Department
for Environment
Food & Rural Affairs

UK Report on measures for 2016 exceedance of the Target Value for Nickel

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Llywodraeth Cymru
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1. Introduction

1.1 This document

This report provides an overview of the measures being taken to address the exceedances of the pollutant nickel (Ni) in the United Kingdom (UK) for the compliance year 2016, including updates on the measures for exceedances in the compliance years 2013, 2014 and 2015[1], as reported to the European Commission in September 2015, 2016 and 2017 respectively. Defra also publish an annual *Air Pollution in the UK* report alongside the compliance assessment submission which can be found here: http://uk-air.defra.gov.uk/library/annualreport/index . More detailed information on these exceedances and measures being taken to address them can be found in the individual zonal reports provided as an Annex to this document.

Copies of previous annual air quality submissions can be found on the Commission website: http://cdr.eionet.europa.eu/gb/eu/annualair and http://cdr.eionet.europa.eu/gb/eu/aqd/.

1.2 Background and Context

The EU Directive[2] 2004/107/EC aims to improve and maintain air quality by setting target values for the concentration in ambient air of metals cadmium, arsenic and nickel and for benzo[a]pyrene. The target value for nickel is an annual mean concentration of 20 nanograms (one billionth of a gram (10^{-9})) per cubic metre (m^{-3}) in ambient air or lower.

About Nickel

Nickel is a toxic metallic element found in ambient air as a result of releases from oil and coal combustion, metal processes, manufacturing and other sources. The main source of emissions to air of nickel in the UK is the combustion of heavy fuel oil and solid fuels derived from petroleum.

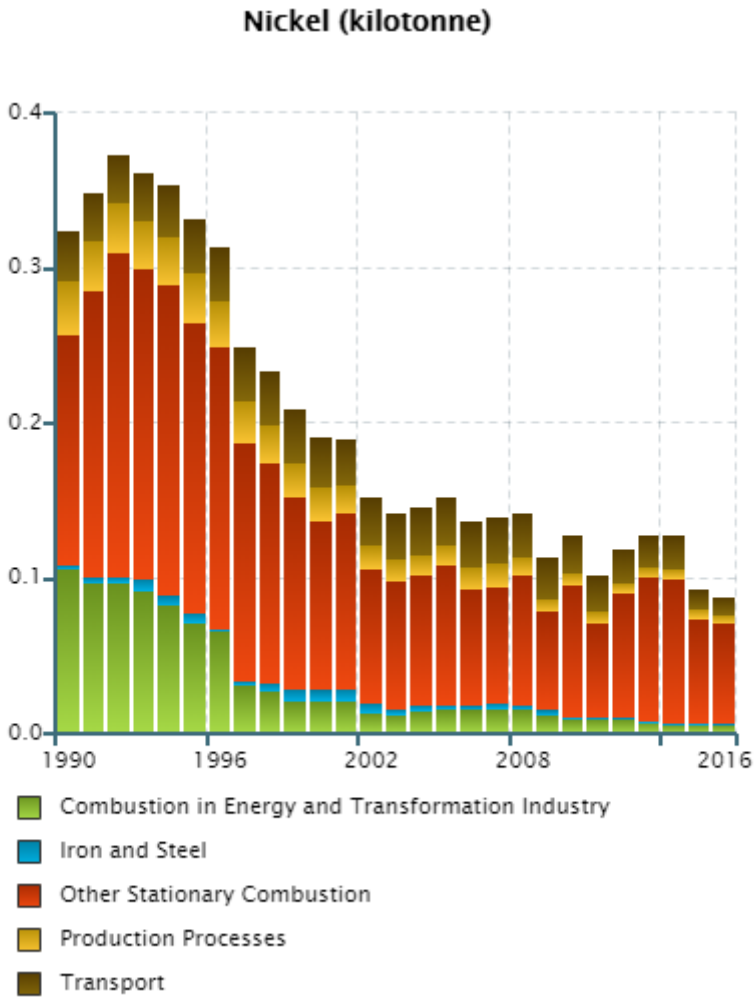
[1] https://uk-air.defra.gov.uk/library/bap-nickel-measures
[2] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32004L0107&rid=1

Nickel compounds are human carcinogens by inhalation exposure. They can cause irritation to the nose and sinuses and allergic responses and can lead to the loss of the sense of smell. Long-term exposure may lead to respiratory diseases and cancers[3]. Nickel can also pollute soil and water, thus having environmental impacts as well as health impacts.

