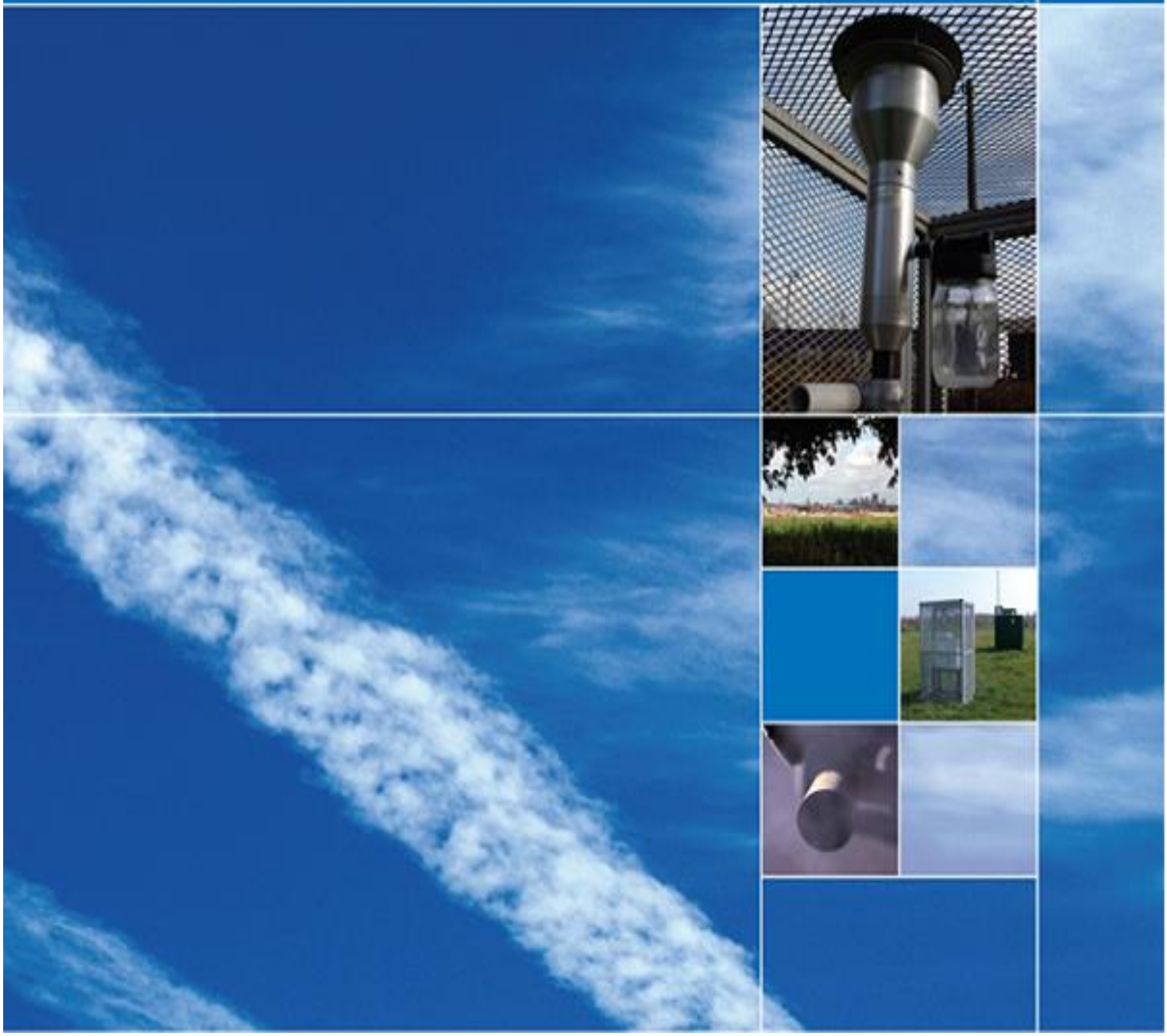
North Lincolnshire Council

Detailed Assessment of the Scunthorpe Town and Low Santon PM_{10} Air Quality Management Areas 2016



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1 Executive summary

In 2005 North Lincolnshire Council declared an Air Quality Management Area (AQMA) for exceedances of the PM_{10} daily mean objective, covering the integrated steelworks site and a large area of east Scunthorpe. This was followed in 2008 with a smaller AQMA for exceeding the PM_{10} annual mean objective at Low Santon.

The purpose of this report is to review the AQMA's and consider whether they can be revoked or amended. It is over ten years since the Scunthorpe daily mean AQMA was declared and in that time a large amount of air quality data has been gathered from a number of locations. The total production from the integrated steelworks site has remained fairly stable over the last ten years.

The daily mean AQMA boundary was based upon modelled data as there was only one air quality monitoring site near to the integrated steelworks site. New air quality monitors were then positioned in and around the AQMA and an air quality action plan was produced. Some of the original monitors have been moved in subsequent years whilst others, for example East Common Lane, have remained in situ for many years. There are three monitoring sites that have almost ten years of continuous data, which enables a robust analysis of any trends in the data.

Over the last ten years a great deal of work has been done to improve the air quality in Scunthorpe, involving the Environment Agency, British Steel, Harsco Metals, Tarmac, Public Health England and North Lincolnshire Council.

Data shows that the PM_{10} daily mean objective is not being breached in all the areas within the current AQMA boundary, it is therefore proposed to amend the boundary to reduce the geographical area that it covers. This amendment would remove approximately 5,000 residential properties from within the AQMA (2005).

Data also shows that the PM_{10} annual mean objective is no longer being breached at Low Santon and it is therefore proposed that this AQMA is revoked.

There are challenges ahead, both for the steel industry and regulatory bodies, it is however hoped that air quality improvements can still be made.

2 Contents

3 Introduction

3.1 North Lincolnshire

The administrative area of North Lincolnshire was created on 1 April 1996 when a new unitary authority area came into being. Apart from the urban area of Scunthorpe and Bottesford, North Lincolnshire covers a mainly agricultural area. This comprises of around 85,000 hectares with a population of approximately 167,500 (Figure 1).

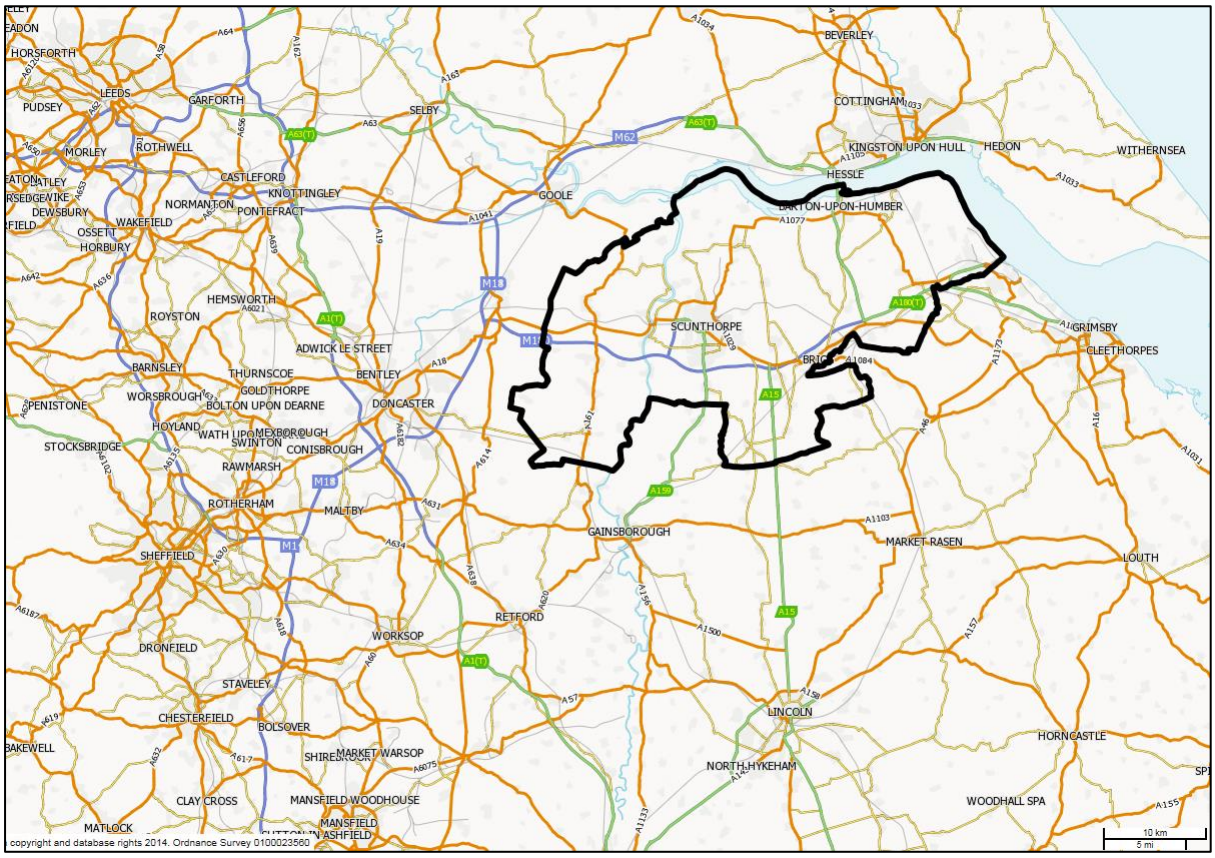

Figure 1: The boundary of the North Lincolnshire Local Authority and its location within the surrounding area.

The local economy of North Lincolnshire was built and still relies upon traditional industries such as steel manufacturing (and related industries) and agriculture. More recently there has been the establishment of two oil refineries; the location of these on the South Humber Bank is where major developments are planned, principally for the off shore wind energy industry.

3.2 Local Air Quality Management

Local Air Quality Management (LAQM) was introduced by the Environment Act 1995, placing a duty on all Local Authorities to review air quality in their area. Before the Environment Act came into force, air quality was primarily concerned with smoke and Sulphur Dioxide (SO_2) emissions. By 1995 SO_2 had been controlled in almost every part of the UK, but the health effects of Nitrogen Dioxide (NO_2) and Particulate Matter (PM) were beginning to become evident.

Local authorities use a number of techniques to assess the impacts of potentially polluting activities such as transport, industry and domestic emissions. Since December 1997 each local authority in the UK has been carrying out a review and assessment of air quality in their area. Assessments can be made using indicative or quantitative monitoring techniques, air quality modelling, or screening tools. To help local authorities DEFRA has produced a manual, Local Air Quality Management Technical Guidance LAQM.TG(09). This document is designed to guide local authorities through the Review and Assessment process, as well as containing information to declare, revoke or amend an Air Quality Management Area (AQMA).

The aim of the review and assessment regime is to make sure that the national air quality objectives will be achieved throughout the UK by the relevant deadlines. These objectives have been put in place to protect people's health and the environment.

3.3 Air Quality in North Lincolnshire

In November 2005 an AQMA was declared in Scunthorpe in relation to a potential breach of the daily mean objective for PM_{10} (particulate matter less than 10 microns in diameter). The specific objective for PM_{10} is a 24 hour mean of 50µg/m^3, which is not to be exceeded more than 35 times in one year. A further assessment into the sources of the pollutant was published in 2006. More information on AQMA's can be found on DEFRA's website (http://uk-air.defra.gov.uk/aqma/). A summary of the process of declaration of the Scunthorpe PM_{10} daily mean AQMA is shown in Figure 2.

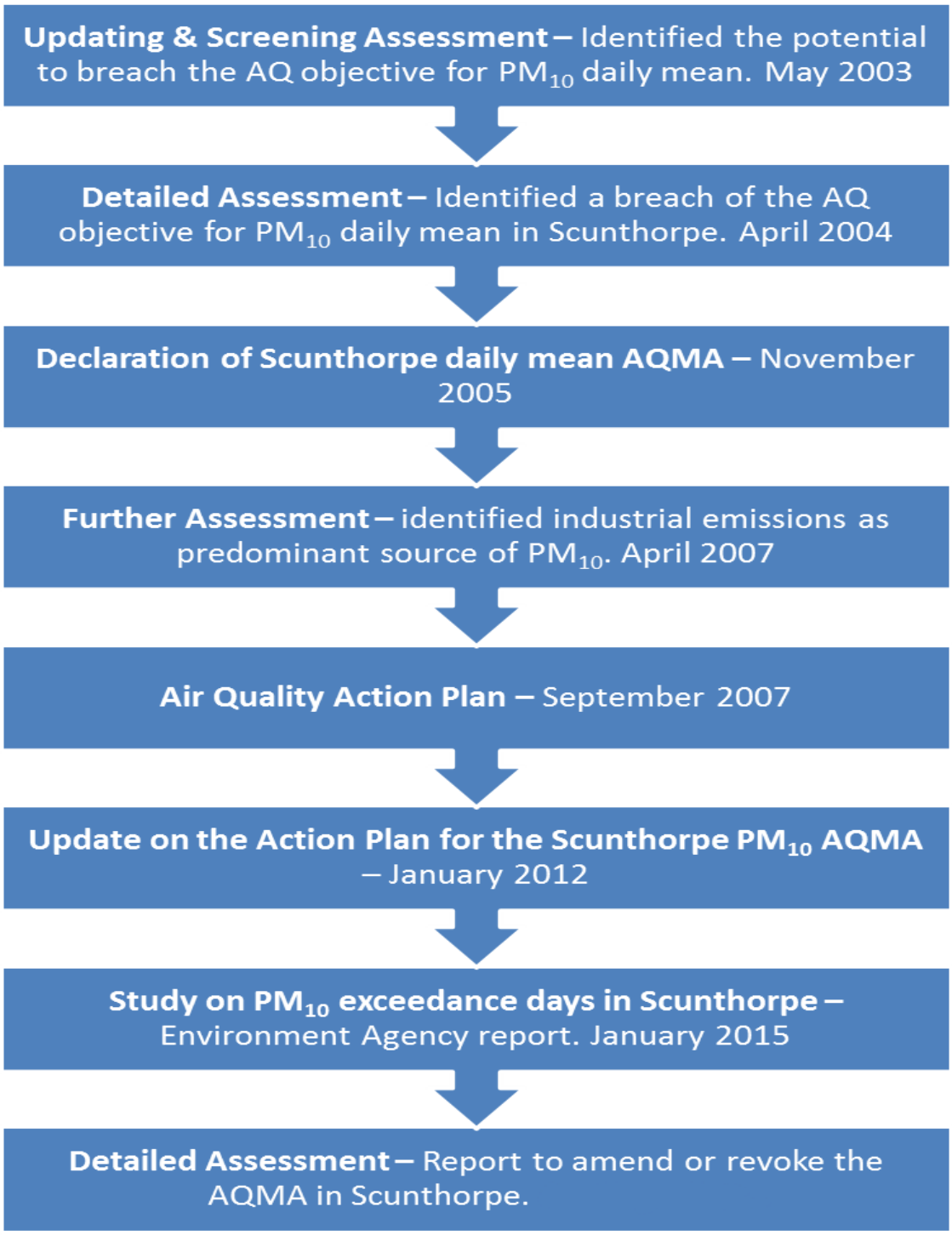

Figure 2: A summary of the process for the Scunthorpe daily mean PM_{10} AQMA.

AQMA's are not unique to North Lincolnshire, with over 250 local authorities declaring AQMA's. Across the UK 587 separate AQMA's have been declared for NO_2 and 94 for PM_{10}, with the majority of these referring to transport issues, along with another seven for SO_2. The purpose of AQMA's are to focus air quality

monitoring in a smaller area in greater detail, and to work alongside an action plan to improve the air quality.

The extent of Scunthorpe's daily mean PM_{10} AQMA can be seen in Figure 3, which contains approximately 7,000 residential properties.

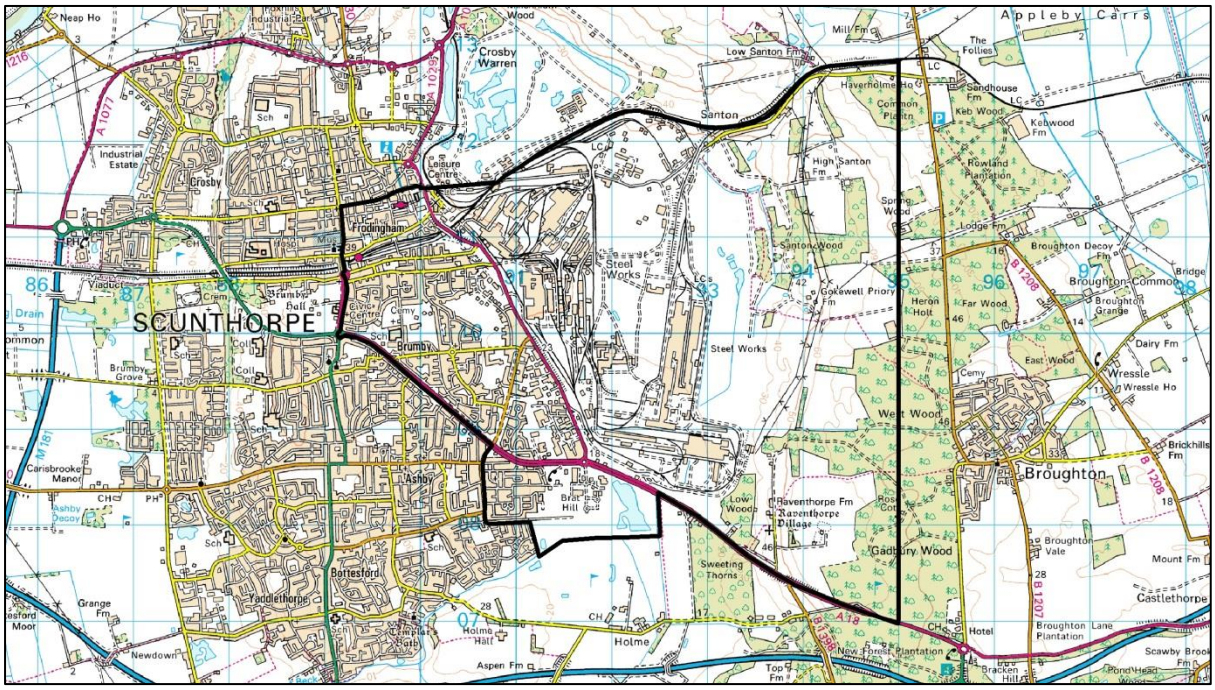

Figure 3: The extent of the PM_{10} daily mean AQMA.

A second AQMA was declared for PM_{10} in 2008 for the small village of Low Santon, in respect of an exceedance of the annual mean air quality objective. The annual mean PM_{10} air quality objective should not exceed 40µg/m^3.

As a consequence of declaring two AQMA's, North Lincolnshire Council was required to formulate two air quality action plans, one for each AQMA. These action plans detailed a range of methods to improve the air quality in the area.

The actions for the Scunthorpe daily mean AQMA were placed into six categories:

A. Air quality monitoring and reports
B. Information to the public
C. Bonfires and non-permitted process emissions
D. Industry
E. Development control
F. Tailpipe emissions

The actions for the Low Santon annual mean AQMA were placed into different categories based on who was responsible for the actions:

A. The Environment Agency
B. British Steel
C. Tarmac
D. Harsco Metals
E. North Lincolnshire Council

Table 1 illustrates how the impact, cost and timescale for the action plan was assessed.

Potential PM_{10} impact reduction	Financial costs	Timescale
Low < 20%	Low < £50k	Short < 6 months
Medium 20 - 80%	Medium £50k - £200k	Medium 6 - 24 months
High > 80%	High > £200k	Long > 24 months

Table 1: The potential impact reduction, costs and timescale for the Low Santon action plan

The action plans also had to take into account potential economic, social and environmental impacts. The action plans are available to download, along with all other published reports, from the North Lincolnshire air quality website (www.nlincsair.info).

The decision to revoke an AQMA can only be taken following a Detailed Assessment or Further Assessment, which would set out in detail all the available information used to reach the decision.

The predominant source of PM_{10} within the Scunthorpe area is from the integrated steelworks site, although it is important to note that the steel industry is complex and operates on a large site. It involves the interaction of many different companies and regulation is split between the Council and the Environment Agency. The major installations on the site are regulated by the Environment Agency with less polluting processes under the jurisdiction of the Council.

There are four main types of PM_{10} emission on the integrated steelworks site:

- Stack emissions – processes which release through discrete emission points.
- Fugitive emissions – processes which release from covered and enclosed areas.
- Mechanical re-suspension – processes which result in dust releases, for example materials handling, road traffic and material crushing.
- Wind-blown emissions – when the wind speed is sufficient to re-suspend particles from stockpiles, roads and dusty areas.

For the young and people in a good state of health, moderate air pollution levels are unlikely to have any serious short term effects. However, elevated levels and/or long term exposure to air pollution can lead to more serious symptoms and conditions affecting human health. This mainly affects the respiratory and inflammatory systems, but can also lead to more serious conditions such as heart disease and cancer. People with lung or heart conditions may be more susceptible to the effects of air pollution. Air quality objectives have been set for seven main pollutants, including PM_{10}, NO_2 and SO_2. $PM_{2.5}$ is the smaller fraction of Particulate Matter and is classed as a non-threshold pollutant, as is PM_{10}; where any exposure is considered to be detrimental to health.

3.4 Purpose of the report

This report fulfils the requirements of the Local Air Quality Management process as set out in Part IV of the Environment Act 1995, the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007 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.

The primary aim of this Detailed Assessment is to review the current AQMAs and consider whether they could be revoked or amended.

The secondary aim of this report is to give an overview of air quality within the current daily mean AQMA, specifically from the last four years (2012-15) as this is sufficient data as required by DEFRA for a decision on revoking or amending an AQMA.

It has been over ten years since the Scunthorpe daily mean AQMA was declared and in that time the location of many of the air quality monitors has changed. There have been some new air quality monitoring sites located inside the AQMA, one site upgraded and three sites outside of the AQMA have been decommissioned. New industries have also been built inside of the AQMA in the last ten years which could potentially make the air quality worse, along with some industries that have closed. The principle operator on the integrated steelworks site has changed from Corus to Tata, to Long Products in 2015 and then to British Steel in 2016 and for the purposes of this report is mainly referred to as British Steel throughout The total production from the steelworks has remained fairly stable over the last ten years.

