



Department
for Environment
Food & Rural Affairs

UK Report on measures for 2019 exceedance of the Target Value for Nickel

December 2021



Llywodraeth Cymru
Welsh Government



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1. Introduction

The UK and Welsh Governments ('Government') recognise the impact that poor air quality can have on human health and the environment. Tackling air pollution is a priority. A cleaner, healthier environment benefits people and the economy. Clean air is vital for people's health and the environment, essential for making sure our cities, towns and villages are welcoming places for people to live and work now and in the future, and for our prosperity. In 2019, the UK Government produced a new Clean Air Strategy for England. In August 2020, the Welsh Government published their Clean Air Plan, Healthy Air, Healthy Wales. These documents set out how Government will work towards our international targets to significantly reduce damaging emissions.

Improving air quality can reduce both the short-term and long-term effects on people's health. This particularly benefits those who may find their conditions are made worse through exposure to air pollution. For example, people with heart or lung conditions or breathing problems, as well as reducing longer term impacts on everyone.

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 2019, including updates on the measures for exceedances in the compliance years 2013, 2014, 2015, 2016, 2017 and 2018¹, as reported in September 2014, 2015, 2016, 2017, 2018 and 2019 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 <https://uk-air.defra.gov.uk/library/bap-nickel-measures>

1.2 Background and Context

The Air Quality Standards Regulations 2010² 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.

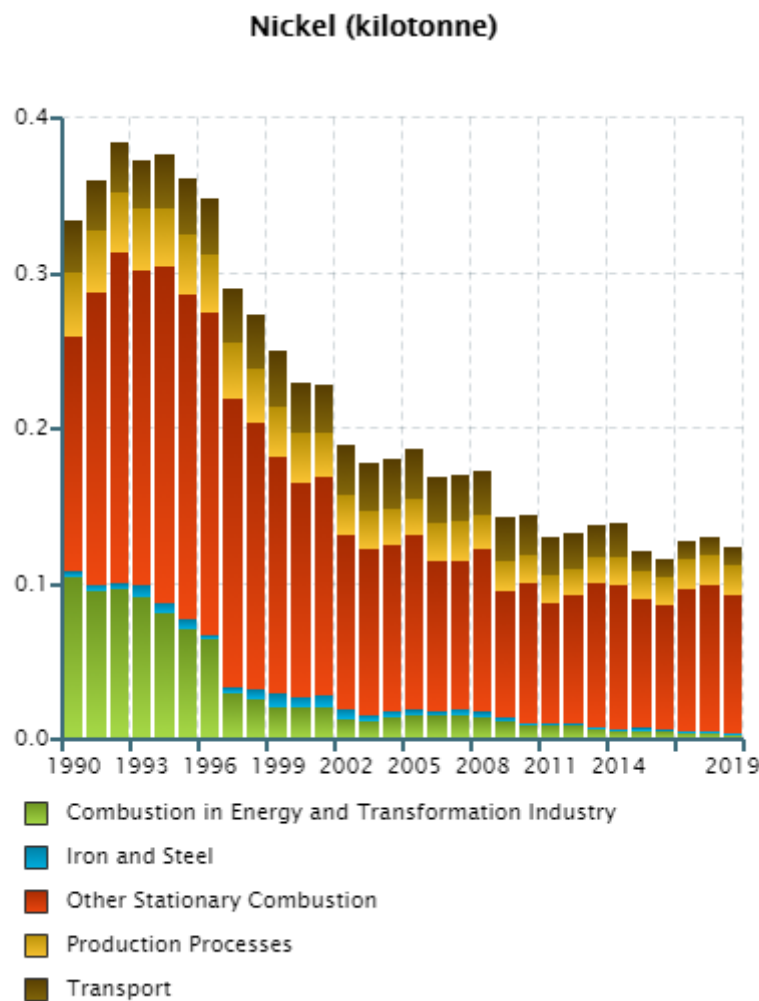
Nickel compounds are human carcinogens by inhalation exposure. They can cause irritation to the nose and sinuses and allergic responses and can lead to the loss of the sense of smell. Long-term exposure may lead to respiratory diseases and cancers³. Nickel can also pollute soil and water, thus having environmental impacts as well as impacts on human health.

