result ($\mu g/m^3$)	Modelled increment NO_x ($\mu g/m^3$)	Calculated NO_2 from NO_x ($\mu g/m^3$)	% Difference	Correction Factor
Tube 20	40.68	100.15	46.39	14	0.88
Tube 40	60.39	86.89	41.48	-31	1.46
Tube 42	42.99	74.35	36.48	-15	1.18
Tube 43	43.97	68.74	34.12	-22	1.29
Tube 44	36.68	61.83	31.11	-15	1.18

Table F.3.2 Statistical analysis of the corrected data

Eastborough Run - 2015	
RMSE	8.95
Fractional Bias	0.17

Figure F.3.1 NO2 Monitored / Modelled scatter graph

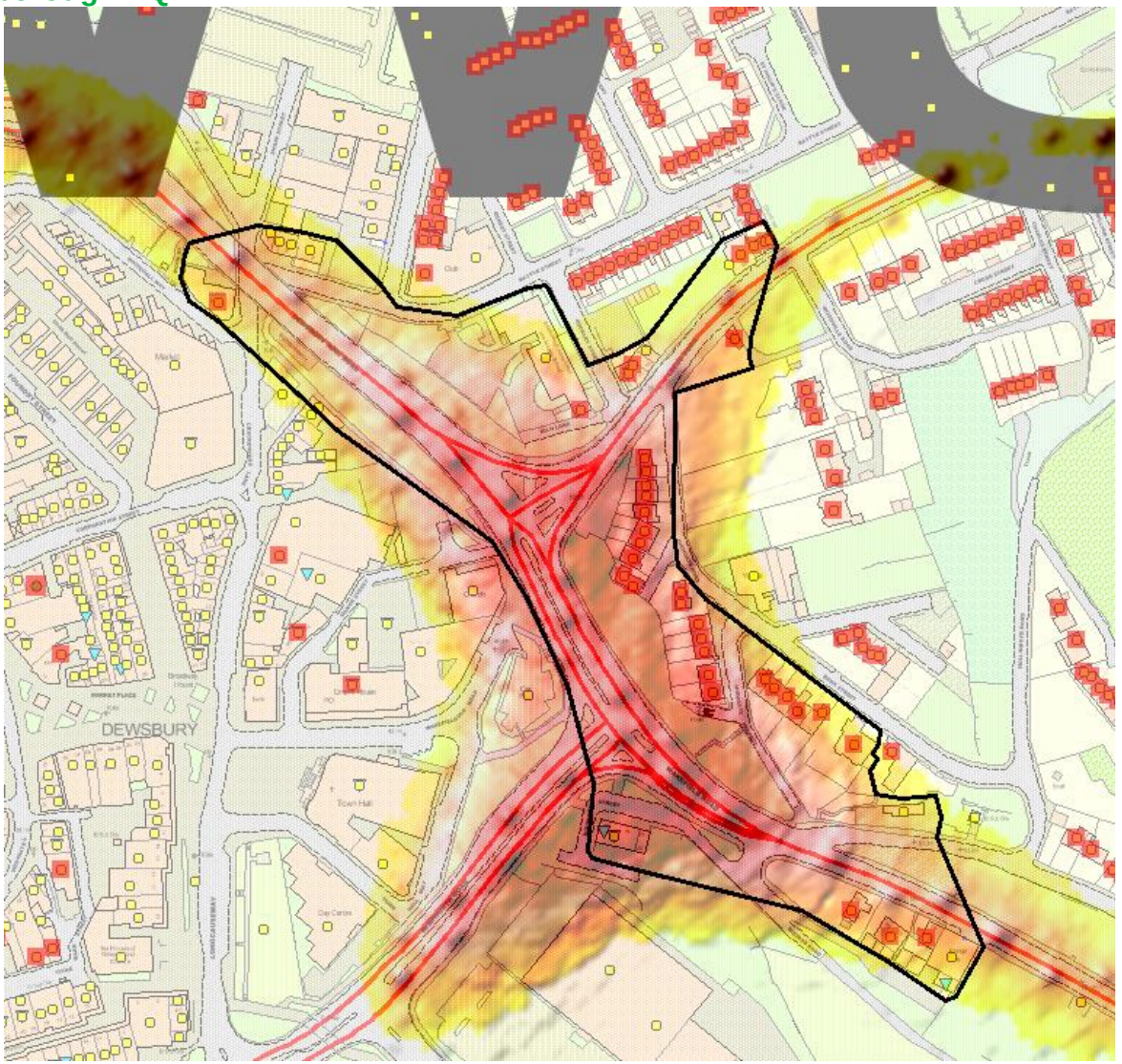


The statistical analysis carried out at the validation stage shows that the model accuracy is average and the fractional bias indicates that the model in the most part is underestimating.

Figure F.3.1 graphs the correlation between the monitored and modelled data. It is clear to see that trend line is close to the mid-point and all points fall within the +/- 20% region

Map 3.3 was constructed using the correction factor of 1.22. The yellow and red areas indicate the areas of exceedance and how NO_2 diffuses around the Eastborough assessment area

Map 3.3 Eastborough AQMA



F.4 Edgerton Detailed Assessment

Kirklees Council has modelled the annual mean NOx for 2015 in the area of Edgerton. This modelling was conducted to determine the boundaries of the AQMA.

Kirklees Council has used Atmospheric Dispersion Modelling System for Urban areas (ADMS Urban) to create this model and validated it against the 2015 automatic monitoring data.

Meteorological Data for the model has been taken from Huddersfield Civic 3 Weather Station. The weather data for 2004 has been selected as the weather patterns in that year are representative of the usual weather conditions in the district.

The Traffic Figures have been obtained from the Department of Transport for 2015 count points in close proximity to the assessment areas.
Traffic counts and average speeds were entered into the Emission Factor Toolkit 2014

Background figures for the model have been taken from the *2015 based background maps* (DEFRA).

The topography and road layout was obtained from Kirklees Council GIS data and ordinance survey records.

Kirklees conducted a statistical procedure as set out in TG(09) to determine the model uncertainty and performance. Table F.4.1 indicates the results at diffusion tube sites and the results of the statistical analysis are contained within Table F.4.2 and Figure F4.1.