3.5 Air Quality Objectives

The air quality objectives from 2005 when the AQMA was declared can be seen in Table 2. In 2016 the PM_{10} air quality objectives remain the same.

Pollutant		Objective	To be achieved by
	Concentration	**Measured as**	
Particles PM_{10}	50µg/m^3	24-Hour Mean not to be exceeded more than 35 times a year.	31/12/2004
	40µg/m^3	Annual Mean	31/12/2004
Nitrogen Dioxide	200µg/m^3	1-Hour Mean not to be exceeded more than 18 times a year.	31/12/2005
	40µg/m^3	Annual Mean	31/12/2005
Sulphur Dioxide	350µg/m^3	1-Hour Mean not to be exceeded more than 24 times a year.	31/12/2004
	125µg/m^3	24-Hour Mean not to be exceeded more than 3 times a year.	31/12/2004
	266µg/m^3	15-Minute Mean not to be exceeded more than 35 times a year.	31/12/2005
Carbon Monoxide	10.0mg/m^3	Maximum Daily Running 8-Hour Mean	31/12/2003
Benzene	16.25µg/m^3	Running Annual Mean	31/12/2003
	5µg/m^3	Annual Mean	31/01/2010
1,3-Butadiene	2.25µg/m^3	Running Annual Mean	31/12/2003
Lead	0.5µg/m^3	Annual Mean	31/12/2004
	0.25µg/m^3	Annual Mean	31/12/2008

Table 2: Air quality objectives from 2005 when the AQMA was declared

4 Background to the daily mean AQMA in Scunthorpe

The Council declared the AQMA in 2005, to safeguard residents from the adverse effects of PM_{10} pollution. At the time of the AQMA declaration there was only one PM_{10} monitor in Scunthorpe, located at Cottage Beck Road. The boundary of the AQMA was therefore heavily reliant on air quality modelling implemented by British Steel (Figure 4). The model plotted contours for the 90th percentile value of daily mean concentrations. The 45µg/m^3 contour formed the basis for the AQMA boundary.

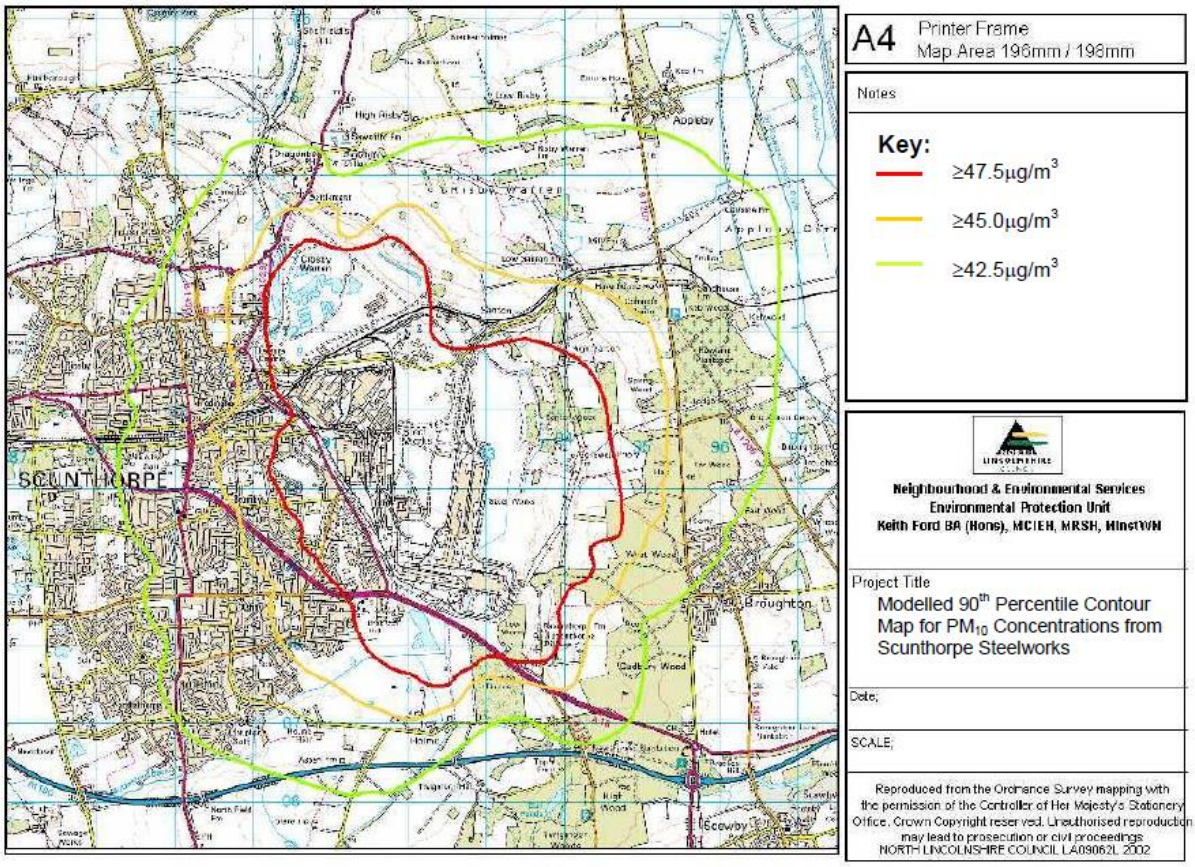

Figure 4: 90th percentile contour modelling implemented by British Steel in 2004

Many local authorities use modelling for much of their analyses, especially if the AQMA that is being declared is predominantly traffic related. Unfortunately for Scunthorpe much of the Particulate Matter is fugitive, in that it does not originate from specific sources, and hence is far more difficult to model with the required level of accuracy. For this reason North Lincolnshire Council uses more air quality

monitors than most other authorities, relying on monitored results as opposed to modelled results.

DEFRA guidance states that the boundaries of an AQMA must be clearly identifiable and should match up with physical features; in declaring an AQMA, the authority must be able to describe its boundary both on a map and in words. It is therefore highly unlikely that the line of exceedance will match with physical features. Wherever possible the AQMA follows major roads through Scunthorpe, before following the railway line north of the integrated steelworks site and then the mapping grid line until joining the A18 to the south east of the steelworks (Figure 3).

4.1 Planning and Air Quality

The Air Quality Progress Report 2010 introduced the concept of different zones within the AQMA. To inform both spatial planning and the development control process it was agreed that further guidance was required to quantify constraints to residential development within the AQMA. In order to zone the AQMA, the boundary of the integrated steelworks site was used as a guide. A number of significant processes lie within the boundary of the site and some may pose a more significant risk than others. Further monitoring equipment was strategically positioned within the AQMA, increasing confidence within the zones and adding to the already extensive data archive within Scunthorpe. This data is regularly reviewed with any changes reflected in the current advice given. Figure 5 illustrates the zoning map within the AQMA and identifies two zones for the purposes of considering the development of residential dwellings.

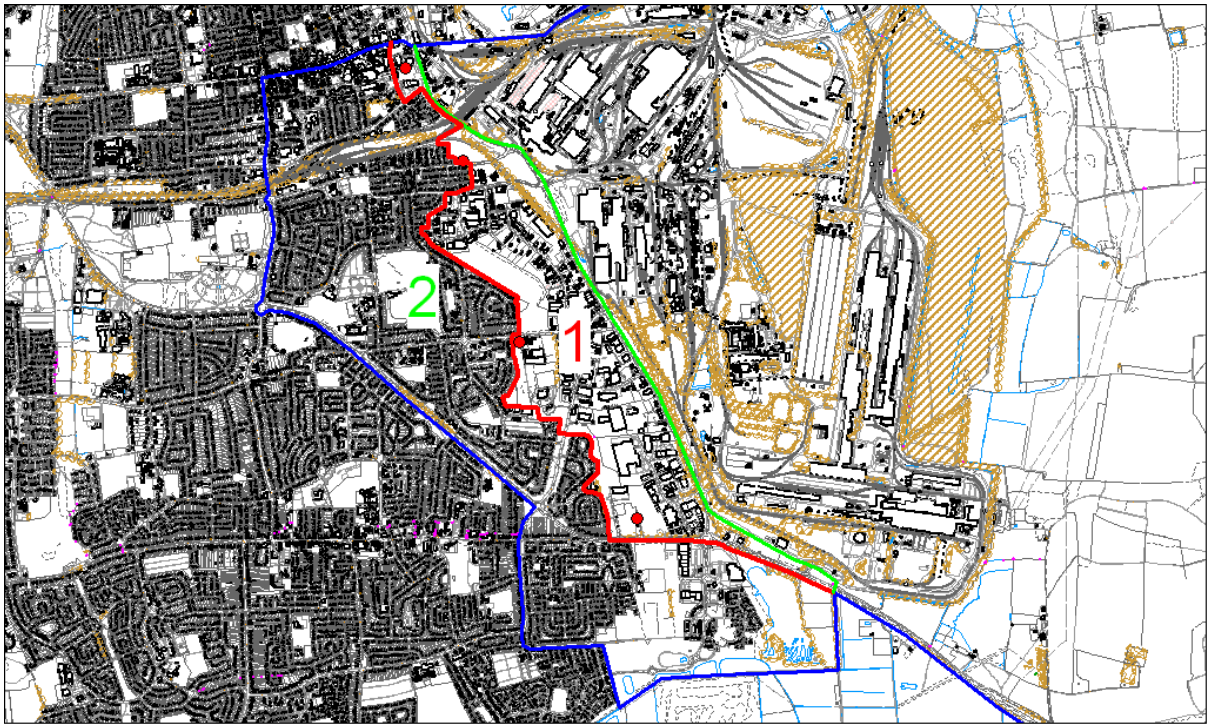

Figure 5: The two different zones within Scunthorpe's AQMA.

Zone 1 is predominantly an industrial area and is designed to maintain the current buffer between the integrated steelworks site and the town of Scunthorpe in order to protect public health.

Zone 2 is less susceptible to elevated concentrations of PM_{10} due to the increased distance from the integrated steelworks site.

Applications for residential development or other sensitive developments in these zones are assessed for air quality impacts on a site-by-site basis using the latest data.

North Lincolnshire Council has a duty to provide enough housing and employment land. The Council has therefore produced a Housing and Employment Land Allocations Development Plan Document (DPD) to highlight where development sites are available. This document is part of the North Lincolnshire Local Development Framework (LDF). The annual housing requirement for North Lincolnshire Council is 882 dwellings with the development sites highlighted in the DPD spread over the whole of North Lincolnshire.

Over the last ten years a great deal of work has been done to improve the air quality in Scunthorpe, but despite this there is still more work required inside the AQMA. The following section of this report examines the air quality results in more detail.

5 Air quality data

5.1 Data correction factors

The UK national air quality monitoring networks are largely founded on the use of the TEOM analyser, although some sites are equipped with Partisol 2025 samplers. A TEOM (Tapered Element Oscillating Microbalance) operates on the principle of an oscillating filter with resulting changes in frequency from particulate deposition. The elevated temperature that a TEOM employs to eliminate water from the sample also leads to the loss of volatile Particulate Matter. Therefore, a default correction factor of 1.3 was historically applied to the TEOM data in order to provide a "gravimetric-equivalent result". This was known to be a precautionary approach likely to overestimate the PM_{10} concentration.

A pure gravimetric result can be provided by the use of a Partisol which collects the required fraction of particulate matter on a filter. An equivalent gravimetric result can also be provided by an FDMS (Filter Dynamics Measurement System). The FDMS monitor was developed as an improvement to the TEOM in order to correct for the loss of semi-volatile particles. The system operates at 30 ºC rather than 50 ºC to reduce particle losses and therefore does not require any correction factor.

One outcome of the UK Equivalence Programme for Monitoring of Particulate Matter report completed in 2006 was that the standard TEOM analyser cannot be considered equivalent to the European reference method within the UK, even if a 1.3 slope correction factor (or any other factor) is applied. Therefore from 2009, DEFRA required all TEOM data to be corrected using the Volatile Correction Model (VCM).

The VCM works by using the volatile particulate matter measurements provided by nearby FDMS instruments (within 130km) to assess the loss of PM_{10} from the TEOM; this value is then added back onto the TEOM measurements. There is an option within the model to indicate if the 1.3 correction factor has already been applied. FDMS data has generally been used from the Scunthorpe AURN site along

with data from the Leeds AURN site and an average of other sites within range to correct TEOM data from other monitoring locations in North Lincolnshire.

This report features data presented in both 1.3 and VCM formats for purposes of data continuity. Data from before 2009 is presented in the original format it was submitted to DEFRA, i.e. VCM has not been applied.

For a strict comparison of data captured by the monitors with air quality objectives, there must be a minimum level of data capture within a calendar year. From 2015 the data capture rate stipulated by DEFRA is 85%; prior to 2015 it was 90%. Where this has not been achieved DEFRA guidance stipulates that the 90th percentile value is reported instead, as this roughly equates to the daily mean objective.

The Council continues to operate a number of TEOM monitors across the air quality network. This assists the Council in assessing progress and improvements that have occurred over a number of years by using consistent data.

5.2 Overview of monitoring in Scunthorpe

For the purpose of this report only those monitoring stations either inside Scunthorpe or in a location that is directly affected by the pollution in the area will be examined. A detailed description of every monitoring station follows in chronological order, along with results for the annual mean and number of daily exceedances. All of the data has been taken from the Updating and Screening Assessments, which are reports published every three years and submitted to DEFRA to comply with Local Air Quality Management requirements.

5.2.1 Cottage Beck Road, Scunthorpe

In 2003, when the declaration of an AQMA was being considered, the Council only operated one air quality monitoring site for PM_{10}. This was located on Cottage Beck Road in Scunthorpe, as illustrated in Figure 6.

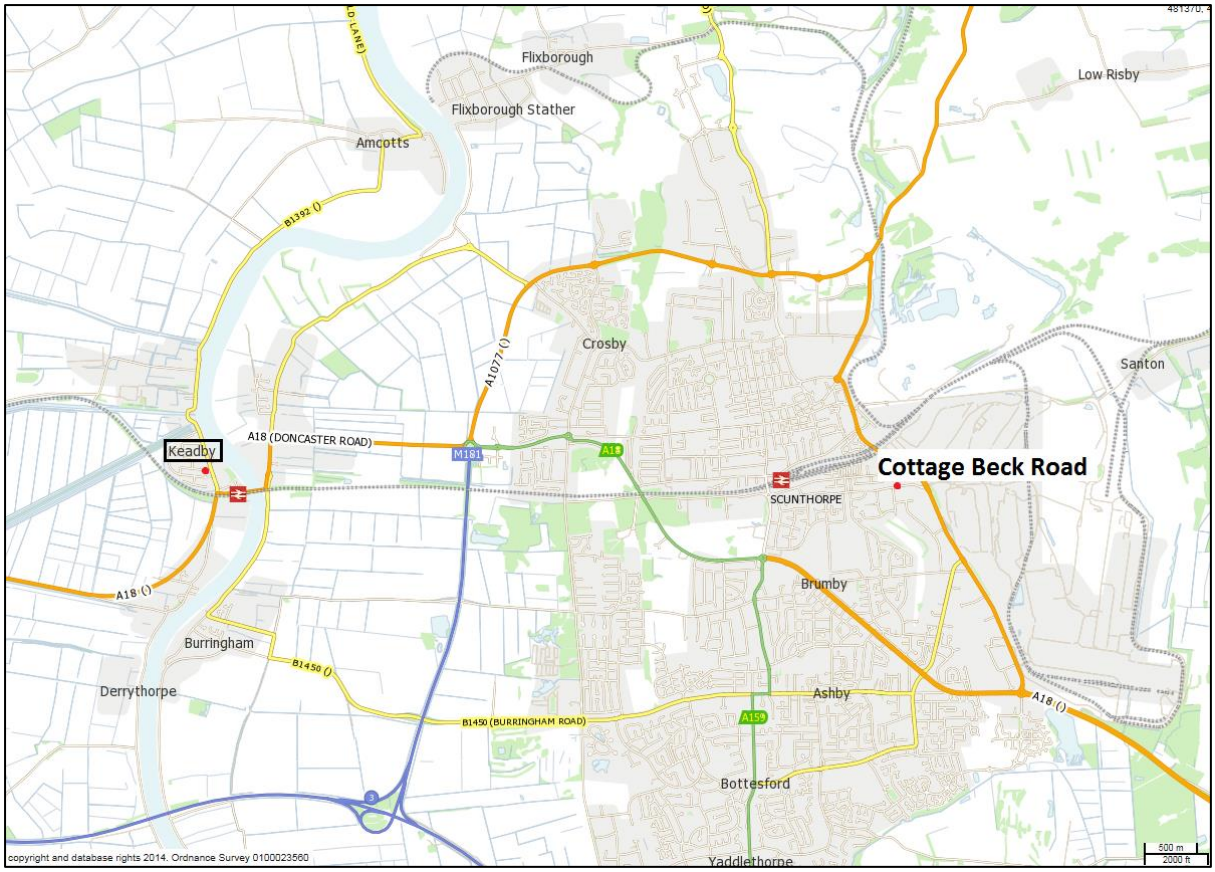

Figure 6: Location of the monitor at Cottage Beck Road

The Cottage Beck Road TEOM monitor was situated on an industrial estate, approximately 400m from the boundary with the steelworks, and measured particulate matter from December 1997 up to March 2004. The Technical Guidance LAQM.TG(09) sets out relevant locations for automatic monitoring sites relative to the averaging time of the specific air quality objective, which in this instance is daily. This location was therefore deemed to be unrepresentative as exposure would be unlikely. In April 2004 the monitor was re-located to Rowland Road and became the Scunthorpe Town AURN monitoring station. It is a similar distance from the steelworks, but is closer to residential properties. The results from the monitor located at Cottage Beck Road in the years directly preceding the AQMA declaration can be seen in Table 3

Year	Data_capture (%)	Annual_mean concentration (µg/m^3)	Number of daily mean exceedances
1998	99.7	28	**41**
1999	98.8	29	**45**
2000	89.5	27	33
2001	93.0	32	**51**
2002	84.4	25	**48**
2003	98.8	39	**95**
2004*	20.5	n/a	59†

Table 3: Monitoring results from the Cottage Beck Road monitor using the 1.3 correction factor. The VCM has not been applied.

* Up to 18th March. † 90th percentile

5.2.2 Scunthorpe Town AURN

This site began monitoring in June 2004 and is located in a small field owned by British Steel on Rowland Road (Figure 7). It is the longest continuous monitoring location operated by North Lincolnshire Council, and it is still in use today. The site is part of the Automatic Urban and Rural Network (AURN), and has had a standard TEOM since the start of the site's operation.

Figure 7: Air quality monitoring stations in Scunthorpe from 2005-2010

In December 2009 an FDMS was added to the site. As discussed earlier, an FDMS is more accurate than a standard TEOM and does not require any correction factors to be applied. Data from this FDMS is also used in the VCM calculation for the standard TEOMs operated in other locations in North Lincolnshire. The results for the Scunthorpe Town AURN can be seen in Table 4 and Table 5.

Year	Data capture (%)	Annual mean concentration 1.3_data (µg/m3)	Annual mean concentration VCM_data (µg/m3)	Number of daily mean exceedances, 1.3.data	Number of daily mean exceedances, VCM data
2004*	54.4	n/a		55†	
2005	98.1	25		25	
2006	96.1	30		**37**	
2007	98.0	25		18	
2008	73.5	n/a		18	22
2009	90.4	24	21	12	11
2010	83.3	23	22	11	16
2011	95.7	24	22	20	24
2012	91.8	23	21	16	16
2013	94.2	26	23	26	24
2014	90.1	21	22	20	18
2015	94.0	21	19	7	9

Table 4: Monitoring results for the standard TEOM from the Scunthorpe Town AURN monitoring station.

* From the 6th June 2004. † 90th percentile

Year	Data capture (%)	Annual_mean concentration (µg/m3)	Number of daily mean exceedances
2010*	27.0	n/a	43†
2011	95.2	22	20
2012	84.0	21	38†
2013	78.2	23	40†
2014	91.9	21	17
2015	90.3	21	16

Table 5: Monitoring results for the FDMS from the Scunthorpe Town AURN monitoring station.

* From the 23rd September. † 90th percentile

5.2.3 East Common Lane

This site measures PM_{10} using a standard TEOM and is located to the south of a small block of flats on East Common Lane. The integrated steelworks site is approximately 550m east of this site (Figure 7). Monitoring began here in March 2005 and was part of the expansion of the air quality network in response to the declaration of the AQMA. The site is still in operation today, and continues to use a standard TEOM, with the results in Table 6.

Year	Data capture (%)	Annual mean concentration 1.3_data (µg/m3)	Annual mean concentration VCM_data (µg/m3)	Number of daily mean exceedances, 1.3 data	Number of daily mean exceedances, VCM data
2005*	75.1	28		55†	
2006	97.5	29		**43**	
2007	99.5	27		34	
2008	98.1	28	25	**43**	**40**
2009	96.2	24	22	20	17
2010	96.5	25	23	21	11
2011	96.1	27	26	32	29
2012	95.2	24	22	21	19
2013	95.9	28	25	**43**	35
2014	99.1	27	23	**39**	27
2015	94.5	22	19	16	9

Table 6: Results for the East Common Lane monitoring site.

* From the 1st April 2005. † 90th percentile

5.2.4 Allanby Street

This monitoring station was located on a small patch of grass, adjacent to a local car park and close to Scunthorpe Town centre. PM_{10} was measured with a standard TEOM. The High Street is 100m from the site and Britannia Corner, a busy junction is 150m away. The monitor was approximately 1km north east from the boundary of the integrated steelworks site (Figure 7). It began monitoring in July 2005 and stopped recording in 2010. Results from this monitoring station can be seen in Table 7.

Year	Data capture (%)	Annual_mean concentration_1.3_data (µg/m3)	Number of daily mean exceedances, 1.3 data
2005*	42.5	n/a	51†
2006	97.2	28	23
2007	99.6	24	11
2008	98.0	24	12
2009	95.0	22	2
2010[a]	26.3	n/a	38†

Table 7: Results for the Allanby Street monitoring site.

* From the 1st July 2005. † 90th percentile. [a] Up to the 7th April 2010.

