

## **Construction noise and vibration Monthly Report – December 2019**

**London Borough of Ealing**

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# Non-technical summary

This noise and vibration monitoring report fulfils HS2 Limited's commitment detailed in the Environmental Minimum Requirements (EMRs), Annex 1, Code of Construction Practice, to present the results of noise and vibration monitoring carried out within the London Borough of Ealing (LBE) during the month of December 2019.

The report presents data from noise monitoring installations in the vicinity of Atlas Road worksite (ref.: S001-WS02) where ground investigations and surveys were carried out; Willesden EuroTerminal worksite (ref.: S001-WS03) and Victoria Road worksite (ref.: S002-WS01) where activities included construction of concrete footways, surveys and excavations; and Old Oak Common depot worksite (ref.: S004-WS01) where demolition and groundworks were being carried out. Data is also presented from monitoring in the vicinity of Mandeville Road (Badminton Close compound).

Given the nature and location of works currently being undertaken and the high ambient noise in many locations, the measured noise levels are largely dominated by the underlying ambient noise levels, rather than being attributable to construction noise.

No exceedances of the SOAEL and no exceedances of S61 trigger levels due to HS2 related works were measured during the monitoring period. There were also no complaints during the monitoring period.

# Abbreviations and descriptions

The abbreviations, descriptions and project terminology used within this report can be found in the Project Dictionary (HS2-HS2-PM-GDE-000-000002).

Table 1: Table of abbreviations

| Acronym/Term  | Definition   |
|---|--|
| $L_{Aeq,T}$   | See equivalent continuous sound pressure level   |
| Ambient sound   | A description of the all-encompassing sound at a given location and time which will include sound from many sources near and far. Ambient sound can be quantified in terms of the equivalent continuous sound pressure level, $L_{pAeq,T}$   |
| Decibel(s), or dB   | Between the quietest audible sound and the loudest tolerable sound there is a million to one ratio in sound pressure (measured in Pascal (Pa)). Because of this wide range, a level scale called the decibel (dB) scale, based on a logarithmic ratio, is used in sound measurement. Audibility of sound covers a range of approximately 0-140dB.  |
| Decibel(s) A-weighted, or dB(A)                             | The human ear system does not respond uniformly to sound across the detectable frequency range and consequently instrumentation used to measure sound is weighted to represent the performance of the ear. This is known as the 'A weighting' and is written as 'dB(A)'.   |
| Equivalent continuous sound pressure level, or $L_{pAeq,T}$ | An index used internationally for the assessment of environmental sound impacts. It is defined as the notional unchanging level that would, over a given period of time (T), deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating sound levels can be described in terms of an equivalent single figure value, typically expressed as a decibel level.   |
| Façade  | A facade noise level is the noise level 1m in front of a large reflecting surface. The effect of reflection, is to produce a slightly higher (typically +2.5 to +3 dB) sound level than it would be if the reflecting surface was not there.   |
| Free-field  | A free-field noise level is the noise level measured at a location where no reflective surfaces, other than the ground, lies within 3.5 metres of the microphone position.   |
| Exclusion of data   | Measurement of noise levels can be affected by weather conditions such as prolonged periods of rain, winds speeds higher than 5m/s and snow/ice ground cover. Noise levels measured during these periods are considered not representative of normal noise conditions at the site and, for the purposes of this report, are excluded from the assessment of exceedances and calculation of typical noise levels and are also greyed out in charts. Identifiable incongruous noise and vibration events not attributable to HS2 construction noise are also excluded. |
| Equivalent continuous sound pressure level, or $L_{Aeq,T}$  | An index used internationally for the assessment of environmental sound impacts. It is defined as the notional unchanging level that would, over a given period of time (T), deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating sound levels can be described in terms of an equivalent single figure value, typically expressed as a decibel level.   |
| Peak particle velocity, or PPV                              | Instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position. The PPV is a simple indicator of perceptibility and risk of damage to structures due to vibration. It is usually measured in mm/s.   |
| Sound pressure level  | The parameter by which sound levels are measured in air. It is measured in decibels. The threshold of hearing has been set at 0dB, while the threshold of pain is approximately 120dB. Normal speech is approximately 60dB at a distance of 1 metre and a change of 3dB in a time varying sound signal is commonly regarded as being just detectable. A change of 10dB is subjectively twice, or half, as loud.  |
| Vibration dose value, or VDV                                | An index used to evaluate human exposure to vibration in buildings. While the PPV provides information regarding the magnitude of single vibration events, the VDV provides a measure of the total vibration experienced over a specified period of time (typically 16h daytime and 8h night-time). It takes into account the magnitude, the number and the duration of vibration events and can be used to quantify exposure to continuous, impulsive, occasional and intermittent vibration. The vibration dose value is measured in $m/s^{1.75}$ .                |