Figure 1 shows the levels of nickel emissions in the UK and the main contributory sources. This shows that nickel emissions have reduced significantly since 1990.

[3] WHO AQG 2000, PHE Compendium of Chemical Hazards

Figure 1. Nickel emissions by sector (1990-2016)



UK Assessment

Assessment of levels of nickel in the UK with regards to the EU target value are made through a combination of modelling and fixed monitoring. There is a requirement to undertake monitoring at a fixed number of locations to assess key emissions sources, particularly near to large industrial emission sources. Undertaking modelling alongside monitoring enables the UK to calculate concentrations at locations where monitoring is not conducted providing a fuller picture of nickel concentrations across the UK. National assessment is carried out each year for the previous calendar year and results are reported to the Commission on an annual basis (submitted by 30th Sept for the previous calendar year). The 2016 compliance assessment reported that the UK exceeded the target value for nickel in two zones in Wales and one zone in England.

Reporting requirements for the exceedance of a target value

Where a target value is exceeded, Member States are required to specify the areas of exceedance and the sources contributing to it[4]. Following an exceedance Member States must submit a report detailing the measures already taken or that will be taken, to reduce levels of this pollutant, particularly those directed at the main emission sources in order to attain the target value. In the case of industrial installations covered by Directive 96/61/EC this means the application of best available techniques (BAT) as defined by Article 2(11) of that Directive (see industrial measures below). It is required that all reasonable measures should be taken that do not entail disproportionate cost. The report must be submitted no later than 2 years after the end of the year in which the exceedance triggering the measure was observed (i.e. the end of 2018 for 2016 compliance year – see Table 1).

This report on nickel is the fourth such report that the UK has produced and updates the Report on Measures produced for the exceedances reported for 2013, 2014 and 2015[1].

Table 1. Reporting timetable

Compliance year	"Year" (e.g. 2016)
Compliance assessment reporting	Sept 30th "Year"+1 (e.g. 2017)
Report on Measures	Dec 31st "Year"+2 (e.g. 2018)

In the UK, responsibility for meeting air quality target values is devolved to the national administrations in Scotland, Wales and Northern Ireland. The Secretary of State for Environment, Food and Rural Affairs (Defra) is responsible for meeting the target values in England. Defra has co-ordinated the production of this report in conjunction with the Welsh Government.

[4] Further detail on the reporting requirements can be found in the Commission Implementing Decision 2011/850/EC

2. Overview of Affected Zones

2.1 General information on zones

For the purposes of EU compliance reporting against EU Directive 2004/107/EC, the UK is divided into 43 zones, termed agglomerations (large urban areas) and non-agglomeration zones (regional areas). There are 15 non-agglomeration zones (Non-AZ) and 28 agglomeration zones (AZ). The 15 non-agglomeration zones match:

1. The boundaries of England's former Government Offices for the Regions; and
2. The boundaries agreed by the Scottish Executive, National Assembly for Wales, and Department for Agriculture, Environment and Rural Affairs in Northern Ireland.

An agglomeration is defined as any urban area with a population greater than 250,000.