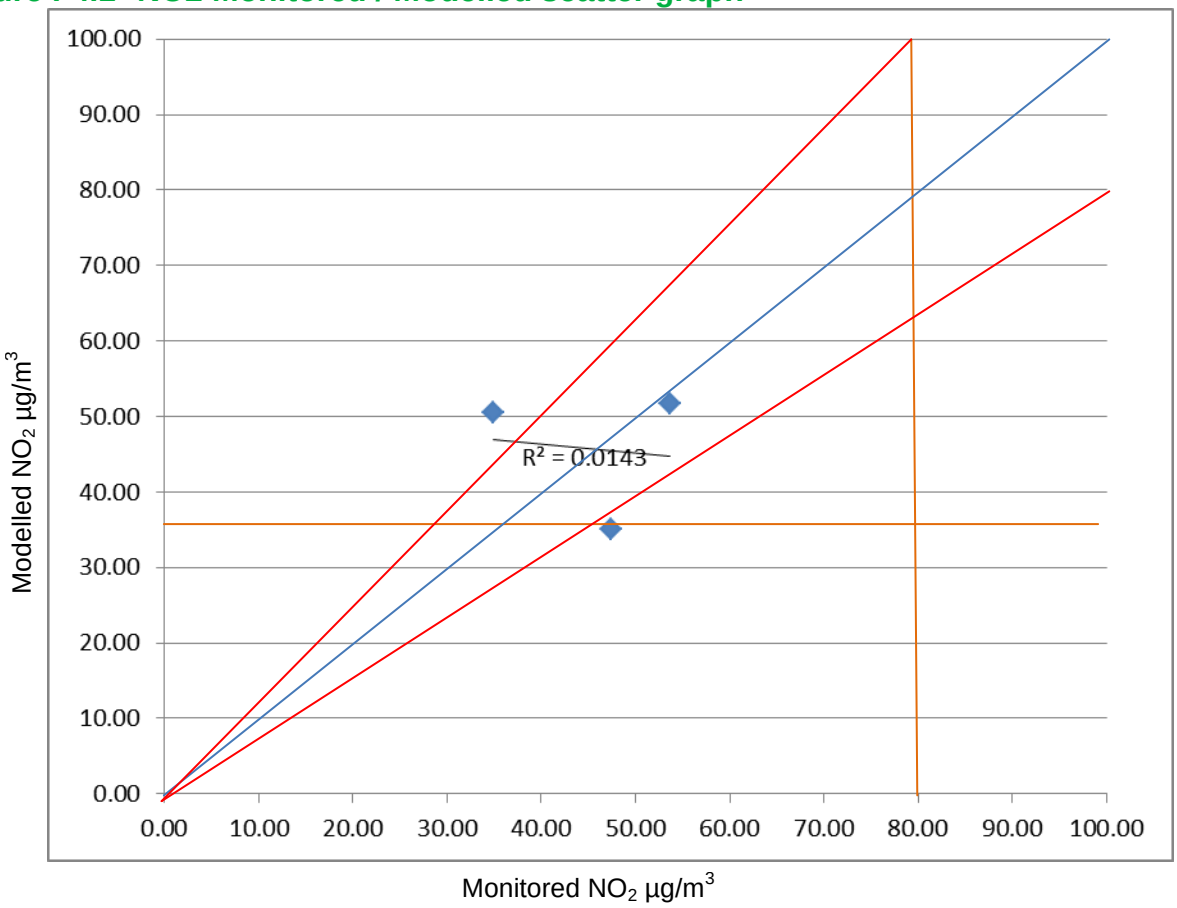
Table F.4.1 Results of Run at diffusion tube sites and statistical analysis of model

	Tube result ($\mu g/m^3$)	Modelled increment NO_x ($\mu g/m^3$)	Calculated NO_2 from NO_x ($\mu g/m^3$)	% Difference	Correction Factor
Tube 3	53.70	73.10	51.72	-4	1.04
Tube 31	34.96	69.30	50.45	44	0.69
Tube 32	47.42	28.39	35.04	-26	1.35

Table F.4.2 Statistical analysis of the corrected data

Edgerton Run - 2015	
RMSE	8.14
Fractional Bias	-0.01

Figure F4.1 NO2 Monitored / Modelled scatter graph

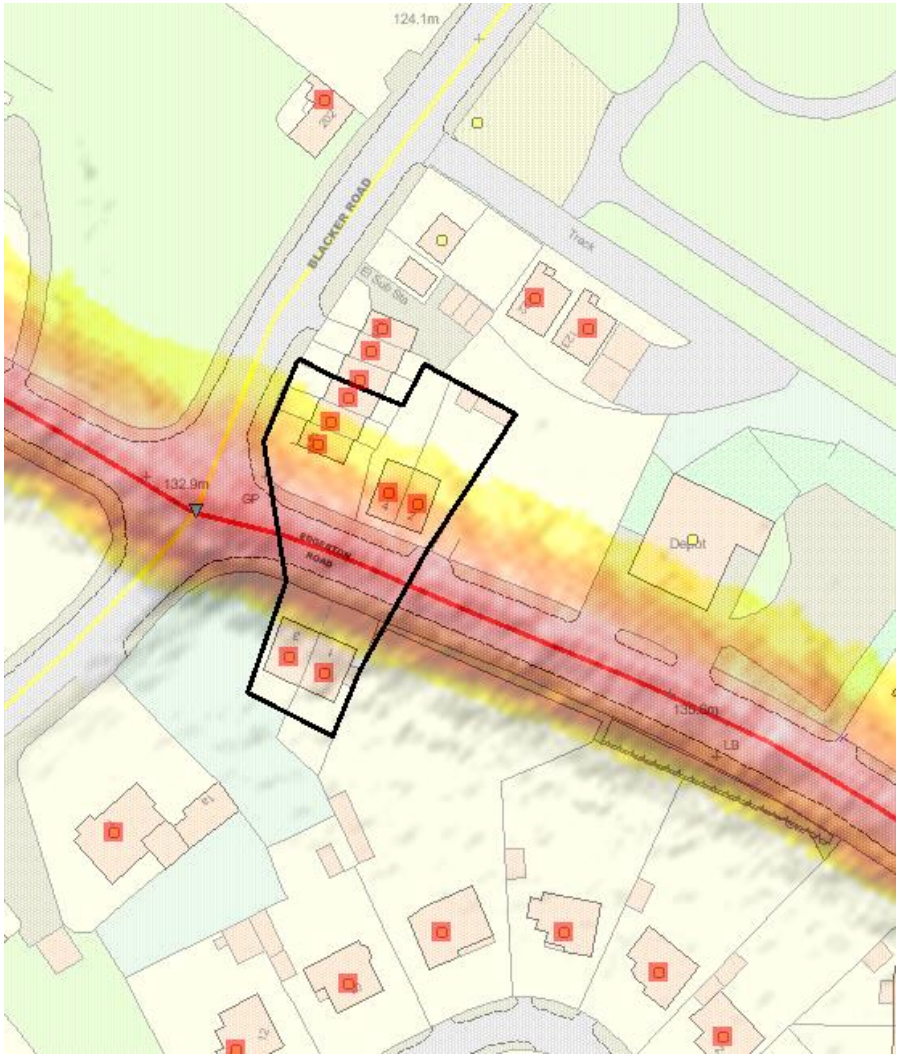


The statistical analysis carried out at the validation stage shows that the model accuracy is average and the fractional bias indicates that the model is overestimating.