# 1 Introduction

1.1.1 The nominated undertaker is required to undertake noise (and vibration) monitoring as necessary to comply with the requirements of the High Speed Rail (London-West Midlands) Environmental Minimum Requirements, including specifically Annex 1: Code of Construction Practice, in addition to any monitoring requirements arising from conditions imposed through consents under Section 61 of the Control of Pollution Act, 1974 or through Undertakings & Assurances given to third parties. Such monitoring may be undertaken for the following purposes:

- monitoring the impact of construction works;
- to investigate complaints, incidents and exceedance of trigger levels; or
- monitoring the effectiveness of noise and vibration control measures.

Monitoring data and interpretive reports are to be provided to each relevant local authority on a monthly basis and shall include a summary of the construction activities occurring, the data recorded over the monitoring period, any complaints received, any periods in exceedance of agreed trigger levels, the results of any investigations and any actions taken or mitigation measures implemented. This report provides noise data, and interpretation thereof, for monitoring carried out by HS2 within the London Borough of Ealing (LBE) for the period 1<sup>st</sup> to 31<sup>st</sup> December 2019.

1.1.2 Active construction sites potentially contributing to noise in the local authority area during this period include:

- Atlas Road worksite (ref.: S001-WS02), where ground investigation and surveys were undertaken;
- Willesden EuroTerminal worksite (ref.: S001-WS03), where works included preparation works to install services / drainage including surveying routes, continuation of vegetation clearance and cleaning up existing hard standing of soil, relocation of soil stockpile within the site onto an area of hard standing, vacuum excavation around services, setting up / constructing concrete surfaced pedestrian walkways within the site, installation of additional temporary offices / welfare accommodation from modular units including linking utilities, delivery of generators and other stores, setting up barriers / fencing within the site;
- Victoria Road worksite (ref.: S002-WS01), where works included construction of concrete pedestrian footways, test excavations, investigation of utilities discovered in the NE corner of the site, adjustment of hoarding along Network Rail boundary, breaking out footings, excavation to level sections of the site, test construction of section of designed working platform, vacuum excavation around services in Bethune Road area, installation of fencing within the site area, excavation of additional trial pits, continued site set-up works including painting zebra crossings over haul route, installation of segregated smoking shelter and moving stockpiled material; and

- Old Oak Common depot worksite (ref.: S004-WS01), where demolition activities and groundworks were carried out

In addition there were also work activities at the Atlas Road Substation in the form of installation of 3x33/11kV transformers, completion of 11kV switch room including cabling and hard landscaping. Network Rail on-network preparatory works and utility upgrade works were also taking place in the Local Authority area this month.

- 1.1.3 The applicable standards, guidance, and monitoring methodology is outlined in the construction noise and vibration monitoring methodology report which can be found at the following location <https://www.gov.uk/government/collections/monitoring-the-environmental-effects-of-hs2>. Noise and vibration monitoring reports for previous months can also be found at this location.

## 1.2 Measurement Locations

- 1.2.1 Table 2 summarises the position of noise and vibration monitoring installations within the LBE area in December 2019. Maps showing the position of noise and vibration monitoring installations are presented in Appendix B.