5.2.5 Lincoln Gardens

This site was located within the grounds of Lincoln Gardens Primary School approximately 2.5 km west of the integrated steelworks site (Figure 7). To the east of the site was a park with the remaining area all being residential. The site began monitoring in December 2004 and stopped in June 2010. The results for the Lincoln Gardens monitor can be seen in Table 8.

Year	Data capture (%)	Annual_mean concentration_1.3_data (µg/m3)	Number of daily mean exceedances, 1.3 data
2005	98.2	23	9
2006	98.0	25	17
2007	99.5	23	14
2008	94.6	23	21
2009	91.5	21	7
2010	81.8	20	31†
2011*	25.4	n/a	38†

Table 8: Results for the Lincoln Gardens monitoring site.

* Up to 4th April. † 90th percentile.

5.2.6 Low Santon

The analysers at the Low Santon monitoring station are housed within an enclosed unit to the north east of Scunthorpe, on the eastern boundary of the integrated steelworks site (Figure 8). Dawes Lane is 5m to the south of the monitoring station, running from a rural location in the east through the steelworks and into Scunthorpe. A raised embankment 5m north of the site carries freight traffic along one of the major rail lines into the steelworks. The surrounding area consists of arable fields with a number of trees and to the east, a small residential area.

A standard TEOM began monitoring PM_{10} in October 2005, and subsequently an FDMS monitor was installed in March 2010. Results can be seen in Table 9 and Table 10.

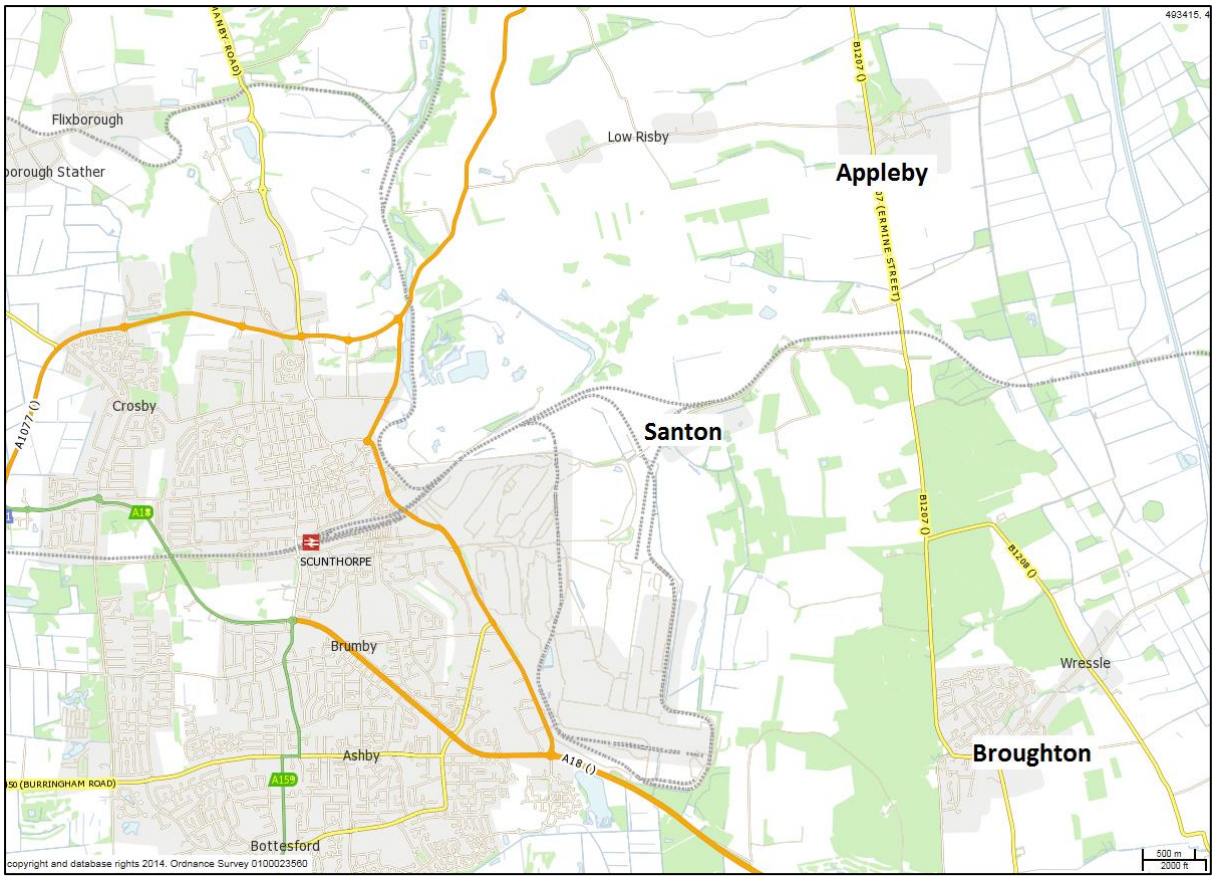

Figure 8: The villages of Broughton, Appleby and Santon in relation to Scunthorpe and the integrated steelworks site.

Year	Data capture (%)	Annual mean concentration 1.3_data (µg/m3)	Annual mean concentration VCM_data (µg/m3)	Number_of daily_mean exceedances, 1.3 data	Number_of daily mean exceedances, VCM data
2005*	24.9	n/a		94†	
2006	96.0	59		**158**	
2007	91.6	51		**133**	
2008	84.9	46	39	**79**†	**73**
2009	93.5	46	39	**97**	**78**
2010	92.6	39	33	**84**	**58**
2011	87.0	47	39	**78**†	**73**
2012	90.7	33	29	**38**	21
2013	90.2	39	33	**61**	**43**
2014	84.6	35	30	**61**†	32
2015	58.2	n/a	28	**42**	**68†**

Table 9: Results for the Low Santon standard TEOM.

* From the 1st October 2005. † 90th percentile.

Year	Data capture (%)	Annual mean concentration (µg/m3)	Number of daily mean exceedances
2010*	47	n/a	62†
2011	92.4	35	**50**
2012	89.0	26	42†
2013	85.6	28	44†
2014	92.8	25	18
2015	88.5	28	22

Table 10: Results for the Low Santon FDMS.

* From the 1st April 2010. † 90th percentile

5.2.7 Broughton

To the east of the AQMA a standard TEOM was situated in the village of Broughton in the approximate direction of the prevailing wind (Figure 8). The site was located in an Anglian Water enclosure within a residential area, approximately 3km east of the steelworks site. The B1207 is 500m west of the site and the area between this road and the integrated steelworks site is comprised of woods and fields. Results for the Broughton monitoring site can be seen in Table 11.

Year	Data_capture (%)	Annual mean concentration 1.3 data (µg/m3)	Number of daily mean exceedances, 1.3 data
2006[a]	72.9	n/a	39†
2007	98.7	23	5
2008	99.1	22	3
2009	97.7	20	0
2010*	45.4	n/a	35†

Table 11: Results for the Broughton monitoring site.

[a] From the 10th March 2006. * Up to 23rd July. † 90th percentile

5.2.8 Appleby

At the start of 2007 a standard TEOM was located in the village of Appleby, situated to the east of the integrated steelworks site, approximately 6km northeast of Scunthorpe (Figure 8). This monitor was located on a playing field in the village and surrounded by arable farmland and open fields. Results for the Appleby monitoring site can be seen in Table 12.

Year	Data capture (%)	Annual mean concentration 1.3 data (µg/m3)	Annual mean concentration VCM data (µg/m3)	Number of daily mean exceedances, 1.3 data	Number of daily mean exceedances, VCM data
2007[a]	87.1	24		8	
2008	97.6	24	22	5	5
2009	97.2	21	20	1	5
2010	77.8	19	19	28†	2
2011	90.2	22	21	3	7
2012	92.8	18	18	0	1
2013	96.5	21	18	3	6
2014	96.9	21	16	1	4
2015	92.6	21	19	1	2

T**able 12:** Results for the Appleby TEOM.

* From the 24th March to 24th August 2005. † 90th percentile. [a] From the 7th February 2007.

The monitoring stations installed in Appleby and Broughton were both part of the expansion of the monitoring network to determine whether the scope of the AQMA

was correct. However, a secondary use for the sites has been that they provide a local 'background' concentration. This allows a comparison to be made between concentrations with and without emissions from the steelworks site.

The results from the monitors situated outside of the AQMA suggested that the boundary was originally situated in the correct position. The monitor at Broughton stopped measuring at the end of 2008, Allanby Street at the end of 2010 and Lincoln Gardens at the end of 2011. The monitors were then re-positioned into areas with poorer air quality inside the AQMA.

5.2.9 Redbourn Club

Redbourn Club is a sports and social club situated 1km from the boundary of the integrated steelworks site (Figure 7). The monitoring station is sited away from buildings and trees close to the boundary of the clubs cricket pitch. PM_{10} is monitored at this site using a standard TEOM monitor and the results can be seen in Table 17.

Year	Data capture (%)	Annual mean concentration 1.3 data (µg/m3)	Annual mean concentration VCM data (µg/m3)	Number of daily mean exceedances, 1.3 data	Number of daily mean exceedances, VCM data
2010	36.6	n/a		36†	
2011	97.6	24	22	17	22
2012	92.7	21	20	12	10
2013	77.0	23	22	44†	17
2014	95.2	24	21	21	18
2015	99.0	21	19	10	6

Table 13: Results for the Redbourn Club TEOM.

* From the 17th August 2010. † 90th percentile.

5.2.10 Lakeside

The Lakeside monitoring station sits within a newly built housing development 600m to the south of the integrated steelworks site (Figure 7). It is sited within the communal front garden of the development less than 5m from the road. Originally the Lakeside area was not intended to be included in the AQMA as the area was

undeveloped with no relevant receptors, but prior to declaration of the AQMA the boundary was revised to include this area due to the planned development of a large housing estate. In 2011 a TEOM was successfully installed with the results available in Table 14.

Year	Data capture (%)	Annual mean concentration 1.3 data (µg/m3)	Annual mean concentration VCM data (µg/m3)	Number of daily mean exceedances, 1.3 data	Number of daily mean exceedances, VCM data
2011	71.1	n/a		49†	
2012	78.3	24	22	43†	**39†**
2013	98.5	25	23	14	12
2014	94.8	25	22	10	10
2015	92.9	23	20	11	13

Table 14: Results for the Lakeside TEOM.

* From the 14th April 2011. † 90th percentile.

5.2.11 Amvale

This site is located on a brownfield site towards the south of the daily mean AQMA (Figure 7). Originally an Osiris monitor was used for screening and was in place from June 2010. The first full year of Osiris data was 2011, when there were 14 daily exceedances, and then 16 in 2012. Subsequently this site was upgraded to a TEOM in April 2013 with the results available in Table 15.

Year	Data capture (%)	Annual mean concentration 1.3 data (µg/m3)	Annual mean concentration VCM data (µg/m3)	Number of daily mean exceedances, 1.3 data	Number of daily mean exceedances, VCM data
2013*	62.2	n/a		42†	
2014	83.3	24	21	44†	13
2015	89.1	22	20	37†	9

Table 15: Results for the Amvale TEOM.

* From the 25th April 2013. † 90th percentile.

5.2.12 Church Square

The site was located west of the integrated steelworks site, close to the 20-21 Visual Arts Centre at Church Square on council owned land. The nearest road is Brigg Road and the distance from the site is approximately 78m. The site operated from July 2013 monitoring PM_{10} using a TEOM. This monitor was relocated in July 2014 to High Street East as the site was being redeveloped. Results from this monitoring site can be seen in Table 16.

Year	Data capture (%)	Annual mean concentration 1.3 data (µg/m3)	Number of daily mean exceedances, 1.3 data
2013*	46.7	n/a	40†
2014*	50.2	n/a	51†
12 months continuous data	96.9	25	16

Table 16: Results for the Church Square TEOM.

* From the 12th July 2013 up to the 11th July 2014. † 90th percentile.

5.2.13 High Street East

The TEOM at High Street East started measurement in August 2014. The High Street East site is approximately 300m from Church Square and is less than 100m from the boundary of the integrated steelworks site. Results from this monitoring site can be seen in Table 17.

Year	Data capture (%)	Annual mean concentration 1.3 data (µg/m3)	Annual mean concentration VCM data (µg/m3)	Number of daily mean exceedances, 1.3 data	Number of daily mean exceedances, VCM data
2014*	28.4	n/a		41†	
2015	94.2	25	22	10	12

Table 17: Results for the High Street East TEOM.

* From the 22nd August 2014. † 90th percentile.

5.3 Partisol monitors

North Lincolnshire council has also operated two Partisol monitors. These require one filter per day which are then sent off to a laboratory for analysis. The results are an exact measurement of captured particulates and therefore do not require a correction factor to be applied. The monitors held two weeks' worth of filters which would be replaced on a fortnightly basis. One Partisol operated from December 2006 to December 2014 at High Santon. The other Partisol was operational at the Scunthorpe Town AURN site on Rowland Road from September 2006 up to March 2010. Results from the High Santon and Rowland Road Partisol monitors can be seen in Table 18.

	Scunthorpe Town		High Santon	
Year	Annual mean (ug/m3)	Number of daily exceedances	Annual mean (ug/m3)	Number of daily exceedances
2006	23	8		
2007	22	15	31	38
2008	21	24	31	36
2009	19	6	27	28
2010	20	2	24	13
2011			29	35
2012			25	10
2013			25	12
2014			26	19

Table 18: Results from the two Partisol monitors at Scunthorpe Town and High Santon.

5.4 Osiris monitors

Osiris air quality monitors are smaller more mobile units which measure PM_{10}, $PM_{2.5}$ and PM_{1}. They are not as accurate as TEOMs and cannot be used to declare or revoke an AQMA, but they can be used as a screening tool. For this reason an Osiris monitor is often placed in a location for a short period of time, before being moved onto another site. This has helped to identify areas where there is a potential problem with the local air quality, for example, an Osiris monitor was placed at the Amvale site in June 2010 before being replaced with a TEOM in April 2013.

North Lincolnshire Council currently has five Osiris monitors, including one co-located at the East Common Lane site for the purpose of measuring $PM_{2.5}$. Another is permanently is situated at South Ferriby, close to a large Cemex plant, approximately 10 miles north east of Scunthorpe. The remaining monitors are used as spares or for short term placements.

5.5 Current air quality monitoring inside the AQMA

Inside the AQMA there are currently seven sites, each with a TEOM, and two sites with an additional FDMS monitor (Table 19).

Monitoring site	Monitor type	Date monitoring began
Scunthorpe Town AURN	TEOM	June 2004
	FDMS	December 2007
East Common Lane	TEOM	April 2005
Redbourn Club	TEOM	August 2010
Low Santon	TEOM	October 2005
	FDMS	April 2010
Lakeside	TEOM	April 2011
Amvale	TEOM	April 2013
High Street East	TEOM	August 2014

Table 19: Date monitoring began for the current sites inside of the AQMA

The continuous monitoring from the TEOMs at the Scunthorpe Town AURN site and Low Santon, along with the East Common Lane TEOM provide a very good long term robust record of the air quality inside the AQMA.

6 Data Analysis

This section will examine the air quality data in more detail, beginning with the sites that are no longer in operation, and then the established sites that have been in operation since 2006. Finally this section will look at wind data, and how it affects PM_{10} pollution.

6.1 Former monitoring sites

The air quality monitoring sites at Lincoln Gardens and Allanby Street were only in operation for a limited number of years, but as can be seen in Figure 9 they were always compliant with the daily mean air quality objective. Allanby Street monitor recorded the highest number of daily exceedances with 23, although this was in 2006 before initiatives from the air quality action plan had been implemented.

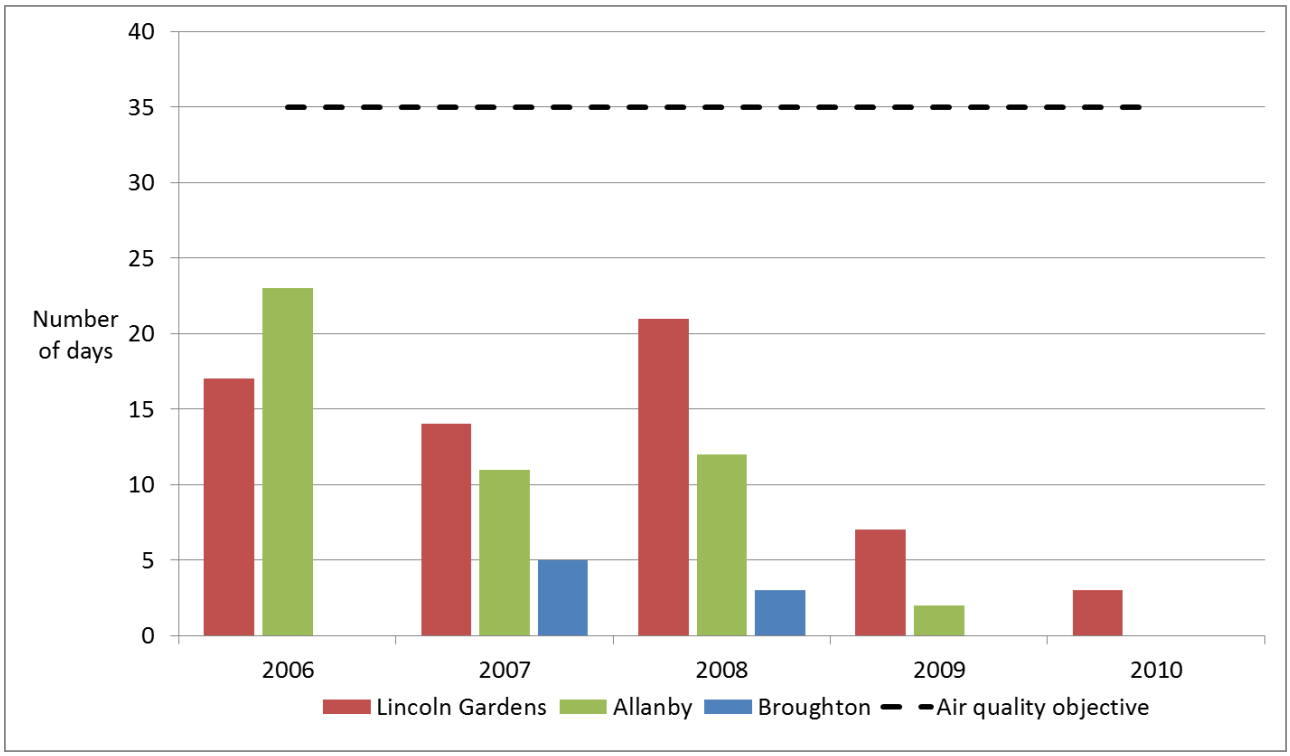

Figure 9: Daily mean exceedances using 1.3 data for the former sites at Lincoln Gardens, Allanby Street and Broughton

The monitors at Lincoln Gardens and Allanby Street were situated outside of the AQMA boundary to ensure that some of the high density residential areas were not breaching the air quality objectives. When it became clear that these two sites were not likely to exceed the daily mean objective the monitors were moved to new sites within the AQMA boundary.

Monitors were located at Broughton and Appleby as these were the closest residential areas to the east of the Steelworks site, where they would be affected by the prevailing wind. Despite a history of compliance with air quality objectives, the Appleby monitor has been retained as it is useful to determine the background pollution concentration. Further, days when there are regional or national air quality incidents, which are not related to the integrated steelworks site can be identified.

6.2 Established monitoring sites

The monitors at Scunthorpe Town, East Common Lane and Low Santon provide a good long term record of air quality within the AQMA, as all of these monitors have been recording data since 2006. The Scunthorpe Town and Low Santon sites have the additional data from FDMS monitors, providing an even more robust view of the air quality in Scunthorpe. The long term data from the Scunthorpe Town and East Common Lane sites is presented in Figure 10. It can be seen that the only breach to have occurred since 2009 is at East Common Lane with the 1.3 data, although there were 35 exceedances with VCM data in 2013. Technically 35 exceedances is not a breach of the daily mean objectives. The Scunthorpe Town site has not recorded a breach of the daily mean objective since 2006, although both the 1.3 and VCM data recorded more than 20 exceedances in 2013. There does not appear to be any long term trends in the data from these two monitoring sites.

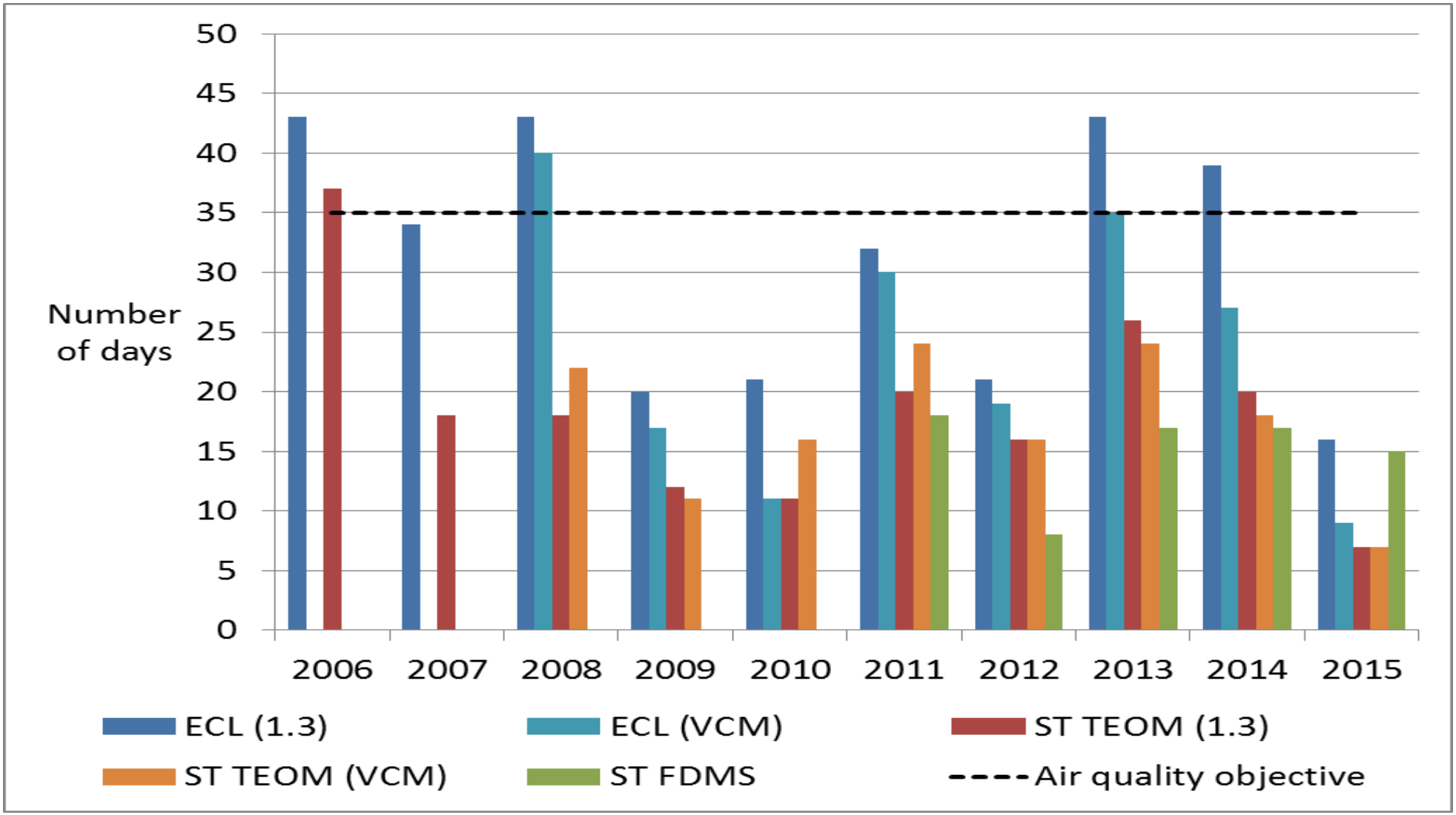

Figure 10: The long term data from the East Common Lane (ECL) monitor and the Scunthorpe Town AURN site (ST).

