



Cyngor Castell-nedd Port Talbot  
Neath Port Talbot Council

# STOR DIFFUSION TUBE STUDY

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2022 – 2023

Report for: Neath Port Talbot County Borough Council

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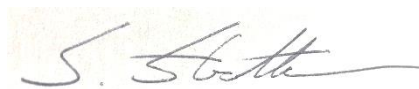
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# CONTENTS

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|                                                                 |    |
|-----------------------------------------------------------------|----|
| 1. INTRODUCTION                                                 | 1  |
| 1.1 AIR QUALITY STRATEGY OBJECTIVES                             | 1  |
| 1.2 LOCAL AIR QUALITY MANAGEMENT – NEATH PORT TALBOT            | 1  |
| 2. METHODOLOGY                                                  | 2  |
| 2.1 SITE DESCRIPTION                                            | 2  |
| 2.2 MONITORING SITES                                            | 2  |
| 2.3 QUALITY ASSURANCE / QUALITY CONTROL (QA/QC)                 | 6  |
| 3. RESULTS                                                      | 6  |
| 3.1 DIFFUSION TUBE MONITORING                                   | 6  |
| 3.2 SENSOR MONITORING                                           | 8  |
| 3.3 ESTIMATED ANNUAL MEAN NO <sub>2</sub> CONCENTRATIONS – 2022 | 9  |
| 4. SUMMARY                                                      | 11 |
| APPENDIX 1 DIFFUSION TUBE BIAS ADJUSTMENT                       | 12 |
| APPENDIX 2 ANNUALISATION - 2022                                 | 14 |

|                                                                                                                                            |    |
|--------------------------------------------------------------------------------------------------------------------------------------------|----|
| Table 1-1 Air Quality Strategy (AQS) Objectives included in Regulations for the purpose of LAQM and monitored by Neath Port Talbot Council | 1  |
| Table 2-1 Details of STOR diffusion tube monitoring sites                                                                                  | 2  |
| Table 2-2 Details of nearby Vortex IoT sensor monitoring sites                                                                             | 5  |
| Table 3-2 STOR Diffusion Tube Monitoring Results for 2022 to 2023                                                                          | 7  |
| Table 3-1 Vortex IoT mean NO <sub>2</sub> concentrations, June 2022 to August 2023                                                         | 8  |
| Table 3-4 Annualised annual mean NO <sub>2</sub> concentrations, 2022                                                                      | 9  |
| Table A2-1 Annualisation factors, 2022 – NO <sub>2</sub> diffusion tubes                                                                   | 14 |
| Table A2-2 Annualisation factors, 2022 – Vortex sensor systems                                                                             | 15 |
| Figure 2-1 Map of STOR and diffusion tube monitoring locations                                                                             | 4  |
| Figure 2-2 Nearby Vortex IoT sensor system monitoring locations                                                                            | 5  |
| Figure 3-1 Trends in bias adjusted diffusion tube monthly NO <sub>2</sub> concentrations 2022 to 2023                                      | 6  |
| Figure 3-2 Vortex IoT sensor hourly NO <sub>2</sub> concentrations July-2022 to July-2023                                                  | 8  |
| Figure 3-3 Bar chart of annualised NO <sub>2</sub> annual mean concentrations - 2022                                                       | 10 |
| Figure A1-1 NO <sub>2</sub> diffusion tube bias correction results                                                                         | 12 |
| Figure A1-2 National bias adjustment, September 2023                                                                                       | 13 |



# 1. INTRODUCTION

This report details the results of a study of the local air quality in and around the Short-Term Operating Reserve (STOR) at Afan Way, Neath Port Talbot. In May 2021 concerns were raised about the local Air Quality near the STOR. Air quality modelling was undertaken to understand potential air quality issues and the results suggested that operation of the STOR would not give rise to any breach of Air Quality objectives. To ensure that there was no risk to local air quality, Environmental Health undertook monitoring for nitrogen dioxide (NO<sub>2</sub>).

A 14-month air quality monitoring study has now been completed. Monthly nitrogen dioxide data has been collected from diffusion tubes at locations around the STOR and in nearby residential areas. Trend analysis is also presented using real-time data collected from four Vortex air pollution sensors as part of a separate study.

## 1.1 AIR QUALITY STRATEGY OBJECTIVES

Table 1 details the air quality objectives for nitrogen dioxide (NO<sub>2</sub>), applicable to Local Air Quality Management (LAQM) in Wales and monitored in the Neath Port Talbot Council (NPT) area.

Table 1-1 Air Quality Strategy (AQS) Objectives included in Regulations for the purpose of LAQM and monitored by Neath Port Talbot Council

| Pollutant                           | Concentration                                            | Measured as |
|-------------------------------------|----------------------------------------------------------|-------------|
| Nitrogen Dioxide (NO <sub>2</sub> ) | 200 µg m <sup>-3</sup> , not to be exceeded more than 18 | 1-hour mean |
|                                     | 40 µg m <sup>-3</sup>                                    | Annual mean |

## 1.2 LOCAL AIR QUALITY MANAGEMENT – NEATH PORT TALBOT

Part IV of the Environment Act 1995 as amended by the Environment Act 2021 requires every Local Authority to review the present and likely future air quality within its area. It requires Local Authorities to designate an air quality management area (AQMA) when a national air quality objective is not being achieved or is not likely to be achieved. The Local Authority is then required to develop an action plan for the AQMA.

Neath Port Talbot Council (NPT) declared an AQMA for the PM<sub>10</sub> 24-hour objective in Neath Port Talbot ([https://uk-air.defra.gov.uk/aqma/details?aqma\\_ref=76#98](https://uk-air.defra.gov.uk/aqma/details?aqma_ref=76#98)) on 01/07/2000. Since then, NPT have monitored and assessed concentrations of particulate matter (PM<sub>10</sub>, PM<sub>2.5</sub>), sulphur dioxide (SO<sub>2</sub>), carbon monoxide (CO) and NO<sub>2</sub> as part of its LAQM obligations.

The NPT air quality monitoring network comprises six automatic monitoring sites using reference or reference-equivalent monitoring methods and 27 indicative NO<sub>2</sub> diffusion tube sites, in addition to an air quality sensor network comprising 70 sites in Port Talbot. It is important to note that 'reference', 'reference-equivalent' and 'indicative' are formal designations for the monitoring methods. Reference and indicative methods have the following associated Data Quality Objectives (DQO) for the measurement uncertainty, which have been demonstrated through rigorous testing and through an ongoing quality assurance / quality control (QA/QC) regime:

- Gaseous pollutants: ±15% / ±25% for reference / indicative methods, respectively
- Particulate Matter: ±25% / ±50% for reference or equivalent / indicative methods, respectively

The monitoring network within NPT's boundary has evolved through annual review and assessment of potential emission sources and monitoring results in line with Technical Guidance LAQM.TG(22)<sup>1</sup>. This process aims to ensure that all areas within the council boundary that could exceed the air quality objectives are being monitored and assessed; with action plans put in place to reduce pollutant concentrations where needed. The overarching process that drives the development of the local authority monitoring regime is as follows:

<sup>1</sup> Local Air Quality Management Technical Guidance (TG22), Defra, August 2022: <https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf>

- Identify where there is a potential for an exceedance through identification of relevant emission sources e.g., road traffic, residential, industrial etc
- Monitor and assess using indicative monitoring methods
- Monitor and assess using reference sites to confirm any indicated exceedances

## 2. METHODOLOGY

### 2.1 SITE DESCRIPTION

The Afan Way STOR is a 20 MW gas powered Standby Electricity Generating Plant. It occupies an area of around half a hectare, on land located to the west of Afan Way, south of Victoria Road, Port Talbot (Figure 2-1).

