



Department  
for Environment  
Food & Rural Affairs

# Report on measures for 2018 exceedance of the Target Value for Nickel in Swansea Urban Area agglomeration zone (UK0027)

December 2020



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# 1. Introduction

## 1.1 Context

Under the EU Directive 2004/107/EC<sup>1</sup>, the target value (TV) for nickel (Ni) is an annual mean concentration of 20 nanograms (a nanogram is one billionth of a gram ( $10^{-9}$ )) per cubic metre ( $m^{-3}$ ) of ambient air or lower. The Directive requires that Member States shall 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.

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. 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 place<sup>2</sup>.

This document reports the exceedance situation for 2018 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 Ni within the Swansea Urban Area agglomeration zone identified within the 2018 UK air quality assessment. Exceedances within this zone were identified on the basis of measurement data, with model results on a 1 km x 1 km grid resolution providing supplementary information. Fine scale modelling on a 20 m x 20 m grid resolution located around an identified industrial source provided a more detailed local assessment. This exceedance was reported via e-Reporting dataflow G<sup>3</sup> on attainment and Air Pollution in the UK<sup>4</sup>.

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

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

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

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

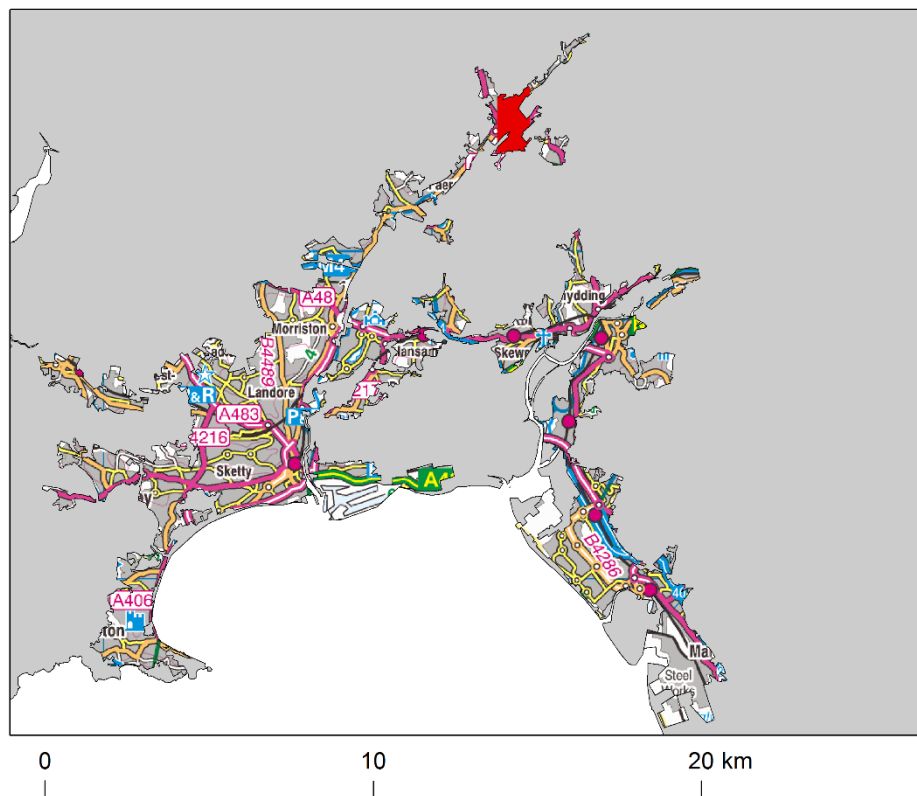
Table 1 summarises the spatial extent and associated resident population for the exceedances identified in this zone, as reported via e-Reporting.

**Table 1. Area exceeding Ni target value in 2018 and associated resident population for exceeding areas within Swansea Urban Area zone UK0027.**

| Zone code | Zone Name          | Area exceeding TV (km <sup>2</sup> ) | Population exceeding TV |
|-----------|--------------------|--------------------------------------|-------------------------|
| UK0027    | Swansea Urban Area | 1                                    | 2,141                   |

Figure 1 shows the locations of the exceedances in the context of the zone.

**Figure 1. Location of exceedance of the Ni target value during 2018 in Swansea Urban Area agglomeration zone UK0027. Areas of the zone in exceeding grid squares are marked red.**



An initial source apportionment was carried out and this analysis identified one exceedance situation within this zone related to industrial emissions:

Swansea Urban area [Ni\_UK0027\_2018\_1] related to industrial emissions (area of exceedance: 1 km<sup>2</sup>)

This report describes the exceedance situation in the zone. The sections below provide a description of the exceedance situation, including maps, information on source apportionment and a list of measures already taken or to be taken. Information on measures is reported within e-Reporting dataflow K<sup>5</sup>. This exceedance situation is adjacent to and shares common sources with the exceedance situation South Wales [Ni\_UK0041\_2018\_1] for which further information can be found in the report on measures for [South Wales UK0041](#).

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

## 2 Exceedance situation Swansea Urban Area [Ni\_UK0027\_2018\_1] related to industrial emissions

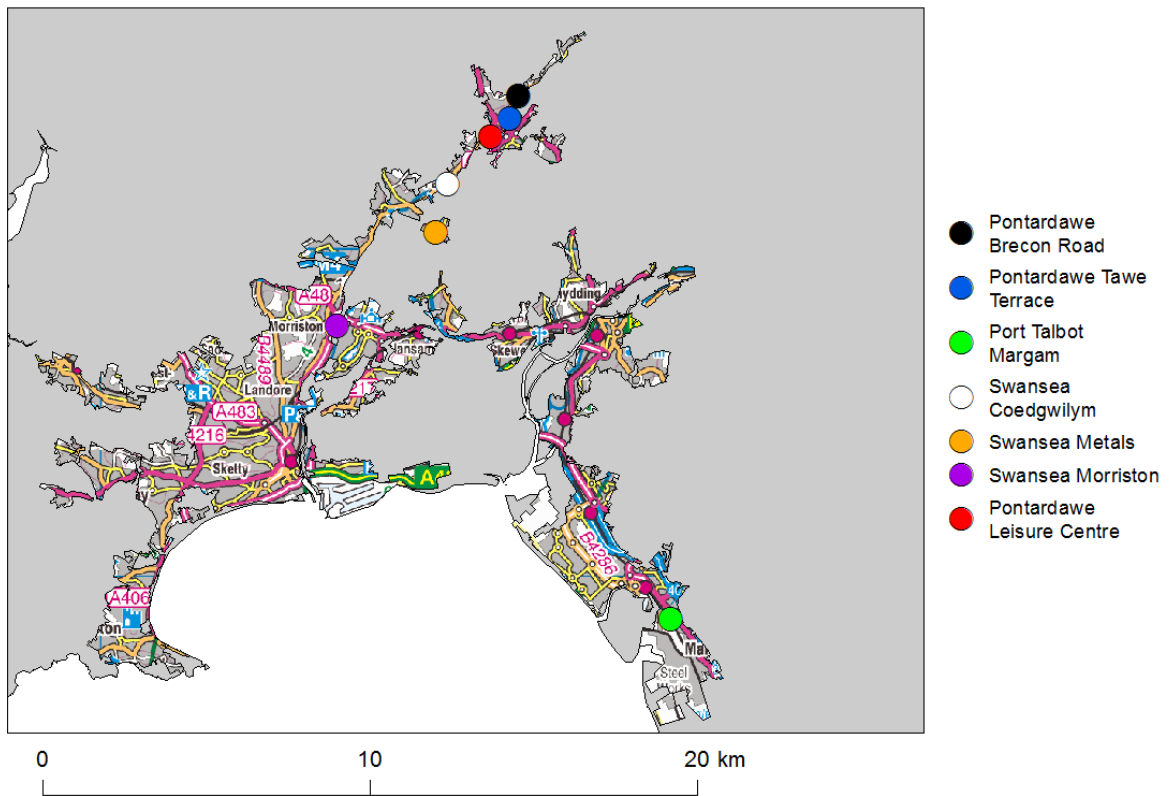
### 2.1 Description of exceedance

This exceedance situation is an area of exceedance of 1 km<sup>2</sup> and is located in the Swansea valley in the north of the Swansea Urban Area agglomeration zone. The resident population associated with this exceedance situation is 2,141. This exceedance situation is adjacent to and shares common sources with the exceedance situation for South Wales [Ni\_UK0041\_2018\_1].