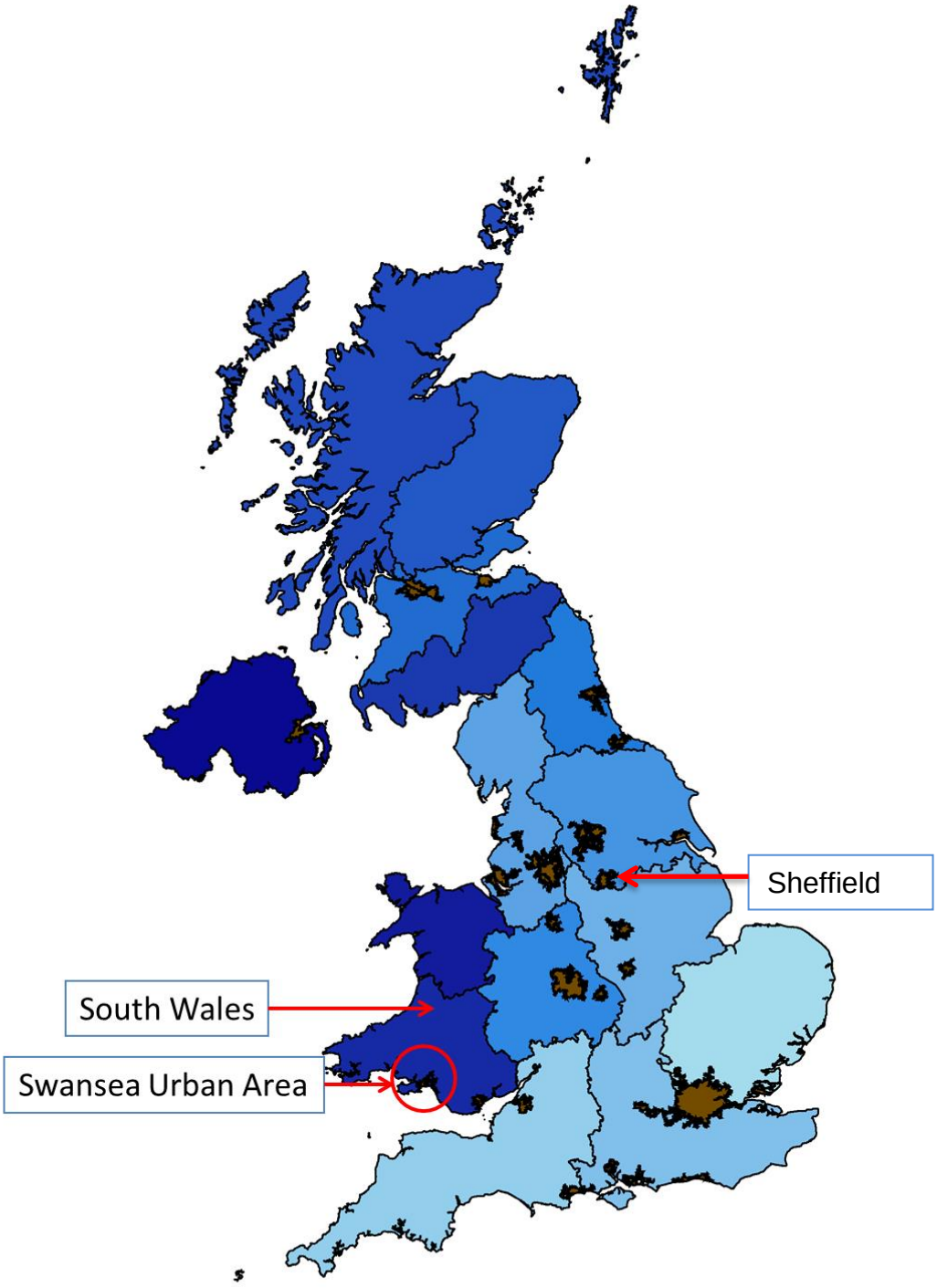
In 2016, three of the 43 zones in the UK were reported to have exceeded the target value for nickel (one non-agglomeration (non-AZ) and two agglomeration zones (AZ)). The affected zones were:

1. Sheffield Urban Area (UK0007) (AZ)
2. Swansea Urban Area (UK0027) (AZ);
3. South Wales (UK0041) (Non-AZ).

The locations of these zones are indicated on the map shown in Figure 2. Of the three exceedances reported, two were monitored (UK0007 and UK0027) and one was modelled (UK0041). There are detailed zonal reports for each of these exceedances.

The exceedances in both zones in Wales are attributed to emissions from the same industrial sources, which are located close to the zone boundary. The zonal reports provide a detailed breakdown of the affected area in each zone, including information about where the exceedance occurs, how it was assessed, information on sources of the exceedance and location maps.