Figure F.4.1 graphs the correlation between the monitored and modelled data. It is clear to see that trend line is close to the mid-point and all points fall within the +/- 20% region

Map 3.4 was constructed without a correction factor. The yellow and red areas indicate the areas of exceedance and how NO_2 diffuses around the Edgerton assessment area

Map 3.4 Edgerton AQMA



F.5 Heckmondwike Detailed Assessment

Kirklees Council has modelled the annual mean NOx for 2015 in the area of Heckmondwike. This modelling was conducted to determine the boundaries of the AQMA.

Kirklees Council has used Atmospheric Dispersion Modelling System for Urban areas (ADMS Urban) to create this model and validated it against the 2015 automatic monitoring data.

Meteorological Data for the model has been taken from Huddersfield Civic 3 Weather Station. The weather data for 2004 has been selected as the weather patterns in that year are representative of the usual weather conditions in the district.

The Traffic Figures have been obtained from the Department of Transport for 2015 count points in close proximity to the assessment areas.
Traffic counts and average speeds were entered into the Emission Factor Toolkit 2014

Background figures for the model have been taken from the *2015 based background maps* (DEFRA).

The topography and road layout was obtained from Kirklees Council GIS data and ordinance survey records.

Kirklees conducted a statistical procedure as set out in TG(09) to determine the model uncertainty and performance. Table F.5.1 indicates the results at diffusion tube sites and the results of the statistical analysis are contained within Table F.5.2 and Figure F5.1.

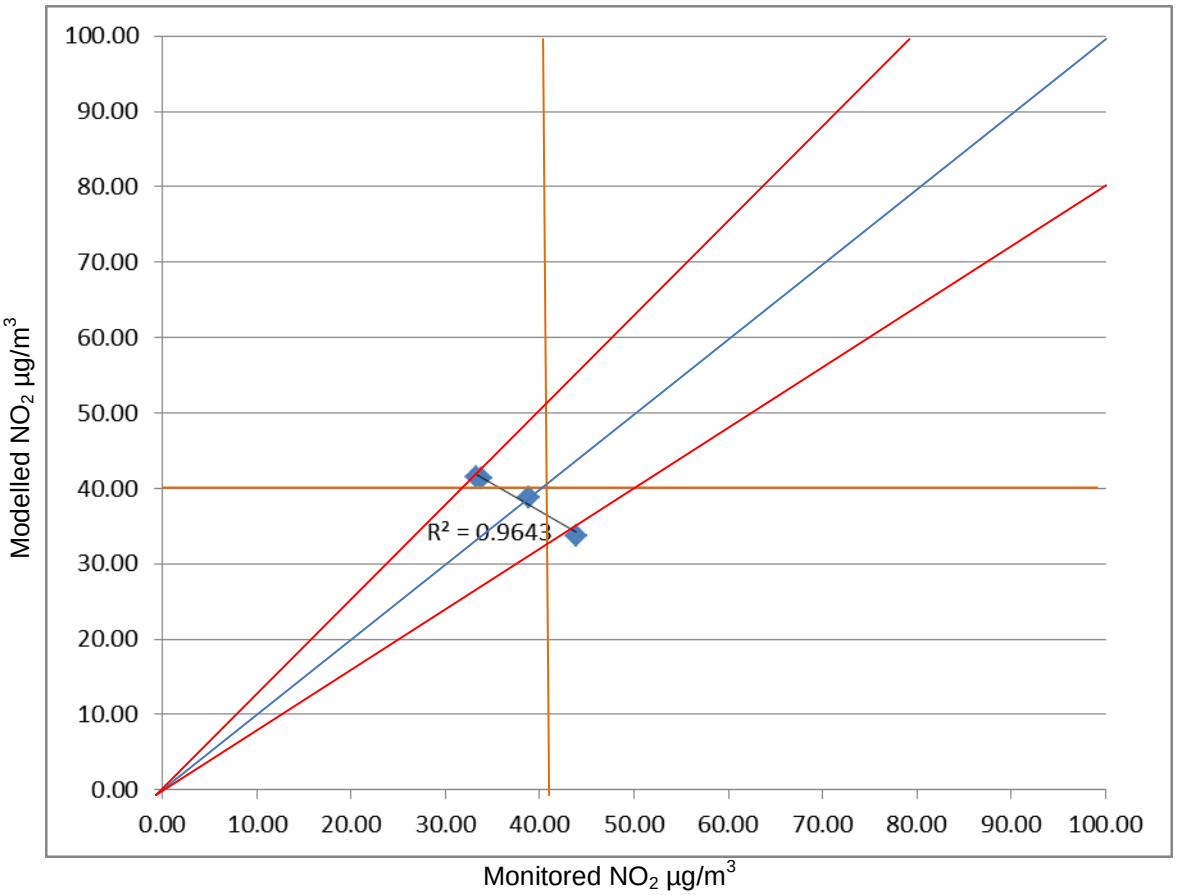
Table F.5.1 Results of Run at diffusion tube sites and statistical analysis of model

	Tube result ($\mu g/m^3$)	Modelled increment NO_x ($\mu g/m^3$)	Calculated NO_2 from NO_x ($\mu g/m^3$)	% Difference	Correction Factor
Tube 33	33.75	44.12	41.38	23	0.82
Tube 34	33.21	44.64	41.58	25	0.80
Tube 35	38.86	37.67	38.85	0	1.00
Tube 48	43.82	25.33	33.74	-23	1.30