Table 2 lists measured annual mean concentrations of Ni from monitoring sites in Swansea Urban Area agglomeration zone from 2004 to 2019, and Figure 2 indicates the location of measurement sites. There was one measured exceedance at Pontardawe Tawe Terrace (GB1016A) in 2018 for which this report relates. Figure 3 shows the location of the exceedance situation in detail. This map also shows the locations of the monitoring sites in the vicinity of the exceedance situation and the locations of local industrial sources. The map in Figure 3 shows that Pontardawe Tawe Terrace is located within the exceedance situation for Swansea [Ni\_UK0027\_2018\_1]. The measured concentrations of Ni at other national monitoring sites within the Swansea Urban Area agglomeration zone were all below the TV in 2018.

Figure 3 shows the high-resolution zone boundary used to assign the locations of monitoring sites in grey and the zone boundaries for the 1 km grid used to assign exceedance situations and associated populations as black hatching. The local topography and locations of settlements results in the Swansea Urban Area Agglomeration zone extending up the Swansea Valley but only the larger urban areas are assigned to the agglomeration zone within the 1 km gridded data.

Figure 2. Location of monitoring sites in Swansea Urban Area



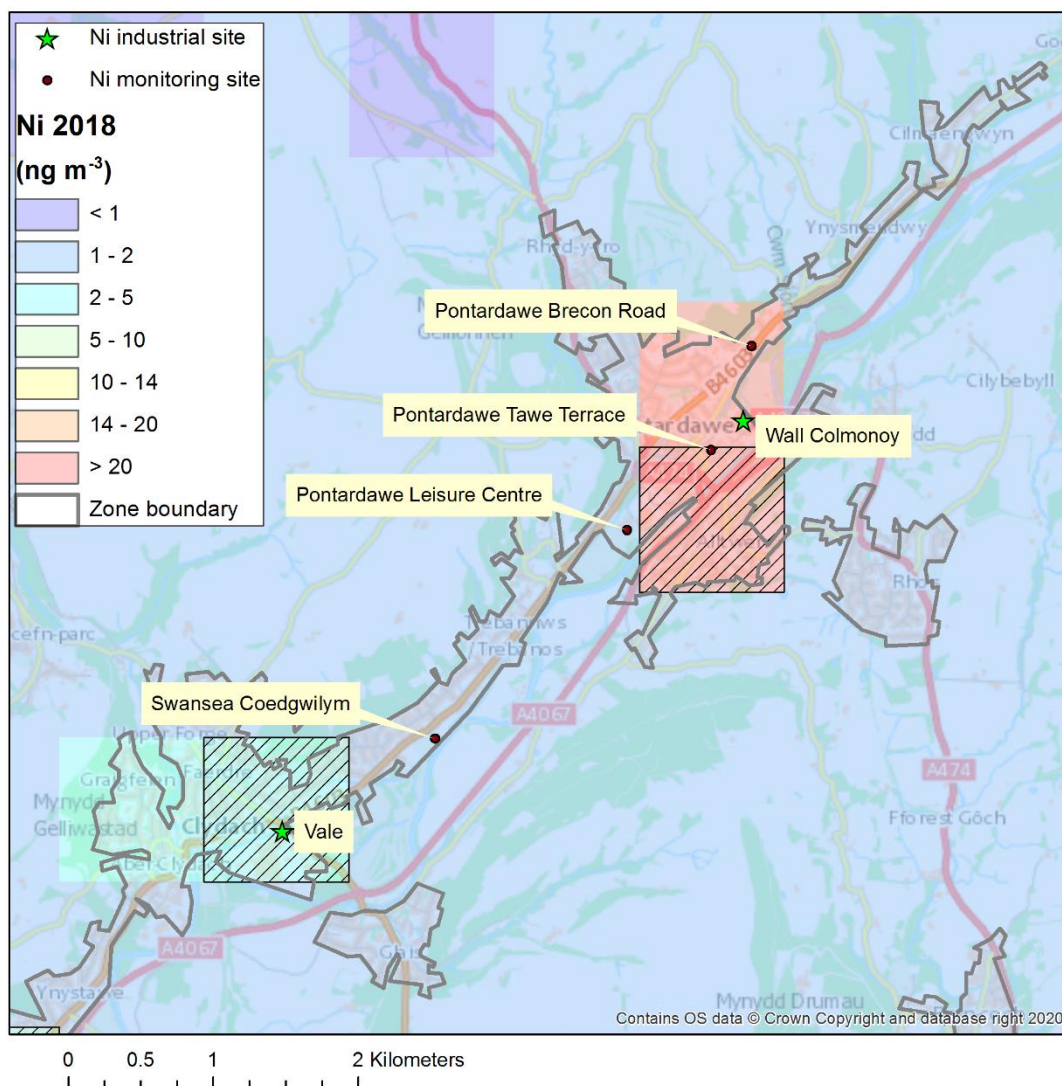


**Table 2. Measured annual mean Ni concentrations in Swansea Urban Area agglomeration zone UK0027 from 2004 to 2019 (ngm<sup>-3</sup>). (Percentage data capture is shown in brackets).**

| Station (Eol code)                | 2004       | 2005       | 2006       | 2007       | 2008        | 2009        | 2010         | 2011        | 2012        | 2013         | 2014         | 2015         | 2016         | 2017         | 2018         | 2019         |
|-----------------------------------|------------|------------|------------|------------|-------------|-------------|--------------|-------------|-------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Pontardawe Brecon Road (GB1015A)  |            |            |            |            |             |             |              | 6.5<br>(37) | 6.6<br>(94) | 5.7<br>(98)  | 8.1<br>(96)  | 9.2<br>(97)  | 4.8<br>(100) | 4.5<br>(94)  | 6.2<br>(98)  | 5.6<br>(98)  |
| Pontardawe Tawe Terrace (GB1016A) |            |            |            |            |             |             |              | 28<br>(93)  | 30<br>(98)  | 37<br>(98)   | 43<br>(100)  | 28<br>(100)  | 47<br>(97)   | 19<br>(95)   | 57<br>(100)  | 35<br>(100)  |
| Port Talbot Margam (GB0906A)      |            |            |            |            | 2.0<br>(98) | 1.4<br>(92) | 1.5<br>(100) | 1.7<br>(97) | 1.4<br>(99) | 1.5<br>(100) | 1.7<br>(100) | 4.1<br>(100) | 2.4<br>(98)  | 1.4<br>(100) | 1.6<br>(100) | 1.1<br>(98)  |
| Swansea Metals (GB0876A)          | 34<br>(96) | 20<br>(97) | 26<br>(97) | 28<br>(64) |             |             |              |             |             |              |              |              |              |              |              |              |
| Swansea Coedgwilym (GB0981A)      |            |            |            |            | 20<br>(100) | 16<br>(96)  | 10<br>(98)   | 11<br>(92)  | 8.5<br>(84) | 7.8<br>(100) | 12<br>(100)  | 13<br>(100)  | 10<br>(100)  | 8.5<br>(98)  | 12<br>(100)  | 14<br>(95)   |
| Swansea Morrision (GB0979A)       |            |            |            |            | 7.6<br>(87) | 9.3<br>(98) | 15<br>(98)   | 8.2<br>(95) | 5.6<br>(98) | 6.5<br>(100) | 9.4<br>(100) | 7.4<br>(94)  | 5.9<br>(93)  | 5.8<br>(86)  | 8.6<br>(100) | 10<br>(100)  |
| Pontardawe Leisure Centre*        | 76         | 47         | 74         | 70         | 43          | 29          | 8.5          | 15          | 14          | 12           | 22           | 15           | 22           | 10<br>(78)   | 20.2<br>(99) | 15.7<br>(98) |

\* Pontardawe Leisure Centre is a Local Authority monitoring site. It is included here as the site was operated continuously between 2004 and 2019. Data capture statistics were not available for this site before 2017.