Pollution levels at the Low Santon monitoring site have improved vastly over the last ten years, with Figure 11 illustrating a clear long term downward trend in the number of daily mean exceedances. From 2006 to 2012 there has been a reduction from 158 daily mean exceedances down to 38, when looking at the 1.3 data, although this rose to 61 exceedances for 2013 and 2014. This is still almost 100 days when the 2014 daily mean objective was not exceeded compared to 2006. This improvement represents a great deal of hard work by all of the industries located on the Integrated Steelworks, notably British Steel, Tarmac and Harsco, working alongside the Environment Agency and North Lincolnshire Council. The VCM applied data has recorded fewer daily mean exceedances than the daily mean objective in two of the last three years, whilst the FDMS has not breached the objective since 2011.

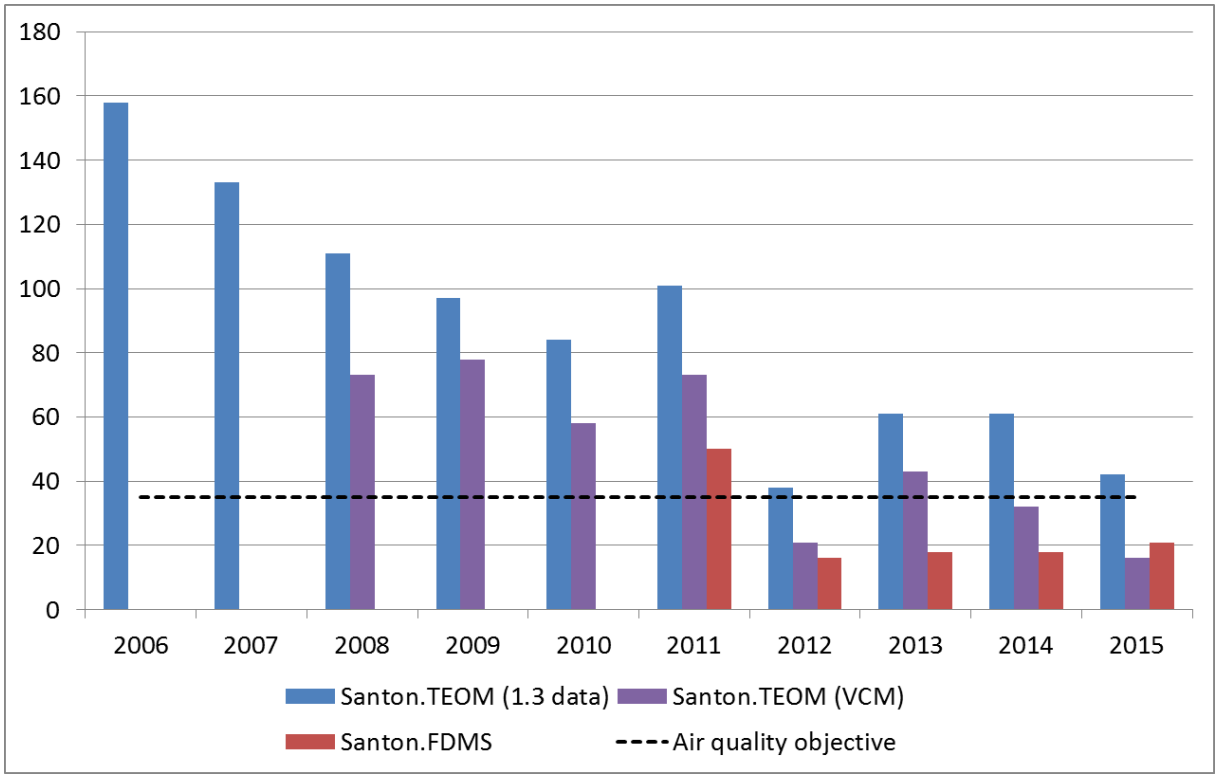

Figure 11: Air quality data from the Santon monitoring station.

One area where the data highlights the good work done by the local industries is illustrated in Figure 12. This shows the number of “high” daily exceedances (1.3 TEOM data), where the daily mean was greater than 60µg/m^3. This reduction from over 100 high daily exceedances ten years ago to 24 in 2015 is also a remarkable turnaround, as illustrated by the trend line. This reduction in the high concentrations recorded is one of the reasons why the annual mean recorded at Low Santon has drastically reduced over the last ten years.

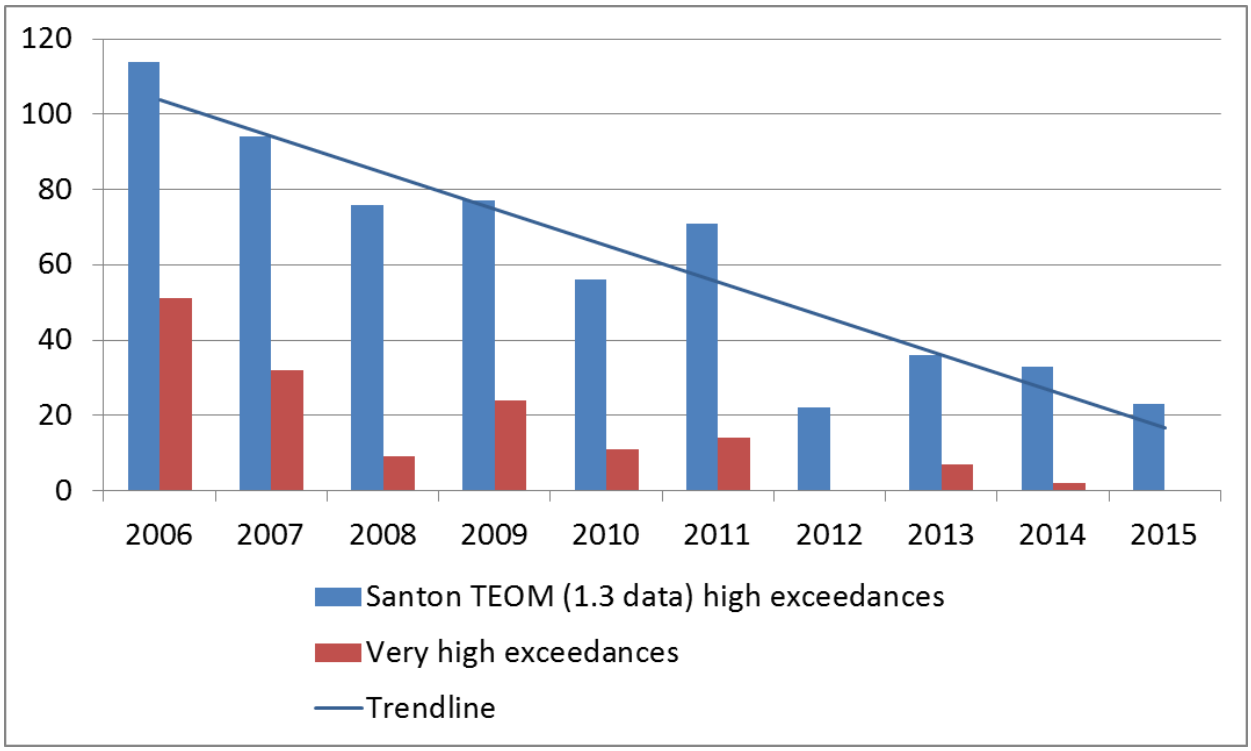

Figure 12: The number of daily mean exceedances at Santon where the concentration is greater than 60µg/m^3 (blue), and then greater than 100µg/m^3 (red).

6.3 Weather

With the integrated steelworks site being so close to Scunthorpe, the weather plays an integral role in the air quality in the town. The wind direction is predominantly from the south west, which partly explains why levels of particulates are higher at Low Santon than at sites to the west of the integrated steelworks site.

Exceedances are more likely to occur at the monitors situated to the west of the steelworks, for example, East Common Lane and the Scunthorpe Town AURN site in the spring and to a lesser extent in the autumn when there are generally greater instances of the wind originating from the north east. Figure 13 illustrates the wind direction and wind speed from 2009 up to 2014, collected from the Scunthorpe Town monitor, and Table 20 shows the percentage for each 30 degree sector. It can also be seen that the four sectors between 180 degrees and 300 degrees is where the wind direction is from most often; demonstrating the predominant wind direction.

Sector\Year	2009	2010	2011	2012	2013	2014	2015
0-30	4.4	7.8	3.6	8.5	9.5	10.2	3.2
30-60	5.7	8.1	4.1	5.6	7.7	7.4	3.2
60-90	5.8	4.6	4.8	4.7	7.4	7.4	3.9
90-120	3.2	3.8	4.0	4.2	5.4	3.9	3.2
120-150	2.5	3.0	3.2	2.9	1.9	2.7	4.7
150-180	10.0	8.5	10.3	7.2	6.1	9.4	7.5
180-210	16.9	11.7	15.9	15.1	15.0	16.1	16.1
210-240	16.1	10.2	17.0	14.9	14.4	14.4	18.1
240-270	13.5	10.7	15.6	12.6	11.3	10.4	14.1
270-300	11.0	12.9	11.3	12.3	9.7	8.4	13.3
300-330	6.7	10.6	6.4	6.9	6.8	5.5	5.5
330-360	4.3	8.1	3.9	5.4	4.8	4.2	2.8

Table 20: Wind direction percentage for each 30 degree sector.

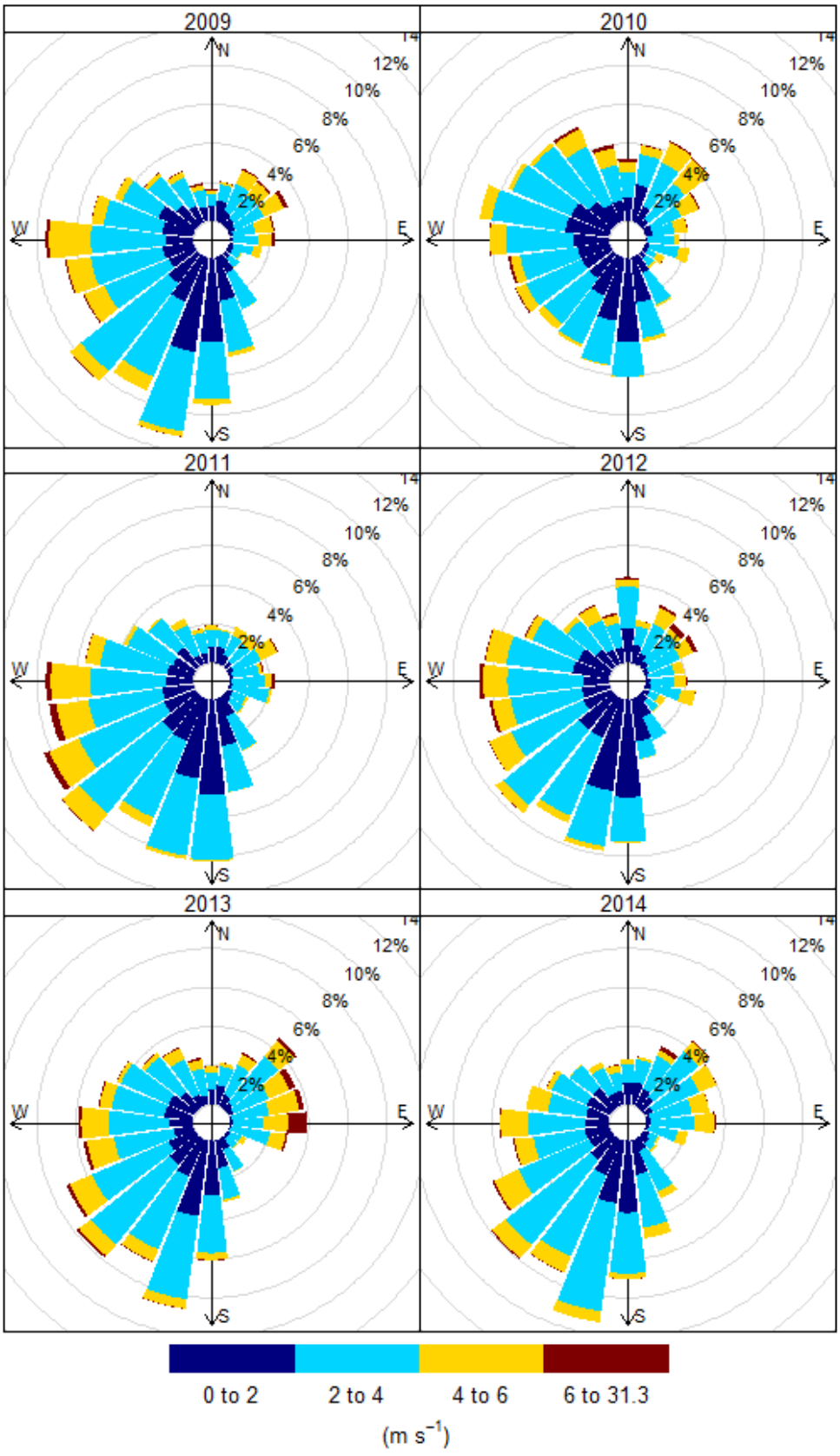

Figure 13: Wind roses for Scunthorpe from 2009 to 2014 using data from the Scunthorpe Town AURN site.

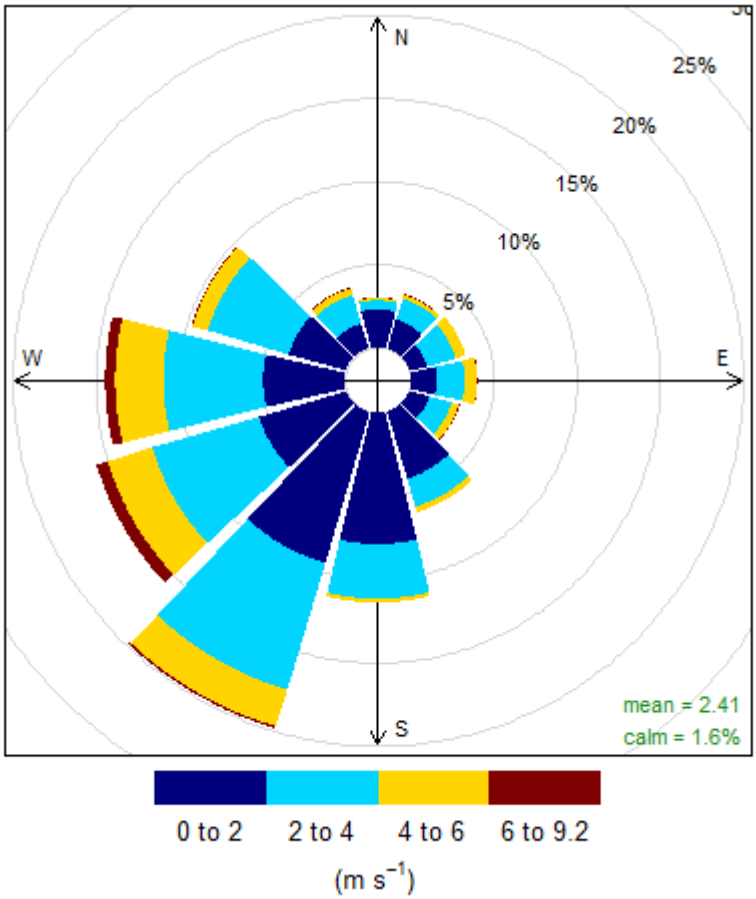

Figure 14: Wind direction and wind velocity for 2015

The predominant wind direction for 2015 was the same as with all previous years, from the south west, as illustrated in Figure 14. There is a difference though, in that there are very few days when the wind comes from the direction of the integrated steelworks site, which partly explains why there are fewer daily exceedances in 2015.

6.4 Wind direction data analysis

The weather plays an integral role in the dispersion of particulate matter, specifically the wind speed and direction. This section therefore combines wind data with pollution data to analyse the more prescient results in more detail. Therefore only the last three years of data will be examined, as these are the most relevant with respect to revoking or amending an AQMA. Scunthorpe Town, East Common Lane, Redbourn Club, Amvale and Low Santon will also be the only sites examined in this section, as they are established sites with historically poor air quality.

6.4.1 Scunthorpe Town AURN

The Scunthorpe Town AURN monitoring station on Rowland Road is situated slightly north and to the west of the steelworks, and experiences fewer daily exceedances than East Common Lane, even though the site is closer to the steelworks. The main areas on the steelworks site that could affect the Scunthorpe Town AURN monitor include the Plate Mill, Redbourne Steel Stocking area, Appleby Coke Ovens and Harsco Metals. Figure 15 illustrates the locations of the main processes and larger regulated industries on the integrated steelworks site.

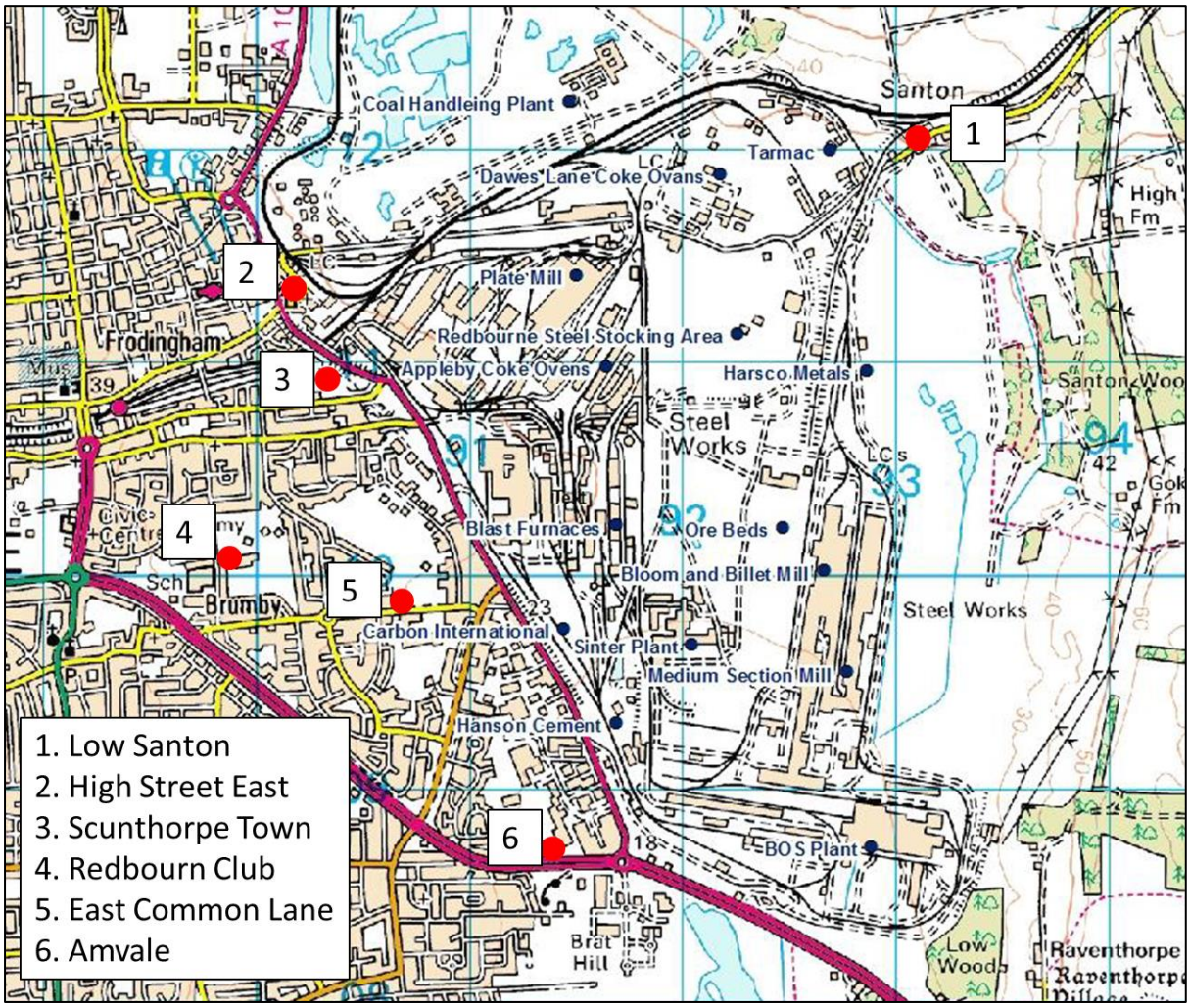

Figure 15: The location of the main processes and larger regulated industries on the integrated steelworks site.