Potential sensitive receptors to changes in air quality were identified as the nearby residential areas, which are located at Glenavon Street, approximately 50 m to the north-east across Afan Way; and Addison Place approximately 100 m to the north.

Modelling has been carried out as part of an air quality assessment (AQA) for the STOR plant and the results were used to inform the placement of the air quality monitoring sites. The potential for the highest concentrations of NO<sub>2</sub> were found on Glenavon Street, with lower concentrations found further away from the site.

Environmental Assessment Levels (EALs) are used by the Environment Agency to judge the acceptability of proposed emissions to air from industrial sites, and their relative contribution to the environment. EALs represent a pollutant concentration in ambient air at which no significant risks to human health are expected. The results of the modelling predicted that emissions from the STOR would contribute a maximum of 60% to 70% of the EAL on Glenavon Street.

### 2.2 MONITORING SITES

Within the study area there is one existing NO<sub>2</sub> monitoring site which forms part of the network of diffusion tubes deployed by Neath Port Talbot Council (NPT). This site is at Water Street and is approximately 500 m away.

Additional NO<sub>2</sub> monitoring was deployed to represent the relevant public exposure across a 360-degree area around the STOR plant, and to capture any potential exceedances of the EAL. The location of the Afan Way STOR site was reviewed in conjunction with NPT, informed by the modelling results and using Google Earth and Google Maps to determine appropriate places for the diffusion tubes to be located to capture any emissions from the STOR site in a representative manner. Although the prevailing wind is from a south westerly direction, locations that encompass the STOR facility from all directions were selected to account for changes in wind direction and speed.

Sensitive human health receptors were identified in Glenavon Street, Glyn Street and Henshaw Street. No nearby sensitive habitats or ecosystems were identified. Monitoring was therefore deployed at 13 locations, bringing the total number of monitoring locations in this study to 14 (Table 2-1 and Figure 2-1).

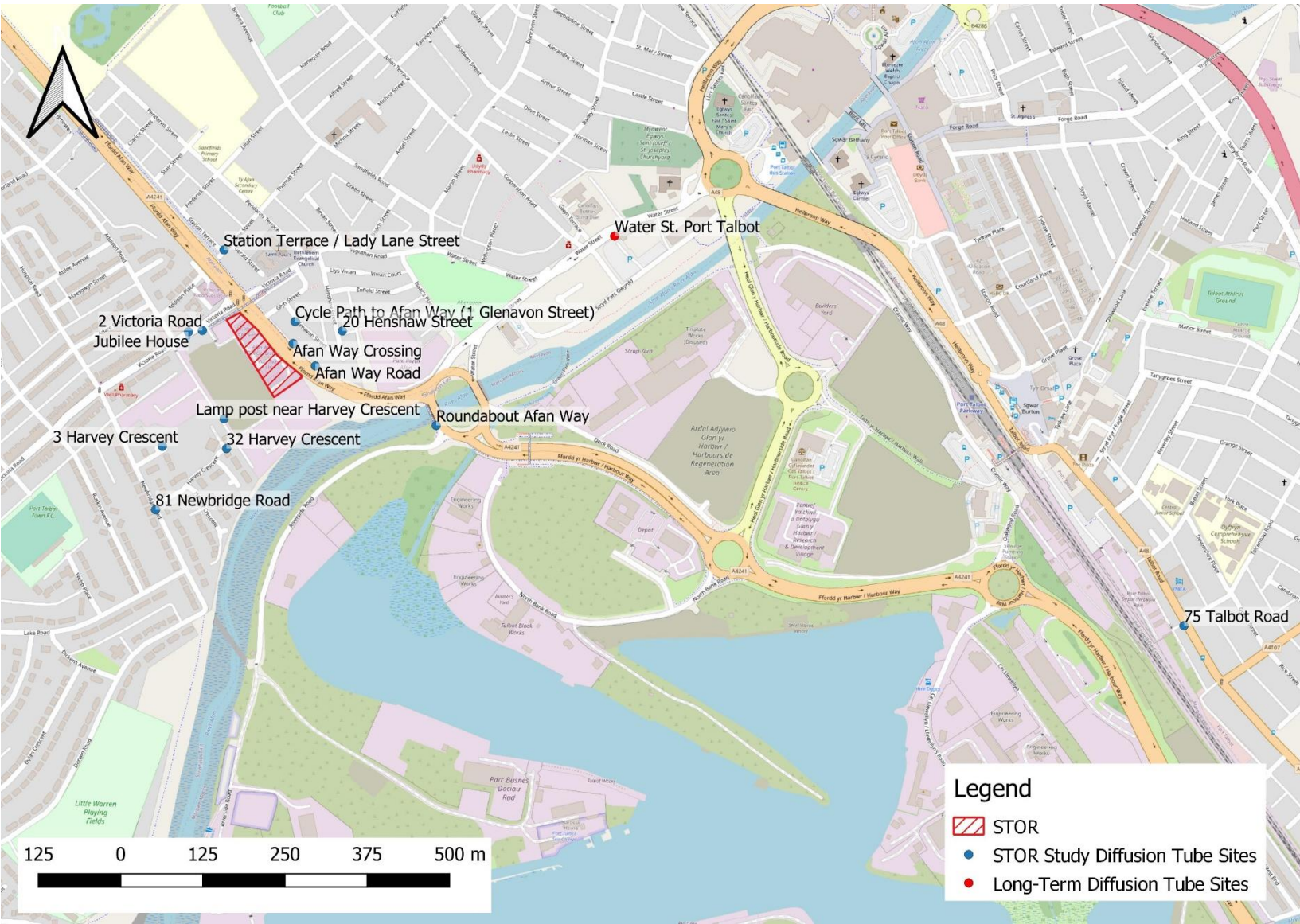
NO<sub>2</sub> diffusion tubes are sourced from the Environmental Scientifics Group Socotec and are prepared using the 50% Acetone TEA in Acetone Method.

