Department
for Environment
Food & Rural Affairs

Report on measures for 2016 exceedance of the Target Value for Benzo[a]pyrene in Swansea Urban Area agglomeration zone (UK0027)

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1. Introduction

1.1 Context

Under the EU Directive 2004/107/EC[1], 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 and 2015 in the Swansea Urban Area and a report on measures was published detailing the exceedance and the measures in place[2].

This document reports the exceedance situation for 2016 reflecting the more recent assessment and updating the 2013, 2014 and 2015 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 2016 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 G[3] on attainment and Air Pollution in the UK[4].

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

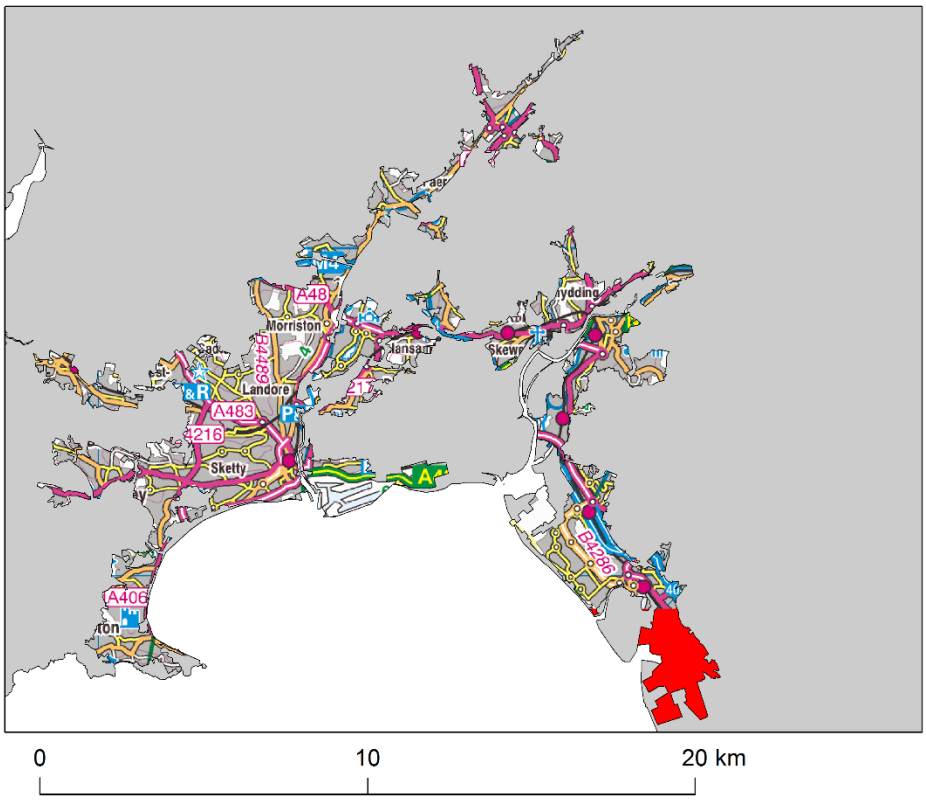
[1] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:023:0003:0016:EN:PDF
[2] https://uk-air.defra.gov.uk/library/bap-nickel-measures
[3] http://cdr.eionet.europa.eu/gb/eu/aqd
[4] http://uk-air.defra.gov.uk/library/annualreport/index

Table 1. Area exceeding B[a]P target value in 2016 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	5	4484

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 2016 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_2016_1] related to industrial emissions (area of exceedance 5 km^2)

Following the approach developed for the previous report on measures for 2014, a subsequent more detailed modelling assessment was carried out for 2015 and 2016 using additional local data. Whereas the previous 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 and again in 2016. 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 K[5].

2 Exceedance situation Swansea Urban Area [B[a]P_UK0027_2016_1] related to industrial emissions

2.1 Description of exceedance

This exceedance situation has an area of exceedance of 5 km^2 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 4,484, the majority being in the exceeding grid squares numbered 1 and 3. This exceedance situation is adjacent to and shares common sources with the exceedance situation South Wales [B[a]P_UK0041_2016_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 concentration at this station was just below the TV in 2016. The modelled concentration at this location is above the TV.

[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 2017 (ngm^{-3}). (Percentage data capture is shown in brackets).

Station (EoI code)	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
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)
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)

Table 3 lists the exceeding grid squares and the resident population. The local modelling identified the same five 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. Thus, exceeding grid square 1 has a modelled annual mean concentration of 1.2 ngm^{-3}. 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 and 2016. However, a 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_2016_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_2016_1] (discussed in the South Wales zone UK0041 report).

Figure 2. Exceedance situation Swansea Urban Area [B[a]P_UK0027_2016_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).