**Figure 3. Exceedance situation Swansea [Ni\_UK0027\_2018\_1]. Exceeding grid squares are marked red. Locations of local industrial sites Wall Colmonoy works at Pontardawe and Vale Europe Ltd Clydach refinery and the locations of local monitoring stations are also shown. Non-hatched grid squares are assigned to the South Wales zone UK0041 and do not form part of this exceedance situation.**



## 2.2 Source apportionment

Modelling has been used to determine the annual mean Ni source apportionment for the exceedance situation. National modelling on a 1 km x 1 km grid resolution apportions the Ni concentration to background sources. Additional fine scale modelling has also been carried out to characterise local industrial emissions for the Wall Colmonoy site located within the exceedance situation, this is described in Appendix 1.

Table 3 provides a breakdown of the main emission sources (source apportionment) that have contributed to the grid square in this exceedance situation. It is clear that industrial sources are the main source associated with this exceedance situation. The penultimate column in the table is the total from all emissions sources. The values in this column have been rounded to integers for consistency with the values 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 4 gives a more detailed source apportionment for the industry sector and shows that the main source associated with this exceedance situation is Wall Colmonoy stack emissions. The emissions from Wall Colmonoy are regulated by the Neath Port Talbot County Borough Council and measures undertaken (see section 2.3) describe how these stack emissions have changed since 2008. Appendix 1 presents modelling undertaken to understand the impact of this emissions source.

In previous years, the Welsh Government have commissioned supplementary monitoring studies to improve the confidence in the source apportionment and identification of the predominant Ni sources. The sampling frequency at the Pontardawe Tawe Terrace measurement site was increased from weekly to daily sampling between August 2015 and February 2016. A subsequent study by King's College London measured the concentration of Nickel and other metals at hourly time resolution during November and December 2015. Both assessments looked at the relationship between local meteorological data, the levels of Ni compared with other metals and industrial activity to help identify Ni sources. Both studies indicated that Wall Colmonoy was a significant source of Ni at the Tawe Terrace monitoring station, although acknowledged that other sources were present. Details of both studies were provided in Appendix A1.2 of the 2015 and 2016 Report on Measures for Swansea Urban Area.<sup>6</sup>

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<sup>6</sup>[https://uk-air.defra.gov.uk/assets/documents/reports/bap-nickel-measures/ni\\_swansea\\_UK0027\\_reportonmeasures\\_2015.pdf](https://uk-air.defra.gov.uk/assets/documents/reports/bap-nickel-measures/ni_swansea_UK0027_reportonmeasures_2015.pdf)  
[https://uk-air.defra.gov.uk/assets/documents/reports/bap-nickel-measures/ni\\_swansea\\_UK0027\\_reportonmeasures\\_2016.pdf](https://uk-air.defra.gov.uk/assets/documents/reports/bap-nickel-measures/ni_swansea_UK0027_reportonmeasures_2016.pdf)

Table 3. Source apportionment for exceedance situation Ni\_UK0027\_2018\_1. Annual mean Ni concentration (ngm<sup>-3</sup>)

| OS easting (m) | OS Northing (m) | Zone | Regional background: Total | Regional background: From within Member State | Urban background increment: Total | Urban background increment: Traffic | Urban background increment: Industry including heat and power production | Urban background increment: commercial and residential | Urban background increment: Shipping | Urban background increment: Off road mobile machinery | Urban background increment: Other | Local increment: Total | Local increment: Industry including heat and power production | Total for all emission sources | Resident population |
|----------------|-----------------|------|----------------------------|-----------------------------------------------|-----------------------------------|-------------------------------------|--------------------------------------------------------------------------|--------------------------------------------------------|--------------------------------------|-------------------------------------------------------|-----------------------------------|------------------------|---------------------------------------------------------------|--------------------------------|---------------------|
| 272500         | 203500          | 27   | 0.94                       | 0.94                                          | 0.97                              | 0.02                                | 0.32                                                                     | 0.59                                                   | 0.01                                 | 0.03                                                  | 0.00                              | 55.59                  | 55.59                                                         | 57                             | 2141                |

Table 4. Detailed source apportionment for industrial sources only for exceedance situation Ni\_UK0027\_2018\_1. Annual mean Ni concentration (ngm<sup>-3</sup>)

| OS easting (m) | OS Northing (m) | Zone | Wall Colmonoy stack emissions | Fugitive emissions | Local increment: Industry including heat and power | Total for all emission sources |
|----------------|-----------------|------|-------------------------------|--------------------|----------------------------------------------------|--------------------------------|
| 272500         | 203500          | 27   | 55.59                         |                    | 55.59                                              | 57                             |

## 2.3 Measures

Improving air quality is a high priority for the Welsh Government. The Clean Air Plan for Wales, published in August 2020, sets out the ambition to deliver compliance with the Target Value as soon as practicable. The Welsh Government brings together the regulators and local industrial operators with emissions of Ni to air in pursuit of this aim. Regular meetings have enabled:

- the Welsh Government to communicate to the industrial regulators and operators the extent of the issue and the seriousness with which it is taken;
- the regulators to demonstrate that the operators are applying all cost-effective measures, and in particular are applying best available techniques as required by Directive 2010/75/EU (IED);
- the operators to cooperate and share best practice in managing their operations; and
- the development of the latest evidence in understanding the predominant sources.

Table 5 presents measures that have been taken and are to be taken at the Wall Colmonoy and Vale industrial sites and the remainder of this section describes action taken at the industrial sites during 2018. Given the level of uncertainty and the cause and spatial extent of this local exceedance, the Welsh Government have undertaken further modelling studies to help identify the predominant sources (more information is provided at the end of this report).

### Vale

A comparison between the reported annual Ni emissions from Vale works in Table 6 and annual Ni concentrations recorded at local monitoring sites in Table 2 shows a positive correlation. This is between the timing of reductions of reported emissions at Vale site and the trend in measured annual mean Ni concentrations at the long running Pontardawe Leisure Centre site – although an increase was seen at this site in 2014. The timing of the large drop in measured concentrations at this site between 2007 and 2010 coincides with the large reduction in reported stack emissions from the Vale works. More recently, trends in the measured annual mean Ni concentrations at the Pontardawe Leisure Centre site have correlated less well with the reported annual Ni emissions from Vale. Table 6 shows that emissions from Vale have been relatively stable since 2011. Emissions were elevated in 2015 compared to recent previous years but decreased in 2016 back to levels similar to other years since 2011. The emissions further decrease in 2017 and continue to decrease in 2018.

The regulator for the Vale site, Natural Resources Wales, has assessed measures already taken by Vale constitute BAT for the industrial site. There is no evidence to suggest the emissions from this source are a significant contributor to the high results

seen at some monitoring stations throughout 2018. Natural Resources Wales will work with Vale to ensure continual improvements are made to the operations and to minimise emissions. However, no additional measures are proposed at this time. The measures reported in Table 5 are unchanged from those reported in the Report on Measures for 2016 exceedance of the Target Value for Nickel in Swansea Urban Area agglomeration zone<sup>7</sup>.

### Wall Colmonoy

The regulator for the Wall Colmonoy site, Neath Port Talbot County Borough Council, has assessed the measures taken at the Wall Colmonoy site also constitute BAT.

Table 7 shows reported annual emissions for the Wall Colmonoy site decreased from 97.74 kg yr<sup>-1</sup> in 2017 to 54.32 kg yr<sup>-1</sup> in 2018. Although, the value for 2018 is a weighted average of four measurements made throughout the year. Estimates of annual stack emissions are based on an annual stack test result, which is a snapshot of emissions and is dependent on the relative Ni content of the specific products that are being made or processed and the operation of the emission abatement equipment at the time of the emissions test.

