



Department
for Environment
Food & Rural Affairs

UK Report on measures for 2015 exceedance of the Target Value for Benzo[a]Pyrene

December 2017



Llywodraeth Cymru
Welsh Government



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1. Introduction

Government recognises 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 to our prosperity.

Through improving air quality we can reduce both the short term and long term effects on people's health. It will have benefits to 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 2015, including updates on the measures for exceedances in the compliance years 2013 and 2014¹, as reported to the European Commission in September 2015 and 2016. 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>.

1.2 Background and Context

The EU Directive² 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}) of ambient air or

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>

lower and must be achieved across Member States where there is relevant exposure.

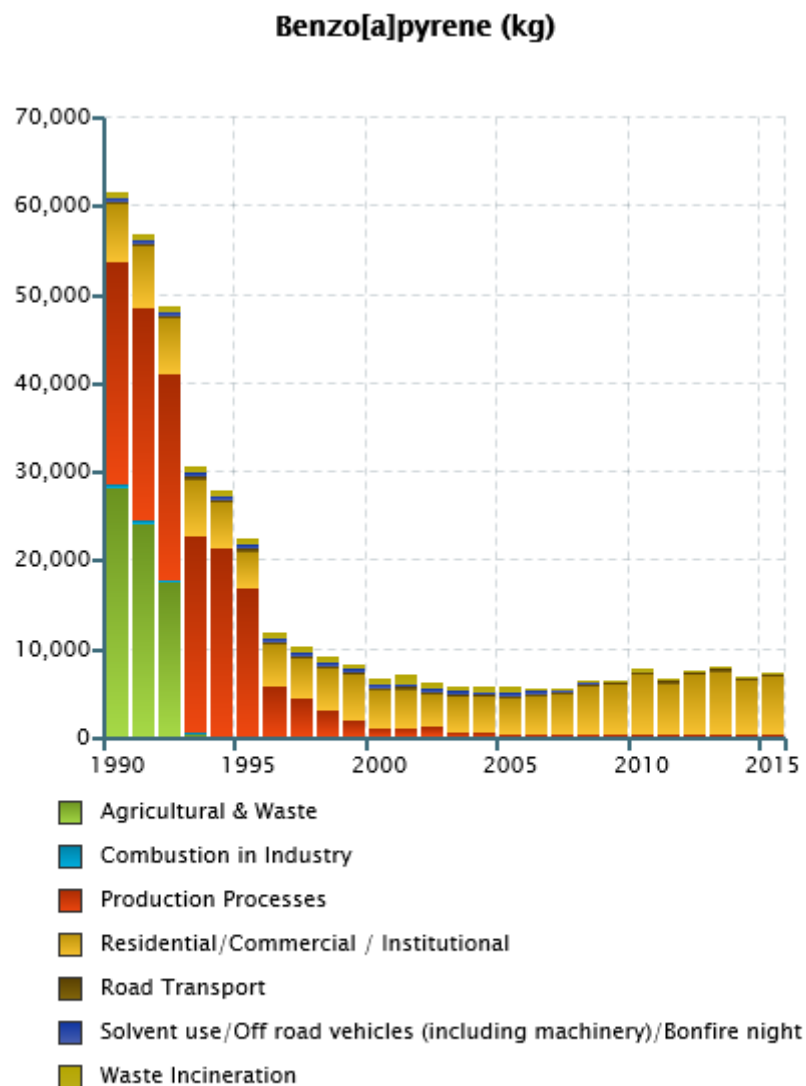
About Benzo[a]Pyrene (B[a]P)

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 air³, 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 88% since 1990 and due to reduced emissions from, 'agriculture and waste' as a result of industrial processes and 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.

³ WHO AQG 2000, PHE Compendium of Chemical Hazards

Figure 1. B[a]P emissions by sector (1990-2015)



UK Assessment

Assessment of levels 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). The 2015 compliance

assessment reported that the UK exceeded the target value for benzo[a]pyrene in five zones; three 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 it⁴. Following this report of exceedance Member States are then required to submit a report (this report) detailing the measures already taken, 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 that do not entail disproportionate cost. The report must be submitted by the end of the year following the exceedance being reported (i.e. the end of 2017 for the 2015 compliance year – see Table 1).