Table F.5.2 Statistical analysis of the corrected data

Heckomndwike Run - 2015	
RMSE	5.73
Fractional Bias	-0.04

Figure F5.1 NO2 Monitored / Modelled scatter graph

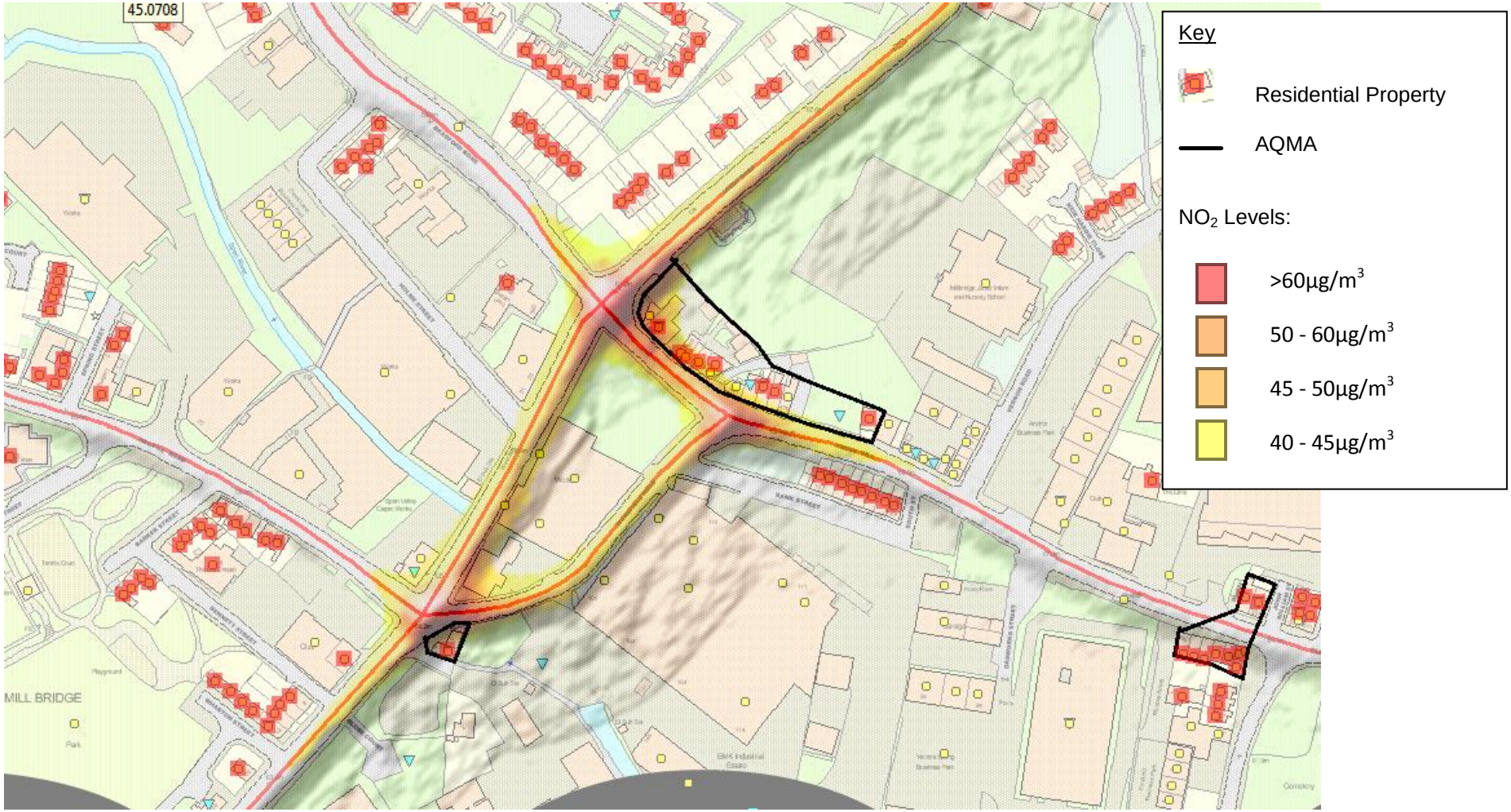


The statistical analysis carried out at the validation stage shows that the model accuracy is average and the fractional bias indicates that the model average distribution of results is similar to the monitoring results.

Figure F.5.1 graphs the correlation between the monitored and modelled data. It is clear to see that trend line is close to the mid-point and all points fall within the +/- 20% region

Map 3.5 was constructed using the correction factor of 0.98. The yellow and red areas indicate the areas of exceedance and how NO_2 diffuses around the Heckmondwike assessment area

Map 3.5 Heckmondwike AQMA



F.6 Huddersfield Town Centre Detailed Assessment

Kirklees Council has modelled the annual mean NOx for 2015 in the area of Heckmondwike. This modelling was conducted to determine the boundaries of the AQMA.

Kirklees Council has used Atmospheric Dispersion Modelling System for Urban areas (ADMS Urban) to create this model and validated it against the 2015 automatic monitoring data.

Meteorological Data for the model has been taken from Huddersfield Civic 3 Weather Station. The weather data for 2004 has been selected as the weather patterns in that year are representative of the usual weather conditions in the district.

The Traffic Figures have been obtained from the Department of Transport for 2015 count points in close proximity to the assessment areas.
Traffic counts and average speeds were entered into the Emission Factor Toolkit 2014

Background figures for the model have been taken from the *2015 based background maps* (DEFRA).

The topography and road layout was obtained from Kirklees Council GIS data and ordinance survey records.

Kirklees conducted a statistical procedure as set out in TG(09) to determine the model uncertainty and performance. Table F.6.1 indicates the results at diffusion tube sites and the results of the statistical analysis are contained within Table F.6.2 and Figure F.6.1.

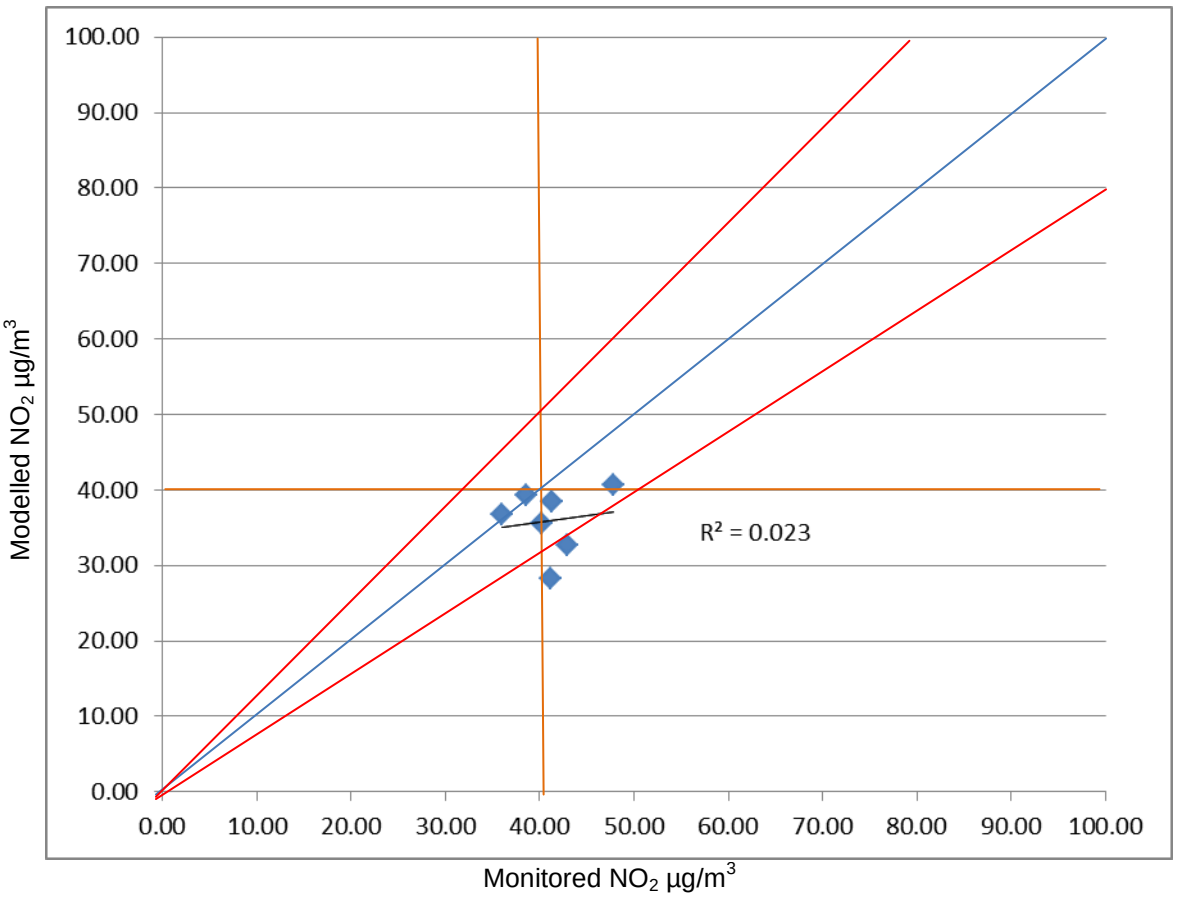
Table F.6.1 Results of Run at diffusion tube sites and statistical analysis of model

