



Department
for Environment
Food & Rural Affairs

Report on measures for 2017 exceedance of the Target Value for Benzo[a]pyrene in Swansea Urban Area agglomeration zone (UK0027)

December 2019



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1. Introduction

1.1 Context

Under the EU Directive 2004/107/EC¹, the target value (TV) for Benzo[a]pyrene (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 lower. The Directive requires Member States report on measures in place to address the exceedance of the TV and that all reasonable measures that do not entail disproportionate cost should be taken to ensure this target is not exceeded.

Exceedance of the TV was reported in 2013, 2014, 2015 and 2016 in the Swansea Urban Area and a report on measures was published detailing the exceedance and the measures in place².

This document reports the exceedance situation for 2017 reflecting the more recent assessment and updating the 2013, 2014, 2015 and 2016 report on measures.

1.2 Status of zone

This is the report on measures required for exceedances of the TV for B[a]P within the Swansea Urban Area zone identified within the 2017 UK air quality assessment. Exceedances within this zone were identified on the basis of model results providing supplementary information for the assessment in addition to the results from fixed monitoring stations. This exceedance was reported via e-Reporting dataflow G³ on attainment and Air Pollution in the UK⁴.

Table 1 summarises the spatial extent and associated resident population for the exceedances identified in this zone, as reported via e-Reporting.

¹ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:023:0003:0016:EN:PDF>

² <https://uk-air.defra.gov.uk/library/bap-nickel-measures>

³ <http://cdr.eionet.europa.eu/gb/eu/aqd>

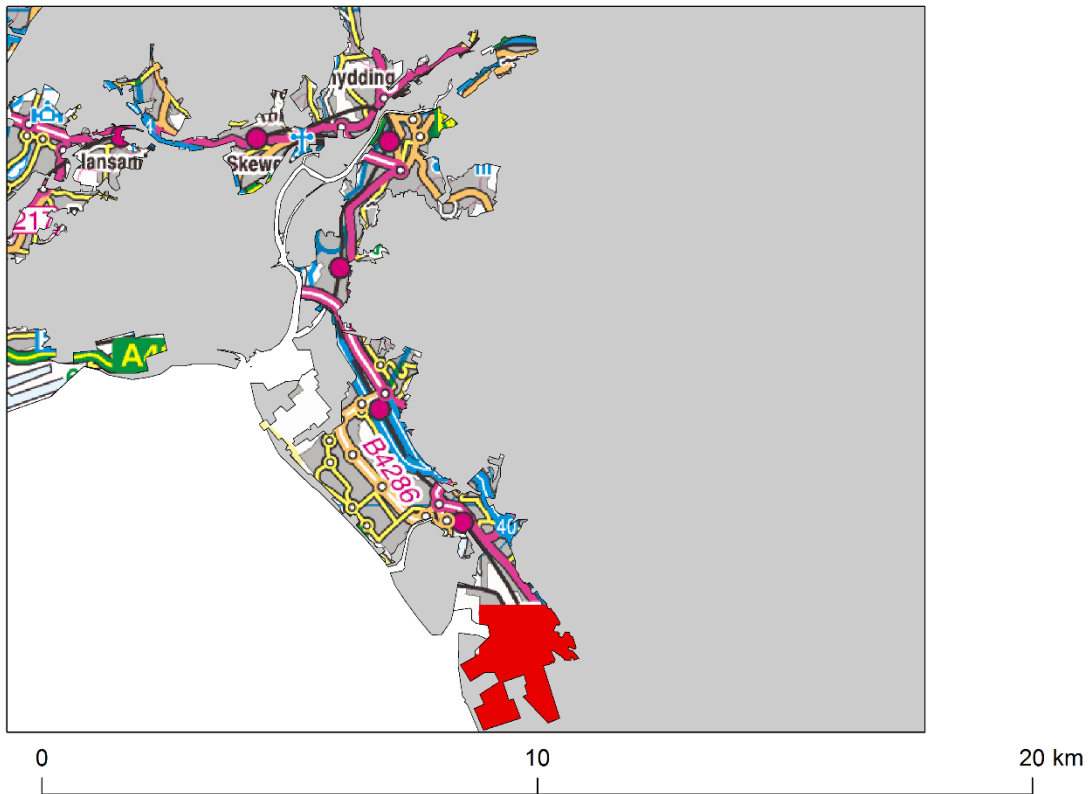
⁴ <http://uk-air.defra.gov.uk/library/annualreport/index>

Table 1. Area exceeding B[a]P target value in 2017 and associated population for Swansea Urban Area zone UK0027

Zone code	Zone Name	Area exceeding TV (km ²)	Population exceeding TV
UK0027	Swansea Urban Area	4	2640

Figure 1 shows the locations of the exceedances in the context of the zone as a whole.