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.

² The Air Quality Standards Regulations 2010 ([legislation.gov.uk](https://www.legislation.gov.uk))

³ WHO AQC 2000, PHE Compendium of Chemical Hazards

Figure 1. Nickel emissions by sector (1990-2019)



UK Assessment

Assessment of levels of nickel in the UK with regards to the EU target value are made through a combination of fixed monitoring supplemented by modelling. 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. The air quality compliance assessment is carried out annually. The results are reported by 30th September each year, for the previous calendar year.

The 2019 compliance assessment reported that the UK exceeded the target value for nickel in two zones in Wales and two zones in England.

Reporting requirements for the exceedance of a target value

Where a target value is exceeded, appropriate authorities in the UK are required to specify the areas of exceedance and the sources contributing to it⁴.

Following an exceedance appropriate authorities in UK 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. The Environmental Permitting Regulations (EPR) (England & Wales) aim to prevent or minimise pollution by placing stringent limits on emissions from industrial sources. 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 2021 for 2019 compliance year – see Table 1).

This report on nickel is the seventh such report that the UK has produced and updates the Report on Measures produced for the exceedances reported for 2013, 2014, 2015, 2016 and 2018¹.

Table 1. Reporting timetable

Compliance year	“Year” (e.g. 2019)
Compliance assessment reporting	Sept 30 th “Year” +1 (e.g. 2020)
Report on Measures	Dec 31 st “Year” +2 (e.g. 2021)

In the UK, the 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 The Air Quality (Miscellaneous Amendment and Revocation of Retained Direct EU Legislation) (EU Exit) Regulations 2018

2. Overview of Affected Zones

2.1 General information on zones

For the purposes of the compliance reporting against Air Quality Standards Regulations 2010, 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, Welsh Government, 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.

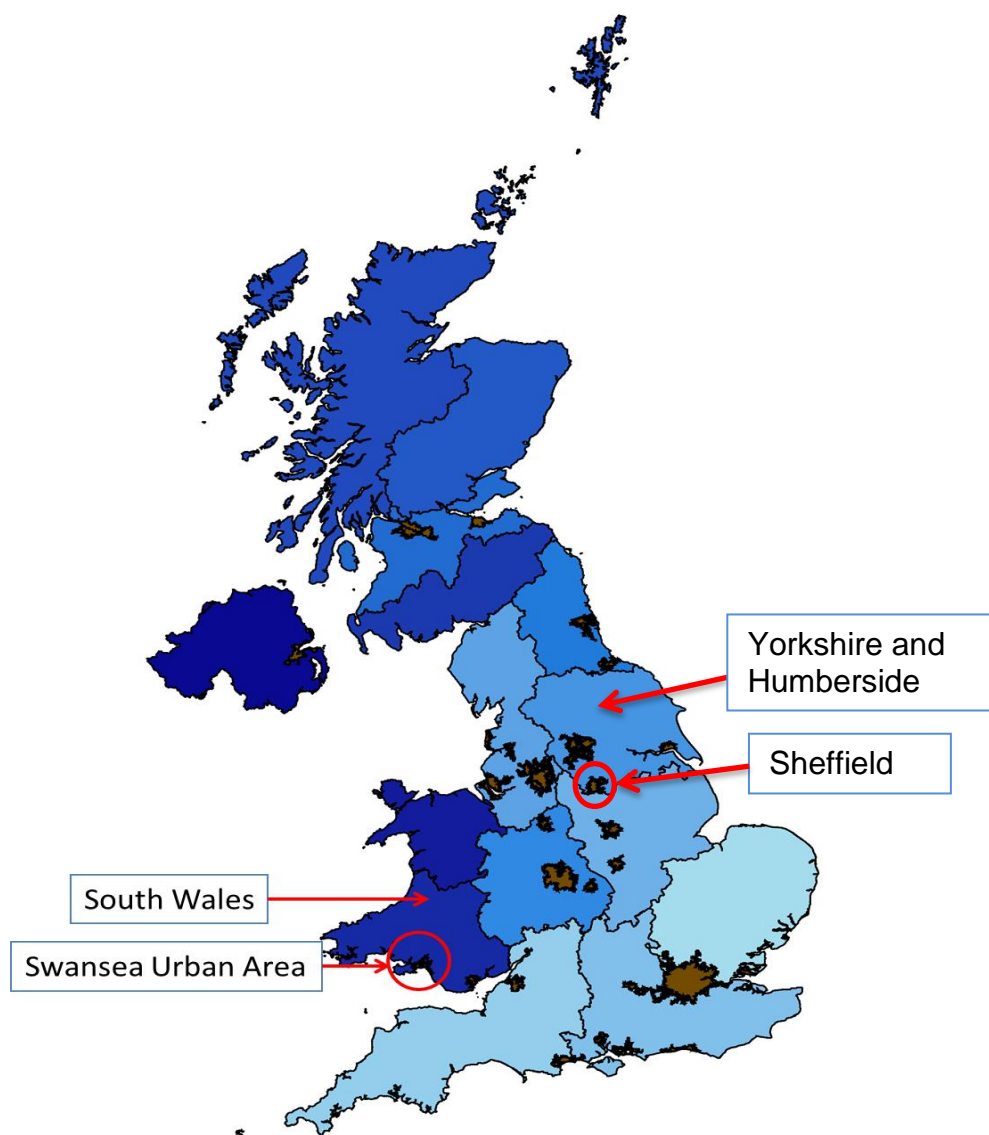
In 2019, four of the 43 zones in the UK were reported to have exceeded the target value for nickel (two non-agglomeration (non-AZ) and two agglomeration zones (AZ)). The affected zones were:

