Department
for Environment
Food & Rural Affairs

UK Report on measures for 2018 exceedance of the Target Value for Benzo[a]Pyrene

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Llywodraeth Cymru
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1. Introduction

The UK and Welsh Government's ('Government') recognises the impact 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 to 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 for Wales, Healthy Air, Healthy Wales. These documents set out how Government will work towards 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 benefit 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 benzo[a]pyrene (B[a]P) in the United Kingdom (UK) for the compliance year 2018. It includes updates on the measures for exceedances in the compliance years 2013, 2014, 2015, 2016 and 2017[1], as reported to the European Commission in September 2014, 2015, 2016, 2017and 2018 respectively. The UK was a Member State during the period this overview covers, and the Directive requirements apply to the UK as part of its obligations during the Transition Period.

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.

[1] https://uk-air.defra.gov.uk/library/bap-nickel-measures

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, nickel and for B[a]P. The target value for B[a]P is an annual mean concentration of 1 nanogram (one billionth of a gram (10^{-9})) per cubic metre (m^{-3}) in ambient air or lower.

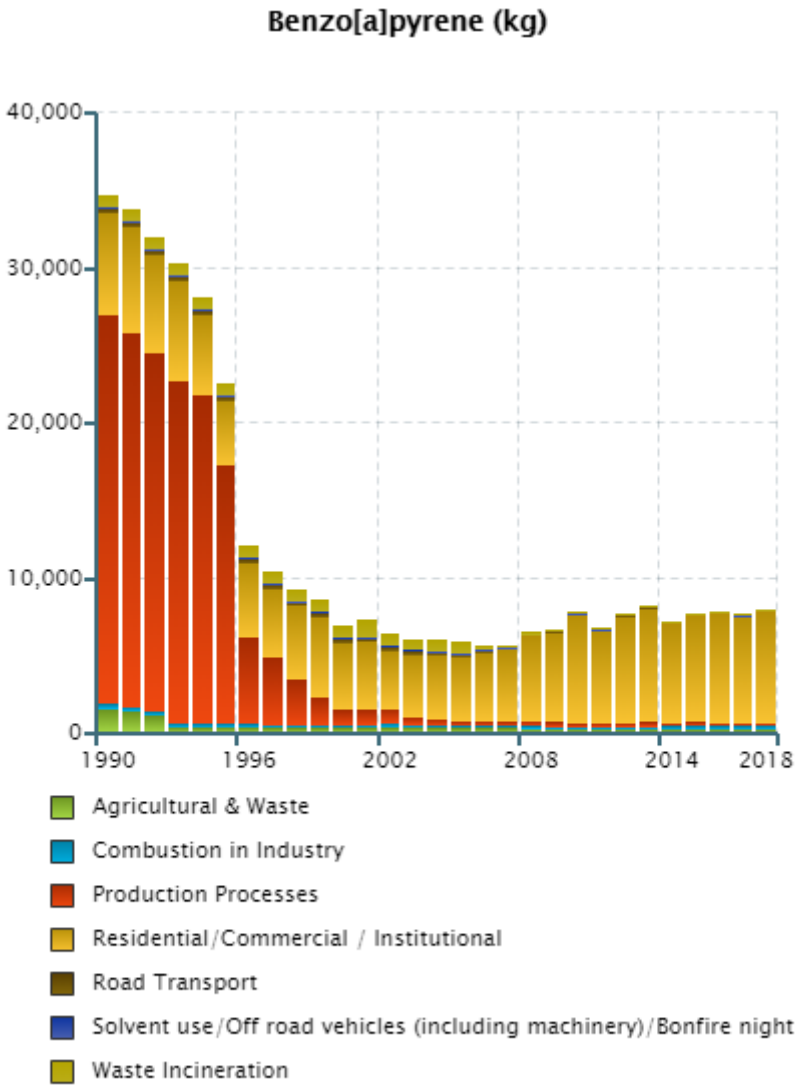
About Benzo[a]Pyrene (B[a]P)

B[a]P is used as a 'marker' for a group of compounds known as polycyclic aromatic hydrocarbons (PAHs). PAHs are a large group of persistent, organic compounds that accumulate in the environment, people and animals and which have toxic and carcinogenic effects. Lung cancer is most clearly linked to exposure to PAHs through inhaled air[3], but bladder cancer is also contributed to. These pollutants can bio-accumulate and be passed up the food chain thus contributing to health impacts as well as ecological impacts.