Figure 1. Location of exceedance of the B[a]P target value during 2017 in Swansea Urban Area zone UK0027. Areas of the zone in exceeding grid squares are marked red.



An initial source apportionment was carried out and this analysis has identified a single exceedance situation in this zone:

- Swansea Urban Area [B[a]P_UK0027_2017_1] related to industrial emissions (area of exceedance 4 km²)

Following the approach developed for the previous report on measures for 2014, a subsequent more detailed modelling assessment was carried out for 2015, 2016 and 2017 using additional local data. Whereas the 2014 assessment concluded that there was unlikely to be exceedance of the TV outside the boundary of the industrial site in 2014, the more recent assessments indicate that it was likely that there was an exceedance of the TV at locations close to the industrial site in 2015, 2016 and again in 2017. This change has been linked to the adoption of an improved assessment method for fugitive emissions, which has led to a significant increase in reported coke ovens emission in recent years and is discussed later in this report. The following section details the exceedance situation in the zone including a description of the exceedance situation, maps, information on source apportionment and a list of measures already taken or to be taken. Information on measures are reported within e-Reporting dataflow K⁵.

2 Exceedance situation Swansea Urban Area [B[a]P_UK0027_2017_1] related to industrial emissions

2.1 Description of exceedance

This exceedance situation has an area of exceedance of 4 km² in Margam in Neath Port Talbot. Figure 2 shows the location of the exceedance situation, as predicted by the national model. Figure 3 shows the location of the exceedance situation in finer detail based on a more detailed, local modelling assessment. The exceeding grid squares are numbered in Figure 2 and in subsequent tables for easy reference. The resident population associated with this exceedance situation is 2,640, the majority being in the exceeding grid square numbered 2. This exceedance situation is adjacent to and shares common sources with the exceedance situation South Wales [B[a]P_UK0041_2017_1].

The fixed monitoring station at Port Talbot Margam is within the exceedance situation. Table 2 lists the measured concentrations of B[a]P in this zone since 2008. The measured and modelled concentrations at this station were below the TV in 2017.

⁵ <http://cdr.eionet.europa.eu/gb/eu/aqd>

Table 2. Measured annual mean B[a]P concentrations in Swansea Urban Area agglomeration zone UK0027 from 2008 to 2018 (ngm⁻³). (Percentage data capture is shown in brackets).

Station (Eol code)	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Port Talbot Margam (GB0906A)	0.53 (99)	0.39 (95)	0.38 (88)	0.40 (95)	0.40 (95)	0.44 (93)	0.60 (100)	0.79 (100)	0.93 (95)	0.64 (93)	0.70 (98)
Swansea Cwm Level Park (GB0943A)	0.32 (90)	0.24 (89)	0.29 (84)	0.27 (93)	0.28 (96)	0.27 (92)	0.33 (100)	0.35 (100)	0.39 (100)	0.33 (97)	0.28 (99)

Table 3 lists the exceeding grid squares and the resident population. The local modelling identified the same four grid squares as exceeding.

The measurements at Port Talbot Margam were less than the TV. In modelling the spatial coverage of B[a]P concentrations, the national scale model predictions were calibrated to match the measurements. The calibrated predictions exceeded the target in the vicinity of the steelworks industrial complex in Port Talbot due to industrial emissions. 1 km grid squares have been classified as exceeding the TV if at least nine 100 m grid squares exceed the TV or at least one 100 m grid square exceeds and there is residential population in the exceeding 100 m grid squares. A concentration value was defined for each 1 km grid square from the fine scale modelling as the mean of the 100 m grid squares exceeding the TV within that 1 km grid square. Subsequent finer scale modelling that included a more detailed assessment also predicted exceedances of the TV at locations close to the industrial site in 2015, 2016 and 2017. However, a slightly smaller area of exceedance was predicted, as shown in Figure 3. The assessment is discussed in more detail in section 2.3.