	Tube result ($\mu g/m^3$)	Modelled increment NO_x ($\mu g/m^3$)	Calculated NO_2 from NO_x ($\mu g/m^3$)	% Difference	Correction Factor
Roadside 3	36.00	32.31	36.68	2	0.98
Tube 16	41.19	12.92	28.22	-31	1.46
Tube 17	41.25	36.70	38.46	-7	1.07
Tube 20	40.17	29.79	35.63	-11	1.13
Tube 33	47.85	42.46	40.74	-15	1.17
Tube 13	38.64	38.74	39.28	2	0.98
Tube 54	42.90	22.85	32.67	-24	1.31

Table F.6.2 Statistical analysis of the corrected data

Town Centre Run - 2015	
RMSE	7.10
Fractional Bias	0.13

Figure F.6.1 NO2 Monitored / Modelled scatter graph

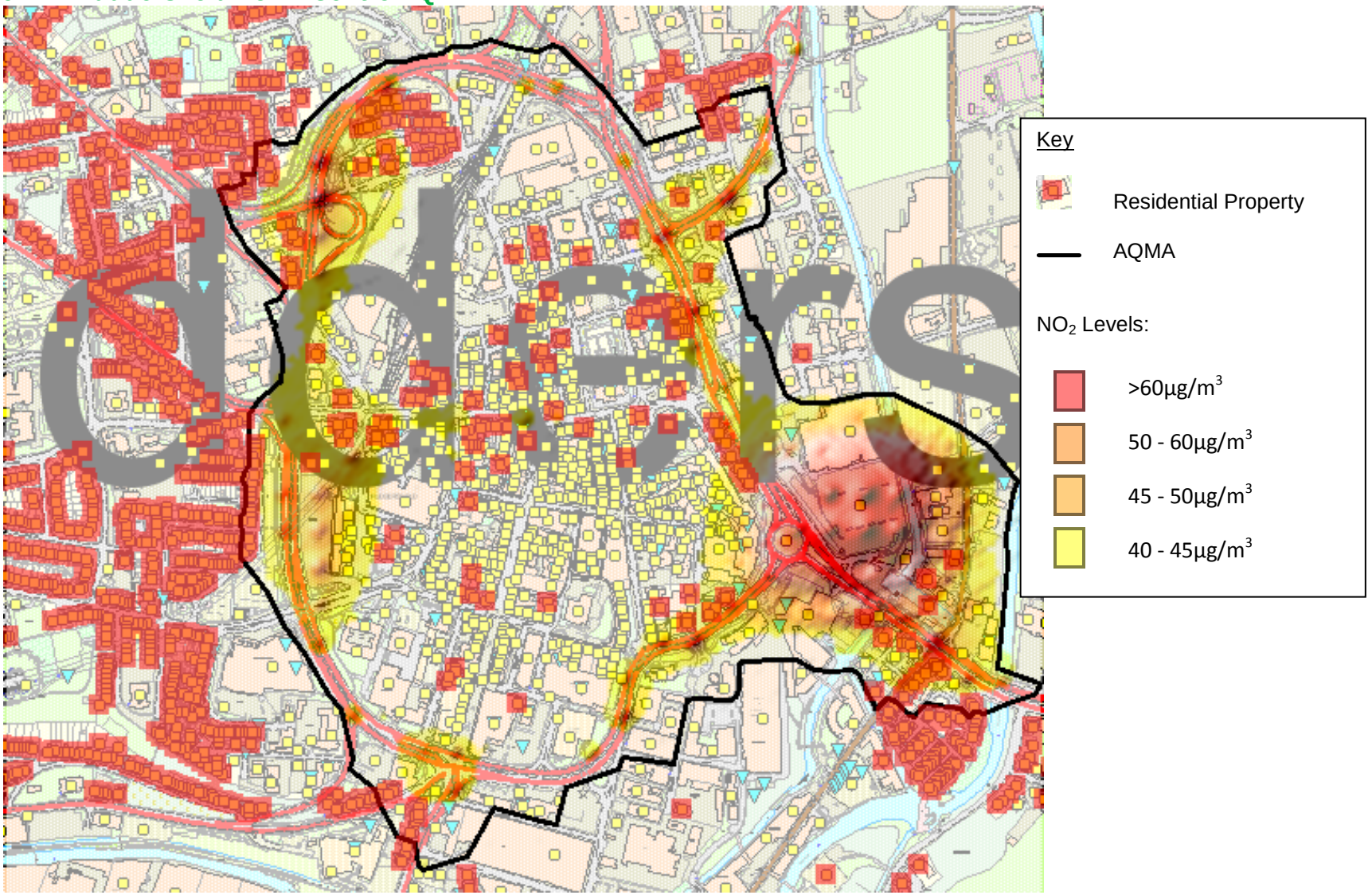


The statistical analysis carried out at the validation stage shows that the model accuracy is average and the fractional bias indicates that the model average distribution of results is similar to the monitoring results.

Figure F.6.1 graphs the correlation between the monitored and modelled data. It is clear to see that trend line is close to the mid-point and all points fall within the +/- 20% region

Map 3.6 was constructed using the correction factor of 0.95. The yellow and red areas indicate the areas of exceedance and how NO_2 diffuses around the Huddersfield Town Centre assessment area

Map 3.6 Huddersfield Town Centre AQMA



F.7 Outlane Detailed Assessment

Kirklees Council has modelled the annual mean NOx for 2015 in the area of Outlane. This modelling was conducted to determine the boundaries of the AQMA.