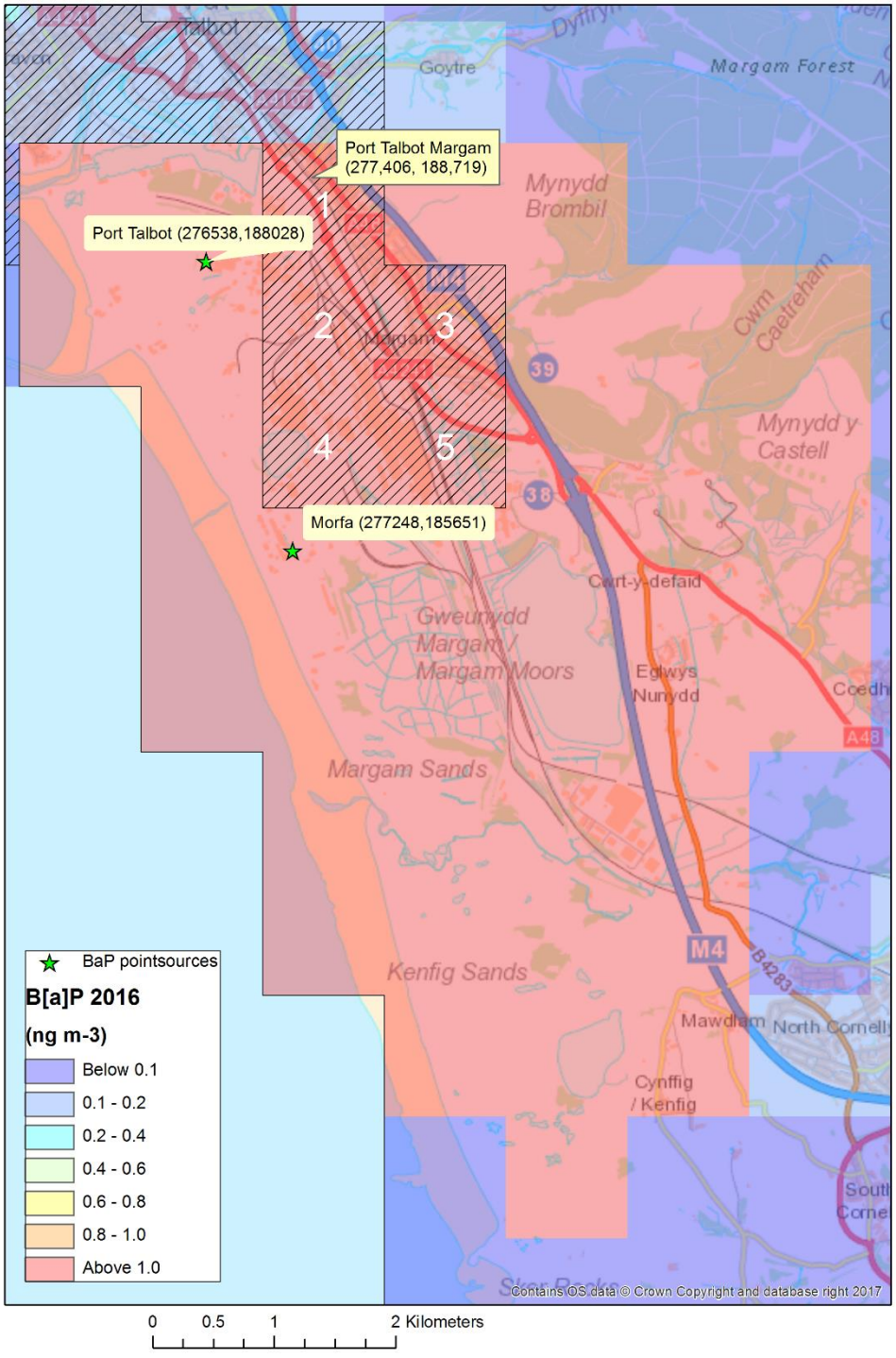


Table 3. Exceeding grid squares for exceedance situation BaP_UK0027_2016_1. * denotes grid squares also identified as exceeding in the detailed local modelling

Grid square number	Resident population	Notes
1*	1844	Partly steelworks industrial complex, Taibach
2*	141	Mostly steelworks industrial complex, Margam
3*	2401	Small part of steelworks industrial complex, playing fields, school, Margam
4*	0	Steelworks industrial complex
5*	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_2016_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	188500	27	n/a	0.136	0.002	0.004	0.123	0.000	0.001	0.007	1.083	1.083	1.2	1844
2	277500	187500	27	n/a	0.081	0.001	0.008	0.065	0.000	0.001	0.006	2.051	2.051	2.1	141
3	278500	187500	27	n/a	0.157	0.002	0.016	0.129	0.000	0.001	0.009	2.088	2.088	2.2	2401
4	277500	186500	27	n/a	0.062	0.000	0.012	0.044	0.000	0.001	0.005	9.426	9.426	9.5	0
5	278500	186500	27	n/a	0.167	0.001	0.102	0.051	0.000	0.007	0.007	4.703	4.703	4.9	97