Figure 2 also shows the locations of the key industrial sources. The area shown on this map includes grid squares assigned to both the Swansea Urban Area (UK0027) and South Wales (UK0041) zones. The grid squares assigned to the Swansea Urban Area zone and this exceedance situation - Swansea Urban Area [B[a]P_UK0027_2017_1] are shown as hatched (in this report) and the non-hatched red grid squares correspond to exceedance situation South Wales [B[a]P_UK0041_2017_1] (discussed in the [South Wales zone UK0041](#) report).

Figure 2. Exceedance situation Swansea Urban Area [B[a]P_UK0027_2017_1]. Exceeding grid squares are marked red. Locations of coke works at Morfa and sinter plant at Port Talbot are also shown. Hatched grid squares are those assigned to Swansea Urban Area zone UK0027 (this report). Non-hatched grid squares are assigned to South Wales zone UK0041 and do not form part of this exceedance situation (see UK0041 report).

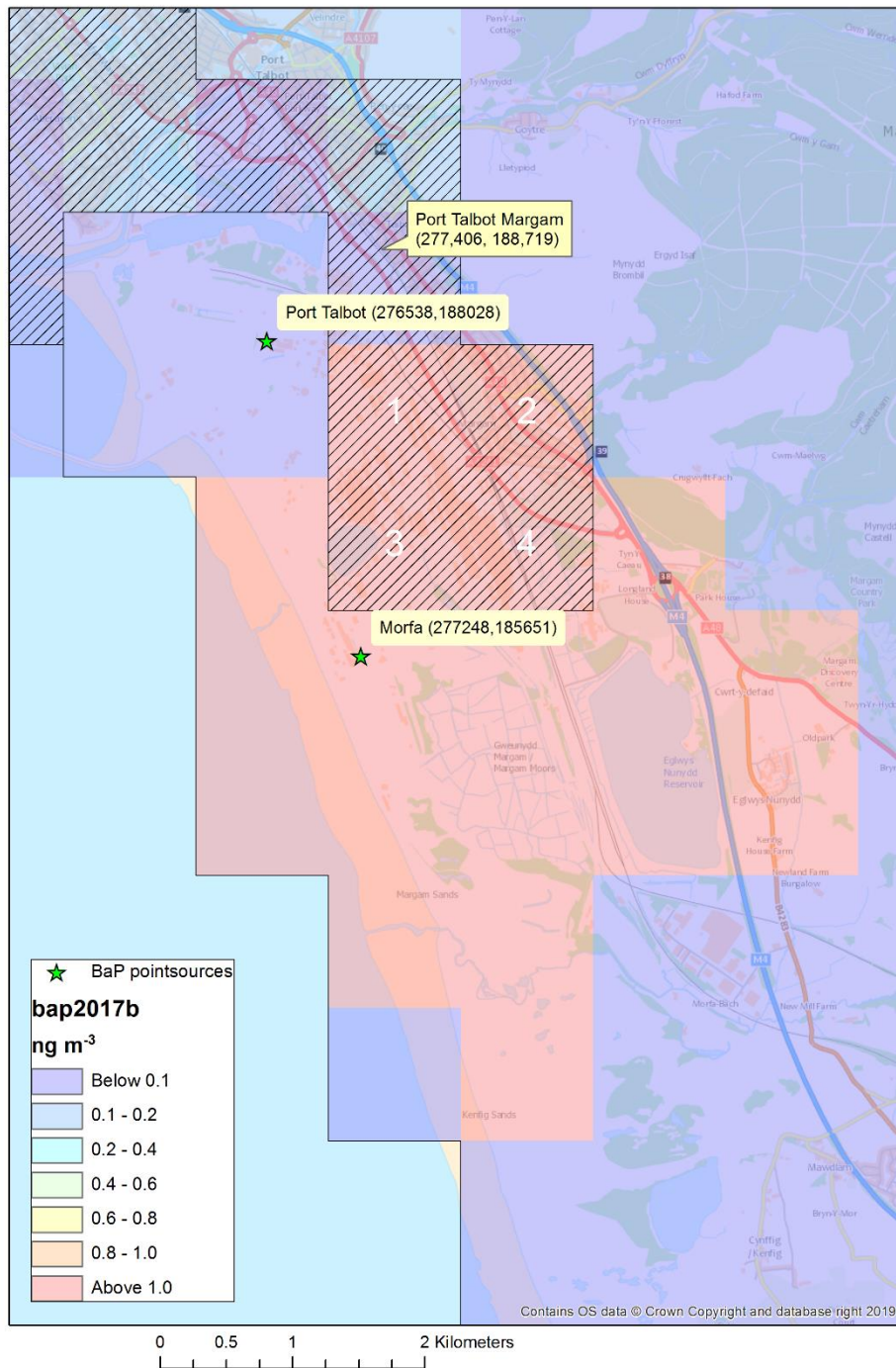


Table 3. Exceeding grid squares for exceedance situation BaP_UK0027_2017_1. * denotes grid squares also identified as exceeding in the detailed local modelling