1. Sheffield Urban Area (UK0007) (AZ)
2. Swansea Urban Area (UK0027) (AZ);
3. Yorkshire and Humberside (UK0034) (Non-AZ);
4. South Wales (UK0041) (Non-AZ).

The locations of these zones are indicated on the map shown in Figure 2. Of the four exceedances reported, one was monitored ([UK0027](#)) and three were modelled ([UK0007](#), [UK0034](#) and [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 exceedances in the two zones in England are associated with industrial sources that are 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 2019 (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)



Map of the UK showing location of non-agglomeration zones (blue) and agglomeration zones (brown). Zones exceeding the nickel target value in 2019 are indicated

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 Air Quality Standards Regulations 2010. 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

The combustion of fuel oils and petroleum coke in domestic, commercial and industrial settings, nickel mining and refining, and municipal waste incineration are the main source of nickel emissions. Levels emitted will depend on the type of appliance, the efficiency of process and the level of emissions abatement that is in place. Large industrial sites where nickel is processed and refined are the most significant sources of industrial nickel emissions in the UK.

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 2019 there were 23 monitoring sites measuring nickel concentrations in the UK. These monitors collect samples of particulate matter from the air (PM₁₀ – 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 Air Quality Standards Regulations 2010 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 UK Air Quality Standards Regulations 2010. 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

⁵ http://uk-air.defra.gov.uk/assets/documents/annualreport/air_pollution_uk_2019_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>

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 regulations.

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.

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.

In 2019 the modelling for nickel in the exceedance area in Sheffield based on the emissions reported for Outokumpu was in good agreement with measurements.

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 2019.

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

Various industrial facilities undertaking specific types of activity are required to use “Best Available Techniques” (BAT) to reduce emissions to air, water and land. BAT means available techniques which are the best for preventing or minimising emissions and impacts on the environment. BAT is used to determine types of abatement, manufacturing and production technologies and methods that operators should put in place. Prior to the end of the transition period, the Industrial Emissions Directive (IED) regulated pollutant emissions from industrial installations throughout Europe. The IED requires regulators to issue environmental permits to operators of certain types of industrial installation - these installations must use BAT.

Industrial emissions of nickel are regulated under the Environmental Permitting (England and Wales) Regulations (EPR) 2016, (as amended) and the Air Quality Standards Regulations 2010. The EPRs (and equivalent legislation in Scotland and Northern Ireland) transposed the IED into UK law, which aim to prevent or minimise pollution by placing stringent limits on emissions from industrial sources.