One method that can be used to determine where the pollution originates is with bivariate polar plots, which are a statistical function used to show pollutant concentration by wind speed and direction, as illustrated in Figure 16.

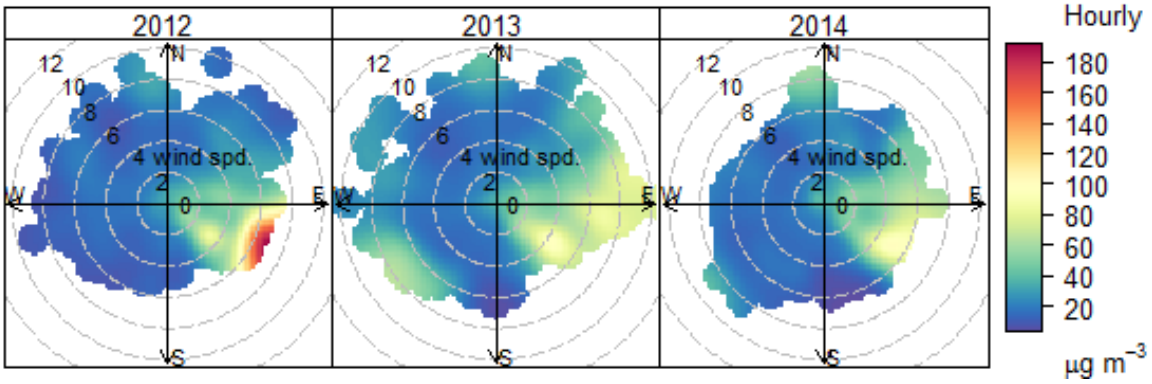

Figure 16: Bivariate polar plots for the years 2012-2014 using 1.3 TEOM data from the Scunthorpe Town monitoring site.

TEOM 1.3 data has been used in this plot and is used throughout this section for long term comparison purposes.

It can be seen in the plots that in 2012 when the wind speed was in excess of 6 m/s and from the east south east direction the PM_{10} hourly concentration was greater than 150µg/m^3. In 2013 and 2014 the hourly pollutant concentrations reached a maximum of 120µg/m^3, but the wind direction when these high concentrations were recorded was again from the east and south east.

6.4.2 East Common Lane

This site is located to the west of the steelworks site and the main areas on the integrated steelworks site where emissions could affect the monitors include the Blast Furnaces, Ore Beds, Sinter Plant and the Medium Section Mill, along with the associated industry of Carbon International (Figure 15).

Figure 17 illustrates the bivariate polar plots from the East Common Lane TEOM using 1.3 data for the last three years, and as with the Scunthorpe Town monitor, it is clear where the pollution originates. The direction of the highest concentrations (> 140 µg/m^3) is similar for all three years, namely from the east, although in 2014 the highest concentrations recorded are lower than the previous two years.

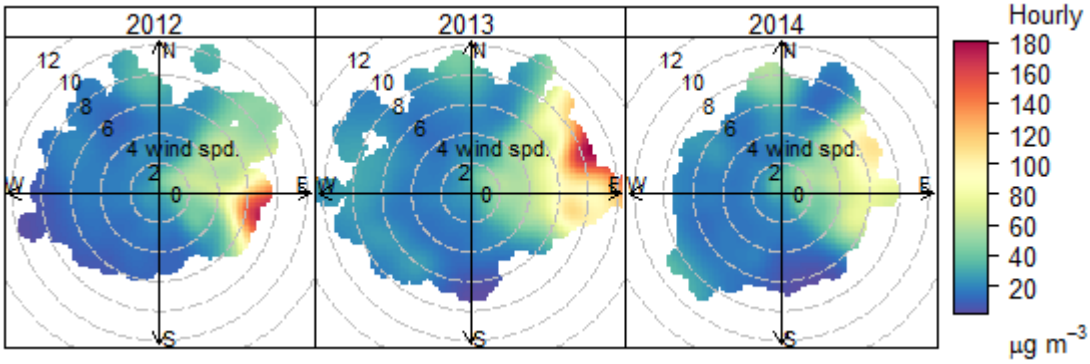

Figure 17: Bivariate polar plots for the years 2012-2014 using 1.3 TEOM data for the East Common Lane monitoring site.

Another way of looking at the data is with what is known as a Polar Annulus plot, as can be seen in Figure 18. This illustration shows all of the data from 2014 for the East Common Lane monitor and has been averaged for each hour of the day, along with showing the wind direction. It can be seen that the higher concentrations of PM_{10} occur when the wind direction is from the east and north east. Higher concentrations are evident from approximately 6am to 6pm, although there are relatively high levels throughout the 24 hour period, demonstrating that the PM_{10} is generated from a variety of sources.

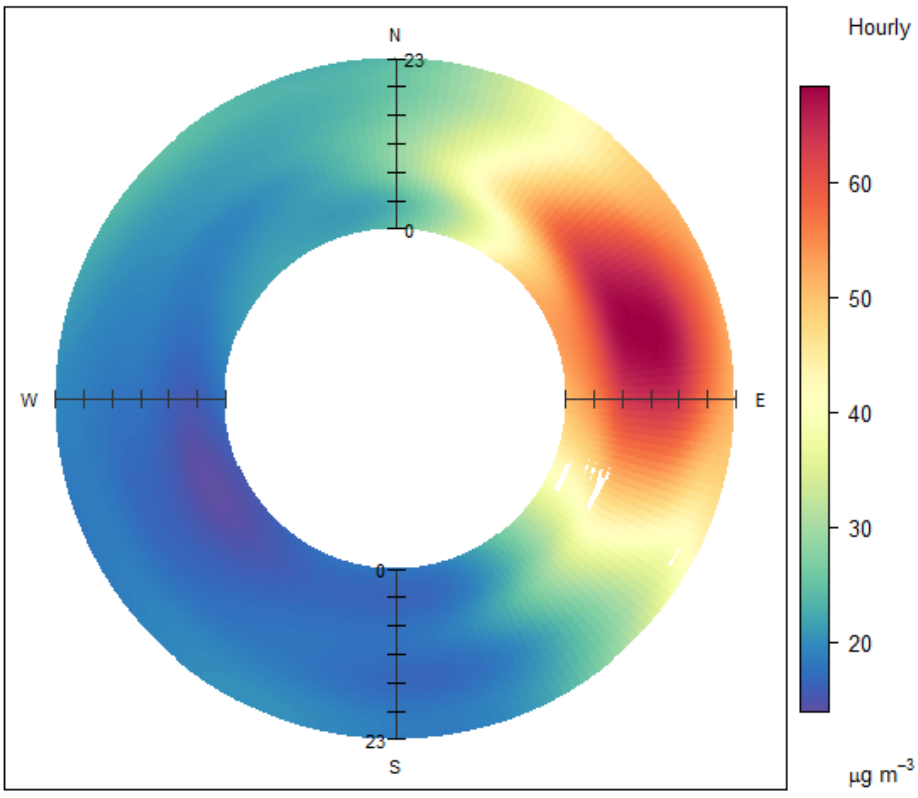

Figure 18: A Polar Annulus plot for East Common Lane from 2014

Further data analysis can be achieved by only looking at those days when the mean wind direction is 30-120 degrees. This can be illustrated with the use of a calendar plot, as seen in Figure 19. This function illustrates one year of data by month, laid out in a conventional calendar format. The main purpose is to help visualise potentially complex data in a familiar way.

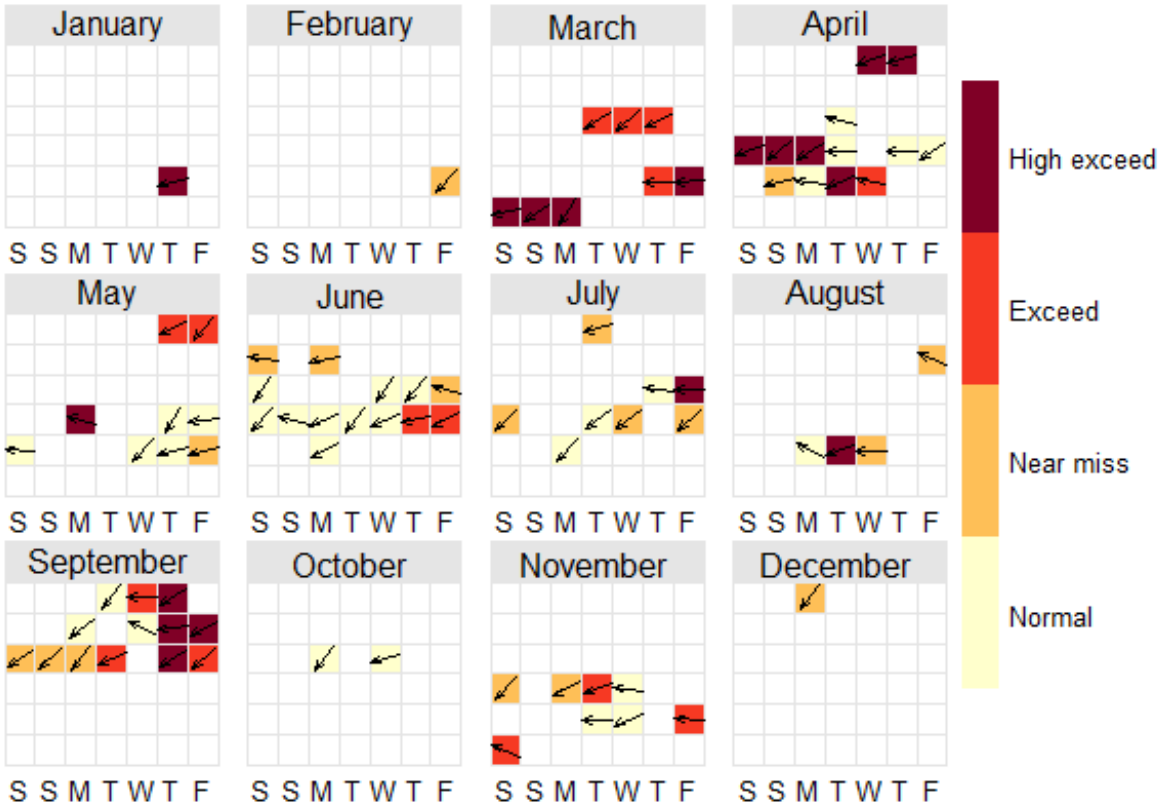

Figure 19: Calendar plot using 1.3 TEOM data for 2014 from the East Common Lane monitor, but only showing results when the mean daily wind direction was 30-120 degrees.

This plot also clearly demonstrates that the higher levels of particulates, and associated exceedances, occur in the spring and early autumn.

In 2014 there were 82 days when the mean wind direction was 30-120 degrees. Of these 82 days, 38% of them had a daily mean greater than 50µg/m^3, as illustrated in Table 21. In total there were only 6 days in 2014 that resulted in an exceedance where the wind direction was not directly from the steelworks.

	Normal (<40µg/m^3)	Near miss (40 - 50µg/m^3)	Exceedance (50 - 60µg/m^3)	High exceedance (>60µg/m^3)
Number_of days	31	18	15	18

Table 21: Analysis of the 82 days when the wind direction was 30-120 degrees from the East Common Lane site.

There are limitations with using a daily mean wind direction; however it does give a good general overview. More in-depth analysis should be undertaken when investigating individual pollution episodes.

6.4.3 Redbourn Club

The monitors at East Common Lane and Redbourn Club are on similar trajectories (Figure 7) from the integrated steelworks. The primary difference between the two sites is that Redbourn Club is approximately 600m further away from the steelworks than East Common Lane. Wind direction analysis for Redbourn Club from 2014 also recorded 82 days when the mean wind direction was from 30-120 degrees. Table 22 highlights the results from this wind direction analysis.

	Normal (<40µg/m^3)	Near miss (40 - 50µg/m^3)	Exceedance (50 - 60µg/m^3)	High exceedance (>60µg/m^3)
Number_of days	43	13	11	10

Table 22: Analysis of the 82 days when the wind direction was 30-120 degrees from the Redbourn Club site.

The annual mean 1.3 data for 2014 for the Redbourn Club site was 24µg/m^3 (Table 6), but when calculated for only those days when the wind direction was 30-120 degrees the mean was 41µg/m^3. Admittedly this is only a quarter of the year, but it highlights the impact that both the wind and the steelworks site have. The mean from East Common Lane using the same wind direction sector for 2014 was 49µg/m^3, compared to the annual mean of only 27µg/m^3.

It can be seen from the data in Tables 21 and 22, that Redbourn Club experiences a lower level of particulate pollution than East Common Lane. This can further be demonstrated in Figure 20 which shows daily PM_{10} concentrations for 2014.

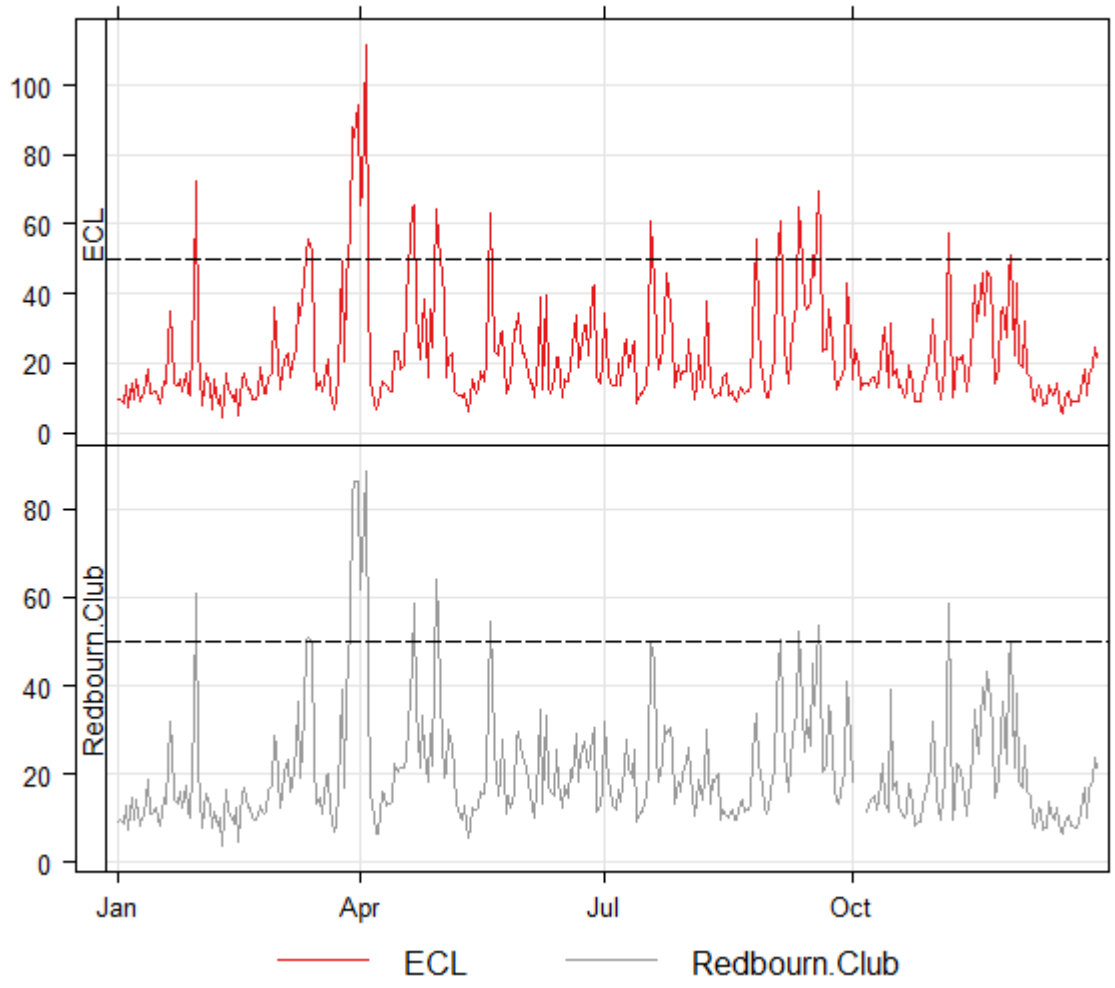

Figure 20: Comparison between East Common Lane (ECL) and Redbourn Club using 2014 1.3 TEOM data.

This plot demonstrates that the Redbourn Club site is affected by the same pollution events as the East Common Lane site, however the magnitude is not as great, due to the greater distance from the integrated steelworks site.

The data capture from the Redbourn club monitor in 2013 was only 77%, but the missing data was predominantly from July and October. Looking at the data from the East Common Lane monitor for the missing days there were five exceedance days, although four of those had a daily concentration of 51 or 52µg/m^3. It is very likely that these specific days would not have resulted in exceedances at Redbourn Club and that at worst there would have been 18 exceedance days at Redbourn Club in 2013.

There is a very close data correlation between the Redbourn Club and East Common Lane sites and the council is satisfied that data from 2013, where data capture was below 90% for Redbourn Club, can be used with confidence in this report to advise on any recommendations.

6.4.4 Amvale

The TEOM monitor at the Amvale site was installed in April 2013 and therefore has a limited amount of data to examine. The location of the site is further south than East Common Lane and therefore the wind directional analysis carried out was 0-90 degrees. The results from this analysis are illustrated in Figure 21.

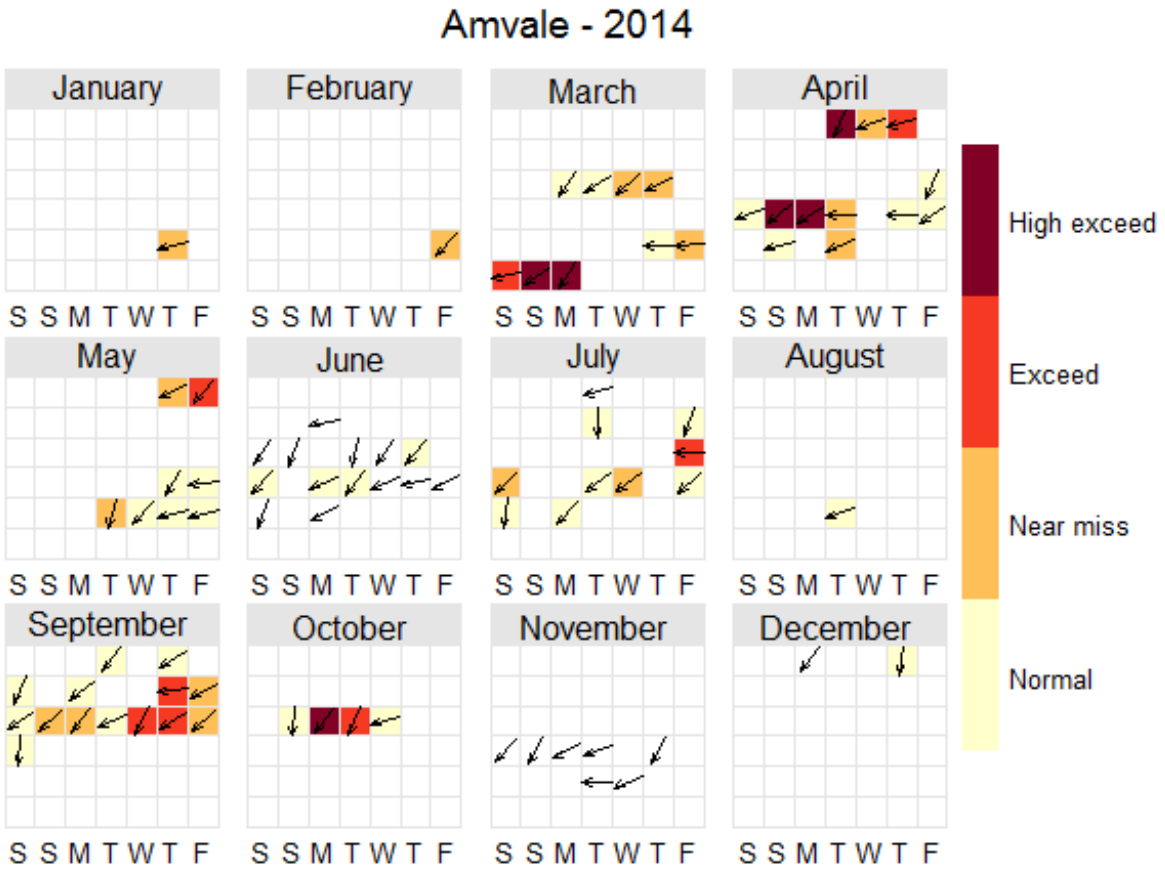

Figure 21: Calendar plot using 1.3 TEOM data for 2014 from the Amvale monitor, but only showing results when the mean daily wind direction was 0-90 degrees.

The more immediate areas of the integrated steelworks site that could potentially emit PM_{10} that would then be recorded at Amvale include the BOS plant, the Medium Section Mill, Ore Beds, Sinter Plant and the Blast Furnaces, along with Carbon International and Civil and Marine (Figure 15).

The results from the wind directional analysis showed that there were 83 days in 2014 when the wind direction was between 0 and 90 degrees. All 14 of the exceedance days occurred when the wind was from this direction, including 6 days classed as a “high” exceedance.

6.4.5 Low Santon

The Low Santon monitor has always historically recorded the highest number of exceedance days in North Lincolnshire. The bivariate polar plot illustrated in Figure 22 highlights that the source of the pollution is from the south west, with hourly concentrations over 160µg/m^3 occurring with higher wind speeds.