Grid square number	Resident population	Notes
1*	141	Mostly steelworks industrial complex, Margam
2*	2401	Small part of steelworks industrial complex, playing fields, school, Margam
3*	0	Steelworks industrial complex
4*	98	Partly steelworks industrial complex, Margam

2.2 Source apportionment

Table 4 provides a breakdown of the main emission sources (source apportionment) that have contributed to the grid squares in this exceedance situation, highlighting the significant contribution from industrial sources. The penultimate column is the total from all emission sources. The values in this column have been rounded to 1 decimal place for consistency with the values used in the compliance assessment. The values in the other columns have not been rounded. The other shaded columns are the subtotals for the regional, urban background and local contributions. Table 5 gives a more detailed source apportionment indicating how the separate industrial processes contribute to the total industrial figure. This shows that the coke ovens at Morfa are the main sources associated with this exceedance situation.

Table 4. Source apportionment for exceedance situation Swansea Urban Area [B[a]P_UK0027_2017_1]. Annual mean B[a]P concentration (ngm⁻³).

Grid square number	OS easting (m)	OS Northing (m)	Zone	a) Regional background: Total	b) Urban background increment: Total	Urban background increment: Traffic	Urban background increment: Industry	Urban background increment: commercial	Urban background increment: Shipping	Urban background increment: Off road	Urban background increment: Other	c) Local increment: Total	Local increment: Industry including heat	Total for all emission sources (a+b+c)	Resident population
1	277500	187500	27	n/a	0.077	0.000	0.040	0.032	0.000	0.000	0.003	1.149	1.149	1.225	141
2	278500	187500	27	n/a	0.182	0.001	0.096	0.079	0.000	0.001	0.005	1.038	1.038	1.220	2401
3	277500	186500	27	n/a	0.063	0.000	0.039	0.021	0.000	0.001	0.002	4.406	4.406	4.469	0
4	278500	186500	27	n/a	0.145	0.000	0.111	0.025	0.000	0.005	0.004	1.829	1.829	1.974	98

Table 5. Detailed source apportionment for industrial sources only for exceedance situation Swansea Urban Area [B[a]P_UK0027_2017_1]. Annual mean B[a]P concentration (ngm⁻³)