Kirklees Council has used Atmospheric Dispersion Modelling System for Urban areas (ADMS Urban) to create this model and validated it against the 2015 automatic monitoring data.

Meteorological Data for the model has been taken from Huddersfield Civic 3 Weather Station. The weather data for 2004 has been selected as the weather patterns in that year are representative of the usual weather conditions in the district.

The Traffic Figures have been obtained from the Department of Transport for 2015 count points in close proximity to the assessment areas.
Traffic counts and average speeds were entered into the Emission Factor Toolkit 2014

Background figures for the model have been taken from the *2015 based background maps* (DEFRA).

The topography and road layout was obtained from Kirklees Council GIS data and ordinance survey records.

Kirklees conducted a statistical procedure as set out in TG(09) to determine the model uncertainty and performance. Table F.7.1 indicates the results at diffusion tube sites and the results of the statistical analysis are contained within Table F.7.2 and Figure F.7.1.

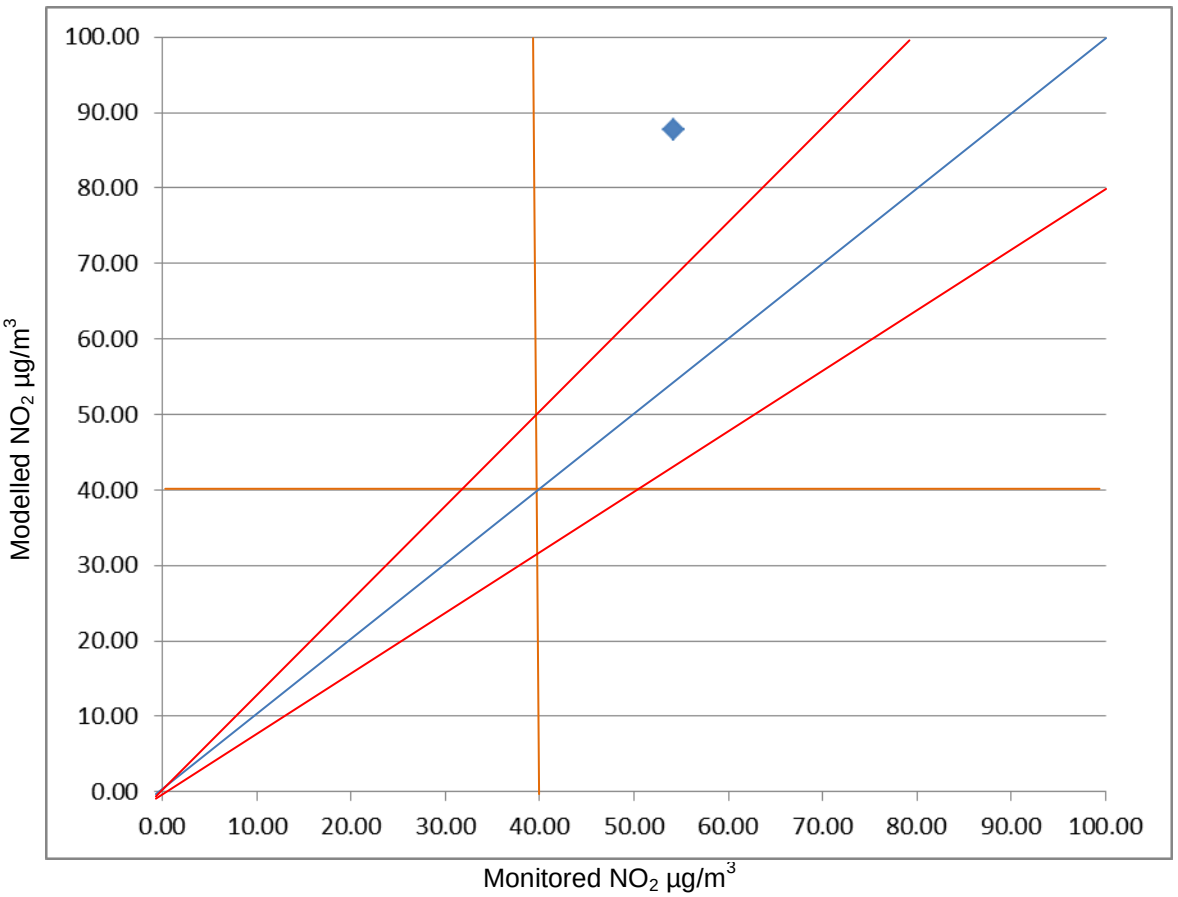
Table F.7.1 Results of Run at diffusion tube sites and statistical analysis of model

	Tube result ($\mu g/m^3$)	Modelled increment NO_x ($\mu g/m^3$)	Calculated NO_2 from NO_x ($\mu g/m^3$)	% Difference	Correction Factor
Tube 47	54.16	226.83	87.75	62	0.62