Table 1. Reporting timetable

Compliance year	“Year” (e.g. 2015)
Compliance assessment reporting	Sept 30 th “Year”+1 (e.g. 2016)
Report on Measures	Dec 31 st “Year”+2 (e.g. 2017)

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 EU compliance reporting against EU Directive 2004/107/EC, the UK is divided into 43 zones, termed agglomeration (large urban areas) and non-

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

agglomeration zones (regional areas)¹. There are 15 non-agglomeration zones and 28 agglomeration zones. 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.

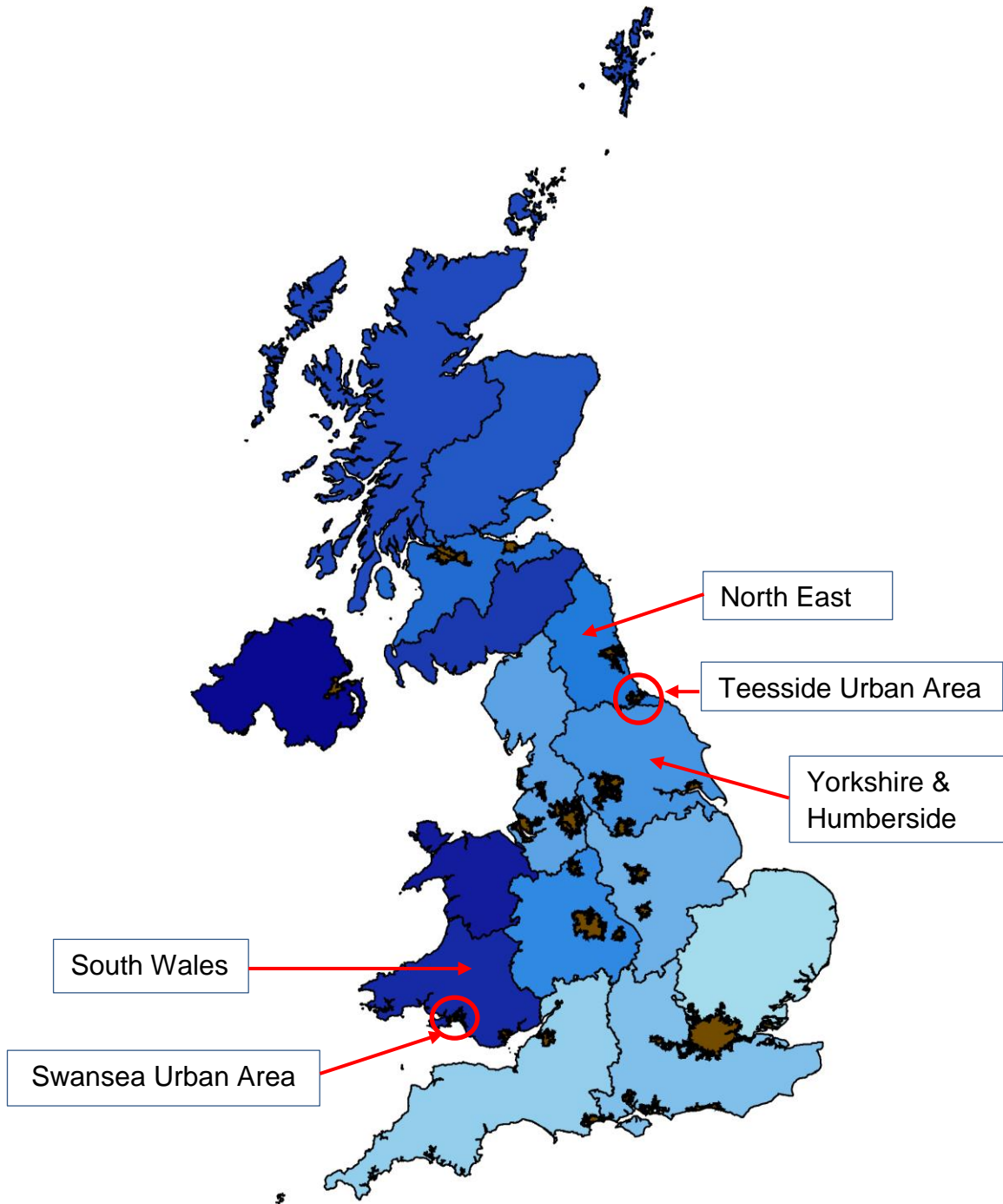
An agglomeration is defined as any urban area with a population greater than 250,000.