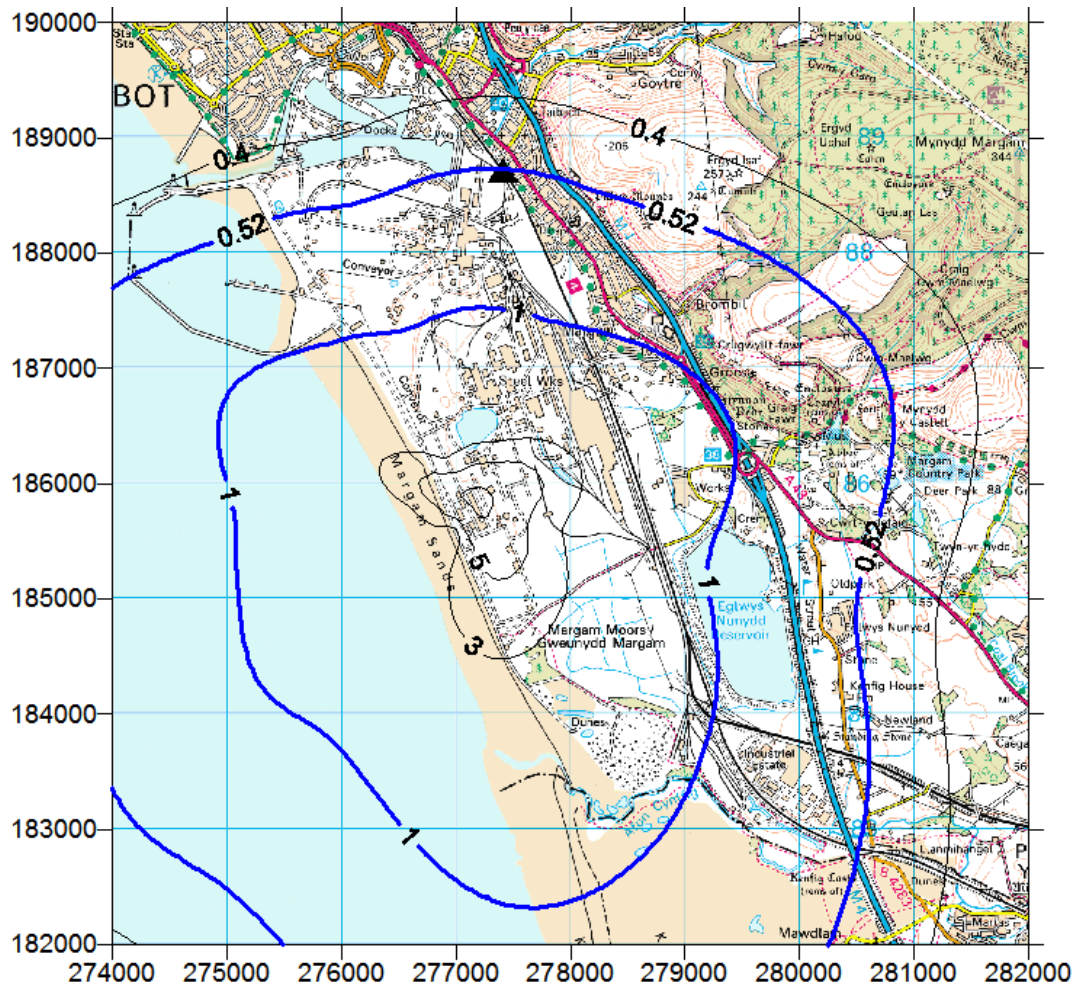
Grid square number	OS easting (m)	OS Northing (m)	Zone	Morfa coke ovens	Port Talbot sinter plant	Local increment: Industry including heat and power production
1	277500	187500	27	1.148	0.000	1.149
2	278500	187500	27	1.037	0.001	1.038
3	277500	186500	27	4.406	0.000	4.406
4	278500	186500	27	1.828	0.000	1.829

2.3 A detailed local assessment

In order to assess this exceedance in more detail, a dispersion modelling assessment was undertaken making use of additional local data. The background concentration for this assessment was derived from local measurements rather than from a model, as was the case for the national modelling assessment. The detailed assessment indicated that off-site concentrations of B[a]P exceeded the TV in 2017. B[a]P emission from the coke ovens in 2017 was estimated to be 79 kg using the new assessment method. Section 2.4 provides more detail on coke oven sources and measures that have been, or will be, implemented to tackle them.

Figure 3 plots the sum of the process contribution, due to emissions from the steelworks complex, and the ambient B[a]P background, derived from the measurement at the Port Talbot Margam monitoring site, which is indicated as a filled black triangle. The blue contour indicates the predicted environmental concentration of 1ng/m³ and shows that it is likely that the TV would have been exceeded beyond the industrial site boundary.

Figure 3. Predicted environmental concentration (PEC) of B[a]P (ng/m³) for 2017.



2.4 Measures

The main overview report contains more information on how industrial sites are regulated. There are no specific BAT conclusions designed to reduce B[a]P under the Industrial Emissions Directive (EU Directive 2010/75/EU), in either the Coke Ovens or Sinter plant, which are the main sources of this pollutant. BAT looks to control emissions in general and the techniques required will also affect B[a]P concentrations. The iron and steel BAT Reference Document (BREF)⁶ contains stringent requirements for iron and steel works to significantly reduce their fugitive emissions, including Polycyclic Aromatic Hydrocarbons (PAH) (B[a]P is a pollutant

⁶ http://eippcb.jrc.ec.europa.eu/reference/BREF/IS_Adopted_03_2012.pdf

from this chemical group). The reduction of emissions of polychlorinated dibenzodioxins/furans (PCDD/F) and polychlorinated biphenyls (PCB) by utilising lignite injection at the sinter plant will also result in a reduction of B[a]P. Monitoring and further modelling as the techniques are employed will demonstrate the scale of the reduction. The regulator is of the view that Tata will be at BAT within the timescales required by the Industrial Emissions Directive or within the periods of any agreed derogations for the Sinter Plant and the Coke Ovens.