Table 2-1 Details of STOR diffusion tube monitoring sites

| Site ID | Site Name                      | Site Type | Latitude  | Longitude |
|---------|--------------------------------|-----------|-----------|-----------|
| STOR-1  | 3 Harvey Crescent              | Roadside  | -3.799453 | 51.591497 |
| STOR-2  | 32 Harvey Crescent             | Roadside  | -3.798042 | 51.591487 |
| STOR-3  | Lamp post near Harvey Crescent | Roadside  | -3.798113 | 51.591895 |

| Site ID | Site Name                                  | Site Type | Latitude  | Longitude |
|---------|--------------------------------------------|-----------|-----------|-----------|
| STOR-4  | Jubilee House                              | Roadside  | -3.79894  | 51.593068 |
| STOR-5  | 2 Victoria Road                            | Roadside  | -3.798637 | 51.593092 |
| STOR-6  | Station Terrace / Lady Lane Street         | Roadside  | -3.798206 | 51.5942   |
| STOR-7  | Afan Way Crossing                          | Roadside  | -3.796637 | 51.592943 |
| STOR-8  | Afan Way Road                              | Roadside  | -3.796137 | 51.592646 |
| STOR-9  | Cycle Path to Afan Way (1 Glenavon Street) | Roadside  | -3.796605 | 51.593245 |
| STOR-10 | 20 Henshaw Street                          | Roadside  | -3.795563 | 51.593133 |
| STOR-11 | Roundabout Afan Way                        | Roadside  | -3.793453 | 51.591873 |
| STOR-13 | 81 Newbridge Road                          | Roadside  | -3.799566 | 51.590627 |
| STOR-17 | 75 Talbot Road                             | Roadside  | -3.776935 | 51.589385 |
| Tube 25 | Water Street, Port Talbot                  | Roadside  | -3.789639 | 51.594521 |

Figure 2-1 Map of STOR and diffusion tube monitoring locations

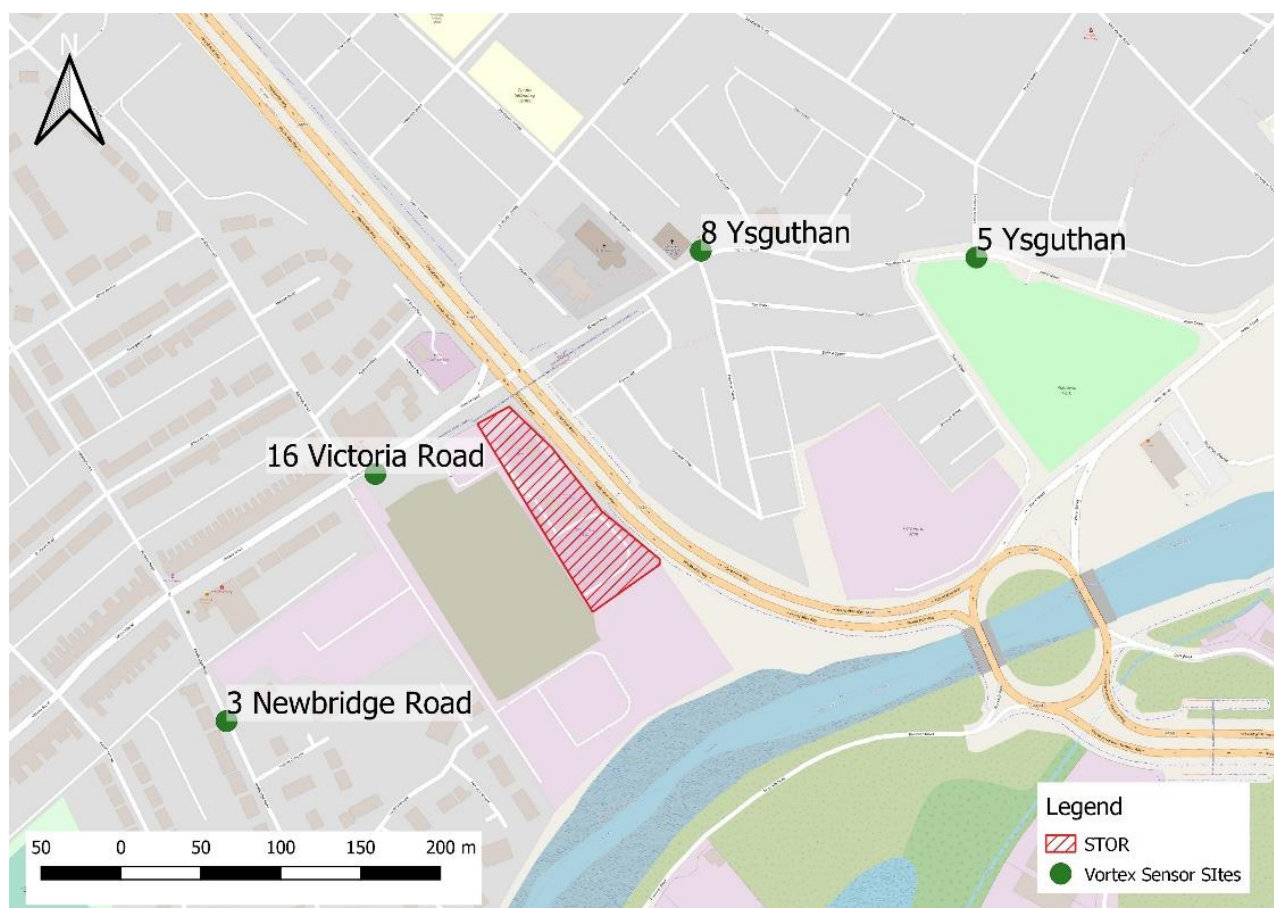


A network of Vortex IoT sensor systems which monitor NO<sub>2</sub> have been deployed around Port Talbot by NPT as part of a separate air quality study, including at four locations in the vicinity of the STOR, detailed in Table 2-2 and represented by the green dots shown in Figure 2-2.

Table 2-2 Details of nearby Vortex IoT sensor monitoring sites

| Site ID   | Site Name        | Site Type | Latitude | Longitude |
|-----------|------------------|-----------|----------|-----------|
| NPT-AQM42 | 3 Newbridge Road | Roadside  | 51.59154 | -3.80031  |
| NPT-AQM44 | 16 Victoria Road | Roadside  | 51.59295 | -3.79902  |
| NPT-AQM45 | 8 Ysguthan       | Roadside  | 51.59425 | -3.79613  |
| NPT-AQM46 | 5 Ysguthan       | Roadside  | 51.59425 | -3.79364  |

Figure 2-2 Nearby Vortex IoT sensor system monitoring locations



## 2.3 QUALITY ASSURANCE / QUALITY CONTROL (QA/QC)

The following corrections were applied to the monitoring data, where required:

- Bias correction of NO<sub>2</sub> diffusion tube data (Appendix 1)
- Annualisation of mean NO<sub>2</sub> concentrations where data capture rates are less than 75% (Appendix 2)
- Vortex sensor data were ratified with unreliable or spurious data being removed from the dataset. No correction for slope or offset were applied.

LAQM.TG(22) was followed for the application of the corrections - details and justification for the corrections applied are provided in Appendices 1 - 2.