Table 2: Monitoring locations

| Worksite Reference       | Measurement Reference | Address  |
|--------------------------|-----------------------|--|
| S001-WS02                | N032                  | Shaftesbury Gardens                                |
|                          | N033                  | Outside The Collective, Atlas Road / Victoria Road |
| S001-WS03                | N034                  | Stephenson Street (north)                          |
|                          | N035                  | Stephenson Street (south)                          |
|                          | N041                  | Junction of Stephenson Street / Goodhall Street    |
| S002-WS01                | N029                  | Braitrim House, Victoria Road                      |
|                          | N030                  | Boden House Car Park                               |
|                          | N031                  | School Road, outside Acton Business Centre         |
| S004-WS01                | N027                  | Old Oak Common Lane                                |
|                          | N028                  | Old Oak Common Lane, Hilltop Works                 |
|                          | V045                  | Old Oak Common Lane                                |
| Badminton Close compound | N040                  | Badminton Close                                    |

## 2 Summary of results

### 2.1 Exceedances of SOAEL

- 2.1.1 The significant observed adverse effect level (SOAEL) is defined in the 'Planning Practice Guidance – Noise' as the level above which "noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area."
- 2.1.2 Where construction noise levels exceed the SOAEL, relevant periods will be identified and summary statistics provided in order to evaluate ongoing qualification for noise insulation and temporary rehousing.
- 2.1.3 Table 3 presents a summary of recorded exceedances of the SOAEL due to HS2 related construction noise at each measurement location over the reporting period, including the number of exceedances during each time period. For this monitoring period no exceedances of the SOAEL were recorded.

Table 3: Summary of exceedances of SOAEL

| Worksite Reference | Measurement Reference | Site Address                                       | Day (Weekday, Saturday, Sunday, Night) | Time period | Number of exceedances of SOAEL |
|--------------------|-----------------------|--|--|-------------|--------------------------------|
| S001-WS02          | N032                  | Shaftesbury Gardens                                | All days                               | All periods | No exceedance                  |
|                    | N033                  | Outside The Collective, Atlas Road / Victoria Road | All days                               | All periods | No exceedance                  |
| S001-WS03          | N034                  | Stephenson Street (north)                          | All days                               | All periods | No exceedance                  |
|                    | N035                  | Stephenson Street (south)                          | All days                               | All periods | No exceedance                  |
|                    | N041                  | Junction of Stephenson Street / Goodhall Street    | All days                               | All periods | No exceedance                  |
| S002-WS01          | N029                  | Braitrim House, Victoria Road                      | All days                               | All periods | No exceedance                  |
|                    | N030                  | Bodens Car Park                                    | All days                               | All periods | No exceedance                  |
|                    | N031                  | School Road, outside Acton Business Centre         | All days                               | All periods | No exceedance                  |
| S004-WS01          | N027                  | Old Oak Common Lane                                | All days                               | All periods | No exceedance                  |
|                    | N028                  | Old Oak Common Lane, Hilltop Works                 | All days                               | All periods | No exceedance                  |

| Worksite Reference       | Measurement Reference | Site Address    | Day (Weekday, Saturday, Sunday, Night) | Time period | Number of exceedances of SOAEL |
|--------------------------|-----------------------|-----------------|--|-------------|--------------------------------|
| Badminton Close compound | N040                  | Badminton Close | All days                               | All periods | No exceedance                  |

2.1.4 Monitoring of vibration peak particle velocity (PPV) was undertaken with the purpose to ensure construction generated vibration levels were below those with potential to damage adjacent buildings, in accordance with Annex 1: Code of Construction Practice of the High Speed Rail (London-West Midlands) Environmental Minimum Requirements. There are no LOAEL and SOAEL criteria based on PPV applicable to HS2 construction vibration.

## 2.2 Summary of measured noise levels

2.2.1 Table 4 presents a summary of the measured noise levels at each monitoring location over the reporting period. The  $L_{Aeq,T}$  is presented for each of the relevant time periods averaged over the calendar month, along with the highest single period  $L_{Aeq,T}$  that was found to occur within the month.

2.2.2 Appendix C presents graphs of the noise monitoring data over the month for each of the measurement locations. Data presented includes the hourly  $L_{Aeq}$  values and, where relevant, the  $L_{Aeq,T}$  values (where the time period T has been taken to be the averaging period as specified in Table 1 of HS2 Information Paper E23). The full data set for the monitoring equipment can be found at the following location:  
<https://data.gov.uk/dataset/24542ae7-dd44-444f-b259-871c4cc43b5e/environmental-monitoring-data>.