Reason for increases in reported coke oven emissions and next steps

In 2015 the implementation of the BREF for Iron and Steel production, resulted in the need to improve the monitoring of fugitive emissions from the coke ovens.

The method employed prior to 2015 (BCRA method) required an estimate to be carried out every three months that relied on a subjective assessment of leak severity. The industrial operator agreed a new method with the regulator (NRW) that was adapted from the US EPA methodology. This methodology requires the leaks be monitored and recorded daily and does not attribute a severity to the leaks, all leaks are treated as a priority. When both methods were assessed side by side it was clear that the BCRA method gave a favourable estimation of the fugitive emission resulting in a low estimation factor per tonne of coke. The new methodology has resulted in an increase in the estimation of B[a]P released from the coke ovens in 2015, however, the actual release is likely to have been similar to previous years.

The change in the methodology has meant that the operator has a better understanding of the precise sources of fugitive emissions and enabled a targeted improvement programme to be established. This improvement programme was expected to show a decrease in results in 2017 and 2018. Monitoring has shown a decrease in 2017 but a slight increase in 2018 caused by a high result in May, with subsequent months showing a return to a lowering trend that continues into 2019. The site regulator will continue to focus on better performance through regulatory work and will review the interventions following analysis of the 2018 and 2019 data.

Table 6 shows the measures taken or to be taken at Port Talbot industrial site.

Table 6. Table of measures taken or to be taken at Port Talbot industrial site

Measure code	Description	Classification	Implementation dates	Other information	Comment	Future work
Coke Ovens 1	Measures to meet new fugitive BAT emission limits (BATELs)	Permit systems and economic instruments: IPPC permits	Start: 2015 Expected end: 2019 Status: Implementation	Source affected: Industry including heat and power production Spatial scale: Local Cost: Not available Indicator: Emissions estimate Target emissions reduction: Not available	Tata has adopted a modified US EPA method for fugitive release assessment. This uses a binary 'leak-no leak' assessment. This method directly compares to the BATc. Tata has committed to coke ovens life extension expenditure worth ~£3m/year over the next three years. Coke ovens life extension project is ongoing and there has been consistent investment in this area by Tata Steel to date. Compliance with the new limits has been summarised below for tops, doors and charging emissions. Where compliance has not been achieved, NRW will respond per its CCS compliance scheme and	Fugitive releases from coke ovens are affected by the internal operating pressure of the ovens. This pressure is at its highest when ovens are initially charged with coal and there is the maximum production of coke oven gas (COG). The rate of COG production gradually decreases as the contents of the oven are carbonised. Tata are investigating the feasibility of installing gas pressure controls on individual ovens to improve the overall control system and therefore minimise fugitive releases of B[a]P from its coke oven batteries. As Morfa Coke Ovens moves towards the end of its extended campaign life (mid-2020s), Tata Steel will need to outline its future strategy for this asset. This strategy is likely to be linked to other critical steelworks assets approaching end of life e.g. sinter plant. A replacement coke oven may require significant planning (~5yrs design & construction) and capital expenditure (>£500m).

					<p>work with Tata to achieve the new limits. NRW continues to apply CCS scores in response to any emission limit breaches. Tata Steel also responded to an EPR Regulation 61 Information Notice in August 2018. The company's response included a plan with timescales outlining a pathway towards compliance.</p> <p>Good progress has been made towards compliance with the doors achieving full compliance in 2018.</p> <p>Compliance with all relevant emission limits achieved in February 2019.</p>	
Coke Ovens 2	<p>Spigot improvements.</p> <p>The spigot is the joint between the oven and the gas main. Measures include fitting of new collars,</p>	Permit systems and economic instruments: IPPC permits	<p>Start:2015</p> <p>Expected end: 2019</p> <p>Status: Implementation</p>	<p>Source affected: Industry including heat and power production</p> <p>Spatial scale: Local</p> <p>Cost: Not</p>	<p>Control of fugitive emissions from coke ovens will result in lower B[a]P emissions.</p> <p>The 1% BAT-AEPL (Associated Emission Performance Level) for tops is very challenging. Leakage rate from coke oven tops - including spigots - has steadily</p>	<p>At Port Talbot there are two COG collection mains for each oven and four charge holes. Tata have assessed the feasibility of a single COG collection main that should halve the number of potential leak sources, thereby reducing fugitive emissions from coke oven tops. An order has been placed with a third party (technology) supplier.</p>