The measured annual mean concentrations of Ni at Pontardawe Tawe Terrace site (the monitoring site nearest to the Wall Colmonoy site) increased significantly between 2017 and 2018. A comparison between reported annual Ni emissions from Wall Colmonoy site in Table 7 and Ni concentrations at local monitoring sites shows that there is a little or no correlation between the reported emissions from the Wall Colmonoy site and measured annual mean Ni concentrations at Pontardawe Tawe Terrace. This may be due to uncertainties in the stack emissions estimation method, amongst other factors.

Two issues were recorded by the regulator and site operator to understand and rectify the increase in emissions during 2018. The first was a blockage in the wet arrester caused by a build-up of metal powder. Action taken to resolve this included a review of the cleaning frequency for parts of the wet arrester and making arrangements to install a continuous particulate monitor, which was installed in 2019. The second issue was a failure of the bag filter for the central vacuum system. The regulator raised this issue with the operator following an increasing trend in the annual stack test results. The operator made plans to change the filter, but the wrong size media were received, and the fault arose before the correct size filters could be installed. The frequency of exchange of these filters has now been increased and will happen annually. The regulator expects this should be sufficient to avoid a recurrence. There

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<sup>7</sup>[https://uk-air.defra.gov.uk/assets/documents/reports/bap-nickel-measures/ni\\_swansea\\_UK0027\\_reportonmeasures\\_2016.pdf](https://uk-air.defra.gov.uk/assets/documents/reports/bap-nickel-measures/ni_swansea_UK0027_reportonmeasures_2016.pdf)

were no new pieces of abatement plant installed in 2018. The emphasis has been on maintenance procedures since all of the previous abatement plant was installed, including:

- Maintenance carried out on wet extractor for foundry (aqualine)
- Pollution measurements were carried inside the building in order to better understand fugitive emissions
- Lip extraction was installed on induction furnaces
- Vibratory feeders were enclosed
- Improvements were made to waste handling arrangements
- Additional stack tests were carried out to gauge improvements to specific abatement plant e.g. Fettling, Cut-off saw
- Tower 4 emissions were connected to different abatement plant for enhanced performance
- Replaced HEPA filters on abatement plant that emits to inside of building
- The permit was reviewed and varied

Detailed local modelling of Ni emissions from the Wall Colmonoy site showed that the reported annual Ni emissions were not representative of emissions throughout 2018. Hence, the four measurements that were made throughout the year were used as a weighted average to show the amount of days each of the measurements represented.



**Table 5. Table of measures taken or to be taken at Wall Colmonoy and Vale industrial sites.**

| Measure code                | Measure Description                                          | Classification                                            | Implementation dates | Other information |                  | Comment                                                                                                                                                          |                                                                                                                                 |
|-----------------------------|--------------------------------------------------------------|-----------------------------------------------------------|----------------------|-------------------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Wall Colmonoy_1             | Water wash cyclone (Aqualine) filtration for casting foundry | Permit systems and economic instruments:<br>Other measure | Start:               | 2010              | Source affected: | Industry including heat and power production                                                                                                                     | Regulator (Neath Port Talbot County Borough Council) have assessed that this system meets BAT.<br><br>This measure is complete. |
|                             |                                                              |                                                           | Expected end:        | 2010              |                  |                                                                                                                                                                  |                                                                                                                                 |
|                             |                                                              |                                                           | Status:              | Complete          | Spatial scale:   | Local                                                                                                                                                            |                                                                                                                                 |
|                             |                                                              |                                                           | Cost:                |                   | Cost:            | Not available                                                                                                                                                    |                                                                                                                                 |
|                             |                                                              |                                                           | Indicator:           |                   | Indicator:       | Nickel concentration in emissions test:<br>October 2014 results of 0.01 mgm <sup>-3</sup> against limit specific in environmental permit of 15 mgm <sup>-3</sup> |                                                                                                                                 |
| Target emissions reduction: |                                                              | Target emissions reduction:                               | Not available        |                   |                  |                                                                                                                                                                  |                                                                                                                                 |
| Wall Colmonoy_2             |                                                              |                                                           | Start:               | 2014              | Source affected: |                                                                                                                                                                  | This measure is complete.                                                                                                       |

|                 |                                                                                       |                                                           |                                                               |                             |                                              |                           |
|-----------------|---------------------------------------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------------------|-----------------------------|----------------------------------------------|---------------------------|
|                 | New local exhaust ventilation system and filter unit installed in the powders section | Permit systems and economic instruments:<br>Other measure | Expected end: 2014<br><br>Status: Complete                    |                             | Industry including heat and power production |                           |
|                 |                                                                                       |                                                           |                                                               | Spatial scale:              | Local                                        |                           |
|                 |                                                                                       |                                                           |                                                               | Cost:                       | Not available                                |                           |
|                 |                                                                                       |                                                           |                                                               | Indicator:                  | Not available                                |                           |
|                 |                                                                                       |                                                           |                                                               | Target emissions reduction: | Not available                                |                           |
| Wall Colmonoy_3 | Deep clean of powders section                                                         | Permit systems and economic instruments:<br>Other measure | Start: 2014<br><br>Expected end: 2014<br><br>Status: Complete | Source affected:            | Industry including heat and power production | This measure is complete. |
|                 |                                                                                       |                                                           |                                                               | Spatial scale:              | Local                                        |                           |
|                 |                                                                                       |                                                           |                                                               | Cost:                       | Not available                                |                           |
|                 |                                                                                       |                                                           |                                                               | Indicator:                  | Not available                                |                           |
|                 |                                                                                       |                                                           |                                                               | Target emissions reduction: | Not available                                |                           |

|                             |                                                                    |                                                           |               |               |                  |                                              |                           |                |       |
|-----------------------------|--------------------------------------------------------------------|-----------------------------------------------------------|---------------|---------------|------------------|----------------------------------------------|---------------------------|----------------|-------|
| Wall Colmonoy_4             | Install new centralised vacuum system in powders section           | Permit systems and economic instruments:<br>Other measure | Start:        | 2014          | Source affected: | Industry including heat and power production | This measure is complete. |                |       |
|                             |                                                                    |                                                           | Expected end: | 2015          |                  |                                              |                           |                |       |
|                             |                                                                    |                                                           | Status:       | Complete      |                  |                                              |                           | Spatial scale: | Local |
|                             |                                                                    |                                                           | Cost:         | Not available |                  |                                              |                           |                |       |
|                             |                                                                    |                                                           | Indicator:    | Not available |                  |                                              |                           |                |       |
| Target emissions reduction: | Not available                                                      |                                                           |               |               |                  |                                              |                           |                |       |
| Wall Colmonoy_5             | New Local Exhaust Ventilation (LEV) and filter in fettling section | Permit systems and economic instruments:<br>Other measure | Start:        | 2014          | Source affected: | Industry including heat and power production | This measure is complete. |                |       |
|                             |                                                                    |                                                           | Expected end: | 2014          |                  |                                              |                           |                |       |
|                             |                                                                    |                                                           | Status:       | Complete      |                  |                                              |                           | Spatial scale: | Local |
|                             |                                                                    |                                                           | Cost:         | Not available |                  |                                              |                           |                |       |
| Indicator:                  | Not available                                                      |                                                           |               |               |                  |                                              |                           |                |       |