B[a]P is a by-product of incomplete combustion. The main sources of emissions to air of B[a]P in the UK are from domestic coal and wood burning, industrial processes (e.g. coke production) and fires (e.g. accidental, bonfires, open fireplaces etc.). Figure 1 shows the main sources of emissions of B[a]P in the UK. This shows that total emissions have decreased by 97% since 1990 due to reduced emissions from 'agriculture and waste', as a result of the cessation of stubble burning, and 'production processes' including the closure of a number of aluminium plants. However, while emissions decreased consistently between 1990 and 2002, subsequently they have stabilised and even increased in some recent years, predominantly due to increased emissions from domestic combustion.

[2] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32004L0107&rid=1
[3] WHO AQG 2000, PHE Compendium of Chemical Hazards

Figure 1. B[a]P emissions by sector (1990-2018)



UK Assessment

Assessment of levels of B[a]P 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 B[a]P 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). Once the Transition Period ends on 31 December 2020, the UK will continue to meet its reporting obligations through making this data available to the public to the same timescales.

The 2018 compliance assessment reported that the UK exceeded the target value for benzo[a]pyrene in three zones; one in England and two in Wales.

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].

The United Kingdom exited the European Union on 31 January 2020. Upon exit, the UK entered a Transition Period which will end on 31 December 2020. The UK was a Member State during the period this report covers, and the Directive requirements apply to the UK as part of its obligations during the Transition Period.

Once the Transition Period ends on 31 December 2020, the UK will continue to meet its reporting obligations through making this data available to the public to the same timescales.

Following this report of exceedance, Member States are then required to and submit a report (this report) detailing the measures already taken, ongoing, or that will be taken, to reduce levels of this pollutant - particularly those measures directed at the main emission sources in order to attain the target value. It is required that all reasonable measures should be taken which 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 2020 for the 2018 compliance year – see Table 1).

This report on B[a]P is the sixth such report that the UK has produced and updates the Report on Measures produced for the exceedances reported for 2013, 2014, 2015, 2016 and 2017[1].

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

Table 1. Reporting timetable

Compliance year	“Year” (e.g. 2018)
Compliance assessment reporting	Sept 30th “Year” +1 (e.g. 2019)
Report on Measures	Dec 31st “Year” +2 (e.g. 2020)

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.

2. Overview of Affected Zones

2.1 General information on zones

For the purposes of the compliance reporting against EU Directive 2004/107/EC, the UK is divided into 43 zones, termed agglomeration (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.