Table F.7.2 Statistical analysis of the corrected data

Outlane Run - 2015	
RMSE	16.80
Fractional Bias	-0.47

Figure F.7.1 NO2 Monitored / Modelled scatter graph

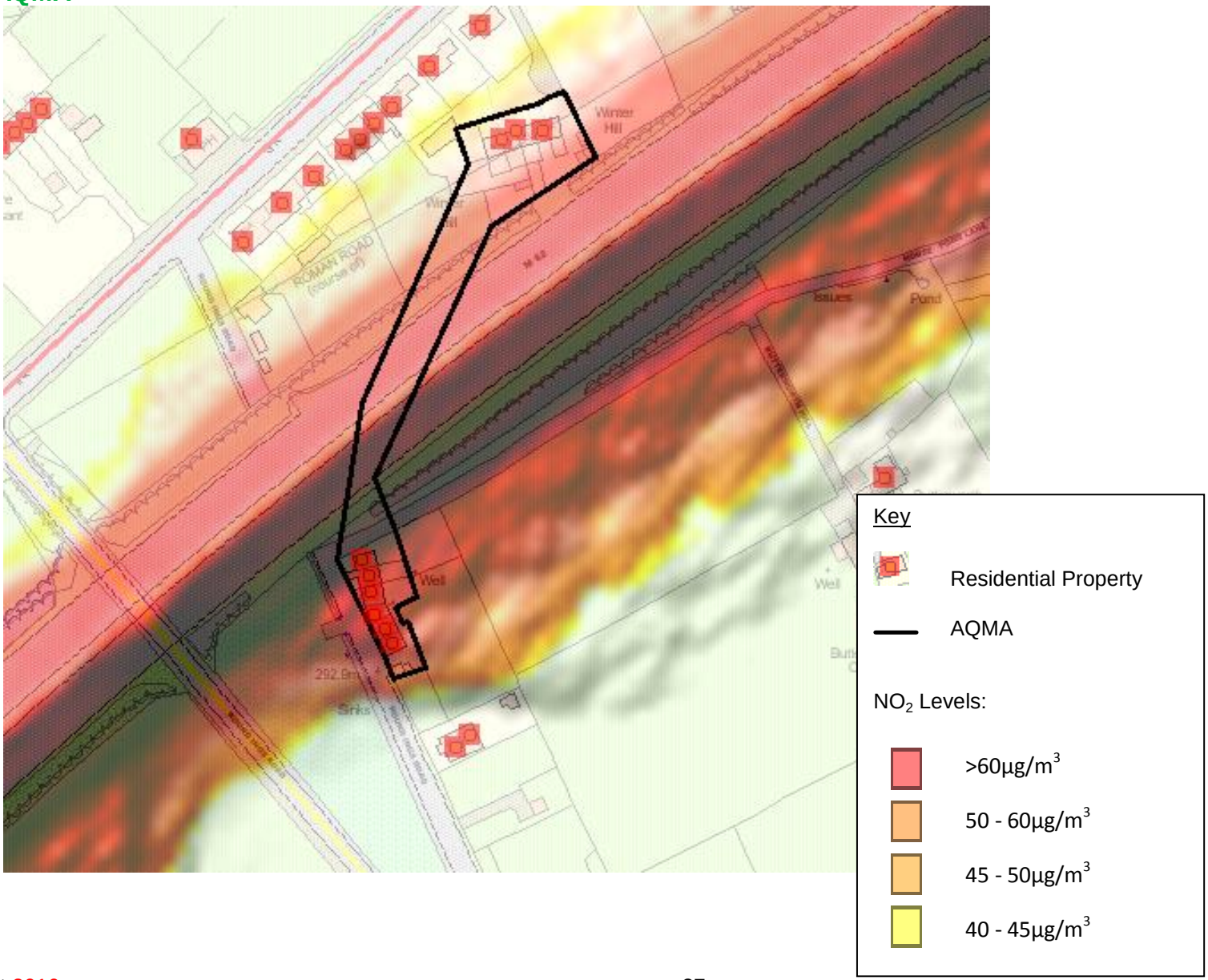


The statistical analysis carried out at the validation stage shows that the model is over predicting.

Figure F.7.1 graphs the correlation between the monitored and modelled data.

Map 3.7 was constructed using the correction factor of 0.62. The yellow and red areas indicate the areas of exceedance and how NO_2 diffuses around the Huddersfield Town Centre assessment area

Map 3.7 Outlane AQMA



F.8 AQMA1 Detailed Assessment

Kirklees Council has modelled the annual mean NOx for 2015 in the area of Outlane. This modelling was conducted to determine the boundaries of the AQMA.

Kirklees Council has used Atmospheric Dispersion Modelling System for Urban areas (ADMS Urban) to create this model and validated it against the 2015 automatic monitoring data.

Meteorological Data for the model has been taken from Huddersfield Civic 3 Weather Station. The weather data for 2004 has been selected as the weather patterns in that year are representative of the usual weather conditions in the district.

The Traffic Figures have been obtained from the Department of Transport for 2015 count points in close proximity to the assessment areas.
Traffic counts and average speeds were entered into the Emission Factor Toolkit 2014

Background figures for the model have been taken from the *2015 based background maps* (DEFRA).

The topography and road layout was obtained from Kirklees Council GIS data and ordinance survey records.

Kirklees conducted a statistical procedure as set out in TG(09) to determine the model uncertainty and performance. Table F.8.1 indicates the results at diffusion tube sites and the results of the statistical analysis are contained within Table F.8.2 and Figure F.8.1.

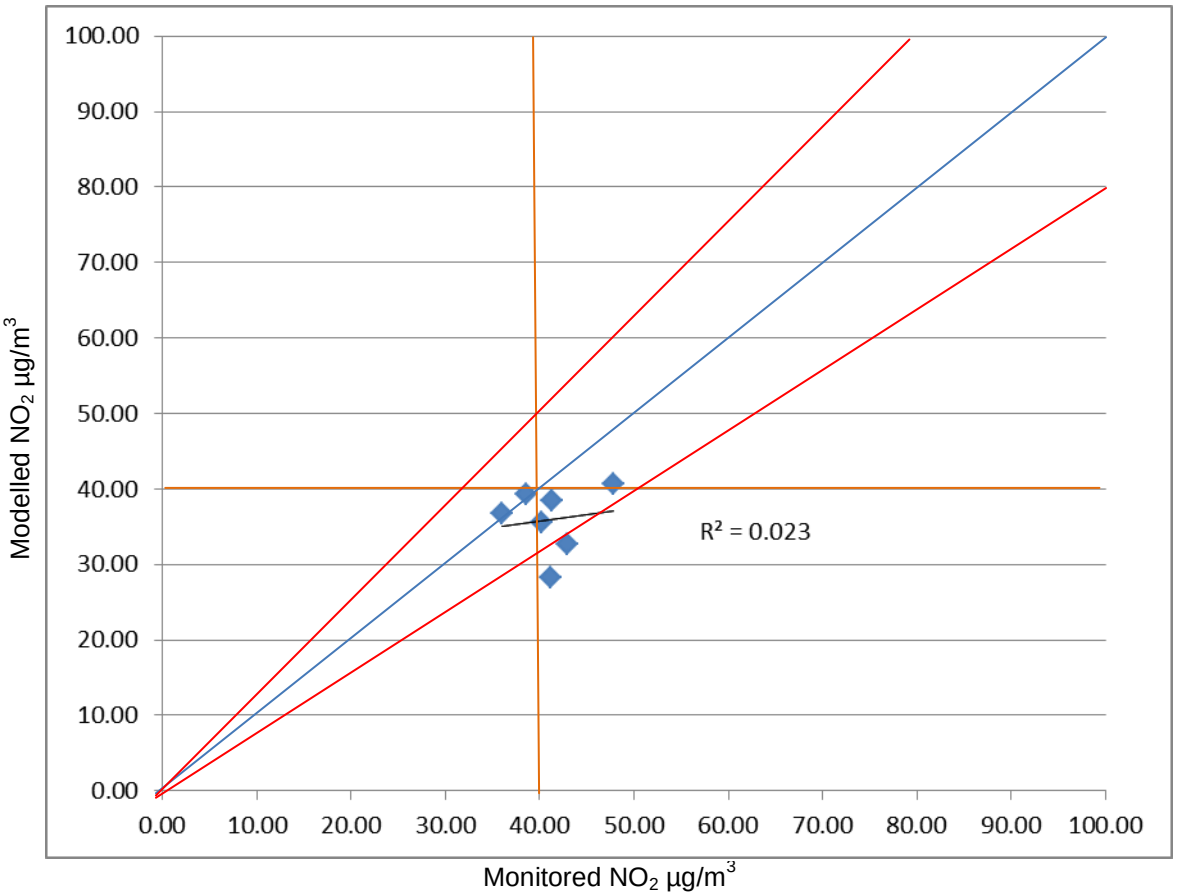
Table F.8.1 Results of Run at diffusion tube sites and statistical analysis of model