2.2.3 Given the nature and location of works currently being undertaken at worksites in LBE, the measured noise levels are largely dominated by the underlying ambient noise levels rather than being attributable to HS2 related construction noise. However, demolition and associated activities, along with other HS2 works, will have given rise to audible noise beyond the site boundary from time to time.



Table 4: Summary of measured dB L<sub>Aeq</sub> data over the monitoring period

| Worksite Reference | Measurement Reference | Site Address                                       | Free-field or Façade measurement | Weekday Average L <sub>Aeq,T</sub><br>(highest day L <sub>Aeq,T</sub> ) |                |                |                |                | Saturday Average L <sub>Aeq,T</sub><br>(highest day L <sub>Aeq,T</sub> ) |                |                |                |                | Sunday / Public Holiday<br>Average L <sub>Aeq,T</sub><br>(highest day L <sub>Aeq,T</sub> ) |                |
|--------------------|-----------------------|--|----------------------------------|---|----------------|----------------|----------------|----------------|--|----------------|----------------|----------------|----------------|--|----------------|
|                    |                       |  |                                  | 0700 - 0800   | 0800 - 1800    | 1800 - 1900    | 1900 - 2200    | 2200 - 0700    | 0700 - 0800  | 0800 - 1300    | 1300 - 1400    | 1400 - 2200    | 2200 - 0700    | 0700 - 2200  | 2200 - 0700    |
| S001-WS02          | N032                  | Shaftesbury Gardens                                | Free field                       | 64.4<br>(66.9)  | 66.2<br>(68.7) | 65.0<br>(67.4) | 64.6<br>(71.2) | 61.2<br>(70.3) | 62.1<br>(63.4)   | 65.5<br>(66.5) | 65.6<br>(66.2) | 65.2<br>(67.8) | 60.4<br>(65.1) | 64.3<br>(70.2)   | 61.2<br>(66.6) |
|                    | N033                  | Outside The Collective, Atlas Road / Victoria Road | Free field                       | 66.6<br>(69.8)  | 68.5<br>(70.7) | 66.9<br>(71.3) | 66.7<br>(75.5) | 62.8<br>(73.7) | 64.4<br>(66.0)   | 68.7<br>(74.9) | 69.0<br>(76.4) | 66.6<br>(69.3) | 62.5<br>(67.8) | 66.1<br>(73.1)   | 63.3<br>(68.3) |
| S001-WS03          | N034                  | Stephenson Street (north)                          | Free field                       | 54.0<br>(58.8)  | 57.2<br>(66.5) | 53.0<br>(57.9) | 52.1<br>(59.5) | 49.5<br>(57.7) | 51.6<br>(54.2)   | 53.4<br>(57.7) | 55.9<br>(63.6) | 52.9<br>(59.9) | 49.3<br>(56.5) | 52.3<br>(57.0)   | 51.6<br>(67.3) |
|                    | N035                  | Stephenson Street (south)                          | Free field                       | 54.9<br>(58.4)  | 54.9<br>(59.5) | 52.3<br>(57.6) | 51.7<br>(59.4) | 49.5<br>(58.3) | 51.1<br>(54.1)   | 53.5<br>(57.0) | 52.3<br>(57.6) | 51.7<br>(59.6) | 48.1<br>(52.4) | 51.8<br>(57.9)   | 49.7<br>(54.7) |
|                    | N041                  | Junction of Stephenson Street / Goodhall Street    | Free field                       | 55.9<br>(63.4)  | 57.1<br>(65.0) | 55.7<br>(58.9) | 55.1<br>(60.9) | 52.3<br>(63.3) | 53.6<br>(56.2)   | 57.3<br>(61.2) | 57.1<br>(62.6) | 60.3<br>(80.4) | 50.7<br>(55.9) | 54.6<br>(60.0)   | 51.3<br>(59.7) |
| S002-WS01          | N029                  | Braitrim House, Victoria Road                      | Free field                       | 52.9<br>(61.2)  | 57.5<br>(61.6) | 52.8<br>(61.6) | 53.6<br>(66.2) | 52.5<br>(64.7) | 50.0<br>(52.0)   | 53.4<br>(58.9) | 52.5<br>(58.1) | 51.9<br>(56.9) | 48.8<br>(55.6) | 52.3<br>(62.2)   | 50.6<br>(59.7) |
|                    | N030                  | Bodens car park                                    | Free field                       | 57.7<br>(61.2)  | 62.1<br>(72.5) | 55.7<br>(57.9) | 55.6<br>(59.3) | 53.4<br>(57.9) | 54.8<br>(56.9)   | 56.8<br>(60.8) | 57.4<br>(60.1) | 55.9<br>(59.1) | 53.1<br>(57.3) | 55.8<br>(60.0)   | 53.6<br>(59.0) |
|                    | N031                  | School Road, outside Acton Business Centre         | Free field                       | 62.1<br>(65.6)  | 64.5<br>(67.9) | 63.8<br>(66.4) | 61.2<br>(64.9) | 57.2<br>(67.7) | 59.1<br>(60.1)   | 63.3<br>(66.4) | 64.6<br>(66.5) | 63.3<br>(69.9) | 56.0<br>(65.8) | 61.8<br>(69.7)   | 57.5<br>(63.4) |