## 3. RESULTS

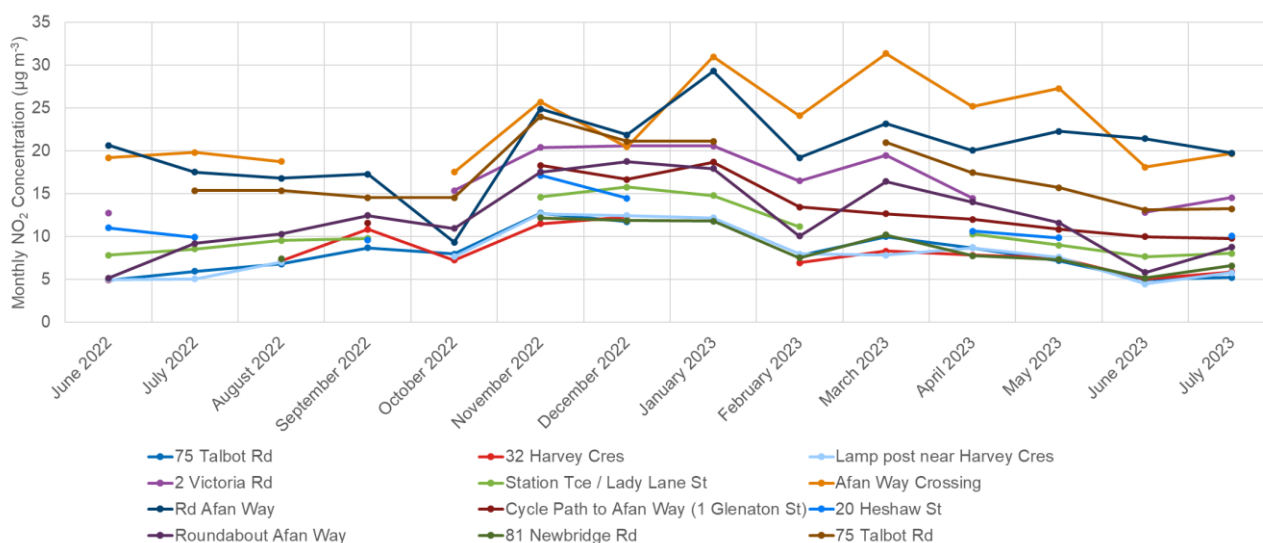
### 3.1 DIFFUSION TUBE MONITORING

Monthly NO<sub>2</sub> concentration data collected at 14 diffusion tube monitoring locations between June 2022 and July 2023 is provided in Table 3-1, including a mean for the 12 months between June-2022 and May-2023. A plot of diffusion tube concentrations at these monitoring sites is shown in Figure 3-1. Diffusion tube data were bias corrected using a locally derived factor (**0.65**) from triplicate tubes located at the Automatic Urban and Rural Network (AURN) Port Talbot Margam monitoring site<sup>2</sup> (Appendix 1).

Data capture rates were below the recommended 90% target for seven of the 13 tube sites, which adds uncertainty to the calculated means. However, the bias corrected means indicate that mean NO<sub>2</sub> concentrations were well below the annual mean objective of 40 µg m<sup>-3</sup> at all sites. Neither were there any exceedances of 60 µg m<sup>-3</sup>, indicating no potential for exceedance of the NO<sub>2</sub> 1-hour mean objective<sup>3</sup>. The maximum mean NO<sub>2</sub> concentration at any site was at 21.8 µg m<sup>-3</sup> at the Afan Way Crossing site (STOR-7).

The highest bias adjusted monthly concentrations were monitored at STOR-7 - Afan Way Crossing (31.0 µg m<sup>-3</sup> in January 2023, 31.4 µg m<sup>-3</sup> in March 2023) and STOR-8, Afan Way Road (29.3 µg m<sup>-3</sup> in January 2023). These two sites are close to a busy road (Afan Way) and these higher concentrations are likely to represent a large contribution from road sources.

Figure 3-1 Trends in bias adjusted diffusion tube monthly NO<sub>2</sub> concentrations 2022 to 2023



<sup>2</sup> <https://airquality.gov.wales/air-pollution/site/PT4#siteinformation>

<sup>3</sup> Local Air Quality Management Technical Guidance (TG22), Defra, August 2022, Box 5-2, Page 64: <https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf>

Table 3-1 STOR Diffusion Tube Monitoring Results for 2022 to 2023

| Site ID | NO <sub>2</sub> Monthly Concentration Data (µg m <sup>-3</sup> ) |        |        |        |        |        |        |        |        |        |        |        |        |        | Data Capture (%) | Mean (µg m <sup>-3</sup> ) | Bias Cor. Period Mean (µg m <sup>-3</sup> ) |
|---------|------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------------------|----------------------------|---------------------------------------------|
|         | Jun-22                                                           | Jul-22 | Aug-22 | Sep-22 | Oct-22 | Nov-22 | Dec-22 | Jan-23 | Feb-23 | Mar-23 | Apr-23 | May-23 | Jun-23 | Jul-23 |                  |                            |                                             |
| STOR-1  | 7.6                                                              | 9.2    | 10.5   | 13.4   | 12.3   | 19.6   | 18.1   |        | 12     | 15.4   | 13.4   | 11.1   | 7.7    | 8.1    | 92.9             | 13.0                       | <b>8.4</b>                                  |
| STOR-2  | 7.6                                                              |        | 11.1   | 16.7   | 11.2   | 17.7   | 19.0   |        | 10.7   | 12.8   | 12.1   | 11.6   | 7.8    | 9.1    | 85.7             | 13.9                       | <b>9.0</b>                                  |
| STOR-3  | 7.7                                                              | 7.8    | 10.8   |        | 11.8   | 19.5   | 19.2   | 18.8   | 12.3   | 12.1   | 13.4   | 11.7   | 6.9    | 8.9    | 92.9             | 13.7                       | <b>8.9</b>                                  |
| STOR-4  | 18.1                                                             | 24.0   |        |        | 21.1   | 32.6   | 30.0   | 35.6   | 23     | 32.7   | 24.4   | 29.5   | 16.3   | 20.6   | 85.7             | 26.9                       | <b>17.5</b>                                 |
| STOR-5  | 19.6                                                             |        |        |        | 23.7   | 31.4   | 31.7   | 31.7   | 25.4   | 30.0   | 22.3   |        | 19.8   | 22.4   | 71.4             | 27.6                       | <b>18.0</b>                                 |
| STOR-6  | 12.1                                                             | 13.2   | 14.7   | 15.1   |        | 22.5   | 24.3   | 22.8   | 17.2   |        | 15.9   | 13.9   | 11.8   | 12.4   | 85.7             | 17.8                       | <b>11.6</b>                                 |
| STOR-7  | 29.6                                                             | 30.5   | 28.9   |        | 27.0   | 39.6   | 31.5   | 47.7   | 37.1   | 48.3   | 38.8   | 42     | 27.9   | 30.4   | 92.9             | 33.5                       | <b>21.8</b>                                 |
| STOR-8  | 31.8                                                             | 27.0   | 25.9   | 26.6   | 14.4   | 38.3   | 33.7   | 45.1   | 29.6   | 35.7   | 30.9   | 34.3   | 33     | 30.4   | 100              | 30.4                       | <b>19.7</b>                                 |
| STOR-9  |                                                                  |        |        | 17.9   |        | 28.2   | 25.7   | 28.8   | 20.7   | 19.5   | 18.5   | 16.7   | 15.4   | 15.1   | 71.4             | 25.2                       | <b>16.3</b>                                 |
| STOR-10 | 17.0                                                             | 15.3   |        | 14.8   |        | 26.4   | 22.3   |        |        |        | 16.4   | 15.2   |        | 15.5   | 57.1             | 19.2                       | <b>12.5</b>                                 |
| STOR-11 | 8.0                                                              | 14.2   | 15.9   | 19.2   | 16.9   | 27.0   | 28.9   | 27.6   | 15.5   | 25.3   | 21.6   | 17.9   | 9.0    | 13.5   | 100              | 19.7                       | <b>12.8</b>                                 |
| STOR-13 |                                                                  |        | 11.4   |        |        | 18.8   | 18.3   | 18.2   | 11.6   | 15.7   | 12.0   | 11.3   | 8.0    | 10.2   | 71.4             | 16.7                       | <b>10.8</b>                                 |
| STOR-17 |                                                                  | 23.7   | 23.7   | 22.4   | 22.4   | 36.9   | 32.5   | 32.5   |        | 32.3   | 26.9   | 24.2   | 20.2   | 20.4   | 85.7             | 27.7                       | <b>18.0</b>                                 |