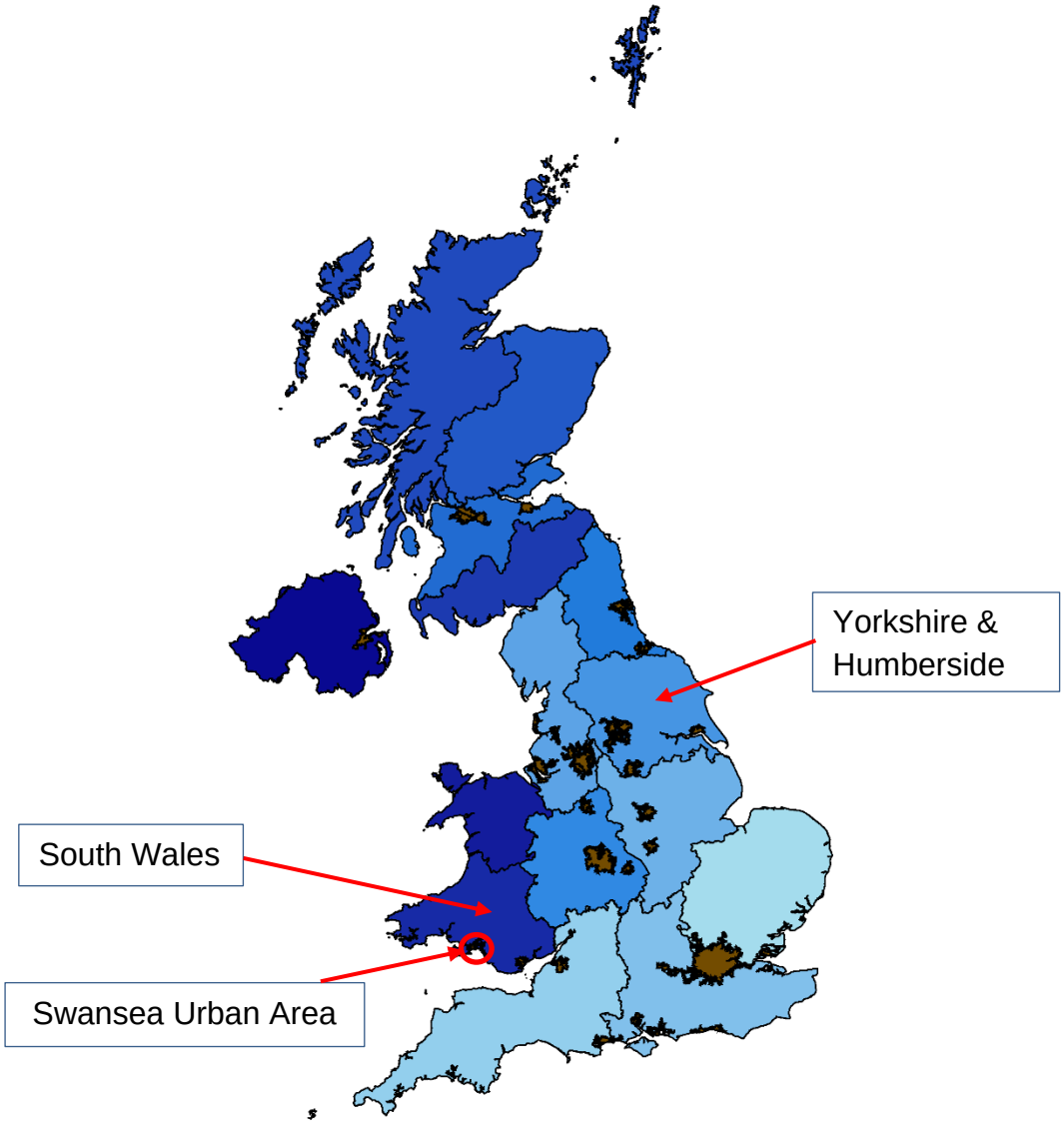
An agglomeration is defined as any urban area with a population greater than 250,000.

In 2018, three of the 43 zones in the UK were reported to have exceeded the target value for B[a]P (two non-agglomeration (non-AZ) and one agglomeration zones (AZ)). The affected zones were:

1. Yorkshire and Humberside (UK0034) (Non-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. These exceedances are due to industrial emissions sources. Two of these exceedances were modelled and one was measured (see section 2.2 below). In all three zones the exceedances are attributed to industrial sources. 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 locations of the zones and agglomerations exceeding the B[a]P target value in 2018 (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 2018 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 European Directives. The use of models, alongside monitoring, allows for a reduction in the number of monitoring stations required and has the added benefit 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.

It is worth noting that the monitors located in the zones reported as exceeding due to modelling did not exceed the target value. Through assessment using both modelling and monitoring, consideration is given to the likely distribution of emissions from the predominant source and therefore a fuller picture of the distribution of B[a]P in the area is reported.

Monitoring

Incomplete burning of fuel can emit significant amounts of B[a]P. Levels emitted will depend on the type of fuel, the type of appliance, the efficiency of combustion and the level of emissions abatement that is in place. Large industrial sites where solid fuel is thermally treated (e.g. coke and sinter plant activities at steel works) are the most significant sources of industrial B[a]P emissions in the UK due to the volume of solid fuel used and the nature of the industrial process. Monitoring situated near to large industrial sources of these types is important for assessing the impact of industrial emissions on concentrations where there is relevant public exposure.