	<p>'repacking' existing spigot seals, fitting new seals and, shortening of ascension pipes.</p>			<p>available</p> <p>Indicator: Percentage leak rate reduced to target of 1%</p> <p>Target emissions reduction: Not available</p>	<p>declined to <1% (99% no leaks) and emissions have been compliant since February 2019. A programme of works is ongoing to reduce leakage, but the rate of spigot renewal is difficult to change due to the complexities of working on a live coke oven. The work must be sequenced to avoid affecting oven integrity (ovens are usually in continuous operation).</p> <p>Significant effort has been applied by Tata Steel to reduce fugitive emissions from coke oven tops. Improved performance has coincided with secured capital expenditure (coke ovens life extension project) and refinement of maintenance plans and procedures.</p> <p>Tata continues to follow a rolling program of work to control leaks from coke oven tops. A full replacement 'cycle' has been completed for the</p>	
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				<p>spigots. Sustained compliance may become more challenging as the batteries approach the end of their campaign life.</p> <p>Significant progress is being made with 97.5 % leak free performance in August 2018.</p> <p>Compliance with the BAT-AEPL for tops was achieved in February 2019 and has been sustained in subsequent months.</p>	
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<p>Coke Ovens 3</p>	<p>Coke Oven door improvements</p> <p>Each coke oven has two sets of doors at either end. Hot coke is pushed from the 'ram side' doors through the 'coke side' doors into waiting rail cars. Doors and door frames require regular maintenance and periodic replacement to minimise fugitive emissions.</p>	<p>Permit systems and economic instruments: IPPC permits</p>	<p>Start: 2015</p> <p>Expected end: 2019</p> <p>Status: Implementation</p>	<p>Source affected: Industry including heat and power production</p> <p>Spatial scale: Local</p> <p>Cost: Not available</p> <p>Indicator: Percentage leak rate reduced to target of 10%</p> <p>Target emissions reduction: Not available</p>	<p>Control of fugitive emissions from coke ovens will result in lower B[a]P emissions.</p> <p>BAT-AEL for doors is 10% leakage or 90% non-leaking doors.</p> <p>Leakage rate from coke oven doors has declined to <10% (90% no leaks). Emissions have been compliant since August 2018.</p> <p>Significant effort has been applied by Tata Steel to reduce fugitive emissions from coke oven doors. Improved performance has coincided with secured capital expenditure (coke ovens life extension project) and refinement of maintenance plans and procedures.</p> <p>Tata continues to follow a rolling program of work to control leaks from coke oven doors. Door cleaning techniques have been critical to achieving the improved performance against the BAT-AEPL. Sustained compliance may become more</p>	<p>Leaks from coke oven doors occur when hot gases penetrate the seals between the door and its frame. Doors and frames are routinely cleaned to ensure a tight seal. There is one small 'leveller' door on each oven that is difficult to clean manually. Tata Steel is working with a specialist supplier to design a remote-controlled cleaning device which can potentially improve the seals on these small doors.</p> <p>Tata is also exploring options to retro-fit a new type of coke oven door (with tighter seals) to its existing ovens.</p>
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					<p>challenging as the batteries approach the end of their campaign life. Tata achieved full compliance with the BAT-AEL for doors in August 2018. Since August 2018, compliance has improved further and is moving towards 95% non-leaking coke oven doors. Target achieved (<10% leakage).</p> <p>BAT-AEPL has been met. Coke Ovens performance is discussed at least every quarter with Tata Steel.</p>	
Coke Ovens 4	<p>Reduction of emissions during charging</p> <p>Coke ovens are 'charged' with coal through charge holes in the top of each oven. The charging</p>	Permit systems and economic instruments: IPPC permits	<p>Start: 2015</p> <p>Expected end:</p> <p>Status: Implementation</p>	<p>Source affected: Industry including heat and power production</p> <p>Spatial Scale: Local</p> <p>Cost: Not available</p> <p>Indicator:</p>	<p>Control of fugitive emissions from coke ovens will result in lower B[a]P emissions.</p> <p>BAT-AEL for charging emissions is 30 seconds as a monthly mean.</p> <p>Charging performance has improved following a deterioration in performance in 2018. The key items of equipment (charge holes and the</p>	