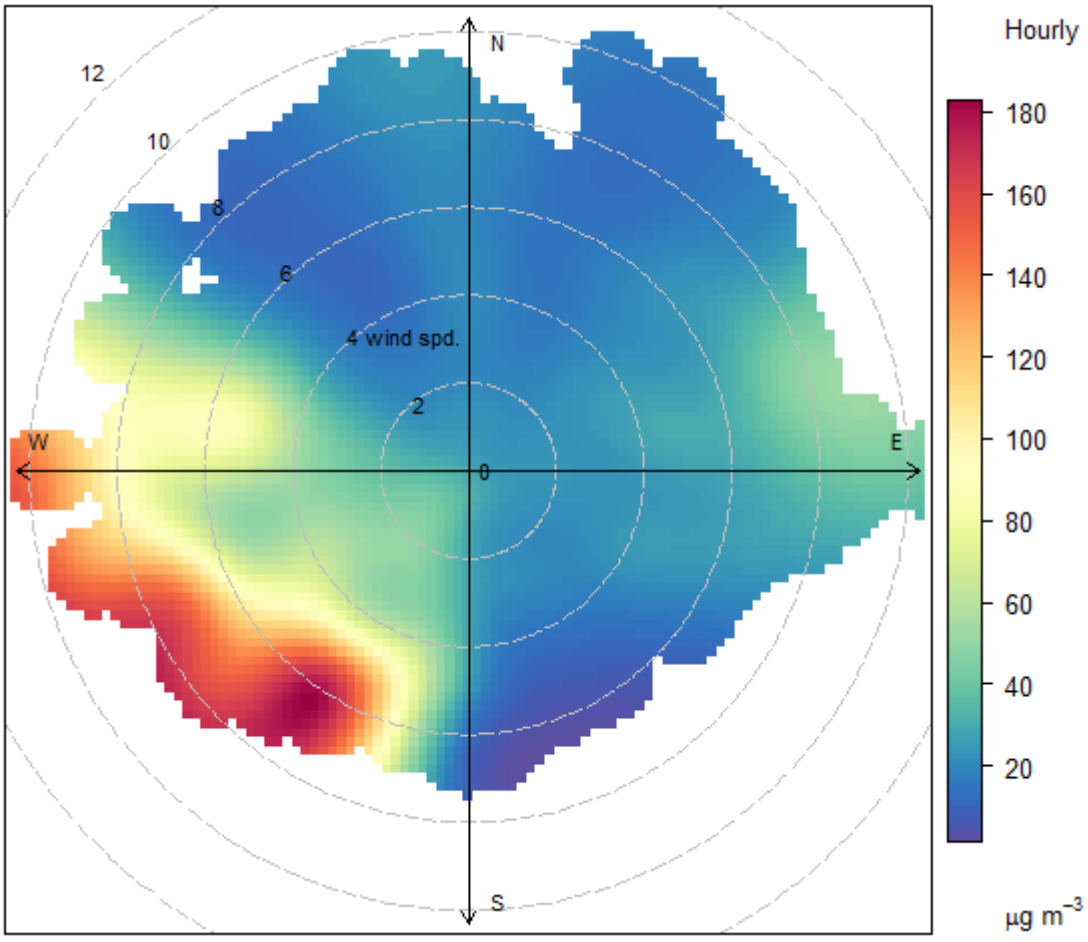

Figure 22: Bivariate polar plot for Santon using 1.3 TEOM data 2012-14

The monitor at Low Santon is much closer to the sources of pollution, which are located in a wider arc. The main pollution sources that are located close to the Santon monitoring station include the Coal Handling Plant, Dawes Lane Coke Ovens (decommissioned in March 2016), the Plate Mill, Appleby Coke Ovens and the Redbourne Steel Stocking area, along with Tarmac and Harsco Metals, although some of the principle Tarmac processes were re-located away from Low Santon in 2012 (Figure 15).

One point to note about bivariate polar plots is that the concentration is based on the hourly mean and that at higher wind speeds the concentration recorded is generally higher. This can therefore distort the appearance of the data, as there are far fewer hours with higher wind speeds.

An alternative method is to use a weighted mean polar frequency plot. These plots identify the conditions that most contribute to poor air quality, both the concentration observed during a specific wind speed and direction, and the frequency with which it has occurred. For a wind speed to contribute significantly to the overall PM_{10} mean, both the concentration and frequency must be high. The weighted mean takes into account the frequency and concentration for a wind direction and wind speed condition, as illustrated in Figure 23. The frequency plots clearly show the wind direction where the PM_{10} originates, while each segment provides the percentage overall contribution to the total concentration.

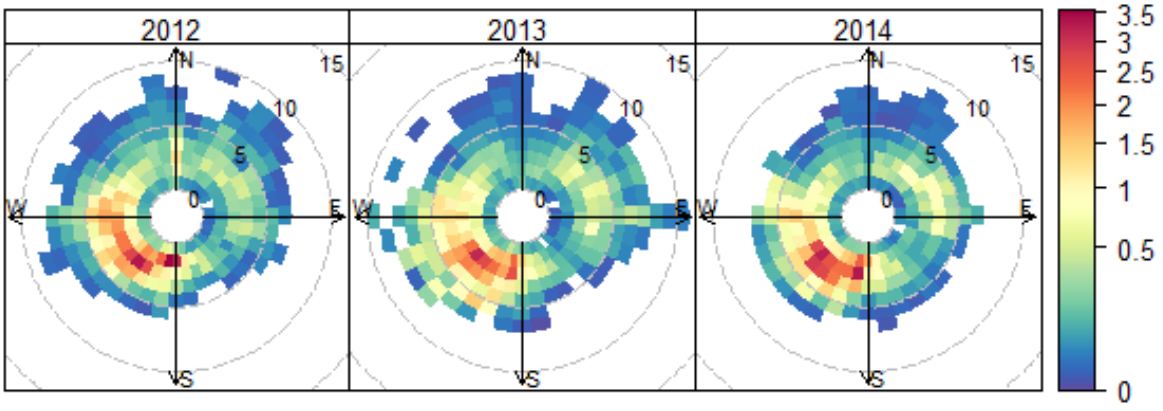

Figure 23: Weighted mean polar frequency plots for the Santon TEOM using 1.3 data.

6.5 Exceedance day analysis

The recently published exceedance day analysis report, Study on PM_{10} exceedance days in Scunthorpe, written by the Environment Agency, split exceedance days into four categories:

- Regional events,
- Sharp peaks,
- Broad peaks
- Day-time elevated periods.

Regional events occur when the elevated concentrations measured during the 24-hour period were not caused solely by emissions from local sources. An example of a regional event occurred at the start of April 2014, where it was suspected that Saharan dust was the reason that many monitors, across the UK and mainland Europe, had recorded daily PM_{10} exceedances. More often regional events occur when pollution is transported from the south east of England or Europe.

A sharp peak event occurs when a single spike in PM_{10} concentration of short duration (1 - 2 hours) and high magnitude (usually >150µg/m^3) occurs. It would be assumed that this peak is due to emissions originating in a discrete event.

A broad peak event occurs when there is PM_{10} concentration of high magnitude (usually >150µg/m^3) over a number of hours, with no associated change in wind direction.

Day-time Elevated Periods are typified by a plateau of higher concentrations, usually experienced during the hours 06:00 – 17:00, whilst night time concentrations are close to background. Concentrations fluctuate during this period, but generally remain in the region of 80 - 150µg/m^3. It is likely that the higher day-time levels of PM_{10} evolve from a number of local processes which cumulatively result in higher concentrations generated during day-time hours. These could include resuspension associated with increased traffic movements and activity during the day as well as dust generating processes that operate exclusively during day-time.

Figure 24 illustrates the number of each type of exceedance event that occurred at Santon between 2009 - 2011 using VCM applied data. It can be seen that most of the exceedances are due to either broad peaks or day-time elevated periods.

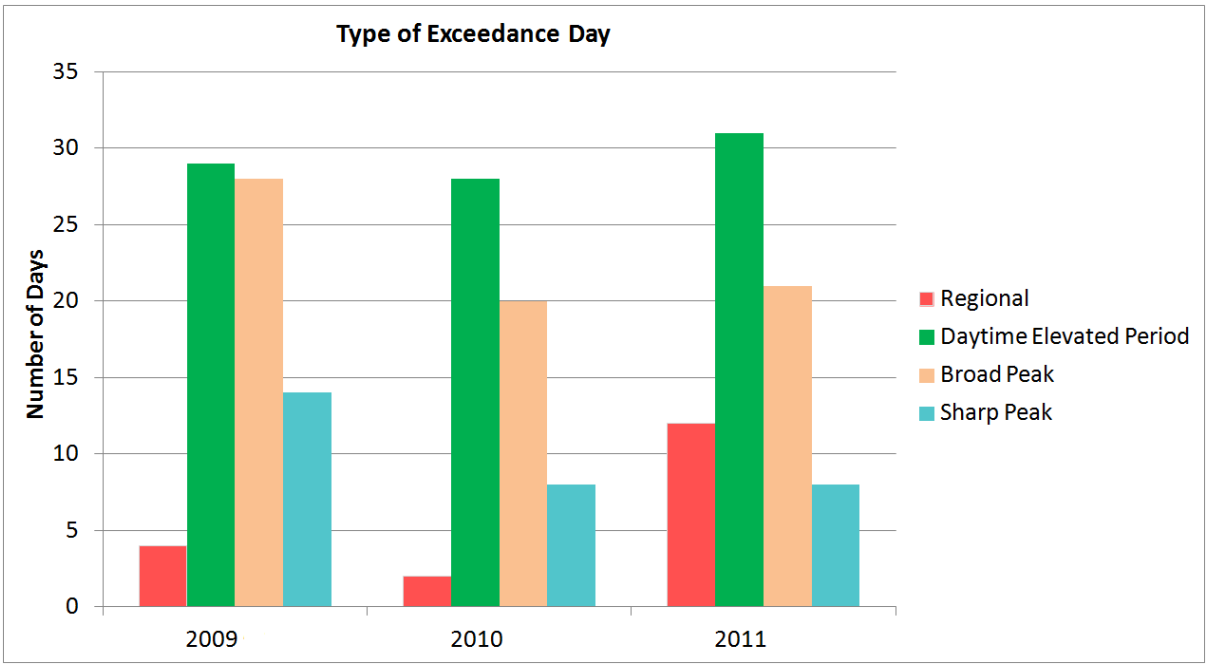

Figure 24: Counts of exceedance days by type from the Santon VCM data.

An alternative exceedance day analysis can be undertaken with a pollution rose, which resembles a regular wind rose, except that the colours used on the “spokes” correspond to the concentration values for that specific direction. The length of each spoke, much like with a wind rose, indicates how often the wind originates from a particular direction. Figure 25 illustrates the wind direction and concentration for four monitoring sites, but only for days when there was an exceedance, using 1.3 TEOM data from 2014. It is not possible to determine the exact concentration in this illustration, it does however, clearly show the location of the emission sources.

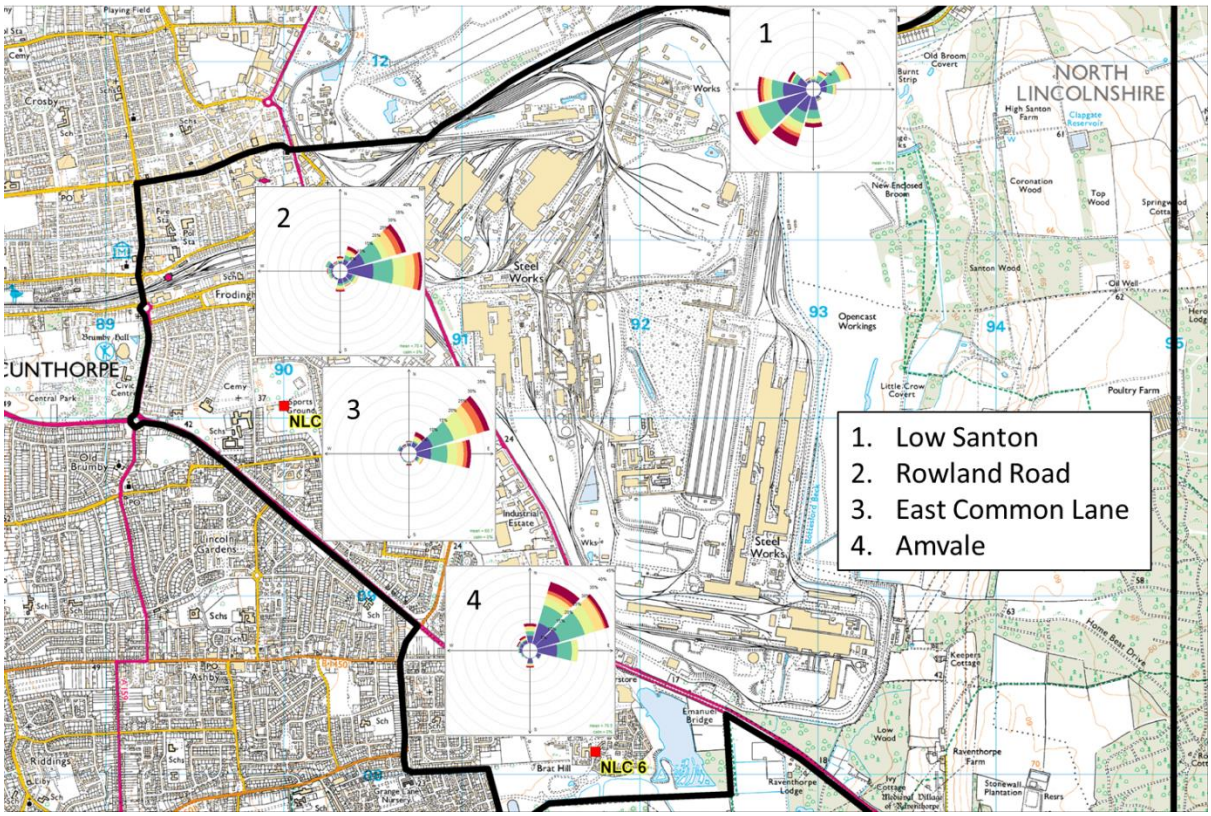

Figure 25: Pollution roses from exceedance days only using 1.3 TEOM data from 2014.

7 Improvements from the Integrated Steelworks

There has been ongoing collaborative work between North Lincolnshire Council, the Environment Agency and local industry to monitor and address PM_{10} emissions from the integrated steelworks site.

Measures introduced by British Steel as part of their PM_{10} improvement plan, when the AQMA was first declared, are presented in Table 23. This initial set of what were considered 'Quick Wins' were implemented in 2010, and other measures continue to be introduced across the site. These measures primarily address fugitive emissions such as wind-blown and mechanical re-suspension. More recent improvements that have been implemented by British Steel are detailed in Table 24.

Option	Status
Quick wins	
Reduced speed limits in key areas on internal roads	Completed in 2010
A full site 'Air Quality Inventory' of all dust arising activities	Completed in 2010
The installation of monitoring equipment – a four camera monitoring system for the site to help develop an alert system	Completed in 2010
Targeted road sweeping and review of sweeping and bowser contracts, routes have been digitally setup and contracts are being reviewed	Completed in 2010
Improved dust suppression at BOS slag pits – 2 x dust suppression cannons	Completed in 2010
Reducing the width of Slag Haul Road	Completed in 2010
Phases 1 and 2	
Reorganisation of materials handling and stocking facilities	Ongoing
Limiting access to unmade roads/areas – segregation and signs in place	Completed in 2011
Review of steel stocking and improve grading of Redbourne	Completed in 2012
Landscaping of high-risk areas	Ongoing
The installation of 8 wheel washers – Dawes Lane Coal Handling Plant, Slag Haul Road, BOS Weighbridge, Ore Blending Plant. Reduced lift-off from unmade tarmac roads.	Completed in 2011
2 x water bowser quick fill facilities to improve efficiency of the systems to reduce lift-off from unmade and tarmac roads	Completed in 2011
Hard standing areas to be created in Redbourne stocking area	Completed in 2011
Air Quality Awareness Campaign to influence behaviours	Completed in 2012

Table 23: Measures in the British Steel PM_{10} improvement plan

Action detail	Further information
Improvements to current bowser use	Optimised current bowser suppression routes, call outs and quick filling points installed at BOS plant and Seraphim Lagoon.
Bowser prioritisation	Prioritise surfaced and unmade road bowser suppression. Developed site procedure and plant call out system to enhance efficiency of water suppression.
Diffuse dust audits	Developed weekly diffuse emission auditing system.
Redbourn management	Road routes for stocking tarmacked. Developed Redbourn site procedure for visual management and water suppression procedure to improve frequency and efficiency.
Source Directions / Study	Detailed assessment to determine priority areas on site for capital expenditure. Fed into OGSM for PM_{10} reduction.
Yarborough	Liaised with Harsco to disseminate best practice and the visual management tool. Reviewed site activities to highlight actions to reduce diffuse dust.
Replace Existing Contractor Bowser	Replaced existing bowser with the most efficient options (i.e. better spray and larger capacity).
Road sweeping	Road sweeping contract reviewed to establish most efficient route and filling/emptying routine. Outdated equipment replaced with new which has improved cleaning.
Roadside grassing	Developed a road side grassing plan to reduce soil/dirt 'creep' into vegetated areas on kerbed and un-kerbed roads. Main roads complete.
Tree planting	Redbourn, Santon and Ore Blending Plant areas of site vegetated.
Wheel wash facilities	Wheel wash facilities installed at entrance / exit to R95 stocking area, Coal Handling Plant, BOS Plant Scrap Weighbridge, Coal Prep Plant entrance / exit and Redbourn Stocking Area.

Table 24: Further improvements carried out by British Steel

Harsco Metals and Minerals are one of the larger industries located on the integrated steelworks site. Their main business is metal recovery from slag. The Scunthorpe plant is split between two sites with one at either side of the steelworks, and as such they have a lot of vehicle movements; one of the main sources of fugitive dust. Harsco Metals have tried to make a number of small but significant improvements to reduce fugitive dust emissions across all of their operations and have successfully implemented a fugitive dust improvement plan for a number of years. Improvements that they have implemented can be seen in Table 25 below.

Action detail	Effectiveness
Fugitive Dust Emission Plan for 2007	
A speed limit of 10mph will be placed on the entire slag pit area to help minimise dust emissions	Decrease in speed has resulted in a reduction of lift off
A new rail breaking attachment has been purchased. This attachment breaks all rail-track and removes the need for burning.	All reductions in burning activities reduces fugitive dust emission
All large scrap from across the site is burnt in the Pyroserv Booth where previously it was burnt in open air.	Significant reduction of emissions with the introduction of this plant
Extension of the current dust suppression system at the Metal Recovery Site to cover the entrance roadway sprinklers on both sides of the road.	Gives the plant the ability to suppress dust independently
A new larger skip or bunker to be installed at the impactor dust suppression unit.	This will aid more storage capacity and also minimise dust spillage.
Narrowing of the haul road to be undertaken.	Reduce vehicle speed and also reduce surface area that will require water suppression.
Unused and open areas of the Metal Recovery Site have been bunded and landscaped.	This will minimise dust lift-off. The bunding will also reduce the amount of water suppression required at the Metal Recovery Plant facility and thus minimise water consumption.
Various procedures and work instructions modified to ensure maintenance checks are adhered to which can have an indirect impact on fugitive emission control.	
Purchase and installation of a weather station at the Coke Crushing Plant.	The weather station will give an indication of the potential impact on dust levels
Fugitive Dust Emission Plan for 2008	
The purchase of a second rigid lorry mounted tanker (20,000 litres) fitted with spray bar and water cannon. This unit is planned to replace the existing tractor & tanker unit which will then be used as a back-up system.	Bowser purchased and fully operational.
To jointly examine with British Steel the feasibility and cost of installing a branch off the existing BOS Plant slag lagoons cooling water spray system manifold to feed a system of water sprays around the adjacent	

Harsco Metals operating area controlled on a timer.	
To jointly examine with British Steel the feasibility and cost of using a proprietary chemical additive to the water sprayed by the Harsco Metals tanker on the Yarborough to BOS Plant haul road to reduce evaporation rates and hence minimise lift-off and to potentially reduce water use and tanker utilisation.	Findings of this work indicated that these chemicals were unsuccessful and did not maintain a film cover for any duration of time. Thus a chemical additive at great expense is not the answer for controlling dust lift-off from un-made roads.
The purchase and installation of an extended water cannon (rain gun) and timer system to provide improved dust suppression of the Metal Recovery Plant feed area and access haul road.	Cannon system installed and fully operational
To improve the bunding of the Metal Recovery Plant along the boundary adjacent to other activities carried out in the area towards the works boundary and Santon Village.	Bunds have been improved and clearly demark ownership of operations within the Yarborough Facility.
Enlarge, heighten and stabilize the existing bunds using either seeding or sealant techniques.	Two perimeter bunds have been enlarged capped with top soil and hydro-seeded. Grass is clearly evident and has improved the visual amenity of the Site. A further two small bunds along the road have also been completed.
Replace the existing Metal Recovery Plant feed hopper and conveyor dust suppression water spray system with improved sprays.	Additional sprays have been added to the Plant and are fully operational.
Fugitive Dust Emission Plan for 2009	
Grass bunds around the workshop area.	This will reduce dust lift off from the surrounding area.
Further improvements and extensions to the concreted areas of the workshop.	This will reduce the dust lift off from the area
Installation of lubrication storage tanks at Caster 4. This will reduce the need to travel large machines across the site to obtain oil, it will also reduce the impact of any spillage.	This will reduce the need for large machines to travel across the site to refuel. It will also reduce the potential for any spillage.
Installation of a gas oil tank at Caster 4.	This will reduce the need for large machines to travel across the site to refuel. It will also reduce the potential for any spillage.
Extend the existing watering system for the slag pits to include the surrounding haul roads.	This will reduce the dust lift off from the haul roads in the area.
Continue to improve the existing hopper system at the Metal Recovery	This has greatly reduced the need to drop material from the

Plant.	stacker, and will minimise the requirement to drop debris to ground and so reduce the dust it generates.
Reduction in the area at the Slag pits that is open to road traffic.	This has reduced dust lift off and improved dust suppression.
Bunding off areas around the scrap breaker.	Reducing the area open to road traffic
'Falling' slag lumps are now dropped into an active pit where they are encapsulated with normal slag.	The change has reduced lift off.
Install wind socks at both the Waste Oxide Briquetting Plant and the Slag pits.	Wind socks provide a quick reliable indication of the wind direction for the operators.
A new awareness briefing for all employees on fugitive dust.	The best way forward in the control of fugitive dust is to ensure the cooperation and engagement of all Harsco employees.
Trial of new mobile water cannon for the slag pit digging operation.	Joint trial between British Steel and Harsco is still underway
Water spray fitted to the Waste Oxide Briquetting Plant building.	This will enable the Waste Oxide Briquetting Plant to water its stock yard independently.
Install upgraded computer software to track wind speed and direction.	This has help in tracking where dust generated in the plant could travel.
Cover new bund in slag pit area with topsoil and hydro seed	Reducing dust lift off.
Fugitive Dust Emission Plan for 2010	
Continue the program of hydro seeding areas of our operation to reduce the level of dust lift off.	
Joint project with British Steel to reduce the width of the slag haul road.	This will reduce the area of potential lift off and increase the effectiveness of dust suppression.
Limit the use of the haul road where ever possible to slag haul dumpers only.	Reducing the amount of traffic using the haul road will benefit the lift off issue.
Change the method for handling skimmer at the Metal Recovery Plant.	Reducing the possibility of dust lift off when this material is processed.
Increased monitoring of the PM_{10} levels at Santon	Cross referencing our activities with PM_{10} results may help in isolating the problem area.
Fugitive Dust Emission Plan for 2011	