There are 32 monitoring sites measuring B[a]P 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 in aerodynamic diameter). Samples are analysed to determine the concentrations of 21 individual PAHs, including B[a]P, and concentrations of B[a]P assessed against the target value. More information on the UK monitoring of pollutants covered by the Fourth Air Quality Daughter Directive (EU Directive 2004/107/EC) can be found on UK-Air [5,6].

[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=pah

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 EU limit and target values at locations defined within EU Air Quality Directives. Modelling is undertaken for 11 air pollutants each year, including B[a]P 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.

Modelling calculates concentrations based on estimates of the spatial pattern of emissions of B[a]P from all known sources. The model calculates the background concentration of B[a]P from all area sources (e.g. domestic solid fuel use, commercial and traffic sources). Modelled B[a]P concentrations are calibrated to those measured at background monitoring stations to ensure concentrations from modelling and monitoring are consistent. Source apportionment indicates that exceedances due to domestic sources are largely driven by contributions from domestic combustion of coal and wood.

Large and small point sources (e.g. from activity at steel works and industrial activity) are modelled separately and added to the background concentrations from all other sources. In order to obtain a model result that is consistent with measured concentrations, the modelled contribution from the point source is calibrated using monitoring data from the national network. Industrial sites only are used to calibrate these large point source contributions. Source apportionment from the industrial sectors indicates that the modelled exceedances are largely driven by the contribution from emissions from coke production.

For Scunthorpe Steelworks, as the modelling is getting closer to the monitoring values, there is scope to further investigate refining the source terms for input into the modelling. The Appleby Coke Ovens has a mixture of fugitive emissions, point source emissions, use of emission factors and more random process safety pressure relief emissions (point sources) are identified as key drivers of the total annual B[a]P emissions. See the zonal report for further details.

Exceedance situations established either by national scale modelling or fixed monitoring are further examined using finer-scale 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 are used to refine the national scale

[7] http://uk-air.defra.gov.uk/data/gis-mapping

PCM assessment and compliance is reported based on these more detailed model results for these locations. 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. Such fine scale assessments are only conducted where exceedance situations are identified. Further additional modelling of this type was also undertaken for the industrial exceedances in the Swansea Urban Area and the South Wales zones and further details are available in the zonal annex.

3. Measures

3.1 Overview of Measures

The UK has a number of measures being taken to address emissions of B[a]P from industrial sources.

Industrial Measures

Industrial emissions of B[a]P are regulated under the Environmental Permitting (England and Wales) Regulations, 2016, amended (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 B[a]P emissions, is the Industrial Emissions Directive EU Directive 2010/75/EU (IED)[8], together with the Best Available Techniques Conclusions (BATCs) Implementing Decisions. The IED Directive sets stringent Emission Limit Values (ELVs) 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 broad range of industrial sectors.

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

The iron and steel sector is the principal source of B[a]P emissions from UK industry. The iron and steel BREF was adopted in March 2012 with compliance required within 4 years of adoption, i.e. by March 2016. The BREF does not contain BAT or BAT-AELs for the reduction of B[a]P or PAH emissions. However, it does contain stringent requirements for iron and steel works to significantly reduce their fugitive emissions of a variety of pollutants. This includes PAHs due to unintended escape from an industrial process or location, often from unknown/unmitigated routes or sources.

The Environment Agency (EA), the regulator in England, and Natural Resources Wales (NRW) the regulator in Wales expected the operators of iron and steel works to improve their operations, and where required, technically upgrade their facilities by 8th March 2016 to relevant BAT Conclusions 2012/135/EU published on 8th March 2012, also set out in the sector BREF. Any plans to refurbish or replace existing coke ovens to achieve the required reductions would require large-scale financial and technical investment by site operators and therefore not all would be able to make the requisite changes by this deadline. The IED (2010/75/EU) allows for the application of derogations under Article 15(3) from BAT Conclusion BAT- Associated Emissions Limits (AELs) that contribute meeting B[a]P target values where costs outweigh the environmental benefits. There are no BAT-AELs specific to B[a]P emissions. As a result, the EA considered and granted applications from operators for specific temporary time-limited derogations from the IED and BREF BAT conclusions for the relevant sites. The relevant derogated BAT Conclusions (49, 50, &51) for the Coke Ovens for Scunthorpe Steelworks are until March 2024. This was to allow them more time to make the necessary upgrades to their facilities in a sustainable manner, to ensure the achievement of the environmental and human health benefits delivered by reducing B[a]P emissions as soon as possible by applying BAT