|                 |                                                                                                        |                                                           |                                                               |                             |                                              |                           |
|-----------------|--------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------------------|-----------------------------|----------------------------------------------|---------------------------|
|                 |                                                                                                        |                                                           |                                                               | Target emissions reduction: | Not available                                |                           |
| Wall Colmonoy_6 | Deep clean of atomising section                                                                        | Permit systems and economic instruments:<br>Other measure | Start: 2014<br><br>Expected end: 2014<br><br>Status: Complete | Source affected:            | Industry including heat and power production | This measure is complete. |
|                 |                                                                                                        |                                                           |                                                               | Spatial scale:              | Local                                        |                           |
|                 |                                                                                                        |                                                           |                                                               | Cost:                       | Not available                                |                           |
|                 |                                                                                                        |                                                           |                                                               | Indicator:                  | Not available                                |                           |
|                 |                                                                                                        |                                                           |                                                               | Target emissions reduction: | Not available                                |                           |
| Wall Colmonoy_7 | Flap curtains installed between the powder room and driers to minimise escape of dust from powder room | Permit systems and economic instruments:<br>Other measure | Start: 2014<br><br>Expected end: 2014<br><br>Status: Complete | Source affected:            | Industry including heat and power production | This measure is complete. |
|                 |                                                                                                        |                                                           |                                                               | Spatial scale:              | Local                                        |                           |
|                 |                                                                                                        |                                                           |                                                               | Cost:                       | Not available                                |                           |

|                 |                                                                                          |                                                           |                             |                             |                             |                                              |                           |
|-----------------|------------------------------------------------------------------------------------------|-----------------------------------------------------------|-----------------------------|-----------------------------|-----------------------------|----------------------------------------------|---------------------------|
|                 |                                                                                          |                                                           |                             | Indicator:                  | Not available               |                                              |                           |
|                 |                                                                                          |                                                           |                             | Target emissions reduction: | Not available               |                                              |                           |
| Wall Colmonoy_8 | Nutating inlets (containment at transfer points) fitted on lockers (screens) 7 & 8       | Permit systems and economic instruments:<br>Other measure | Start:                      | 2014                        | Source affected:            | Industry including heat and power production | This measure is complete. |
|                 |                                                                                          |                                                           | Expected end:               | 2015                        |                             |                                              |                           |
|                 |                                                                                          |                                                           | Status:                     | Complete                    | Spatial scale:              | Local                                        |                           |
|                 |                                                                                          |                                                           | Cost:                       |                             | Indicator:                  | Not available                                |                           |
|                 |                                                                                          |                                                           | Target emissions reduction: |                             | Target emissions reduction: | Not available                                |                           |
| Wall Colmonoy_9 | New enclosure and Local Exhaust Ventilation (LEV) filter on blenders dispense into sieve | Permit systems and economic instruments:<br>Other measure | Start:                      | 2014                        | Source affected:            | Industry including heat and power production | This measure is complete. |
|                 |                                                                                          |                                                           | Expected end:               | 2014                        |                             |                                              |                           |
|                 |                                                                                          |                                                           | Status:                     | Complete                    | Spatial scale:              | Local                                        |                           |

|                  |                                                                                  |                                                           |                                                       |                             |                                              |                           |
|------------------|----------------------------------------------------------------------------------|-----------------------------------------------------------|-------------------------------------------------------|-----------------------------|----------------------------------------------|---------------------------|
|                  |                                                                                  |                                                           |                                                       | Cost:                       | Not available                                |                           |
|                  |                                                                                  |                                                           |                                                       | Indicator:                  | Not available                                |                           |
|                  |                                                                                  |                                                           |                                                       | Target emissions reduction: | Not available                                |                           |
| Wall Colmonoy_10 | Lip extraction fitted to furnaces feeding atomising (powder manufacture) Tower 4 | Permit systems and economic instruments:<br>Other measure | Start: 2014<br>Expected end: 2014<br>Status: Complete | Source affected:            | Industry including heat and power production | This measure is complete. |
|                  |                                                                                  |                                                           |                                                       | Spatial scale:              | Local                                        |                           |
|                  |                                                                                  |                                                           |                                                       | Cost:                       | Not available                                |                           |
|                  |                                                                                  |                                                           |                                                       | Indicator:                  | Not available                                |                           |
|                  |                                                                                  |                                                           |                                                       | Target emissions reduction: | Not available                                |                           |
|                  |                                                                                  |                                                           |                                                       |                             |                                              |                           |
| Wall Colmonoy_11 | Dalamatic filter system upgraded with bags to same                               | Permit systems and economic instruments:<br>Other measure | Start: 2014<br>Expected end: 2014                     | Source affected:            | Industry including heat and power production | This measure is complete. |

|                  |                                      |                                                           |                                                       |                                                                                                                                                                           |  |                           |
|------------------|--------------------------------------|-----------------------------------------------------------|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------------|
|                  | specification as Vale A1 site        |                                                           | Status: Complete                                      | Spatial scale: Local                                                                                                                                                      |  |                           |
|                  |                                      |                                                           |                                                       | Cost: Not available                                                                                                                                                       |  |                           |
|                  |                                      |                                                           |                                                       | Indicator: Nickel concentration in emissions test. November 2014 results of 0.01 mgm <sup>-3</sup> against limit specific in environmental permit of 15 mgm <sup>-3</sup> |  |                           |
|                  |                                      |                                                           |                                                       | Target emissions reduction: Not available                                                                                                                                 |  |                           |
| Wall Colmonoy_12 | Russell sieve enclosed with curtains | Permit systems and economic instruments:<br>Other measure | Start: 2014<br>Expected end: 2014<br>Status: Complete | Source affected: Industry including heat and power production<br>Spatial scale: Local<br>Cost: Not available<br>Indicator: Not available                                  |  | This measure is complete. |

|                             |                                                                                               |                                                           |               |                             |                  |                                              |                           |                |       |
|-----------------------------|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------|---------------|-----------------------------|------------------|----------------------------------------------|---------------------------|----------------|-------|
|                             |                                                                                               |                                                           |               | Target emissions reduction: | Not available    |                                              |                           |                |       |
| Wall Colmonoy_13            | Cut off saw bag filters installed                                                             | Permit systems and economic instruments:<br>Other measure | Start:        | 2012                        | Source affected: | Industry including heat and power production | This measure is complete. |                |       |
|                             |                                                                                               |                                                           | Expected end: | 2014                        |                  |                                              |                           |                |       |
|                             |                                                                                               |                                                           | Status:       | Complete                    |                  |                                              |                           | Spatial scale: | Local |
|                             |                                                                                               |                                                           | Cost:         | Not available               |                  |                                              |                           |                |       |
|                             |                                                                                               |                                                           | Indicator:    | Not available               |                  |                                              |                           |                |       |
| Target emissions reduction: | Not available                                                                                 |                                                           |               |                             |                  |                                              |                           |                |       |
| Wall Colmonoy_14            | Cyclone followed by bag filter (Dalmatic) arrestment used in powder manufacturing (atomising) | Permit systems and economic instruments:<br>Other measure | Start:        | 2014                        | Source affected: | Industry including heat and power production | This measure is complete. |                |       |
|                             |                                                                                               |                                                           | Expected end: | 2014                        |                  |                                              |                           |                |       |
|                             |                                                                                               |                                                           | Status:       | Complete                    |                  |                                              |                           | Spatial scale: | Local |
| Cost:                       | Not available                                                                                 |                                                           |               |                             |                  |                                              |                           |                |       |



|                  |                                                                                                                       |                                                           |                             |                             |                  |                                              |                                                                                          |
|------------------|-----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|-----------------------------|-----------------------------|------------------|----------------------------------------------|------------------------------------------------------------------------------------------|
|                  |                                                                                                                       |                                                           |                             | Indicator:                  | Not available    |                                              |                                                                                          |
|                  |                                                                                                                       |                                                           |                             | Target emissions reduction: | Not available    |                                              |                                                                                          |
| Wall Colmonoy_15 | High-efficiency particulate arrestance (HEPA) filters used on drier units where air is emitted to internal atmosphere | Permit systems and economic instruments:<br>Other measure | Start:                      | 2014                        | Source affected: | Industry including heat and power production | This measure is complete.                                                                |
|                  |                                                                                                                       |                                                           | Expected end:               | 2014                        |                  |                                              |                                                                                          |
|                  |                                                                                                                       |                                                           | Status:                     | Complete                    | Spatial scale:   | Local                                        |                                                                                          |
|                  |                                                                                                                       |                                                           | Cost:                       | Not available               |                  |                                              |                                                                                          |
|                  |                                                                                                                       |                                                           | Indicator:                  | Not available               |                  |                                              |                                                                                          |
|                  |                                                                                                                       |                                                           | Target emissions reduction: | Not available               |                  |                                              |                                                                                          |
| Wall Colmonoy_16 | Workplace nickel monitoring to take place to identify hot spots.                                                      | Permit systems and economic instruments:<br>Other measure | Start:                      | 2015                        | Source affected: | Industry including heat and power production | Results from this monitoring will be used to identify and prioritise future improvements |
|                  |                                                                                                                       |                                                           | Expected end:               | 2018                        |                  |                                              |                                                                                          |