Table 5. Detailed source apportionment for industrial sources only for exceedance situation Swansea Urban Area [B[a]P_UK0027_2016_1]. Annual mean B[a]P concentration (ngm^{-3})

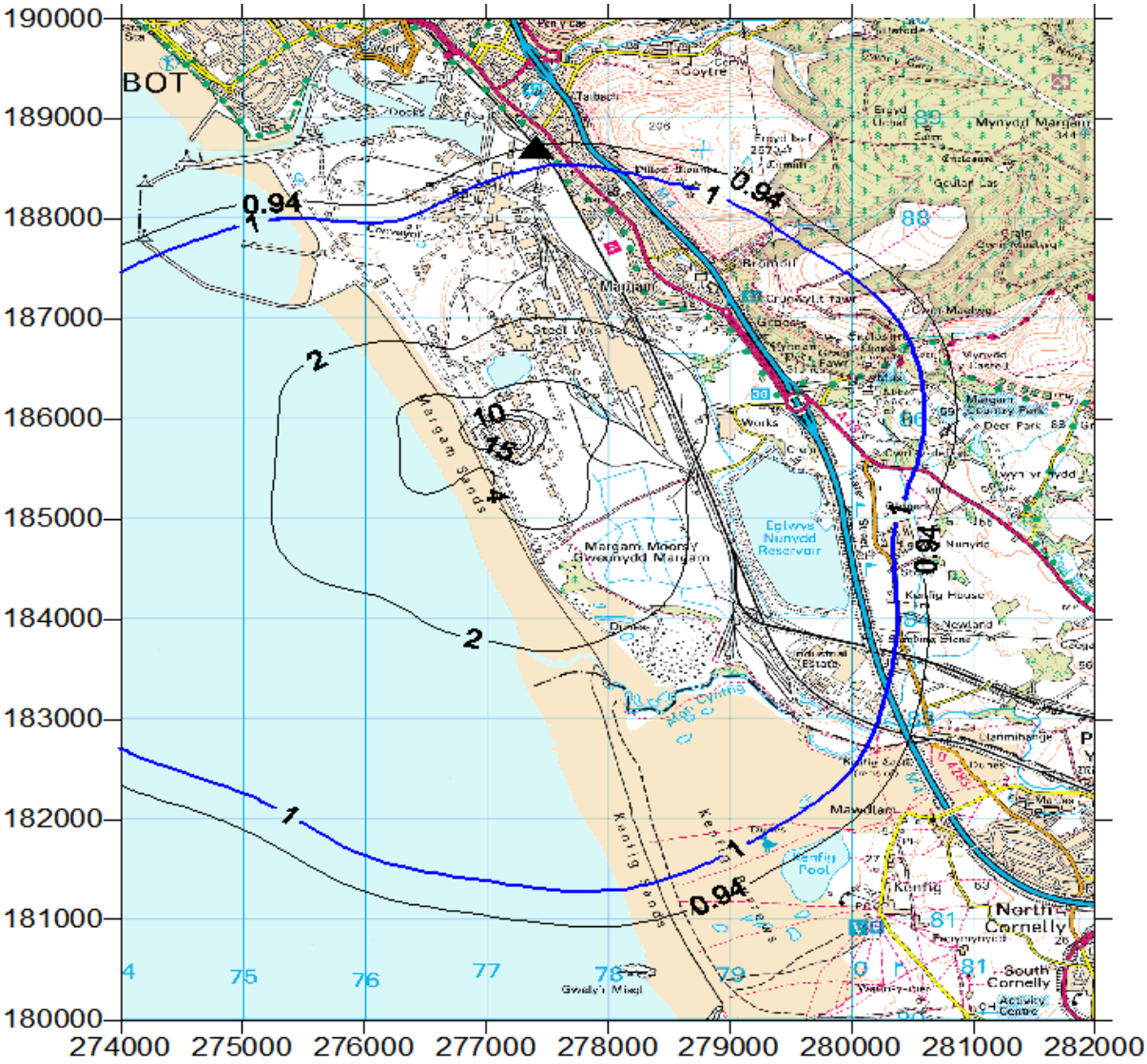
Grid square number	OS easting (m)	OS Northing (m)	Zone	Morfa coke ovens	Port Talbot sinter plant	Local increment: Industry including heat and power production
1	277500	188500	27	1.082	0.001	1.083
2	277500	187500	27	2.051	0.001	2.051
3	278500	187500	27	2.087	0.001	2.088
4	277500	186500	27	9.425	0.001	9.426
5	278500	186500	27	4.703	0.001	4.703

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 2016. B[a]P emission from the coke ovens in 2016 was estimated to be 79 kg using the new assessment method, increasing from 51 kg reported in 2015. 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 site. The blue contour indicates the predicted environmental concentration of $1ng/m^3$ and shows that it is likely that the TV would have been exceeded beyond the industrial site boundary.