In 2015, five of the 43 zones in the UK were reported to have exceeded the target value for B[a]P (three non-agglomeration (non-AZ) and two agglomeration zones (AZ)). The affected zones were:

1. Teesside Urban Area (UK0013) (AZ);
2. Yorkshire and Humberside (UK0034) (Non-AZ);
3. North East (UK0036) (Non-AZ);
4. Swansea Urban Area (UK0027) (AZ);
5. South Wales (UK0041) (Non-AZ).

The locations of these zones are indicated on the map shown in Figure 2. All exceedances are due to industrial emissions sources. Of the five exceedances reported, one was monitored (Yorkshire and Humberside (UK0034)) and four were modelled (see section 2.2 below). The zonal reports provide a detailed breakdown of the affected area in each zone or agglomeration 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 552015 (note: the arrows are for the purposes of labelling the zone or agglomeration 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 minimum 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 of the zones reported as exceeding due to modelling, monitors located in these zones; South Wales, North East and Teesside, 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 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 31 monitoring sites measuring B[a]P concentrations in the UK. These monitors collect samples of particulate matter from the air (PM₁₀ – 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 ^{1,5}.

⁵ <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)⁶. 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 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.

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.

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

⁶ <http://uk-air.defra.gov.uk/data/gis-mapping>

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 that are being taken to address emissions of B[a]P from industrial sources.

Improvements to modelling

As part of an ongoing improvement programme for the National Atmospheric Emissions Inventory (NAEI), which forms part of the underlying data for the PCM model (see section 2.2), Defra is currently exploring options for improving estimates of the spatial distribution of emissions.

Industrial Measures

Industrial emissions of B[a]P 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 B[a]P emissions, is the Industrial Emissions Directive EU Directive 2010/75/EU (IED)⁷. 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)⁸. There are 32 BREFs/BATCs, covering a huge range of industrial sectors, all of which are due to be reviewed by 2020.

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

⁷ <http://ec.europa.eu/environment/industry/stationary/ied/legislation.htm>

⁸ <http://eippcb.jrc.ec.europa.eu/reference/>

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 emissions⁹ of a variety of pollutants, including 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 in England to improve their operations, and where required, technically upgrade their facilities by March 2016. 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 Industrial Emissions Directive allows for the application of a derogation from meeting target values where costs outweigh the environmental benefits. As a result the EA considered and granted applications from operators for temporary derogations from the IED and BREF conditions for the relevant sites 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. NRW has also agreed a programme of works with relevant site operators to ensure compliance with required BAT-AELs. Both approaches will deliver the required environmental improvement without imposing an unreasonable burden on industry.

Energy Efficiency Measures

The Renewable Heat Incentive (RHI) provides financial incentives to install renewable heating in place of fossil fuels, such as heat pumps, biomass boilers and on-site biogas and injection of biomethane into the grid. The non-domestic RHI scheme has been open to commercial, industrial, public sector, not for profit and community generators of renewable heat since November 2011.

The Department for Business, Energy and Industrial Strategy is working together with eight Energy Intensive Industries (EII)¹⁰ on the **Industrial 2050 Roadmaps**¹¹ project. In March 2015 a suite of 'decarbonisation and energy efficiency roadmaps' were published, assessing each sector's potential for a low-carbon future and providing an evidence-based foundation upon which future policy can be implemented and actions delivered. Work has now begun on the next stage of this

¹⁰ Iron & Steel, Oil Refining, Chemicals, Glass, Cement, Ceramics, Paper and Food & Drink.