Tarmac the car park at the BOS plant.	This will reduce lift off from the slag based car park.
Tarmac around the stores and the ramp.	This will reduce the dust lift off from the made up ground.
Relocate the burners to the south side of scrap bay and redesign the area layout.	This will put the operation under cover and reduce the elemental exposure and visual impact.
Fugitive Dust Emission Plan for 2012	
Hydro seed east side of the bank and landscape area to the west side of fire suppression.	This will help seal areas which can generate windblown dust.
Installation of additional fixed water sprays alongside west haul route adjacent to slag silo.	Extending the current fixed system further.
Tarmac in front of garage doors and entrance and exit to steam cleaner ramp.	This will help seal areas which can generate windblown dust.
300mm bunker to be modified at the Metal Recovery Plant, including fabrication of dust suppression sprays.	This will help suppress the material as the plant processes it.
Construction of banking wall around Metal Recovery Plant and planting of trees.	This will help seal areas which can generate windblown dust.
Implementation of PM_{10} awareness boards in key locations.	This will increase the awareness of the operators to the possibility of exceedances from the British Steel risk assessment based on weather conditions.
Fugitive Dust Emission Plan for 2013	
Produce a documented Air quality management plan and submit for EA approval.	This is a specific procedure regarding the process if there is an exceedance on a town monitor and what action Harsco should take.
Improve the Environment Awareness Briefing and deliver the environment awareness training to all employees	This will try and raise all employees' awareness to the current challenges to the site and how we can manage them.
Implement more task specific environmental impact risk assessments.	This is to be included as part of the normal risk assessment process but with specific hazards to the environment.
Review of plant vehicle movements to control and restrict transport routes. Unused areas to be bunded and landscaped.	
Fugitive Dust Emission Plan for 2014	

Stopped cutting high sulphur blooms in the scrap yard and cut them in the lancing booth.	This will ensure that any emissions given off will be captured in the bag filter system of the lancing booth.
Further improve the sheeting enclosure of the Metal Recovery Plant reception hopper.	This will help by encapsulating any dust given off through loading of the plant and at the first screening process.
Extend the sheeting at the Metal Recovery Plant silo area where the dumpers are loaded via automatic silos.	Encapsulating this material drop when the dumpers are loaded will help keep any dust enclosed.
IOSH Working Safety, which has a specific module on the environment is to be delivered to all employees.	This course was delivered to all Harsco employees including supervisors and managers to improve the general awareness of how our activities impact on the environment and how to control it.
New water bowser on site which is a converted dumper which has a water cannon fitted to spray material heaps.	This will enable better suppression coverage of stocking areas and material piles where there is not fixed suppression fitted.
Fugitive Dust Emission Plan for 2015	
Further reclaim and landscaping to be completed at Metal Recovery Plant and Coke Crushing Plant.	This will seal large banks/bund walls and to help protect the plant form excessive wind.
Further review of plant vehicle movements to control and restrict transport routes. Unused areas to be bunded and landscaped on Harsco static process plants, Metal Recovery Plant and Coke Crushing Plant.	
Encapsulate belt ends where possible on static processing plants to minimise potential for fugitive dust emission at material drop points.	
The desulph material is being tipped in a controlled suppression area at the BOS plant and cooled, prior to transporting to the Metal Recovery Plant for processing.	This will reduce the dust during tipping at the Metal Recovery Plant stocking area.
Osiris dust monitors installed at the Coke Crushing Plant and Metal Recovery Plant.	This will help the operations teams better manage their process as due to the live data on dust concentration levels on the process plants.

Table 25: Improvements carried out by Harsco Metals

8 Improvements from the daily mean Air Quality Action Plan

The declaration of the AQMA in 2005 was followed in 2008 with an Air Quality Action Plan (AQAP). The action plan has been reviewed and updated several times since it was created, most recently in the 2014 Progress Report. Table 26 highlights the progress to date that has been made from the Action Plan.

Action	Action Detail	Further Information	Effectiveness
A1	Maintain network of ten PM_{10} analysers at nine locations. Four locations are within the AQMA and five outside.	Presently there are 11 PM_{10} Monitors at 9 Locations. 7 of these locations are within the AQMA.	High – The network maintains focus on AQ issues and enables the Council to measure the effectiveness of any schemes.
A2	Boundary monitoring of PM_{10}, $PM_{2.5}$, PM_1 and Total Suspended Particles at Part A2 and 5 PPC Sites within the AQMA. Including a $PM_{2.5}$ (TEOM) monitor at Low Santon.	The Council has used 2 Osiris monitors placed at industrial locations on the integrated steelworks site. These were used for source identification. British Steel, Lafarge Tarmac and Harsco Metals also have their own particulate monitoring regimes on the site.	High – Allowed greater analysis in specific areas, although the $PM_{2.5}$ TEOM monitor at Low Santon was removed in 2010 after no issues were identified
A3	Traffic count and visual observations at Santon to assess likely contribution from re-suspended road dust.		Medium
A4	PPC Permit Improvement Programme IP 9, 15, 17 & 22 Tata UK Ltd shall undertake a further investigation to monitor and quantify point source and fugitive particulate matter including PM_{10} and $PM_{2.5}$ emissions from the BOS Plant, Sinter Plant, Blast Furnaces, Appleby/ Dawes Lane Coke Ovens point source emissions and associated activities. The investigation should aim to confirm and establish typical release rates/ emission characteristics from significant sources and include localised ambient air quality monitoring. The proposed scope and method to be adopted, with timescales, should be submitted in advance of any study and agreed with the Environment Agency. A report of the investigation shall be sent to the Environment Agency		High – Source appointment to identify problem areas and then reduce emissions

A5	Study into a local TEOM to Partisol correction factor. Consideration of alternative measurements techniques or correction factors as developed.	Low
A6	PPC Permit Improvement Programme IP 33 Tata UK Ltd shall assess the monitoring data recorded by the air quality monitoring stations and the local NETCEN station (including triangulation between stations) to identify process areas/outside influences making significant contribution (short and/or long term) to the pollutant levels measured. The operator shall submit quarterly reports of interpreted monitoring to the Environment Agency.	High – Source appointment to reduce emissions
A7	PPC Permit Improvement Programme IP 37 Tata UK Ltd shall review annually the emissions to air impact assessment and amend as necessary following progressive completion of relevant improvement programme requirements contained within this permit or the identification of any other relevant information or data concerning emissions, dispersion or environmental impact. An annual review report shall be submitted to the Environment Agency	Medium – The results are hard to quantify
A8	PPC Permit Improvement Programme IP 38 Tata UK Ltd shall formulate an air quality management plan for the installation aimed at reducing the impact of pollutants emitted from the installation and ensuring it does not significantly contribute to breaches of the national Air Quality Strategy standards/objectives or EU Directive Limits. Initially, the plan should be based on current emissions and impact assessment knowledge and developed further from the conclusions drawn from the responses	Medium

	made to relevant improvement programme requirements contained within this Permit. The plan should take account of any Local Authority air quality management plans. The operator shall review the air quality management plan annually and include actions to ensure the aim of the plan is delivered. The initial plan and annual reviews shall be submitted to the Environment Agency.		
B1	Launch and maintain North Lincolnshire air quality website with: • Access to real time & historical data, • Production of graphs and pollution roses • Access to air quality reports and latest news updates • General information	The air quality website has recently been updated to improve appearance and functionality. General information and reports are available to the public on pollution levels and the council's monitoring regime. A password protected dedicated area is provided for industry, health professionals and the Environment Agency to access data and produce custom graphs.	High – Raised the issue with British Steel/EA and highlighted to the public air quality problems
B2	Review existing methods of communication of real time data to the public and consider alternatives to internet access. Implement one further method.		Low
B3	Investigate the potential for air pollution forecasting in Scunthorpe	Pollution forecasting is undertaken by operators on the integrated steelworks site. Currently there are no plans for this to be extended for the public to utilise.	High/Low – High for the Steelworks, but low for the Council as it has not been extended to the public
B4	Provide information to the public through publicity campaigns about how they can improve air quality from domestic situation e.g. bonfires and heating fuels	Issue-specific campaigns have previously been undertaken using local press and council publications. Further campaigns will be developed as appropriate.	Medium
C1	Raise profile & encourage attendance at organised community bonfire celebrations rather than individual bonfires.		Medium
C2	Conduct a publicity campaign advising commercial organisations about their legal obligations in relation to their waste, with particular reference to burning of trade waste. To		Medium – Prosecutions have been carried out and are ongoing

	be conducted in co-operation with the Environment Agency.		
C3	Complaints in respect of dust and smoke from commercial premises (not regulated under IPPC regime) will be investigated as a priority and enforcement action taken in accordance with the enforcement policy.	High priority is given to complaints of this nature and appropriate enforcement action is taken. Publicity resulting from successful prosecutions has resulted in a decrease in instances of commercial bonfires.	Medium – British Steel respond quickly and efficiently with any complaints from the public
C4	Identify current road sweeping schedules within the Scunthorpe AQMA and realign schedules as appropriate to minimise resuspended dust emissions from areas such as Brigg Road.		Low
C5	Conduct a publicity campaign advising local residents the implications of living in a domestic smoke control area and encourage people to complain if they are affected by smoke from domestic chimneys.	A publicity campaign was launched authority-wide in 2008. This information is currently available on the council's internet site and residents are advised as required	Low
C6	Complaints in respect of domestic smoke control will be investigated as a priority and enforcement action taken in accordance with the enforcement policy.	High priority is given to complaints of this nature and appropriate enforcement action is taken.	Low
D1	The Council will organise strategic air quality management meeting with other relevant organisations with an interest in air quality issues, including the Health Protection Agency, Primary Care Trust and the Environment Agency. The purpose of the group will be to identify key air quality issues and agree measures for reduction. Meetings to be scheduled approximately quarterly.	The Council continues to organise these meetings, the role of the participants and the objectives have recently been reviewed. The meetings are now to be held annually. Improvement strategies that will benefit eastern Scunthorpe are to be identified.	High – Meetings are now held twice a year, once at the EA offices and the other one organised by NLC. Sharing data and good practices.
D2	Set up a Local Industry Forum involving the Environment Agency, North Lincolnshire Council and Local Industry representatives with the potential to emit PM_{10}. The purpose of the group is to identify key issues, agree measures for reduction of PM_{10} and formulate a memorandum	The Council continues to organise these meetings, the role of the participants and the objectives have recently been reviewed. The meetings are now to be held annually. Improvement strategies that will benefit eastern Scunthorpe are to be identified.	High – Meetings are now held twice a year, once at the EA offices and the other one organised by NLC. Sharing data and good practices.

	of understanding between all industrial operators particularly in respect of issues falling outside the scope of permitting. Meetings to be scheduled approximately every six months. This group may include representatives from other steelwork area sites.		
D3	Formulate an industry overview for the integrated steelworks site. Identifying process areas, haul routes, vehicle flows and operating hours to consider in conjunction with monitoring data. Identify areas of responsibility within general areas of the steelworks site, areas outside the permit regime and regulatory responsibility for the same.	A number of reports have been produced to identify processing areas and regulatory responsibility. Recently the Environment Agency has taken over regulation of a previously regulated council installation to enable a more consistent and holistic approach to be taken.	High – Problem areas have been highlighted.
D4	Continue to lobby central government in relation to permitting of mobile plants and look to identify improved mechanisms of regulation and enforcement.		Low
D5	Ensure that the requirements of the PPC permitting regime are appropriately enforced with inspections prioritised on a risk basis taking account of PM_{10} emissions. Regulators will work closely with process operators to minimise PM_{10} emissions and seek long term solutions to address dusty operations.	Inspections and permit reviews are undertaken as required. A number of site improvements have been implemented including the provision of wheel washes and dust suppression, site-wide hard surfacing and the enclosure of dusty processes.	High – See also D3
D6	Ensure permits issued under LA-IPPC are reviewed in accordance with guidance, with particular attention to processes within the AQMA with the potential to emit PM_{10}.	All permits are reviewed when appropriate and in accordance with DEFRA timescales. Attention is given to potential PM_{10} emissions and appropriate conditions used.	Medium
D7	Work with local industry and EA towards the development of relevant measurable indicators of changes in significant emissions of PM_{10}.	Data is reviewed by the Technical Working Group to analyse trends and determine areas for improvement. Daily pollution episodes are identified and action is taken to review the cause and analyse the process contribution.	Medium/High – Evaluate improvements by looking closely at the data
D8	Work with local industry and EA to develop	Data shows that there are still exceedances of the	High – see review of the

	targets for the reduction of the area covered by the AQMA so that the number of properties affected will be reduced.	Daily Mean Objective within the area covered by the 2005 AQMA. A zoning exercise has been undertaken to identify areas that may not be currently suitable for residential development. The Council and the EA are ensuring that the local operators concentrate their efforts on the affected areas that require a reduction in emissions.	different zones in this report
E1	The impact of development within the Air Quality Management Area shall be considered in relation to air quality. Exposure of new receptors or the introduction of significant new sources of PM_{10} will need to be appropriately addressed until such time as action E2 has been completed.	The Environmental Health (Commercial) Team reviews all planning applications. Applications for residential development, or other sensitive uses, within the AQMA are assessed for air quality impacts on a site-by-site basis using the latest data. Applications for industrial development in the Authority area are looked at on a case by case basis and impact upon local air quality and residential amenity are examined. If emissions cannot be abated or minimised to an acceptable level, then the recommendation would be for refusal of the application.	High – our approach to planning has been consistent and prevented harmful exposure
E2	Develop a Supplementary Planning Document (SPD), which identifies the constraints and mitigation to development within the Air Quality Management Area	A draft SPD has been prepared	Medium – sites within the AQMA have been identified for development
F1	Review new and existing development sites, to monitor the impact of road, rail, air and water traffic and their emission levels.	The Environmental Health (Commercial) Team reviews all planning applications. Applications for development in the Authority area involving transport related emissions are looked at on a case by case basis and impact upon local air quality and residential amenity are examined. If emissions cannot be abated or minimised to an acceptable level, then the recommendation would be for refusal of the application.	Medium – AQ impact assessments are reviewed by the AQ technical officer
F2	Implementing bus priority measures as appropriate at new residential developments to help ensure that public transport is a quicker and	Developers are required to submit Transport Statements/Assessments, supported by Residential Travel Plans for appropriately sized residential	Low

	more direct transport than the car	developments.	
F3	The main measures to implement are improving facilities for pedestrians and cyclists, school and workplace travel planning, implementation of school safety zones, bus and infrastructure enhancements and simplification of the network, ticketing in Scunthorpe and the main rural routes and managing our car parks and tariff structure.	The implementation of this action was incorporated within the Council's Local Transport Plan.	Low
F4	The implementation of an urban traffic control system will assist the traffic manager in delivering a smoother flow of traffic in the urban area of Scunthorpe and reduce levels of congestion. This has been programmed for delivery during the period of this and the next Local Transport Plan.	The urban traffic control system is being rolled out on area by area basis.	Low
F5	Reducing incidents of dangerous driving and enforcing compliance with speed limits will also help maintain a smooth flow of traffic and minimise sudden braking acceleration	The overall responsibility of reducing dangerous driving is handled by the North Lincolnshire Road Safety Partnership. The North Lincolnshire Road Safety Partnership was established to; Significantly reduce the numbers of people killed and seriously injured on roads in North Lincolnshire, raise public awareness of road safety issues, encourage safer driving behaviour through a combination of education, training, publicity and enforcement and to ensure the effective utilisation of resources and a co-ordinated approach to road safety in North Lincolnshire.	Low
F6	Through the North Lincolnshire Road Safety and Safety Camera Partnerships we will deliver continued enforcement of speed limits and driving standards		Low
F7	Through the quality bus partnership we will work with the operators to encourage the replacement of vehicles to the latest European emission standards wherever possible	North Lincolnshire Council and local bus operators are part of a Quality Partnership and operators are encouraged to use vehicles that meet these standards. The two largest operators in the Authority area currently use vehicles that meet the latest standards and it is also a contractual obligation for school bus routes.	Low – New standards have not lowered emissions by as much as initial estimates.

F8	A fleet of vehicles that are powered by LPG already operates (predominantly in waste management), we will continue to update and operate our fleet vehicles to use more environmentally friendly forms of fuel. Particulate traps on our vehicles are also used and we will continue to promote their use to reduce particulate matter	North Lincolnshire Council does not operate any LPG fuelled vehicles and there are no plans to introduce any. Particulate traps are also now not required given the advances made in engine technology and the current Euro IV class engines. The Council used to retrospectively fit these to large goods vehicles when the exhaust PM10 emissions were at 0.15 - 0.1 g/kWh (Euro II - III standards) as the cost of the particulate trap was offset by a reduction in vehicle excise duty as these vehicles were issued with a reduced pollution certificate. Since the introduction of EURO IV PM10 emissions have been reduced to 0.02 g/kWh on the production line. This information will be added to the final report.	Low – New standards have not lowered emissions by as much as initial estimates.
F9	The council will aim to**:** • Reduce traffic flows through promotion of sustainable travel and demand management measures • Reduce transport related emissions by reducing traffic flows and making more efficient use of the network • Deliver environmental improvements • Improve the street scene Make communities places where people want to live	The implementation of this action is incorporated within the Council's current Local Transport Plan.	Low

Table 26: Action Plan Progress

9 The UK Steel Industry

In October 2015 the UK Steel Industry announced 4,000 job losses. Thailand's SSI closed its Redcar plant at Teeside, with the loss of 2,200 jobs. Caparo Industries Steel Operations went into administration putting 1,700 jobs at risk. India's Tata Steel then announced 1,200 job losses at its Scunthorpe and Lanarkshire plants, with 900 of the losses to be at Scunthorpe mostly at the plate mill. In March 2016 Tata Steel announced that it intended to sell its UK steel business. In June 2016 Greybull Capital purchased the Longs Steel business from Tata Steel, this includes the Scunthorpe integrated steelworks site. This business now operates as British Steel.

Production at the Scunthorpe Plant has been consistent over the last five years, with only a relatively small downturn in production, as illustrated in Figure 26.

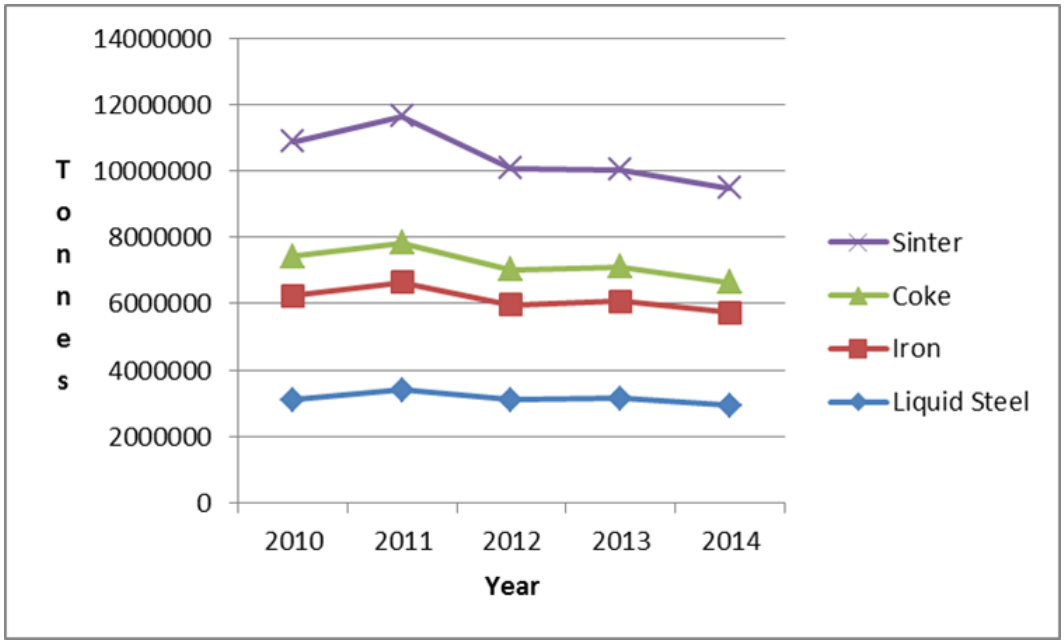

Figure 26: Production figures from the Scunthorpe Steelworks for the period 2010-2014.

There are a few reasons for this downturn in the UK steel industry. The industry has been hit by high energy prices combined with global steel prices falling by half, but the largest impact in the UK has been the rise of imported Chinese steel. In 2013 the UK imported 300,000 tonnes of steel from China, but this rose to almost 700,000 tonnes in 2014. According to the international business media company Bloomberg, in 2014 UK steel on average cost €897 per tonne, whilst Chinese steel cost on average €583 per tonne.

British Steel in Scunthorpe directly employs 4,000 people with many more employed in associated industries. Large scale job losses would have a detrimental impact on the local economy. Any downturn in the production of steel in Scunthorpe will more than likely have a positive effect on the local air quality, however, resulting deprivation and poverty caused by job losses is also a public health concern.