### 3.2 SENSOR MONITORING

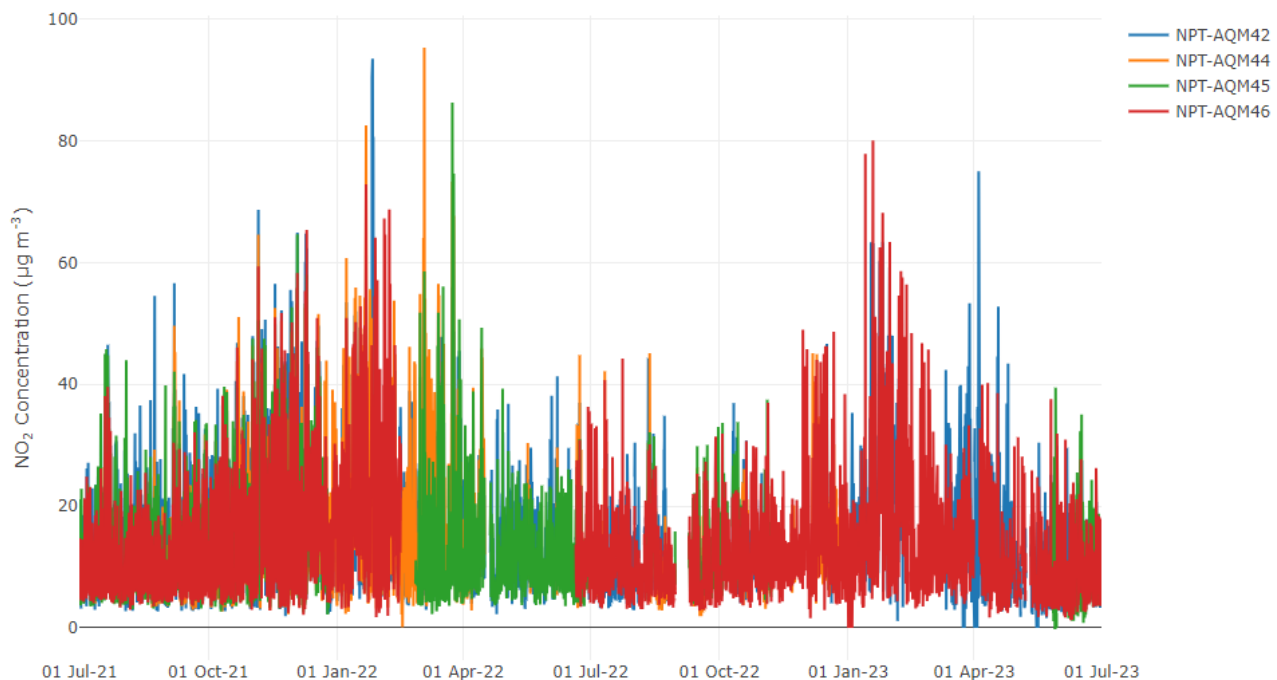
Hourly data was also collected from four Vortex IoT sensors between June 2021 and July 2023. Hourly NO<sub>2</sub> concentrations are graphed in Figure 3-2. Table 3-2 also details the mean NO<sub>2</sub> concentrations for the period June 2022 to July 2023, together with data capture rates. Data capture rates for the Vortex IoT sensors were below 90%, however, measured annual mean NO<sub>2</sub> concentrations are consistent with the bias-corrected diffusion tube results.

From the timeseries plot in Figure 3-2 the sensors did not measure any exceedances of the hourly mean AQS objective for NO<sub>2</sub> (200 µg m<sup>-3</sup>), again in line with the indication from the diffusion tube results. The general trend in concentrations is also similar to that seen in the diffusion tube data with higher concentrations in the winter between December 2022 and March 2023. There were no noticeable spikes or anomalies in the data collected that could be connected with the operation of the STOR. It should be noted that the Vortex IoT data should be treated as indicative only.

Table 3-2 Vortex IoT mean NO<sub>2</sub> concentrations, June 2022 to July 2023

| Device    | NO <sub>2</sub> Mean (µg m <sup>-3</sup> ) | Data Capture – 2022 (%) |
|-----------|--------------------------------------------|-------------------------|
| NPT-AQM42 | 13.2                                       | 65.6                    |
| NPT-AQM44 | 15.4                                       | 46.5                    |
| NPT-AQM45 | 11.7                                       | 44.0                    |
| NPT-AQM46 | 14.0                                       | 60.7                    |

Figure 3-2 Vortex IoT sensor hourly NO<sub>2</sub> concentrations July-2022 to July-2023



### 3.3 ESTIMATED ANNUAL MEAN NO<sub>2</sub> CONCENTRATIONS – 2022

Table 3-3 details the annual mean NO<sub>2</sub> concentrations for all monitoring sites. Where the data capture rate was less than 75% during 2022, mean concentrations have been annualised (Appendix 2). The annual means are also graphed in Figure 3-3. The lowest annual mean NO<sub>2</sub> concentration was measured at STOR13 (9.3 µg m<sup>-3</sup>) and the highest at STOR-7 (22.2 µg m<sup>-3</sup>). Therefore, the results indicate that it is unlikely that the annual mean objective of 40 µg m<sup>-3</sup> was exceeded during 2022.

No hours greater than 200 µg m<sup>-3</sup> were measured at the Vortex sites during 2022. It is also unlikely that there were any exceedances of 60 µg m<sup>-3</sup>, as an annual mean, at the diffusion tube sites, confirming no potential for exceedance of the NO<sub>2</sub> 1-hour mean objective<sup>4</sup>.

If the more conservative approach was taken using the national bias adjustment factor of 0.76 (Appendix 1), the highest indicated annual mean NO<sub>2</sub> concentrations would be 26.0 µg m<sup>-3</sup> at STOR-7. The conclusions that it is unlikely that the NO<sub>2</sub> annual mean and 1-hour mean objectives were exceeded would remain unchanged.