| Worksite Reference       | Measurement Reference | Site Address                       | Free-field or Façade measurement | Weekday Average $L_{Aeq,T}$<br>(highest day $L_{Aeq,T}$ ) |                |                |                |                | Saturday Average $L_{Aeq,T}$<br>(highest day $L_{Aeq,T}$ ) |                |                |                |                | Sunday / Public Holiday<br>Average $L_{Aeq,T}$<br>(highest day $L_{Aeq,T}$ ) |                |
|--------------------------|-----------------------|------------------------------------|----------------------------------|---|----------------|----------------|----------------|----------------|--|----------------|----------------|----------------|----------------|--|----------------|
|                          |                       |                                    |                                  | 0700 - 0800   | 0800 - 1800    | 1800 - 1900    | 1900 - 2200    | 2200 - 0700    | 0700 - 0800  | 0800 - 1300    | 1300 - 1400    | 1400 - 2200    | 2200 - 0700    | 0700 - 2200  | 2200 - 0700    |
| S004-WS01                | N027                  | Old Oak Common Lane                | Free field                       | 69.0<br>(71.0)  | 70.4<br>(72.0) | 69.9<br>(73.3) | 68.9<br>(77.5) | 64.1<br>(68.6) | 65.9<br>(67.2)   | 69.5<br>(70.7) | 70.2<br>(70.9) | 69.2<br>(71.2) | 63.0<br>(67.7) | 67.9<br>(73.4)   | 63.6<br>(68.6) |
|                          | N028                  | Old Oak Common Lane, Hilltop Works | Free field                       | 69.2<br>(72.8)  | 70.6<br>(73.0) | 70.0<br>(76.1) | 69.0<br>(78.2) | 64.1<br>(70.4) | 65.4<br>(66.6)   | 69.8<br>(72.1) | 69.6<br>(70.8) | 69.3<br>(73.9) | 63.7<br>(69.5) | 68.3<br>(74.7)   | 63.8<br>(68.2) |
| Badminton Close compound | N040                  | Badminton Close                    | Free field                       | 56.5<br>(63.9)  | 56.7<br>(59.0) | 56.1<br>(58.8) | 56.2<br>(61.7) | 54.4<br>(70.8) | 57.3<br>(61.4)   | 57.4<br>(59.7) | 56.6<br>(59.7) | 56.2<br>(62.2) | 54.2<br>(59.6) | 56.7<br>(64.0)   | 54.0<br>(62.9) |

2.2.4 Table 5 presents a summary of the measured vibration levels at monitoring location V045 over the reporting period. The highest PPV measured during the monitoring along any axis is presented in the table.

Table 5: Summary of measured PPV data over the monitoring period

| Worksite Reference | Measurement Reference | Monitor Address     | Highest PPV measured in any axis, mm/s |
|--------------------|-----------------------|---------------------|--|
| S004-WS01          | V045                  | Old Oak Common Lane | 0.77 (X-axis)                          |

## 2.3 Exceedances of trigger level

2.3.1 Table 6 provides a summary of exceedances of the S61 trigger noise levels determined to be due to HS2 related construction noise measured during the reporting period, along with the findings of any investigation.