Figure 3. Predicted environmental concentration of B[a]P (ng/m^3) for 2016



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

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

emissions, including Polycyclic Aromatic Hydrocarbons (PAH) (B[a]P is a pollutant 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 is expected to start showing a decrease in the estimated emission in 2017 and 2018.

Performance of the coke ovens at the site continues to improve and it is expected that such improvement will be reflected in the monitoring results for 2017 and 2018. Additionally, the data from 17/18 will enable the site regulator to better evaluate the need to change intervention strategy and in the meantime, will continue to focus on better performance through regulatory work.

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
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	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. 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 work with Tata to achieve
				Spatial scale:	Local	
				Cost:	Not available	
				Indicator:	Emissions estimate	
				Target emissions reduction:	Not available	

						the new limits. Good progress has been made towards compliance with the doors achieving full compliance in 2018
Coke Ovens 2	Spigot improvements. The spigot is the joint between the oven and the gas main. Measures include fitting of new collars, 'repacking' existing spigot seals, fitting new seals and, shortening of ascension pipes.	Permit systems and economic instruments: IPPC permits	Start: 2015 Expected end: 2019 Status: Implementation	Source affected:	Industry including heat and power production	Control of fugitive emissions from coke ovens will result in lower B[a]P emissions. The 1% BAT-AEL for tops is very challenging. Current leakage rate is 8% (or 92% leak free) 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 ovens. The work must be sequenced to avoid affecting oven integrity (ovens are usually in continuous operation). Significant progress is
				Spatial scale:	Local	
				Cost:	Not available	
				Indicator:	Percentage leak rate reduced to target of 1%	
				Target emissions reduction:	Not available	

						being made with 97.5 % leak free performance in August 2018. Further progress towards the BAT AEL of 99% is expected.
Coke Ovens 3	Coke Oven door improvements 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.	Permit systems and economic instruments: IPPC permits	Start: 2015 Expected end: 2019		Source affected:	Industry including heat and power production	Control of fugitive emissions from coke ovens will result in lower B[a]P emissions. BAT-AEL for doors is 10% leakage or 90% non-leaking doors. Battery 1 and 2 have now achieved compliance with the BAT AEL achieving 91.5 % leak free in August 2018 Because of changing shift practices, standardising door cleaning methods and an ongoing door/door frame replacement programme, the door leakage rate has dropped noticeably across both batteries. Tata achieved full compliance with the BAT-AEL for doors in August
			Status:	Implementation	Spatial scale:	Local	
					Cost:	Not available	
					Indicator:	Percentage leak rate reduced to target of 10%	
					Target emissions reduction:	Not available	

						2018 NRW is addressing non-compliance in accordance with its CCS scheme. We have also commenced monthly compliance reviews of coke ovens performance.
Coke Ovens 4	Reduction of emissions during charging. Coke ovens are 'charged' with coal through charge holes in the top of each oven. The charging nozzles, holes and lids all require regular maintenance and periodic replacement to minimise fugitive emissions.	Permit systems and economic instruments: IPPC permits	Start: 2015 Expected end: Status: Implementation	Source affected:	Industry including heat and power production	Control of fugitive emissions from coke ovens will result in lower B[a]P emissions. BAT-AEL for charging emissions is 30 seconds as a monthly mean. During 2017 Tata have improved charging performance and are currently achieving close to 30 seconds. Tata complied with the BAT-AEL for charging emissions during July and August 2017. NRW is addressing non-compliance in accordance with its CCS scheme.
				Spatial scale:	Local	
				Cost:	Not available	
				Indicator:	Duration of release reduced to 30 seconds as a monthly mean	
				Target emissions	Not available	

				reduction:		NRW continue to review coke oven performance as part of its regulatory work.
Sinter Plant	Improvements to Lignite Injection. 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.	Permit systems and economic instruments: IPPC permits	Start: 2015 Expected end: 2018 Status: Implementation	Source affected:	Industry including heat and power production	Lignite-lime injection forms part of several projects to ensure that the sinter plant complies with the new tighter EU (IED) standards. 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. 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. The revised projected 'go live' date is April 2019.
				Spatial scale:	Local	
				Cost:	Not available	
				Indicator:	Emissions abated	
				Target emissions reduction:	Not available	

						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.