Figure 2. Map of the UK showing location of zones and agglomerations exceeding the Nickel target value in 2016 (note: the arrows are for the purposes of labelling the zone and do not point to the location where the exceedance occurred – see zonal reports for more detail)



2.2 Assessment details

The UK's annual assessment of compliance is based on a combination of information from the UK national monitoring network and the results of modelling assessments. The level of fixed monitoring is strictly defined by European Directives. The use of models, alongside monitoring, allows for a reduction in the number of monitoring stations required and has the added benefits of enabling air quality to be assessed at locations without monitoring sites. Modelling also provides additional information on source apportionment (understanding which sources are the main contributors to the concentrations observed) and projections (predicting future concentrations) required for the development and implementation of air quality plans as well as this report on measures.

Monitoring

Monitoring situated near to large industrial sources is important for assessing the impact of industrial emissions on concentrations where there is relevant public exposure. In 2016 there were 24 monitoring sites measuring nickel concentrations in the UK. These monitors collect samples of particulate matter from the air (PM_{10} – Particulate Matter of size fraction up to 10 microns). Samples are analysed to determine the concentrations. More information on the UK monitoring of metals covered by the Fourth Air Quality Daughter Directive (EU Directive 2004/107/EC) can be found on UK-Air [5,6].

Modelling

The UK's modelling for compliance assessment is undertaken using a national-scale model known as Pollution Climate Mapping (PCM)[7]. PCM has been designed to assess compliance with environmental objectives at locations defined within EU Air Quality Directives. Modelling is undertaken for 11 air pollutants each year, including nickel and completed each year in time for compliance assessment submission at the end of September. The model performs an annual calculation covering the whole of the UK and outputs concentrations on a 1km square grid. These grid squares are assigned to each of the 43 zones and agglomerations for the purposes of assessing compliance status with respect to limit and target values in the Directives.

[5] http://uk-air.defra.gov.uk/assets/documents/annualreport/air_pollution_uk_2016_issue_1.pdf
[6] http://uk-air.defra.gov.uk/networks/network-info?view=metals
[7] http://uk-air.defra.gov.uk/data/gis-mapping

Modelling calculates concentrations based on estimates of emissions of nickel from all known sources. The model calculates the background concentration of nickel from all area sources (e.g. domestic fuel use, commercial and traffic sources).

Large and small point sources (e.g. from industrial activity) are modelled separately and added to the background concentrations from all other sources.

Exceedance situations established either by national scale modelling or fixed monitoring are further examined using additional modelling (outside of the PCM model) carried out at a more detailed spatial resolution in order to understand the scope of the exceedance. Such assessments can help validate or refine the national scale PCM assessment. Additional information input into the finer scale models includes more detailed emissions source information (with up to date information on emission amount and release characteristics obtained from the process operators and regulators) and local meteorological data. Such assessments enable a more detailed assessment of the exceedance situation helping to establish the key sources and reasons behind an exceedance. Depending on the conclusions of such finer scale modelling, additional understanding may then be incorporated into the PCM model for future year assessments. Such fine scale assessments are only conducted where exceedance situations are identified.

The 2016 modelling for nickel in the exceedance area in Sheffield suggests a shortfall in terms of emissions from sources for which reported emissions estimates are available. The modelling of these sources of Ni in the area was unable to account for the observed concentrations at Sheffield Tinsley (local monitoring site), indicating there are other nickel sources that are not well quantified. Work is ongoing to address this issue and is set out in Section 4 (next steps) below.

Fine scale modelling for nickel in the vicinity of the exceedance areas in Swansea and South Wales showed good agreement with measured concentrations at nearby monitoring stations in 2016.

3. Measures

3.1 Overview of Measures

The UK has a number of measures that are being taken to address emissions of nickel from industrial sources.

Industrial Measures

Industrial emissions of nickel are regulated under the Environmental Permitting (England and Wales) Regulations (EPR) (Scotland and Northern Ireland have similar legislation in place which performs the same function). In particular, the EPRs transpose a number of EU Directives on industrial emissions. Foremost amongst these, and most relevant for nickel emissions, is the Industrial Emissions Directive (IED) EU Directive 2010/75/EU[8]. This Directive sets stringent Emission Limit Values for pollutants emitted from a number of industrial sectors such as Large Combustion Plants and incinerators. The IED also requires that the operators of industrial facilities use the 'best available techniques' (BAT) to reduce their emissions and that they demonstrate this by complying with BAT-associated emission limits (BAT AELs). BAT and their BAT-AELs are set out in BAT reference documents (BREFs)[9]. There are 32 BREFs/BATCs, covering a wide range of industrial sectors, all of which are due to be reviewed by 2020. The Non-Ferrous Metals BREF for example was reviewed and recently adopted and its requirements will need to be reflected in permits by 2020. The revised iron and steel BREF (adopted in 2012) (currently under review) is also relevant. Depending on the size and location of the plant, the regulator for these sites is either Natural Resources Wales (when in Wales), the Environment Agency (in England) or the relevant local authority.