|                  |                                                                               |                                                           |                                                             |                                                               |  |                                                                                                                                                                     |
|------------------|-------------------------------------------------------------------------------|-----------------------------------------------------------|-------------------------------------------------------------|---------------------------------------------------------------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                  |                                                                               |                                                           | Status: Implementation                                      | Spatial scale: Local                                          |  | A new tranche of monitoring started in Sep 2017                                                                                                                     |
|                  |                                                                               |                                                           |                                                             | Cost: Not available                                           |  |                                                                                                                                                                     |
|                  |                                                                               |                                                           |                                                             | Indicator: Not available                                      |  |                                                                                                                                                                     |
|                  |                                                                               |                                                           |                                                             | Target emissions reduction: Not available                     |  |                                                                                                                                                                     |
| Wall Colmonoy_17 | Ambient (external) monitoring is to take place to help identify any hot spots | Permit systems and economic instruments:<br>Other measure | Start: 2015<br>Expected end: 2018<br>Status: Implementation | Source affected: Industry including heat and power production |  | Hourly monitoring study by King's College London in November/December 2015 is now complete. Monitoring by Wall Colmonoy and at Pontardawe Tawe Terrace is on-going. |
|                  |                                                                               |                                                           |                                                             | Spatial scale: Local                                          |  |                                                                                                                                                                     |
|                  |                                                                               |                                                           |                                                             | Cost: Not available                                           |  |                                                                                                                                                                     |
|                  |                                                                               |                                                           |                                                             | Indicator: Not available                                      |  |                                                                                                                                                                     |
|                  |                                                                               |                                                           |                                                             | Target emissions reduction: Not available                     |  |                                                                                                                                                                     |

|                             |                                                                                                     |                                                           |               |               |                  |                                              |                           |                |       |
|-----------------------------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------|---------------|---------------|------------------|----------------------------------------------|---------------------------|----------------|-------|
| Wall<br>Colmonoy_18         | Modify hoods in castings 450kg furnaces. Only extract from two working furnaces instead of all four | Permit systems and economic instruments:<br>Other measure | Start:        | 2015          | Source affected: | Industry including heat and power production | This measure is complete. |                |       |
|                             |                                                                                                     |                                                           | Expected end: | 2016          |                  |                                              |                           |                |       |
|                             |                                                                                                     |                                                           | Status:       | Complete      |                  |                                              |                           | Spatial scale: | Local |
|                             |                                                                                                     |                                                           | Cost:         | Not available |                  |                                              |                           |                |       |
|                             |                                                                                                     |                                                           | Indicator:    | Not available |                  |                                              |                           |                |       |
| Target emissions reduction: | Not available                                                                                       |                                                           |               |               |                  |                                              |                           |                |       |
| Wall<br>Colmonoy_19         | Install water flow alarms on Aqualine filter system                                                 | Permit systems and economic instruments:<br>Other measure | Start:        | 2015          | Source affected: | Industry including heat and power production | This measure is complete. |                |       |
|                             |                                                                                                     |                                                           | Expected end: | 2015          |                  |                                              |                           |                |       |
|                             |                                                                                                     |                                                           | Status:       | Complete      |                  |                                              |                           | Spatial scale: | Local |
|                             |                                                                                                     |                                                           | Cost:         | Not available |                  |                                              |                           |                |       |
| Indicator:                  | Not available                                                                                       |                                                           |               |               |                  |                                              |                           |                |       |

|                  |                                                                                                                          |                                                           |                             |                             |                             |                                              |                           |
|------------------|--------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|-----------------------------|-----------------------------|-----------------------------|----------------------------------------------|---------------------------|
|                  |                                                                                                                          |                                                           |                             | Target emissions reduction: | Not available               |                                              |                           |
| Wall Colmonoy_20 | Roll out of differential pressure gauges on all Local Exhaust Ventilation (LEVs) including those < 50m <sup>3</sup> /min | Permit systems and economic instruments:<br>Other measure | Start:                      | 2015                        | Source affected:            | Industry including heat and power production | This measure is complete. |
|                  |                                                                                                                          |                                                           | Expected end:               | 2015                        |                             |                                              |                           |
|                  |                                                                                                                          |                                                           | Status:                     | Complete                    | Spatial scale:              | Local                                        |                           |
|                  |                                                                                                                          |                                                           | Cost:                       |                             | Indicator:                  | Not available                                |                           |
|                  |                                                                                                                          |                                                           | Target emissions reduction: |                             | Target emissions reduction: | Not available                                |                           |
| Wall Colmonoy_21 | Air drier pans LEV to be improved                                                                                        | Permit systems and economic instruments:<br>Other measure | Start:                      | 2015                        | Source affected:            | Industry including heat and power production | This measure is complete. |
|                  |                                                                                                                          |                                                           | Expected end:               | 2016                        |                             |                                              |                           |
|                  |                                                                                                                          |                                                           | Status:                     | Complete                    | Spatial scale:              | Local                                        |                           |
| Cost:            |                                                                                                                          | Cost:                                                     | Not available               |                             |                             |                                              |                           |

|                  |                                                                           |                                                           |                             |                             |                             |                                              |                          |
|------------------|---------------------------------------------------------------------------|-----------------------------------------------------------|-----------------------------|-----------------------------|-----------------------------|----------------------------------------------|--------------------------|
|                  |                                                                           |                                                           |                             | Indicator:                  | Not available               |                                              |                          |
|                  |                                                                           |                                                           |                             | Target emissions reduction: | Not available               |                                              |                          |
| Wall Colmonoy_22 | Door closures for existing maintenance area                               | Permit systems and economic instruments:<br>Other measure | Start:                      | 2015                        | Source affected:            | Industry including heat and power production | Complete                 |
|                  |                                                                           |                                                           | Expected end:               | 2015                        |                             |                                              |                          |
|                  |                                                                           |                                                           | Status:                     | Complete                    | Spatial scale:              | Local                                        |                          |
|                  |                                                                           |                                                           | Cost:                       |                             | Indicator:                  | Not available                                |                          |
|                  |                                                                           |                                                           | Target emissions reduction: |                             | Target emissions reduction: | Not available                                |                          |
|                  |                                                                           |                                                           |                             |                             |                             |                                              |                          |
| Wall Colmonoy_23 | Improve powder decanting arrangements on Tower 4. Better extraction & LEV | Permit systems and economic instruments:<br>Other measure | Start:                      | 2015                        | Source affected:            | Industry including heat and power production | This measure is complete |
|                  |                                                                           |                                                           | Expected end:               | 2015                        | Spatial scale:              | Local                                        |                          |