Table 3-3 Annualised annual mean NO<sub>2</sub> concentrations, 2022

| Site               | Network        | Mean NO <sub>2</sub> Concentration, 2022 (µg m <sup>-3</sup> ) | Data Capture Rate (%) | Annualised NO <sub>2</sub> Annual Mean, 2022 (µg m <sup>-3</sup> ) |
|--------------------|----------------|----------------------------------------------------------------|-----------------------|--------------------------------------------------------------------|
| STOR-1             | Diffusion Tube | 13.0                                                           | 58.3                  | 14.8                                                               |
| STOR-2             | Diffusion Tube | 13.9                                                           | 50.0                  | 15.2                                                               |
| STOR-3             | Diffusion Tube | 12.8                                                           | 50.0                  | 14.0                                                               |
| STOR-4             | Diffusion Tube | 25.2                                                           | 41.7                  | 17.5                                                               |
| STOR-5             | Diffusion Tube | 26.6                                                           | 33.3                  | 17.4                                                               |
| STOR-6             | Diffusion Tube | 17.0                                                           | 50.0                  | 12.3                                                               |
| STOR-7             | Diffusion Tube | 31.2                                                           | 50.0                  | 22.2                                                               |
| STOR-8             | Diffusion Tube | 28.2                                                           | 58.3                  | 20.9                                                               |
| STOR-9             | Diffusion Tube | 23.9                                                           | 25.0                  | 14.2                                                               |
| STOR-10            | Diffusion Tube | 19.2                                                           | 41.7                  | 13.6                                                               |
| STOR-11            | Diffusion Tube | 18.6                                                           | 58.3                  | 13.8                                                               |
| STOR-13            | Diffusion Tube | 16.2                                                           | 25.0                  | 9.3                                                                |
| STOR-17            | Diffusion Tube | 26.9                                                           | 50.0                  | 19.0                                                               |
| NPT-AQM42          | Vortex         | 13.2                                                           | 65.6                  | 13.2                                                               |
| NPT-AQM44          | Vortex         | 15.4                                                           | 46.5                  | 13.1                                                               |
| NPT-AQM45          | Vortex         | 11.7                                                           | 44.0                  | 12.5                                                               |
| NPT-AQM46          | Vortex         | 14.0                                                           | 60.7                  | 13.8                                                               |
| Port Talbot Margam | Reference      | 12.0                                                           | 97.6                  | n/a                                                                |

<sup>4</sup> Local Air Quality Management Technical Guidance (TG22), Defra, August 2022, Box 5-2, Page 64: <https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf>

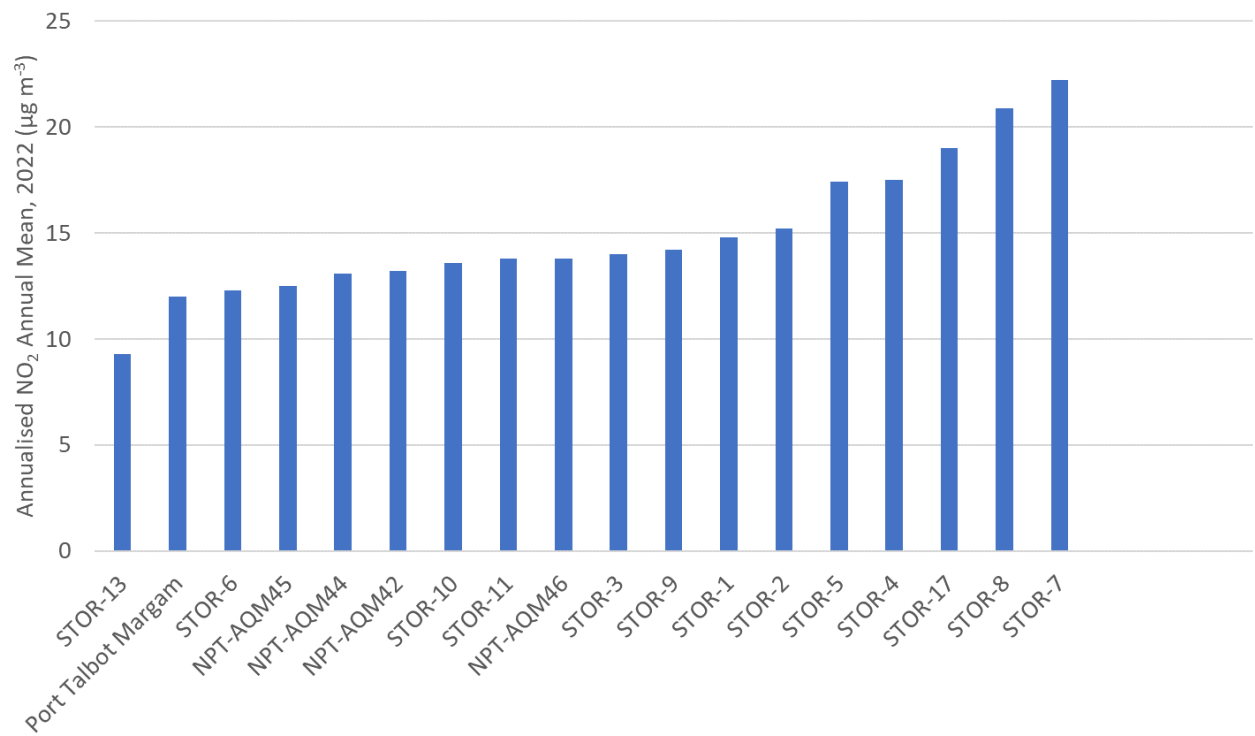


Figure 3-3 Bar chart of annualised NO<sub>2</sub> annual mean concentrations - 2022

## 4. SUMMARY

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Monthly nitrogen dioxide (NO<sub>2</sub>) data was collected from diffusion tubes at locations around the Afan Way STOR in Port Talbot and at nearby residential receptors for 14 months over 2022 and 2023. Vortex IoT sensor data between June 2021 and July 2023 were also utilised.

The measurement data from all locations indicate that it is unlikely that there were any exceedances of the annual mean AQS objective for NO<sub>2</sub> of 40 µg m<sup>-3</sup> during 2022. No hours greater than 200 µg m<sup>-3</sup> were measured at the Vortex sites during 2022 and it is also unlikely that there were any exceedances of 60 µg m<sup>-3</sup>, as an annual mean at the diffusion tube sites, also indicating no potential for exceedance of the NO<sub>2</sub> 1-hour mean objective.

Based on these results, and in light of the results of the previous modelling study, it is unlikely that the operation STOR will cause exceedances of the NO<sub>2</sub> objectives in the vicinity of the STOR.

## APPENDIX 1 DIFFUSION TUBE BIAS ADJUSTMENT

The NO<sub>2</sub> diffusion tubes were sourced from the Environmental Scientifics Group Socotec and were prepared using the 50% Acetone TEA in Acetone Method. A bias correction was applied using a locally derived factor from triplicate tubes co-located at the AURN Port Talbot Margam monitoring site<sup>5</sup>. Figure A1-1 below details the results from the triplicate tubes and automatic oxides of nitrogen (NO<sub>x</sub>) analyser. Overall, both the tube precision and automatic data capture were good with a derived bias correction factor of 0.65.