¹¹ <https://www.gov.uk/government/publications/industrial-decarbonisation-and-energy-efficiency-roadmaps-to-2050>

process, which is to develop an action plan for each of the sectors. The aim of these action plans is to agree a series of concrete steps and commitments by Government and Industry that can be completed in the short term, to help enable the longer-term transition to decarbonisation while remaining competitive in the international marketplace.

EU Emissions Trading System scheme

Launched in 2005, the European Union Emissions Trading System (EU ETS) is the first and largest 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. Negotiations to reform the EU ETS post-2020 are ongoing.

UK energy efficiency schemes

The Climate Change Agreements scheme is a targeted scheme to support competitiveness and energy efficiency in energy intensive industry. It provides a tax discount in return for companies signing up to stretching energy efficiency improvement targets.

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 CRC seeks 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).

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.

Reform of the business energy efficiency tax and policy landscape. At the March 2016 Budget, the UK government published its response to the *Reforming the business energy efficiency tax landscape* review, conducted in 2015, which set out that:

- The UK government will **close the CRC Energy Efficiency Scheme following the 2018-19 compliance year**, and will work with the devolved administrations on scheme closure arrangements.

- The main **rates of the Climate Change Levy (CCL) will increase from April 2019**. This will drive energy efficiency across the CCL-paying population through a single energy tax.
- The **CCL rates for different fuel types will be rebalanced** to reflect recent data on the fuel mix used in electricity generation, moving to a ratio of 2.5:1 (electricity:gas) from April 2019, compared to the current 2.9:1 ratio. This will more strongly incentivise reductions in use of gas. In the longer term, the government intends to **rebalance the rates further, reaching a ratio of 1:1 (electricity:gas) by 2025** (liquefied petroleum gas [LPG] and other fuels [such as coal] will be adjusted to maintain their existing ratio with gas rates.
- The UK government acknowledges support for a streamlined reporting framework and intends to consult on a **simplified energy and carbon reporting framework for introduction by April 2019**.

Combined Heat and Power (CHP) can improve energy efficiency by up to 30%. The UK Government has introduced a number of fiscal and financial support mechanisms designed to improve the economics of developing and operating CHP plants certified, either fully or partly, as “Good Quality” by the CHP Quality Assurance programme. These include exemptions from the Carbon Price Support and Climate Change Levy taxes, business rates exemptions, and enhanced capital allowances. Renewable CHP plants can also receive payments from the Renewable Heat Incentive, Renewables Obligation and Contracts for Difference.

4. Next steps

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

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.

Closure of the coke ovens at Redcar and Dawes Lane, Scunthorpe will significantly reduce the emissions of B[a]P in these areas, reducing the impact of these emissions sources on modelled and monitored concentrations of B[a]P in future years.

Annex A: Zones

Zone or agglomeration	Zone code	Link to zonal report
Teesside Urban Area	UK0013	https://uk-air.defra.gov.uk/assets/documents/reports/bap-nickel-measures/bap_teesside_UK0013_reportonmeasures_2015.pdf
Yorkshire and Humberside	UK0034	https://uk-air.defra.gov.uk/assets/documents/reports/bap-nickel-measures/bap_yorkshireandhumberside_UK0034_reportonmeasures_2015.pdf
North East	UK0036	https://uk-air.defra.gov.uk/assets/documents/reports/bap-nickel-measures/bap_northeast_UK0036_reportonmeasures_2015.pdf
Swansea Urban Area	UK0027	https://uk-air.defra.gov.uk/assets/documents/reports/bap-nickel-measures/bap_swansea_UK0027_reportonmeasures_2015.pdf
South Wales	UK0041	https://uk-air.defra.gov.uk/assets/documents/reports/bap-nickel-measures/bap_southwales_UK0041_reportonmeasures_2015.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
HETAS	Heating Equipment Testing and Approval Scheme
IED	Industrial Emissions Directive
Non- AZ	Non- Agglomeration Zone
PAHs	Polycyclic Aromatic Hydrocarbons
PCM	Pollution Climate Mapping
SCA	Smoke Control Area