|                  |                                                                                        |                                                           |                                                       |                                                                                                                                                                                       |                                              |                                                                                                            |
|------------------|----------------------------------------------------------------------------------------|-----------------------------------------------------------|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|------------------------------------------------------------------------------------------------------------|
|                  |                                                                                        |                                                           | Status: Complete                                      | Cost: Not available                                                                                                                                                                   |                                              |                                                                                                            |
|                  |                                                                                        |                                                           |                                                       | Indicator: Not available                                                                                                                                                              |                                              |                                                                                                            |
|                  |                                                                                        |                                                           |                                                       | Target emissions reduction: Not available                                                                                                                                             |                                              |                                                                                                            |
| Wall Colmonoy_24 | TD100 discharge under positive pressure. Can put strain on neoprene at transfer points | Permit systems and economic instruments:<br>Other measure | Start: 2015<br>Expected end: 2016<br>Status: Complete | Source affected: Industry including heat and power production<br>Spatial scale: Local<br>Cost: Not available<br>Indicator: Not available<br>Target emissions reduction: Not available | Industry including heat and power production | This measure is complete.                                                                                  |
|                  |                                                                                        |                                                           |                                                       |                                                                                                                                                                                       |                                              |                                                                                                            |
|                  |                                                                                        |                                                           |                                                       |                                                                                                                                                                                       |                                              |                                                                                                            |
|                  |                                                                                        |                                                           |                                                       |                                                                                                                                                                                       |                                              |                                                                                                            |
|                  |                                                                                        |                                                           |                                                       |                                                                                                                                                                                       |                                              |                                                                                                            |
| Wall Colmonoy_25 | Enclose vibratory feeders                                                              | Permit systems and economic instruments:<br>Other measure | Start: 2015<br>Expected end: 2016                     | Source affected: Industry including heat and power production                                                                                                                         | Industry including heat and power production | This measure is complete. This is also additionally addressed through a process design change in the feed. |

|                  |                                                                                                               |                                                           |                                                       |                                                                                                                                                                                       |  |                           |
|------------------|---------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------------|
|                  |                                                                                                               |                                                           | Status: Complete                                      | Spatial scale: Local                                                                                                                                                                  |  |                           |
|                  |                                                                                                               |                                                           |                                                       | Cost: Not available                                                                                                                                                                   |  |                           |
|                  |                                                                                                               |                                                           |                                                       | Indicator: Not available                                                                                                                                                              |  |                           |
|                  |                                                                                                               |                                                           |                                                       | Target emissions reduction: Not available                                                                                                                                             |  |                           |
| Wall Colmonoy_26 | DSB mill LEV solution to be established before installation. Although this is already within an enclosed room | Permit systems and economic instruments:<br>Other measure | Start: 2015<br>Expected end: 2015<br>Status: Complete | Source affected: Industry including heat and power production<br>Spatial scale: Local<br>Cost: Not available<br>Indicator: Not available<br>Target emissions reduction: Not available |  | This measure is complete. |
|                  |                                                                                                               |                                                           | Start: 2014                                           | Source affected:                                                                                                                                                                      |  | This measure is complete. |

|                     |                                                                                                                                                                                                                                                                          |                                                           |                             |          |                             |                                              |  |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|-----------------------------|----------|-----------------------------|----------------------------------------------|--|
| Wall<br>Colmonoy_27 | Waste from bag filters are collected in enclosed drums, which are sealed prior to disposal by licenced carrier. Dust collected by the Aqualine system is saturated with water and is placed in Intermediate Bulk Containers before disposal by registered waste carrier. | Permit systems and economic instruments:<br>Other measure | Expected end:               | 2014     |                             | Industry including heat and power production |  |
|                     |                                                                                                                                                                                                                                                                          |                                                           | Status:                     | Complete | Spatial scale:              | Local                                        |  |
|                     |                                                                                                                                                                                                                                                                          |                                                           | Cost:                       |          | Cost:                       | Not available                                |  |
|                     |                                                                                                                                                                                                                                                                          |                                                           | Indicator:                  |          | Indicator:                  | Not available                                |  |
|                     |                                                                                                                                                                                                                                                                          |                                                           | Target emissions reduction: |          | Target emissions reduction: | Not available                                |  |

|        |                                                                                           |                                                      |               |          |                  |                                              |                                                        |
|--------|-------------------------------------------------------------------------------------------|------------------------------------------------------|---------------|----------|------------------|----------------------------------------------|--------------------------------------------------------|
| Vale_1 | Installation of stack filtration plant (bag house) to replace electrostatic precipitators | Permit systems and economic instruments: IED permits | Start:        | 2007     | Source affected: | Industry including heat and power production | This was the most significant measure for this source. |
|        |                                                                                           |                                                      | Expected end: | 2007     |                  |                                              |                                                        |
|        |                                                                                           |                                                      | Status:       | Complete | Spatial scale:   | Local                                        | Cost:                                                  |



|        |                                                                                                      |                                                      |                                                       |                             |                                                                                                                               |                           |
|--------|------------------------------------------------------------------------------------------------------|------------------------------------------------------|-------------------------------------------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------|---------------------------|
|        |                                                                                                      |                                                      |                                                       | Indicator:                  | Monthly average particulate concentration from main stack reduced from ~10 mgm <sup>-3</sup> to less than 1 mgm <sup>-3</sup> |                           |
|        |                                                                                                      |                                                      |                                                       | Target emissions reduction: | 3: Annual stack emission reduced from 2855 kg in 2007 to less than 100 kg by 2009, value in 2013 was 42 kg                    |                           |
| Vale_2 | Undertook soil remediation on abandoned parcel of contaminated land to render contained nickel inert | Permit systems and economic instruments: IED permits | Start: 2011<br>Expected end: 2011<br>Status: Complete | Source affected:            | Industry including heat and power production                                                                                  | This measure is complete. |
|        |                                                                                                      |                                                      |                                                       | Spatial scale:              | Local                                                                                                                         |                           |
|        |                                                                                                      |                                                      |                                                       | Cost:                       | £90K                                                                                                                          |                           |
|        |                                                                                                      |                                                      |                                                       | Indicator:                  | Not available                                                                                                                 |                           |
|        |                                                                                                      |                                                      |                                                       | Target emissions reduction: | Not available                                                                                                                 |                           |
| Vale_3 | Consolidated 3 emission points from Powder Plant Storage                                             | Permit systems and economic instruments: IED permits | Start: 2012<br>Expected end: 2012                     | Source affected:            | Industry including heat and power production                                                                                  | This measure is complete. |

|        |                                                                                                         |                                                      |                                                       |                                                               |  |                           |
|--------|---------------------------------------------------------------------------------------------------------|------------------------------------------------------|-------------------------------------------------------|---------------------------------------------------------------|--|---------------------------|
|        | Hoppers into 1 emission point and installed HEPA filter at outlet                                       |                                                      | Status: Complete                                      | Spatial scale: Local                                          |  |                           |
|        |                                                                                                         |                                                      |                                                       | Cost: £100K                                                   |  |                           |
|        |                                                                                                         |                                                      |                                                       | Indicator: Not available                                      |  |                           |
|        |                                                                                                         |                                                      |                                                       | Target emissions reduction: Not available                     |  |                           |
| Vale_4 | Replaced cladding and added belt enclosure on feed conveyors                                            | Permit systems and economic instruments: IED permits | Start: 2013<br>Expected end: 2013<br>Status: Complete | Source affected: Industry including heat and power production |  | This measure is complete. |
|        |                                                                                                         |                                                      |                                                       | Spatial scale: Local                                          |  |                           |
|        |                                                                                                         |                                                      |                                                       | Cost: £600K                                                   |  |                           |
|        |                                                                                                         |                                                      |                                                       | Indicator: Not available                                      |  |                           |
|        |                                                                                                         |                                                      |                                                       | Target emissions reduction: Not available                     |  |                           |
| Vale_5 | Replaced all 1700 filter bags on the Stack Filtration Plant as part of planned preventative maintenance | Permit systems and economic instruments: IED permits | Start: 2014<br>Expected end: 2014<br>Status: Complete | Source affected: Industry including heat and power production |  | This measure is complete. |
|        |                                                                                                         |                                                      |                                                       | Spatial scale: Local                                          |  |                           |
|        |                                                                                                         |                                                      |                                                       | Cost: £160K                                                   |  |                           |
|        |                                                                                                         |                                                      |                                                       | Indicator: Not available                                      |  |                           |

|        |                                                                                                                                                                      |                                                      |                                                    |                             |                                              |                           |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|----------------------------------------------------|-----------------------------|----------------------------------------------|---------------------------|
|        |                                                                                                                                                                      |                                                      |                                                    | Target emissions reduction: | Not available                                |                           |
| Vale_6 | Replacement of gas fired band dryer in effluent treatment plant with a vacuum dryer.<br><br>Resulting in the removal of three emissions points and efficient drying. | Permit systems and economic instruments: IED permits | Start : 2015<br>Expected: 2017<br>Status: Complete | Source affected             | Industry including heat and power production | This measure is complete. |
|        |                                                                                                                                                                      |                                                      |                                                    | Spatial scale               | Local                                        |                           |
|        |                                                                                                                                                                      |                                                      |                                                    | Cost:                       | £4 million                                   |                           |
|        |                                                                                                                                                                      |                                                      |                                                    | Indicator                   | Reduction in emission points                 |                           |
|        |                                                                                                                                                                      |                                                      |                                                    | Target emissions reduction: | Not available                                |                           |