In the Yorkshire and Humberside region, the closure of Dawes Lane Coke Ovens in March 2016 meant the time-limited Derogations and it associated Emissions Limits stopped applying. This closure and subsequent improvement works at Appleby Coke Ovens has had a significant effect on lowering B[a]P emissions during 2017 and 2018. EA had placed in the February 2016 reviewed EPR permit, conditions on emissions limits linked to relevant BAT Conclusions as set out in the sector BREF and on developing an Air Quality Management Plan to prevent and minimise PAH B[a]P emissions. EA have also annually inspected the Appleby coke oven battery and coke oven by-products plant improvements, recovery plan and related works. Significant rebuilding of ACO slot ovens within the four Battery's and associated recovery works has been done and continues. Similarly, regulatory compliance improvements and works on the Iron Ore preparation sinter plant particulate emissions has been carried out that indirectly affect B[a]P emissions. The IED approach takes account of not entailing excessive cost to an Operator within the

definition of BAT. Given this, it is not an Emission Limit, but a Target Value as set out by EU Directive 2004/107/EC that aims to improve and maintain air quality. NRW has also agreed a programme of works with relevant site operators to ensure compliance with relevant BAT-AELs that affect B[a]P emissions. Both approaches by the two Regulatory bodies will deliver the required environmental improvement without imposing an unreasonable burden on industry.

Energy Efficiency Measures

The Non-domestic and Domestic Renewable Heat Incentive (RHI) schemes help businesses, public sectors, non-profit organisations and domestic customers meet the cost of installing renewable heat technologies. The types of heating that can be claimed in the Non-domestic scheme range from biomass to heat pumps and biomethane amongst others. In the Domestic scheme heat can be claimed for biomass, solar water and certain heat pumps. The Non-domestic RHI scheme has been open since November 2011 and the Domestic scheme opened in April 2014.

EU Emissions Trading System scheme

Launched in 2005, the European Union Emissions Trading System (EU ETS) is a cap-and-trade system of allowances for emitting greenhouse gases in the world. It sets an emissions cap for installations covered by the system but allows trading and the carbon market to determine the carbon price and therefore where emissions can be reduced most cheaply. The underlying principle of emissions trading is to ensure that emissions reductions are made where it is most cost-effective to do so. The UK Government and Devolved Administrations consulted on the future of UK carbon pricing in 2019.

UK energy efficiency schemes

The Climate Change Agreements (CCA) scheme is a targeted scheme to support competitiveness and energy efficiency across 53 industrial sectors. It provides a tax discount in return for companies signing up to stretching energy efficiency improvement targets.

The Energy Savings Opportunity Scheme (ESOS) is an energy assessment scheme that is mandatory for all large undertakings (non-SMEs). Qualifying organisations must measure their total energy consumption and carry out audits (or equivalent) of the energy used by their buildings, industrial processes and transport

to identify cost-effective energy saving measures, by 5 December 2015 and every four years thereafter.

The Streamlined Energy and Carbon Reporting framework (SECR) covers all UK quoted and large UK businesses, requiring them to disclose energy and emissions information and details of the key energy efficiency actions taken in their annual reports.

The CRC Energy Efficiency Scheme (to 2019) is a mandatory scheme covering large, non-intensive, users of energy in both the public and private sectors. The scheme ended with the 2018/19 compliance year as announced at the March 2016 Budget. The CRC sought to incentivise the uptake of energy efficiency measures where the energy use by organisations is not covered by other schemes namely Climate Change Agreements and the EU Emissions Trading System (EU ETS).