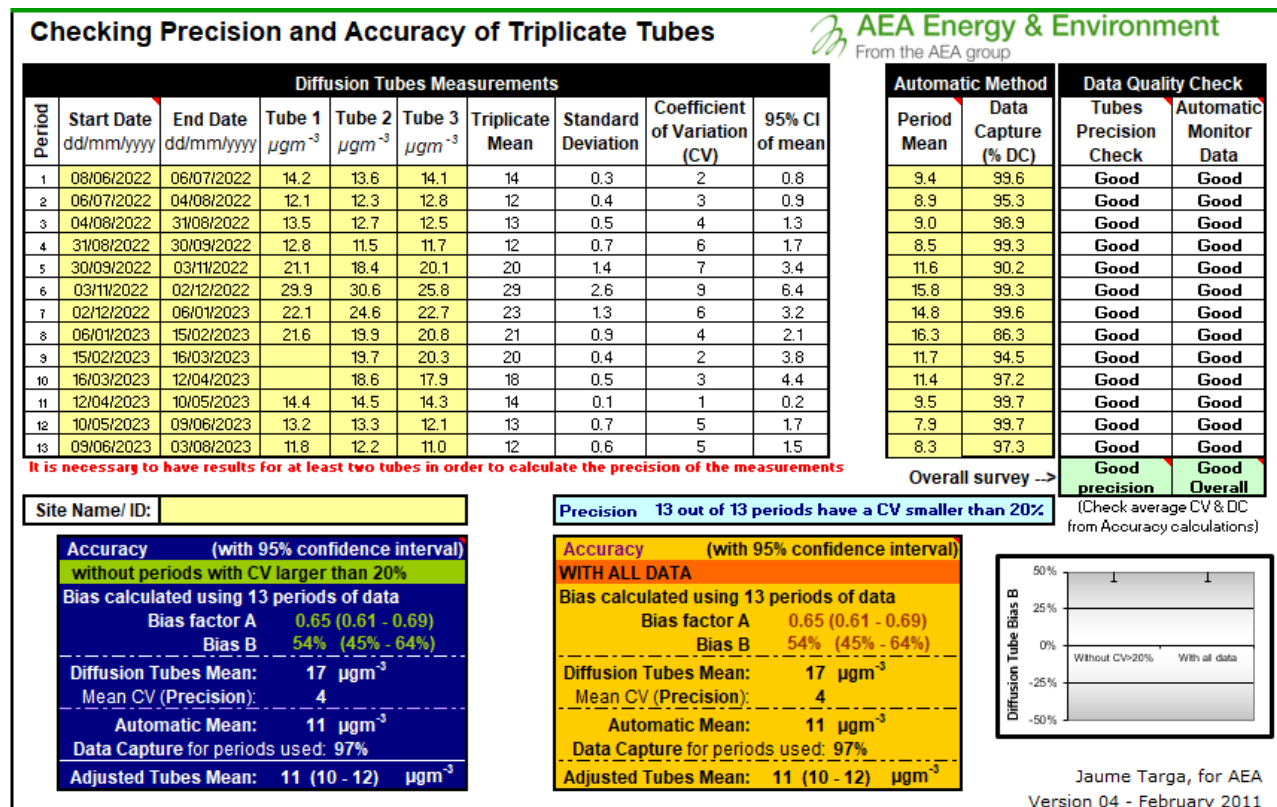


Figure A1-1 NO<sub>2</sub> diffusion tube bias correction results

In addition to the local bias correction, the national Diffusion Tube Bias Adjustment Factors Spreadsheet<sup>6</sup> released in September 2023 was also available. The results from the national bias adjustment spreadsheet is shown in Figure A1-2 A1-2, with a calculated bias adjustment factor of 0.76 using a total of 29 studies. For this study, the local bias adjustment factor of **0.65** has been applied to the diffusion tube data for the following reasons:

- The factor is locally derived and so likely more reflective of local trends in NO<sub>2</sub> concentrations.
- The locally derived factor was derived using the same date range as the monitoring study – 08/06/2022 to 03/08/2023

<sup>5</sup> <https://airquality.gov.wales/air-pollution/site/PT4#siteinformation>

<sup>6</sup> <https://laqm.defra.gov.uk/air-quality/air-quality-assessment/national-bias/>

| National Diffusion Tube Bias Adjustment Factor Spreadsheet                                                                                                                             |                                                                                      |                                                                                           |                                         |                                                                                                                                                                                                                                         | Spreadsheet Version Number: 09/23                                                                             |                                                     |                                                        |                                                                                                                   |                             |                                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-----------------------------|------------------------------------|
| Follow the steps below <b>in the correct order</b> to show the results of <b>relevant</b> co-location studies                                                                          |                                                                                      |                                                                                           |                                         |                                                                                                                                                                                                                                         |                                                                                                               |                                                     |                                                        | This spreadsheet will be updated at the end of March 2024                                                         |                             |                                    |
| Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods                                                                  |                                                                                      |                                                                                           |                                         |                                                                                                                                                                                                                                         |                                                                                                               |                                                     |                                                        | Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet |                             |                                    |
| This spreadsheet will be updated every few months: the factors may therefore be subject to change. This should not discourage their immediate use.                                     |                                                                                      |                                                                                           |                                         |                                                                                                                                                                                                                                         |                                                                                                               |                                                     |                                                        | LAQM Helpdesk Website                                                                                             |                             |                                    |
| The LAQM Helpdesk is operated on behalf of Defra and the Devolved Administrations by Bureau Veritas, in conjunction with contract partners AECOM and the National Physical Laboratory. |                                                                                      |                                                                                           |                                         |                                                                                                                                                                                                                                         | Spreadsheet maintained by the National Physical Laboratory. Original compiled by Air Quality Consultants Ltd. |                                                     |                                                        |                                                                                                                   |                             |                                    |
| Step 1:                                                                                                                                                                                |                                                                                      | Step 2:                                                                                   | Step 3:                                 | Step 4:                                                                                                                                                                                                                                 |                                                                                                               |                                                     |                                                        |                                                                                                                   |                             |                                    |
| Select the Laboratory that Analyses Your Tubes from the Drop-Down List                                                                                                                 |                                                                                      | Select a Preparation Method from the Drop-Down List                                       | Select a Year from the Drop-Down List   | Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor <sup>3</sup> shown in blue at the foot of the final column. |                                                                                                               |                                                     |                                                        |                                                                                                                   |                             |                                    |
| If a laboratory is not shown, we have no data for this laboratory.                                                                                                                     |                                                                                      | If a preparation method is not shown, we have no data for this method at this laboratory. | If a year is not shown, we have no data | If you have your own co-location study then see footnote <sup>6</sup> . If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@bureauveritas.com or 0800 0327953                                |                                                                                                               |                                                     |                                                        |                                                                                                                   |                             |                                    |
| Analysed By <sup>1</sup>                                                                                                                                                               | Method<br><small>To make your calculation, choose (All) from the pop-up list</small> | Year <sup>2</sup><br><small>To make your calculation, choose (All)</small>                | Site Type                               | Local Authority                                                                                                                                                                                                                         | Length of Study (months)                                                                                      | Diffusion Tube Mean Conc. (Dm) (µg/m <sup>3</sup> ) | Automatic Monitor Mean Conc. (Cm) (µg/m <sup>3</sup> ) | Bias (B)                                                                                                          | Tube Precision <sup>4</sup> | Bias Adjustment Factor (A) (Cm/Dm) |
| SOCOTEC Didcot                                                                                                                                                                         | 50% TEA in Acetone                                                                   | 2022                                                                                      | UL                                      | North Lincolnshire Council                                                                                                                                                                                                              | 12                                                                                                            | 18                                                  | 13                                                     | 32.1%                                                                                                             | G                           | 0.76                               |
| SOCOTEC Didcot                                                                                                                                                                         | 50% TEA in Acetone                                                                   | 2022                                                                                      | R                                       | Waverley Borough Council                                                                                                                                                                                                                | 11                                                                                                            | 27                                                  | 20                                                     | 32.7%                                                                                                             | G                           | 0.75                               |
| SOCOTEC Didcot                                                                                                                                                                         | 50% TEA in Acetone                                                                   | 2022                                                                                      | R                                       | Waverley Borough Council                                                                                                                                                                                                                | 12                                                                                                            | 29                                                  | 20                                                     | 43.1%                                                                                                             | G                           | 0.70                               |
| SOCOTEC Didcot                                                                                                                                                                         | 50% TEA in acetone                                                                   | 2022                                                                                      |                                         | Overall Factor <sup>3</sup> (29 studies)                                                                                                                                                                                                |                                                                                                               |                                                     |                                                        | Use                                                                                                               | 0.76                        |                                    |