**Table 6. Reported annual Ni emissions to air from Vale works (kg year<sup>-1</sup>).**

|       | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|-------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Stack | 1934 | 763  | 1382 | 3154 | 2855 | 193  | 56   | 96   | 25   | 31   | 42   | 11   | 108  | 36   | 17.3 | 13.6 |
| Other | 54   | 280  | 31   | 12   | 116  | 93   | 45   | 16   | 11   | 29   | 37   | 12   | 38   | 19   | 0.74 | 1.61 |

**Table 7. Reported annual stack emissions of Ni from Wall Colmonoy site (kg year<sup>-1</sup>).**

|       | 2008   | 2009   | 2010 <sup>a</sup> | 2011  | 2012  | 2013  | 2014 | 2015  | 2016  | 2017  | 2018 <sup>b</sup> |
|-------|--------|--------|-------------------|-------|-------|-------|------|-------|-------|-------|-------------------|
| Stack | 157.57 | 157.57 | 89.93             | 37.25 | 74.48 | 15.82 | 3.73 | 24.23 | 95.37 | 97.74 | 54.32             |

<sup>a</sup> Abatement measures implemented mid-2010. Reported emissions assume 6 months emissions at 2009 levels and six months at post abatement emissions level of 22.29 kg year<sup>-1</sup>.

<sup>b</sup> four stack emissions were reported in 2018, a weighted average is presented here representing the days for which each stack emission was assumed. The stack emissions were 102.73 kg, 53.71 kg, 216.11 kg and 39.51 kg.

# Appendix

## A1 Assessment of industrial source

### A1.1 Local scale modelling of the industrial point source

Detailed dispersion modelling has been undertaken using ADMS 5.2 for the area in South Wales where exceedances of the annual mean TV of 20 ng m<sup>-3</sup> have been measured in 2018. This fine-scale modelling has been used to assess the likely magnitude and spatial extent of exceedance. Modelling was carried out at a spatial resolution of 20 m x 20 m over an area of 2.5 km x 2.5 km centred on the industrial point source.

Information on the Ni emissions from the principal Ni point source were provided by the site operator. Four measurements of the annual Ni emissions rate were reported by the site operator at different times of the year account for different situations at the site. These were 102.73, 53.71, 216.11 and 39.51 kg year<sup>-1</sup>. The modelling was performed for each of these situations assuming that each was the emission for a full year to calculate the Ni contributing at the monitoring sites. A time-weighted mean was calculated using the results from the model runs based on operational information provided by the site operator and to provide the best fit to the monitoring data at Pontardawe Tawe Terrace.

Emissions were released from thirteen emission points distributed across the site. Building effects were included in the model, and a 6 km x 6 km area was extracted from the OS Terrain 50 dataset to allow the effect of the topographical features of the valley to be included in the model. The height of the terrain was specified at the centre of each 50 m x 50 m grid square.

Table A1 compares measured annual mean Ni concentrations with modelled concentrations. The modelled concentrations include a component resulting from the local industrial point source in Pontardawe and a background component from the annual modelling Ni concentrations across the UK. The model reproduces the measured concentration at Pontardawe Leisure Centre and Pontardawe Brecon Road well. Agreement is also good at Pontardawe Tawe Terrace, for which the measured concentration was used to inform the time weighting of emissions estimates and thus good agreement is to be expected.

Figure A1 shows the modelled annual mean Ni concentration on a 20 m x 20 m grid resulting from the local industrial point source in Pontardawe and including a

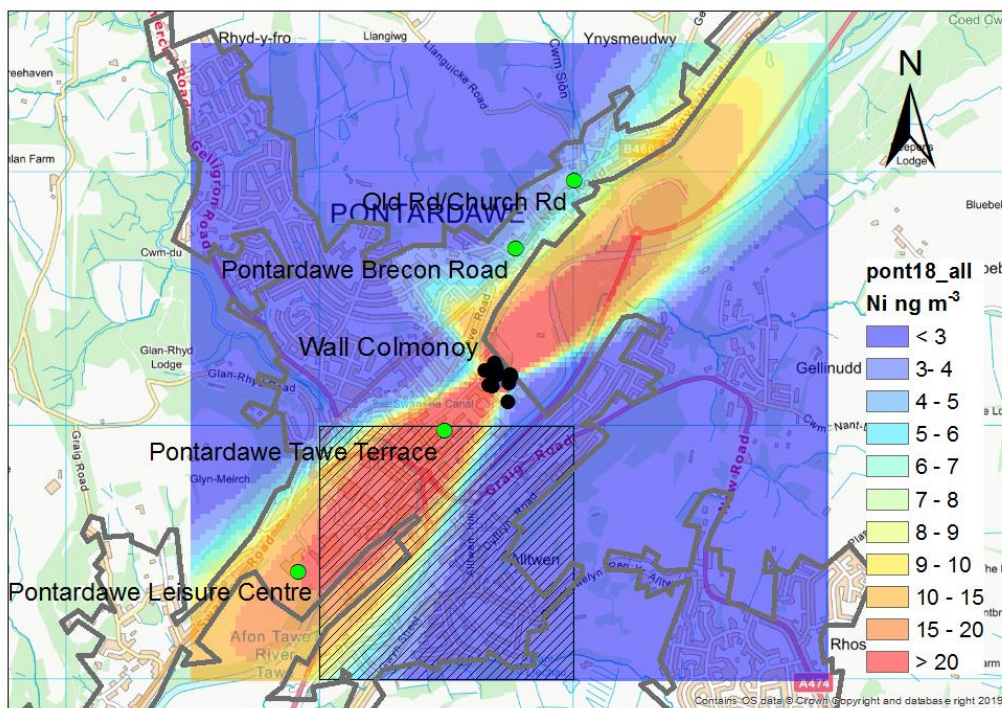
background component from the annual modelling of Ni concentrations across the UK. The Ni concentrations in Pontardawe were strongly influenced by the terrain in the area, as can be seen in Figure A1. The Swansea Valley runs south-west to north-east through the village of Pontardawe, where the point source is located. The distribution of the Ni concentrations in the vicinity of Pontardawe shows the channelling of the local wind flow by the Swansea Valley.

The conclusions from this dispersion modelling study are that Ni concentrations in both the South Wales and Swansea Urban Area zones in 2018 exceeded the Ni TV.

**Table A1 – Comparison of annual mean measured and modelled Ni concentrations at Pontardawe Tawe Terrace, Pontardawe Leisure Centre and Pontardawe Brecon Road in 2018.**

|                           | Measured Ni (ng m <sup>-3</sup> ) | Modelled Ni (ng m <sup>-3</sup> ) |
|---------------------------|-----------------------------------|-----------------------------------|
| Pontardawe Tawe Terrace   | 57                                | 57                                |
| Pontardawe Leisure Centre | 20                                | 20                                |
| Pontardawe Brecon Road    | 6.2                               | 5.1                               |

**Figure A1: Modelled annual mean Ni concentration resulting from the local industrial point source in Pontardawe in 2018.**



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