	<p>nozzles, holes and lids all require regular maintenance and periodic replacement to minimise fugitive emissions.</p>			<p>Duration of release reduced to 30 seconds as a monthly mean.</p> <p>Target emissions: Not available</p>	<p>coal charging apparatus) have now all been refurbished and/or replaced. Emissions have been compliant (<30 seconds visible emissions per charge) since February 2019.</p> <p>Tata continues to follow a rolling program of work to maintain the equipment used for charging coal. Sustained compliance may become more challenging as the batteries approach the end of their campaign life. Tata complied with the BAT-AEL for charging emissions during July and August 2017.</p> <p>Since February 2019, compliance has improved further and has been moving towards 20 seconds visible emissions per charge as a monthly average figure. Further improvement may be possible. BAT-AEPL has been met. Coke Ovens performance is discussed at least every quarter with Tata Steel.</p> <p>Target achieved (<30</p>	
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					seconds visible emission per charge).	
Sinter Plant	<p>Improvements to Lignite Injection</p> <p>Lignite is used in combination with lime to trap and neutralise certain pollutants present in hot flue gases. These additives are injected directly into the hot flue gases. The integrity of the flues and the emissions abatement systems must be sound for lignite-lime injection to be used safely.</p>	<p>Permit systems and economic instruments: IPPC permits</p>	<p>Start: 2015</p> <p>Expected end: 2018</p> <p>Status: Implementation</p>	<p>Source affected: Industry including heat and power production</p>	<p>Lignite-lime injection forms part of several projects to ensure that the sinter plant complies with the new tighter EU (IED) standards.</p> <p>The lignite-lime injection system at Port Talbot has not yet been commissioned.</p> <p>There are no specific BATc or BAT-AELs designed to reduce B[a]P from sinter plant emissions. However, reducing overall emissions will result in lower B[a]P emissions.</p> <p>Associated work and regulatory interventions by NRW to address persistent particulate emission limit (BAT-AEL) breaches from the sinter plant main stack should indirectly reduce B[a]P emissions from this source.</p> <p>Re main stack particulate emissions: Tata Steel responded to an EPR</p>	<p>The interior of each ESP and the (waste gas) wind main system are subject to high temperatures and continual physical abrasion by entrained dust, which progressively wears away exposed surfaces and parts. Keeping pace with this degradation and maintaining an 'air-tight' system is critical to the safe commissioning of lignite-lime injection.</p> <p>Tata Steel is adjusting its maintenance strategy to allow shorter stops to be taken more frequently, enabling worn parts to be replaced before they degrade completely. The engineering challenges and associated unavailability of lignite-lime injection may increase as the sinter plant ages.</p> <p>Tata Steel will need to outline its future strategy for this asset. This strategy is likely to be linked to other critical steelworks assets approaching end of life e.g. coke ovens.</p>

				<p>Regulation 61 Information Notice in August 2018. The company's response included a plan with timescales outlining a pathway towards compliance.</p> <p>Lignite-lime injection has already been approved by Tata and is still progressing. Several preparatory works must be completed over planned sinter plant stops before the system can be brought online.</p> <p>The preparatory works remain incomplete but are still being pursued by Tata Steel. Air ingress issues must be resolved before lignite-lime can be brought online. A key performance indicator is 17% oxygen within the waste gas stream - sensors are now in place to monitor this. The valves at the base of each ESP (dust) collection hopper have also been upgraded and are subject to a rolling maintenance programme. Previously the valve seals were degrading too quickly and</p>	
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				<p>allowing air into the system.</p> <p>Bringing lignite-lime online prematurely can result in fires starting within the main stack Electrostatic Precipitators (ESPs) as a result of lignite (fuel) + heat + oxygen.</p> <p>The system is unlikely to be commissioned before 2020 because of the extended preparatory works described above.</p> <p>This project has been delayed due to problems with the performance of the electrostatic precipitators. NRW are currently working with Tata to agree new timescales for the implementation of lignite injection.</p> <p>Sinter Plant performance is discussed at least every quarter with Tata Steel. NRW continues to focus on persistent particulate emission limit breaches from the main stack. Addressing the root</p>	
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					cause(s) of these breaches should reduce air ingress into the system and allow lignite-lime to be brought online.	
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