	Tube result ($\mu g/m^3$)	Modelled increment NO_x ($\mu g/m^3$)	Calculated NO_2 from NO_x ($\mu g/m^3$)	% Difference	Correction Factor
Roadside 3	36.00	32.31	36.68	2	0.98
Tube 16	41.19	12.92	28.22	-31	1.46
Tube 17	41.25	36.70	38.46	-7	1.07
Tube 20	40.17	29.79	35.63	-11	1.13
Tube 33	47.85	42.46	40.74	-15	1.17
Tube 13	38.64	38.74	39.28	2	0.98
Tube 54	42.90	22.85	32.67	-24	1.31

Table F.8.2 Statistical analysis of the corrected data

AQMA 1 Run - 2015	
RMSE	7.10
Fractional Bias	0.13

Figure F.8.1 NO2 Monitored / Modelled scatter graph

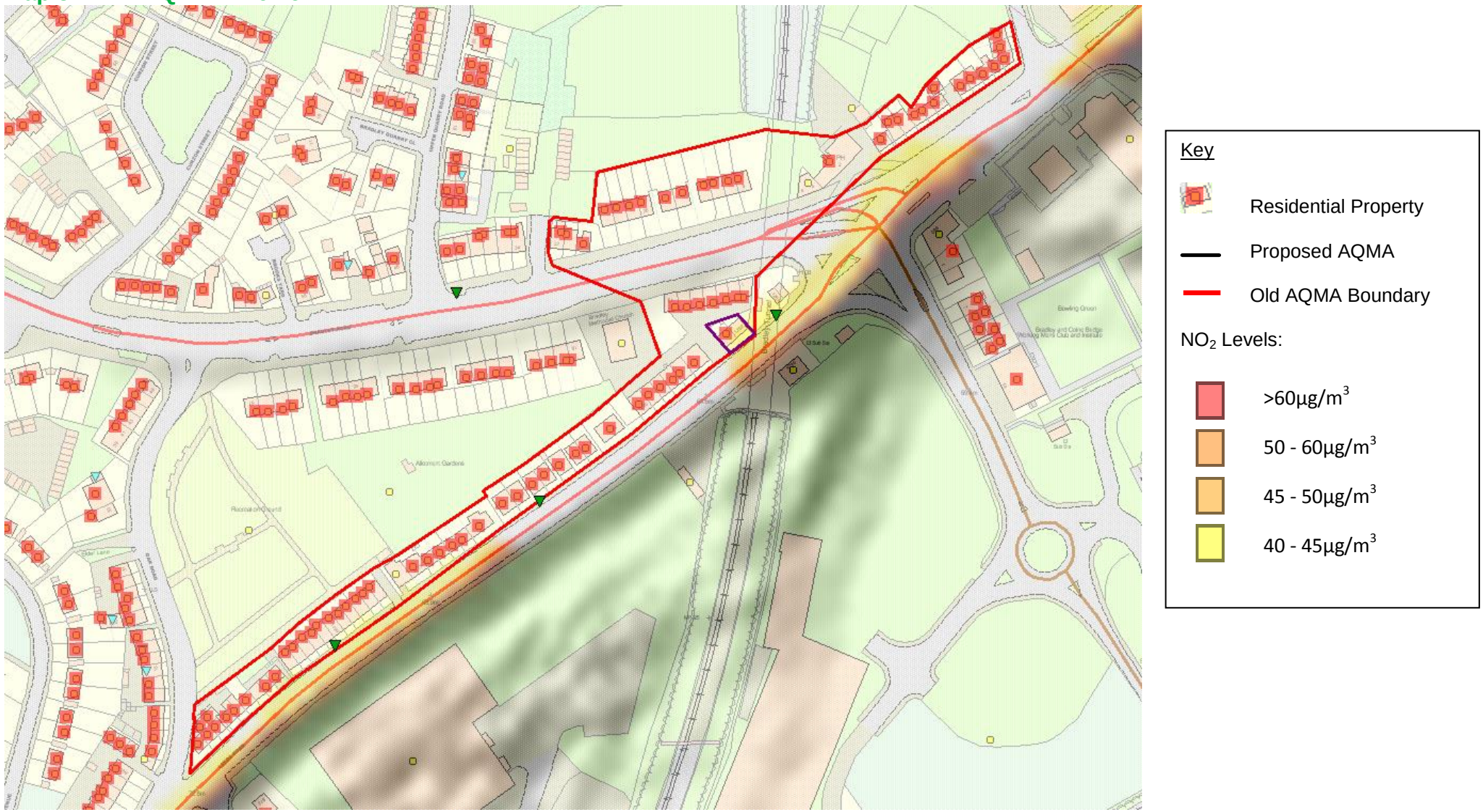


The statistical analysis carried out at the validation stage shows that the model accuracy is good and the fractional bias indicates that the model average distribution of results is similar to the monitoring results.

Figure F.8.1 graphs the correlation between the monitored and modelled data. It is clear to see that trend line is close to the mid-point and all points fall within the +/- 20% region

Map 3.8 was constructed using the correction factor of 0.98. The Red line denotes the previous AQMA and the purple line indicates the new AQMA proposal in accordance with recent modelling study.

Map 3.7 AQMA 1 Review




Playground
50.1m
Nun Brook
FB
Three Nuns (PH)
53.3m
54.3m
Stubbin's Plantation
Dumb Steeple Obelisk
Gas Gov
MP .5
GVC
Rose Cottage
Tanks
MP .5
L Twr
Filter Beds

Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values'
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
ASR	Air quality Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
EU	European Union
FDMS	Filter Dynamics Measurement System
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

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Local Air Quality Management Technical Guidance LAQM TG (16) DEFRA 2016

Air Quality (England) Regulations 2000. SI 2000/928, London: HMSO

Air Quality (England) (Amendment) Regulations 2002. SI 2002/3043, London: HMSO

Paul Bailey - Environmental Health Officer for Air Quality
(Kirklees Environmental Health)

Alex Garry – Environmental Health Officer for PPC
(Kirklees Environmental Health)

Health and Safety Laboratories
(WASP Tubes)

National Physical Laboratories Management Ltd
(Intercomparison Scheme)