10 Revoked or amended AQMA

DEFRA Local Air Quality Management Technical Guidance Document TG(09) states:

> *The decision to revoke or amend an AQMA should recognise that pollutant concentrations can vary significantly from one year to the next, due to the influence of meteorological conditions. It is important that authorities should avoid cycling between declaring, revoking and declaring again, due simply to these variations. The authority therefore needs to be reasonably certain that any future exceedances (that might occur in more adverse meteorological conditions) are unlikely. For this reason, it is expected that authorities will need to consider measurements carried out over several years or more, as well as the national trends in emissions, and local factors that may affect the AQMA, including measures introduced as part of the Action Plan, together with information from national monitoring on high and low pollution years.*

Using the DEFRA guidance North Lincolnshire Council has made the decision to retain the PM_{10} daily mean AQMA, specifically due to the number of daily exceedances that have occurred 2012 – 2014 at Low Santon and East Common Lane, as well as the 24 exceedances that occurred at Scunthorpe Town in 2013.

Air quality data gathered since 2005 within the AQMA demonstrates that not all of the areas within it experience such elevated levels of PM_{10}, it is therefore appropriate to review the boundary. For the purpose of the boundary review the Council in consultation with health professionals has, as a precautionary measure, decided on a criterion of 20 daily exceedances, using the highest number recorded in the four year period 2012 – 2015. A value of 20 daily exceedances would give enough headroom to anticipate poorer air quality in the future. This would also then follow DEFRA guidance in not revoking and then declaring an AQMA in subsequent years. Figure 27 illustrates the highest number of daily exceedances, using VCM applied data that each monitoring station within the AQMA has recorded in the years 2012 – 2015.

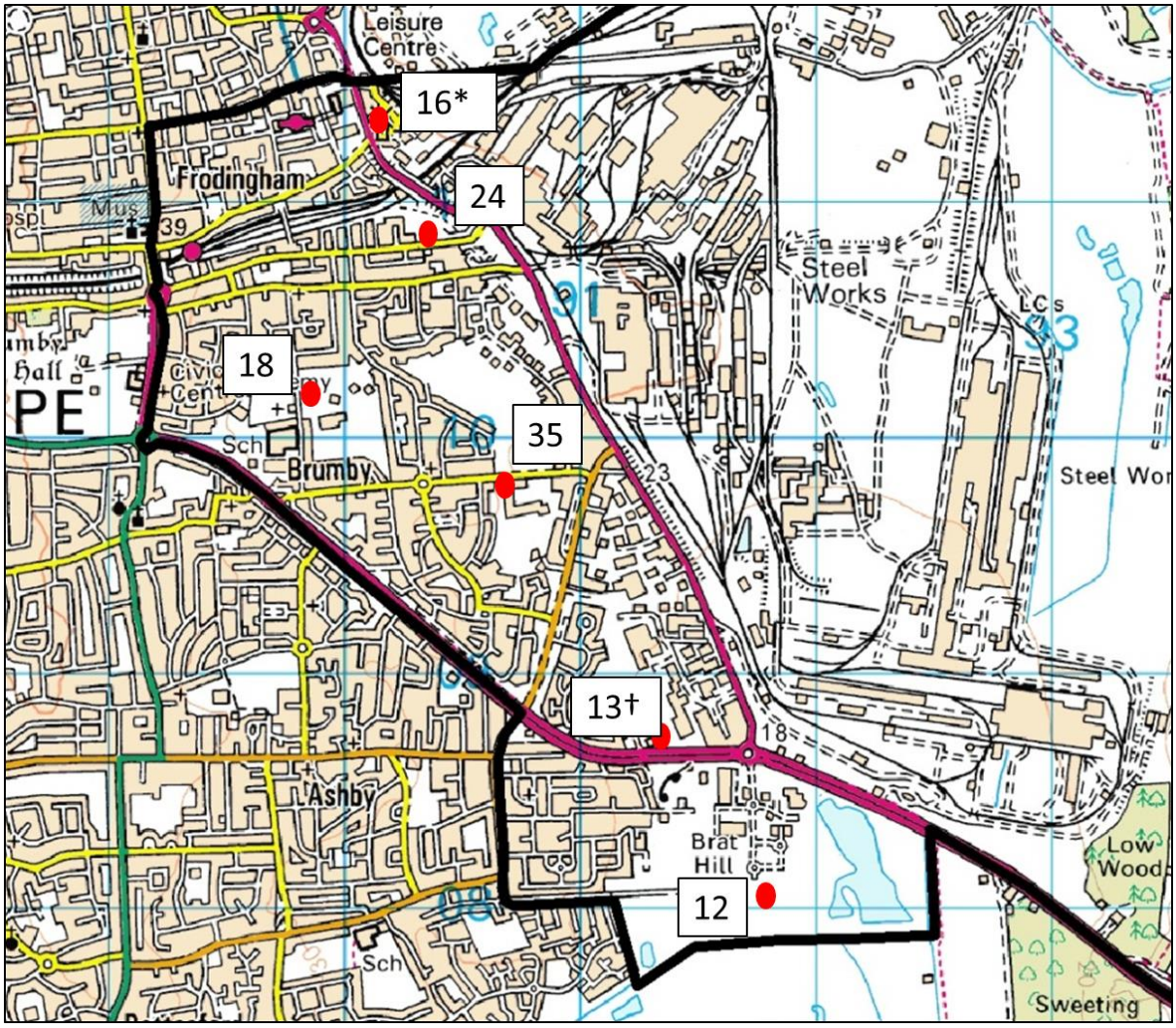

Figure 27: The highest number of daily mean exceedances recorded with VCM applied data 2012-2015.

The black line is the current AQMA boundary. * Church Square and High Street East monitor data combined from 2014. † 2014 data for the Amvale monitor.

Using the guidance from DEFRA, the Council needs to be certain that areas removed from the AQMA will not in the near future breach the air quality objectives. With the highest number of daily exceedances being 12 recorded at Lakeside, it can be reasonably certain that this area will not breach 35 daily exceedances under current conditions. For Redbourn Club in the last four years 2014 was the worst year with 18 exceedances. Again it can be reasonably certain that this area will not breach 35 daily exceedances under current conditions.

The Amvale and High Street East sites will be retained within the AQMA, as insufficient data is available at this time to make a reliable determination. The Church Square site was only located for a period of 12 months and data from it, using the 90th percentile value, for 2014 indicated a potential breach of the daily mean objective. It is therefore proposed to also retain this location within the AQMA until further monitoring can be undertaken to establish if this precautionary measure is appropriate.

Figure 28 illustrates the proposed new boundary for the Scunthorpe Town PM_{10} daily mean AQMA, using the criteria set out above. This would then remove the Redbourn Club and Lakeside monitors from the AQMA. The boundary around the eastern side of the integrated steelworks site would remain the same.

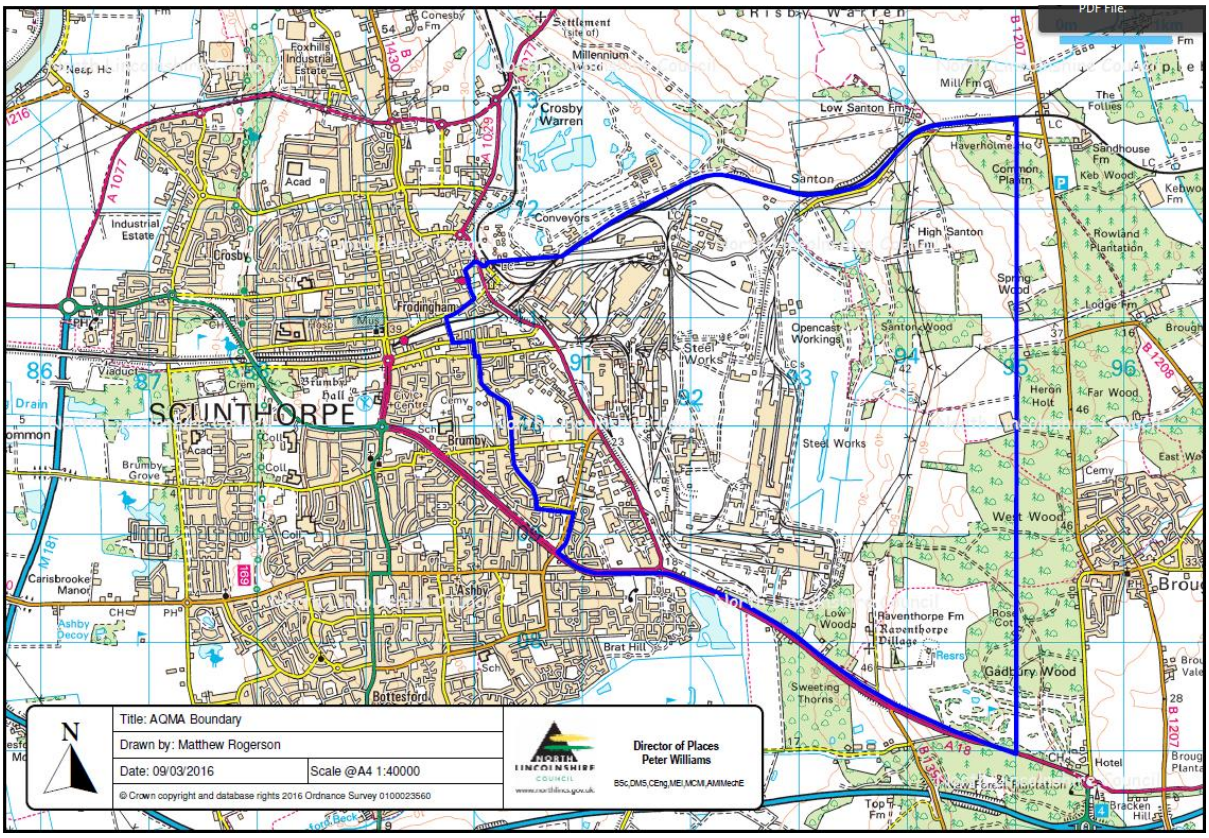

Figure 28: The proposed new boundary for the Scunthorpe Town PM_{10} daily mean AQMA.

This would reduce considerably the size of the AQMA in Scunthorpe, without affecting the boundary around the integrated steelworks site. As discussed earlier, the original AQMA boundary contains approximately 7,000 residential properties. The proposed amended boundary will remove over 5,000 residential properties from the AQMA, with only 1,750 remaining inside the new AQMA.

The Environmental Protection UK (EPUK) Guidance on AQMA boundaries is as follows:

> *The boundaries of the AQMA must be clearly identifiable and should match up with physical features; in declaring an AQMA, the authority must be able to describe its boundary both on a map and in words. It is highly unlikely that the line of exceedance will match with physical features.*

The new boundary description in words, in an anti-clockwise direction, starting on Dawes Lane towards the north (as indicated in Figure 28 by the former Leisure Centre) is as follows:

> Starting on Dawes Lane the amended AQMA boundary crosses Brigg Road onto High Street, across Church Square and onto Carlton Street before joining Station Road. The boundary crosses the railway line using the Frodingham Footpath and joins Rowland Road. The boundary leaves Rowland Road at Cliff Street and continues down Warwick Road, crossing East Common Lane and following Healey Road. The boundary then goes along Warley Road and joins Grange Lane North. From there the boundary follows Queensway until it joins with the old AQMA boundary further along the A18.

11 Santon annual mean AQMA

In December 2008 a second PM_{10} AQMA was declared, this time for exceeding the annual mean objective of 40µg/m^3. It covers a small area of land incorporating three houses at Low Santon, which is a small village adjacent to the north eastern boundary of the integrated steelworks site (Figure 29). The Low Santon PM_{10} annual mean AQMA is located within the boundary of the Scunthorpe Town daily mean AQMA.

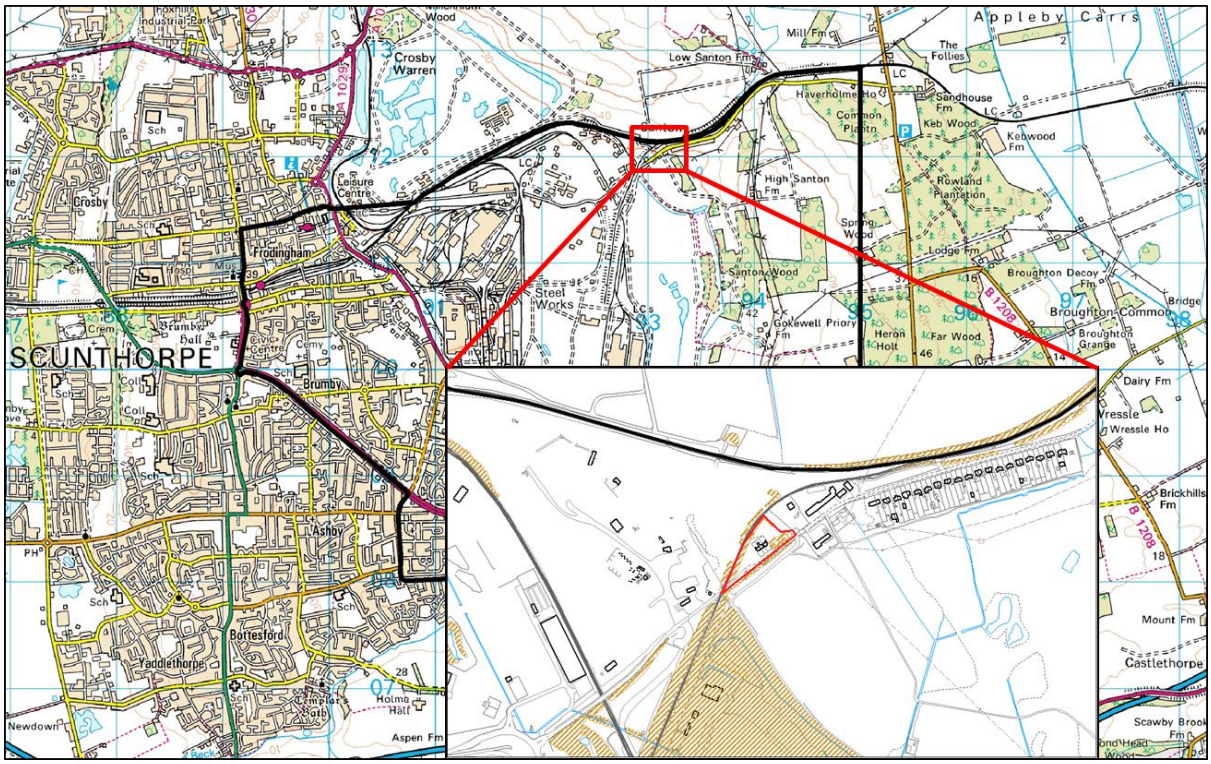

Figure 29: The location of the Low Santon annual mean AQMA in relation to Scunthorpe.

The relevant data from the monitors at Santon can be seen in Table 27.

	TEOM			FDMS	
Year	**Data capture (%)**	**Annual mean concentration 1.3 data (µg/m^3)**	**Annual mean concentration VCM data (µg/m^3)**	**Data capture (%)**	**Annual mean concentration (µg/m^3)**
2005	24.9	n/a			
2006	96.0	59			
2007	91.6	51			
2008	84.9	46	39		
2009	93.5	46	39		
2010	92.6	39	32	47.0	n/a
2011	87.0	47	39	92.6	35
2012	90.7	33	29	89.0	26
2013	90.2	39	33	85.6	28
2014	84.6	35	30	92.8	25
2015	58.2	35	28	88.5	28

Table 27: Annual mean data for Low Santon from both the TEOM and FDMS monitors

It can be seen that the annual mean objective of 40ug/m^3 was exceeded (TEOM 1.3 data) in 2006, 2007, 2008, 2009 and 2011.

A Detailed Assessment of PM_{10} (2008) concluded that results from the Low Santon monitoring station were breaching the annual mean PM_{10} objective, but not in the area around the High Santon Partisol. The Low Santon area contains receptors that are relevant to the annual mean objective and thus an AQMA was declared in 2008.

Since the declaration of the AQMA, compliance has been achieved with the annual mean objective for PM_{10}. The results have demonstrated a step change in compliance in recent years firstly because of the application of the VCM and secondly the reporting of results from an FDMS TEOM monitor. The 1.3 TEOM data has continued to be examined because it demonstrates the long term trend, as illustrated in Figure 30.

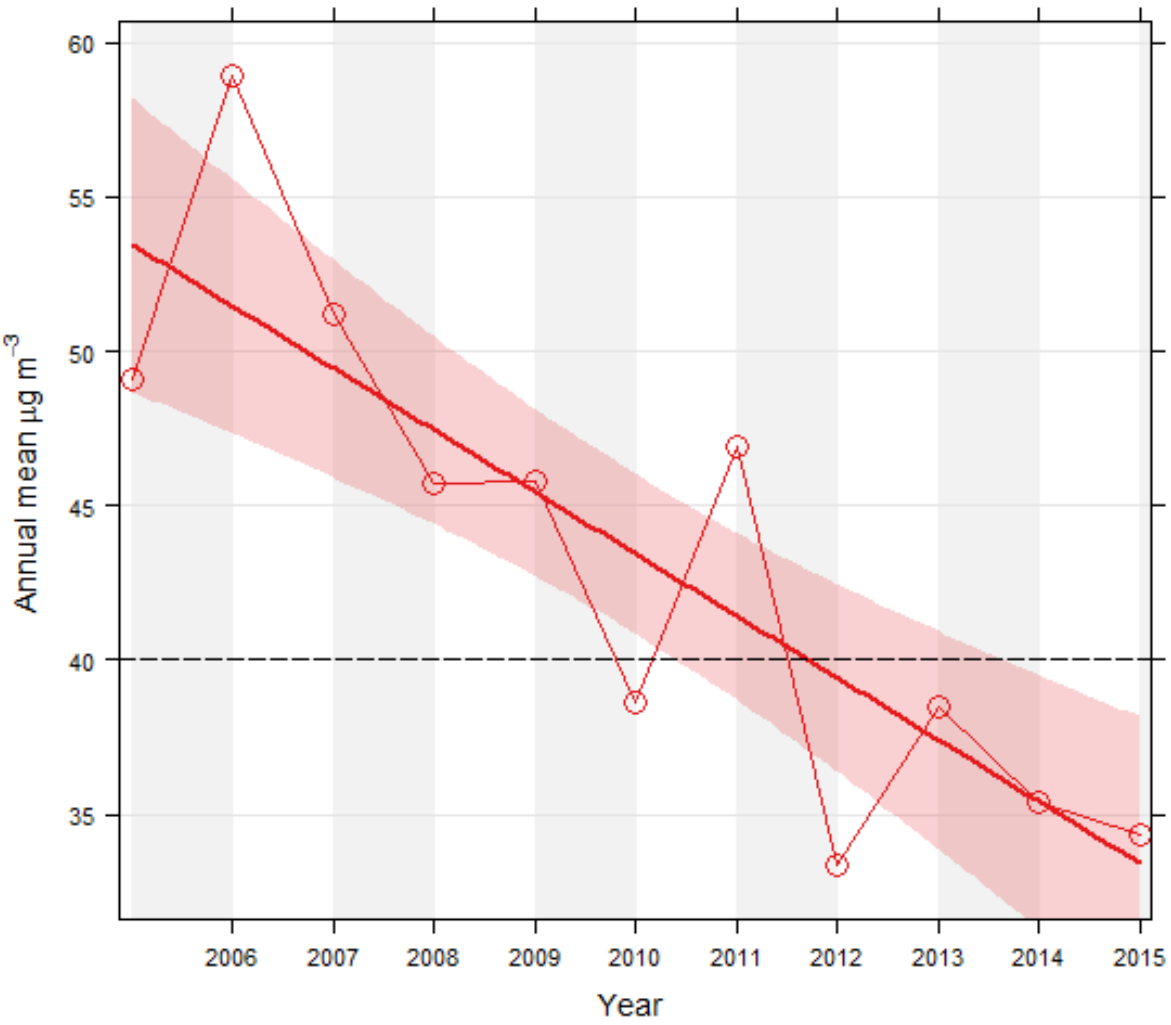

Figure 30: The long term trend in the annual mean PM_{10} concentration recorded from the TEOM monitor at Santon using 1.3 data.

The Council produced an air quality action plan for Low Santon in 2012, which was implemented with the assistance of the Environment Agency; the principal regulator for the site. The report also contained specific actions for British Steel, Tarmac and Harsco. The initiatives in the action plans that have been successfully implemented have been discussed earlier in this report.

The declining trend in overall concentrations of PM_{10} suggests that the measures in place continue to have a positive impact at Low Santon. The TEOM 1.3 data has not breached the annual mean air quality objective for PM_{10} since 2011, while the VCM applied data and the FDMS data have never breached. It is therefore the recommendation of North Lincolnshire Council that the annual mean PM_{10} AQMA at Low Santon should be revoked.

12 Conclusions

This report has reviewed the two AQMA's in North Lincolnshire and examined the air quality data since their declaration. The daily mean AQMA that covers eastern Scunthorpe and the integrated steelworks site was declared in 2005 predominantly based upon modelled data. For this reason early monitoring was undertaken beyond the AQMA as a precautionary principal to determine if the boundary was appropriate.

It is proposed that the Scunthorpe Town daily mean AQMA should be retained, although the boundary should be amended and reduced in size to only cover areas where a breach of the objective may occur. Approximately five years after the AQMA declaration, the air quality monitors at Lincoln Gardens and Allanby Street were relocated to areas where the air quality was poorer. The data also shows that the Redbourn Club and Lakeside monitoring sites are no longer required to be within the current AQMA boundary. Conversely, the data from East Common Lane, the Scunthorpe Town AURN site and Low Santon all suggest that these sites should remain inside the current AQMA.

The proposed new boundary for the daily AQMA therefore includes Amvale, East Common Lane, Scunthorpe Town AURN and the whole of the integrated steelworks site, including Low Santon, as illustrated in Figure 28.

The annual mean AQMA at Low Santon was declared in 2008, and as the annual mean PM_{10} concentrations have been compliant in all of the last four years (2012-15), it is proposed to revoke this AQMA.

A great deal of work has been done by the council in conjunction with the Environment Agency, British Steel, Tarmac and Harsco to improve air quality for local residents. Operators on the steelworks site have initiatives planned, and despite the current uncertainty surrounding the industry, it is hoped that these will still be implemented to further improve air quality. It would be prudent to continue to operate the Lakeside and Redbourn Club air quality monitors for a period of at least twelve months to ensure that an action taken as a result of this report is fully justified.

The council will continue to review data from the air quality monitoring network, this will be used to identify areas requiring improvement measures and to check the effectiveness of any measures implemented. Data will also be used to inform any future decisions on the AQMA boundary.