Combined Heat and Power (CHP) can improve energy efficiency by up to 30%. The UK Government has introduced a number of fiscal support mechanisms designed to improve the economics of operating CHP plants. Since 2000, the CHP Quality Assurance (CHPQA) Scheme has assessed the primary energy savings of participating CHP plant to certify it either fully or partly, as “Good Quality” CHP. Certification through the CHPQA scheme makes the operators eligible for exemptions from the Carbon Price Support and Climate Change Levy taxes, business rates exemptions, and enhanced capital allowances (until 31 March 2020). Renewable CHP plants can also receive support under the Renewable Heat Incentive, Renewables Obligation and Contracts for Difference dependant on when they became operational. Support for CHP and the CHPQA scheme is currently under review. A Call for Evidence concluded in September 2020 and a Consultation will be launched in 2021.

4. Next steps

The compliance assessment for 2019 was submitted in September 2020. Comparisons of the results between the 2013, 2014, 2015, 2016, 2017 and 2018 can be seen here: http://uk-air.defra.gov.uk/data/gis-mapping. The next compliance assessment for levels of B[a]P in 2020 will be published in September 2021.

We will continue to monitor and/or model the affected areas and implement existing measures set out in this Report. We will also keep the measures contained in this Report under review to enable us to track progress towards meeting the target values.

A change in the method for monitoring and calculating fugitive emissions from the coke ovens at the Tata Steel UK, Port Talbot, has led to the operator having a better

understanding of the precise sources of fugitive emissions. This has enabled a targeted improvement programme to be established. This improvement programme is underway, and monitoring has shown a decrease in 2017 but a slight increase in 2018, due to a spike in the spring. However, subsequent months show a downward trend continuing into 2019. This site regulator will continue to focus on better performance through regulations and a review of data analysis for 2019.

Considerable investments and engineering resources have been made in the Appleby Coke Ovens (ACO) and subsequently maintenance of these, following the closure of the DLCO Plant in March 2016. Significant rebuilding of ACO slot ovens within the four Battery's and associated recovery works has been done and continues. This is to improve operational performance on both the Coke Oven Batteries and the By-products plant with improved infrastructure. Spikes in monitoring B[a]P emissions has led to work on the 2019 B[a]P mass emissions. We are focusing on the emissions from the Coke Oven Battery pressure relief and flaring abatement system to reduce B[a]P emissions.

In relation to the Iron Ore preparation sinter plant and particulate emissions, on-going projects to improve abatement and achieve compliance with specific BAT Conclusions are being implemented to reduce both particulate and dioxin/furan emissions. These will in turn have secondary potential to minimise B[a]P emissions.

Defra will convene with regulators on a quarterly basis during 2021 to agree on a proportional and coordinated plan to reduce emissions, working closely with site operator to identify sources and review implemented measures.

Annex A: Zones

Zone or agglomeration	Zone code	Link to zonal report
Swansea Urban Area	UK0027	https://uk-air.defra.gov.uk/assets/documents/reports/bap-nickel-measures/bap_swansea_UK0027_reportonmeasures_2018.pdf
Yorkshire and Humberside	UK0034	https://uk-air.defra.gov.uk/assets/documents/reports/bap-nickel-measures/bap_yorkshireandhumberside_UK0034_reportonmeasures_2018.pdf
South Wales	UK0041	https://uk-air.defra.gov.uk/assets/documents/reports/bap-nickel-measures/bap_southwales_UK0041_reportonmeasures_2018.pdf

Annex B: Acronyms

AZ	Agglomeration Zone
B[a]P	Benzo[a]Pyrene
BAT	Best Available Techniques
BAT-AEL	BAT-associated emission limits
BREF	BAT Reference Documents
CAA	Clean Air Act 1993
EA	Environment Agency
EPR	Environmental Permitting (England and Wales) Regulations
IED	Industrial Emissions Directive
Non- AZ	Non- Agglomeration Zone
PAHs	Polycyclic Aromatic Hydrocarbons
PCM	Pollution Climate Mapping
SCA	Smoke Control Area