All necessary measures not entailing disproportionate costs have been taken by the local industrial operators with emissions of nickel to air.

4. Next steps

A further assessment was undertaken for the annual compliance assessment for 2017 and this was submitted in September 2018. The next compliance assessment for levels of nickel in 2018 will be submitted to the European Commission in September 2019.

The Welsh Government continues to invest in a number of activities to further understand the key sources of emissions and enable industry and regulators to implement measures to ensure compliance with the target value in future years. The Welsh Government has undertaken further detailed assessments to help improve the confidence in the source apportionment and further confirmation/identification of the predominant sources, and to confirm the spatial extent of the exceedance.

[8] http://ec.europa.eu/environment/industry/stationary/ied/legislation.htm
[9] http://eippcb.jrc.ec.europa.eu/reference/

Exceedances in both the South Wales (UK0041) and Swansea (UK0027) zones in 2016 can generally be attributed to abatement/equipment failures at the Wall Colmonoy site during the second half of the year, which is likely to have lasted a number of months, leading to significant exceedances for monitored Nickel levels. The observed breaches were not, however, representative of normal operations.

Significant work was undertaken by the regulator and site operator to understand and rectify the increase in emissions during 2016. Ambient monitoring data and internal nickel monitoring results were used to try to identify possible areas for improvement. An action tracker was used to identify, prioritise and track possible improvements, with further effort being put into maintenance activities.

A comprehensive programme of maintenance and improvement activities were carried out and it is believed that these interventions have had a significant impact on Ni concentrations in the area, with monitored (and modelled) levels of Nickel being reported as compliant with the target Value in 2017.

Work has been undertaken to better understand the emissions sources contributing to measured concentrations in the Sheffield exceedance area. Higher time resolution measurements at daily time resolution were undertaken to provide evidence to identify emissions sources contributing to nickel concentrations in the Tinsley area. The study identified sources to the south (likely Outokumpu) and unknown sources to the north east of Tinsley.

During 2017 King's College London were commissioned to undertake an hourly measurement campaign to measure the concentrations of nickel and other metals in the Tinsley area and provide further evidence on nickel sources in the area. This study identified sources to the south (Outokumpu) and north east, plus additional sources to the west with a smaller contribution to nickel concentrations. Sources could be apportioned between point and fugitive type sources.

The high time resolution monitoring studies in conjunction with the detailed modelling study have been used to inform the understanding of nickel sources in the Tinsley area and focus resources to identify specific processes from the identified industrial sources. These actions have facilitated the ongoing review of known sources that have a significant impact, and the further mitigation of impacts from any newly identified sources. Work is ongoing to inspect identified sites and work with site operators to identify emissions reduction plans.

Annex A: Zones

Zone or agglomeration	Zone code	Link to zonal report
Sheffield Urban Area	UK0007	https://uk-air.defra.gov.uk/assets/documents/reports/bap-nickel-measures/ni_sheffield_UK0007_reportonmeasures_2016.pdf
Swansea Urban Area	UK0027	https://uk-air.defra.gov.uk/assets/documents/reports/bap-nickel-measures/ni_swansea_UK0027_reportonmeasures_2016.pdf
South Wales	UK0041	https://uk-air.defra.gov.uk/assets/documents/reports/bap-nickel-measures/ni_southwales_UK0041_reportonmeasures_2016.pdf

Annex B: Acronyms

AZ	Agglomeration Zone
BAT	Best Available Techniques
BAT-AEL	BAT-associated emission limits
BREF	BAT Reference Documents
EPR	Environmental Permitting (England and Wales) Regulations
IED	Industrial Emissions Directive
Ni	Nickel
Non- AZ	Non- Agglomeration Zone
PCM	Pollution Climate Mapping