Figure A1-2 National bias adjustment, September 2023

## APPENDIX 2 ANNUALISATION - 2022

As detailed in LAQM.TG(22), it is also recommended that data are annualised<sup>7</sup> if the data capture rate is less than 75%. As a result, a further correction of annual mean NO<sub>2</sub> concentrations for 2022 were applied to all diffusion tube data. Three reference sites were used to calculate the annualisation factors:

- Narberth, Rural Background
- Swansea Cwm Level Park, Urban Background
- Port Talbot Margam, Urban Industrial

Although it is recommended that background sites are used for derivation of the annualisation factors, NO<sub>2</sub> concentrations at Port Talbot Margam are not overly influenced by industrial emissions. As a result, and as is reflected in the factors derived in Table A2-1, Port Talbot Margam seems to be a good representation of urban background concentrations within Port Talbot. In this table Pm is the period mean and Am is the annual mean.

Table A2-1 Annualisation factors, 2022 – NO<sub>2</sub> diffusion tubes

| STOR-1, 8, 11          |      |           |       |
|------------------------|------|-----------|-------|
| Reference Site         | Pm   | Am (2022) | Am/Pm |
| Narberth               | 2.3  | 2.9       | 1.26  |
| Swansea Cwm Level Park | 11.8 | 12.8      | 1.08  |
| Port Talbot Margam     | 11.2 | 12.0      | 1.07  |
| Average:               |      |           | 1.14  |
| STOR-2                 |      |           |       |
| Narberth               | 2.4  | 2.9       | 1.21  |
| Swansea Cwm Level Park | 12.4 | 12.8      | 1.03  |
| Port Talbot Margam     | 11.5 | 12.0      | 1.04  |
| Average:               |      |           | 1.09  |
| STOR-3, 7              |      |           |       |
| Narberth               | 2.4  | 2.9       | 1.21  |
| Swansea Cwm Level Park | 12.1 | 12.8      | 1.06  |
| Port Talbot Margam     | 11.7 | 12.0      | 1.03  |
| Average:               |      |           | 1.10  |
| STOR-4                 |      |           |       |
| Narberth               | 2.4  | 2.9       | 1.21  |
| Swansea Cwm Level Park | 12.5 | 12.8      | 1.02  |
| Port Talbot Margam     | 12.2 | 12.0      | 0.98  |
| Average:               |      |           | 1.07  |
| STOR-5                 |      |           |       |
| Narberth               | 2.5  | 2.9       | 1.16  |
| Swansea Cwm Level Park | 13.8 | 12.8      | 0.93  |
| Port Talbot Margam     | 12.9 | 12.0      | 0.93  |
| Average:               |      |           | 1.01  |
| STOR-6                 |      |           |       |
| Narberth               | 2.4  | 2.9       | 1.21  |
| Swansea Cwm Level Park | 12.1 | 12.8      | 1.06  |
| Port Talbot Margam     | 11.2 | 12.0      | 1.07  |
| Average:               |      |           | 1.11  |

<sup>7</sup> Local Air Quality Management Technical Guidance (TG22), Defra, August 2022, Box 7-10, Page 137: <https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf>

| STOR-9                 |      |      |      |
|------------------------|------|------|------|
| Narberth               | 2.8  | 2.9  | 1.04 |
| Swansea Cwm Level Park | 16.4 | 12.8 | 0.78 |
| Port Talbot Margam     | 13.0 | 12.0 | 0.92 |
| Average:               |      |      | 0.91 |
| STOR-10                |      |      |      |
| Narberth               | 2.4  | 2.9  | 1.21 |
| Swansea Cwm Level Park | 12.5 | 12.8 | 1.02 |
| Port Talbot Margam     | 11.5 | 12.0 | 1.04 |
| Average:               |      |      | 1.09 |
| STOR-13                |      |      |      |
| Narberth               | 3.0  | 2.9  | 0.97 |
| Swansea Cwm Level Park | 16.5 | 12.8 | 0.78 |
| Port Talbot Margam     | 13.3 | 12.0 | 0.88 |
| Average:               |      |      | 0.88 |
| STOR-17                |      |      |      |
| Narberth               | 2.4  | 2.9  | 1.21 |
| Swansea Cwm Level Park | 12.7 | 12.8 | 1.01 |
| Port Talbot Margam     | 11.5 | 12.0 | 1.04 |
| Average:               |      |      | 1.09 |

### Vortex IoT sensor systems

All Vortex sensors achieved data capture rates less than 75% and so annualisation factors have been derived and provided in Table A2-2.

Table A2-2 Annualisation factors, 2022 – Vortex sensor systems

| NPT-AQM42              |      |           |       |
|------------------------|------|-----------|-------|
| Reference Site         | Pm   | Am (2022) | Am/Pm |
| Narberth               | 3.0  | 2.9       | 0.97  |
| Swansea Cwm Level Park | 12.3 | 12.8      | 1.04  |
| Port Talbot Margam     | 12.0 | 12.0      | 1.00  |
| Average:               |      |           | 1.00  |
| NPT-AQM44              |      |           |       |
| Narberth               | 3.4  | 2.9       | 0.85  |
| Swansea Cwm Level Park | 15.8 | 12.8      | 0.81  |
| Port Talbot Margam     | 13.5 | 12.0      | 0.89  |
| Average:               |      |           | 0.85  |
| NPT-AQM45              |      |           |       |
| Narberth               | 2.9  | 2.9       | 1.00  |
| Swansea Cwm Level Park | 11.7 | 12.8      | 1.09  |
| Port Talbot Margam     | 10.9 | 12.0      | 1.10  |
| Average:               |      |           | 1.06  |
| NPT-AQM46              |      |           |       |
| Narberth               | 2.7  | 2.9       | 1.07  |
| Swansea Cwm Level Park | 13.5 | 12.8      | 0.95  |
| Port Talbot Margam     | 12.9 | 12.0      | 0.93  |
| Average:               |      |           | 0.98  |



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