The EU regime established a rolling programme of BAT reviews that specified mandatory emission standards for each sector. This includes maximum allowable Emission Limit Values (ELVs) for pollutants emitted from certain industrial sectors, such as incinerators. BAT Reference Documents (BRefs) containing associated emission limits are produced forming the basis of subsequent decisions containing BAT Conclusions. Once published, regulators are obliged by law to review permits and to implement new BAT either (i) within 4 years for existing installations or (ii) immediately for new installations.

The UK Government introduced secondary legislation under the EU (Withdrawal) Act 2018 to ensure the IED continues to operate; all existing EU BATCs from the review programme hitherto have been transposed into UK law.

The Non-Ferrous Metals sector, for example, was reviewed and a new BRef and BAT Conclusions were adopted in 2016. Environmental permits for existing installations (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) were subsequently revised by 2020 (with

the exception of one Local Authority-regulated permit where a derogation application is still being determined).

A new autonomous air quality regime is being established to ensure that future UK BAT decisions are enforceable under national legislation.

4. Next steps

A further assessment was undertaken for the annual compliance assessment for 2020 and this was submitted in September 2021. The next compliance assessment for levels of nickel in 2021 will be published in September 2022.

Zones in Wales

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. Further detailed assessments have been undertaken 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.

Exceedances in both the South Wales (UK0041) and Swansea (UK0027) zones in 2019 can generally be attributed to emissions from the Wall Colmonoy site.

Significant work was undertaken by the regulator and site operator to understand and rectify the increase in emissions during 2018. 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 nickel concentrations in the area.

Zones in England

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. There is population exceeding TV in Sheffield (9987) but not in Yorkshire and Humberside

The regulator and the operators of industrial sites in the Tinsley area of Sheffield have continued to work closely to understand, assess and address the sources of nickel originating from their process.

The stainless steelmaking site which was identified as the largest single source contribution for the Tinsley area, continues to control emissions from its stationary sources working with Best Available Techniques (BAT) or beyond and meeting the BAT-associated emission levels defined in their environmental permit. Significant investment was made during the course of 2018 to improve primary source emission control. Following the completion of a modelling study, the operator also focused on tackling less-known fugitive emissions on their site, targeting the raw materials reception and stockyard areas which were estimated to account for 12% of the emissions arising from their site. Emissions from these areas may be due to vehicle movements and wind-whip from stockpiles and exposed surfaces, including re-suspension of dust on haul routes. As a result, they have developed and implemented a risk assessment tool based on a three-day weather forecast, directing bowser and sweeper activities to respond to these conditions and prevent dust resuspension.

Another major industrial contributor to the ambient nickel load in Tinsley, a stainless steel scrap handling plant, made significant capital expenditures to upgrade their process and install a metal shearing machine. As a result, they have reduced by half in 2019 the need to use oxy-propane cutting which was identified as a significant source of nickel-containing fugitive fumes. There is however scope for further improving understanding of these emissions and activity levels which would focus attention on the main nickel emitters.

The exceedance situation in Yorkshire and Humberside [Ni_UK0034_2019_1] shares common industrial sources with Sheffield agglomeration zone, and no additional sources of nickel have been identified for the exceedance situation in Yorkshire and Humberside. We will continue to investigate the undefined and scaled source contributions.

Over the next twelve months Defra convene quarterly with regulators to agree on a proportional and coordinated plan to tackle exceedances, working closely with site operators to identify sources and review implemented measures.

The regulator and the operators of industrial sites in the Tinsley area of Sheffield will collaborate to assess to what extent the newly implemented control measures have been effective. Further work will focus on identifying other potential sources of fugitive emissions and determining appropriate abatement technologies in order to prevent nickel exceedances.

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_report_onmeasures_2019.pdf
Swansea Urban Area	UK0027	https://uk-air.defra.gov.uk/assets/documents/reports/bap-nickel-measures/ni_swansea_UK0027_report_onmeasures_2019.pdf
Yorkshire and Humberside	UK0034	https://uk-air.defra.gov.uk/assets/documents/reports/bap-nickel-measures/ni_yorkshireandhumberside_UK0034_reportonmeasures_2019.pdf
South Wales	UK0041	https://uk-air.defra.gov.uk/assets/documents/reports/bap-nickel-measures/ni_southwales_UK0041_reportonmeasures_2019.pdf

Annex B: Acronyms

AQSR	Air Quality Standards Regulations
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
TV	Target Value