Table 6: Summary of exceedances of trigger levels

| Complaint Reference Number (if applicable) | Worksite Reference | Date and Time Period | Identified Source | Results of Investigation (including noise monitoring results) | Actions Taken |
|--|--------------------|----------------------|-------------------|---|---------------|
| -  | -                  | -                    | -                 | -   | -             |

2.3.2 There were no exceedances of trigger levels as defined in section 61 consents during the reporting period at any monitoring position.

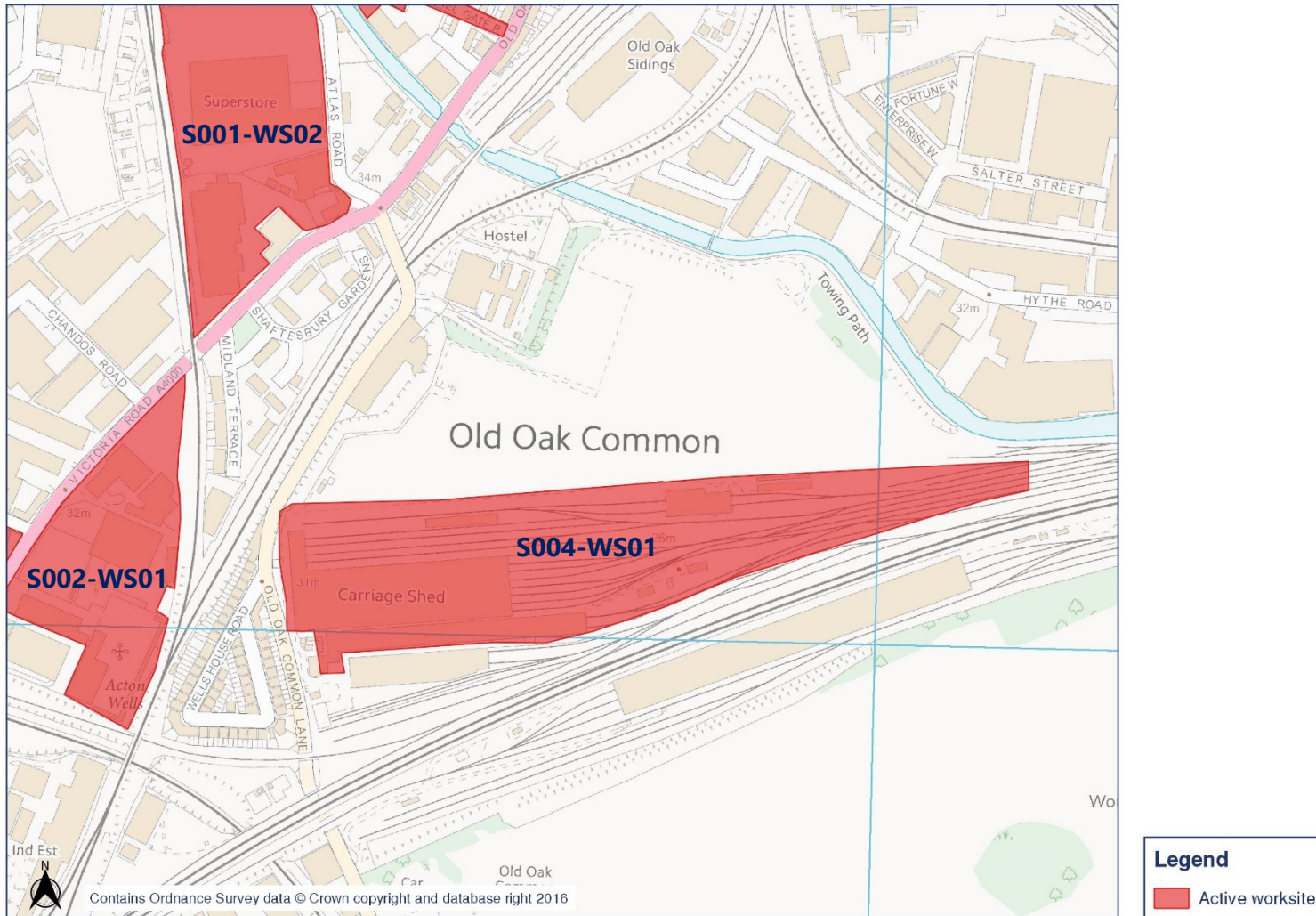
## 2.4 Complaints

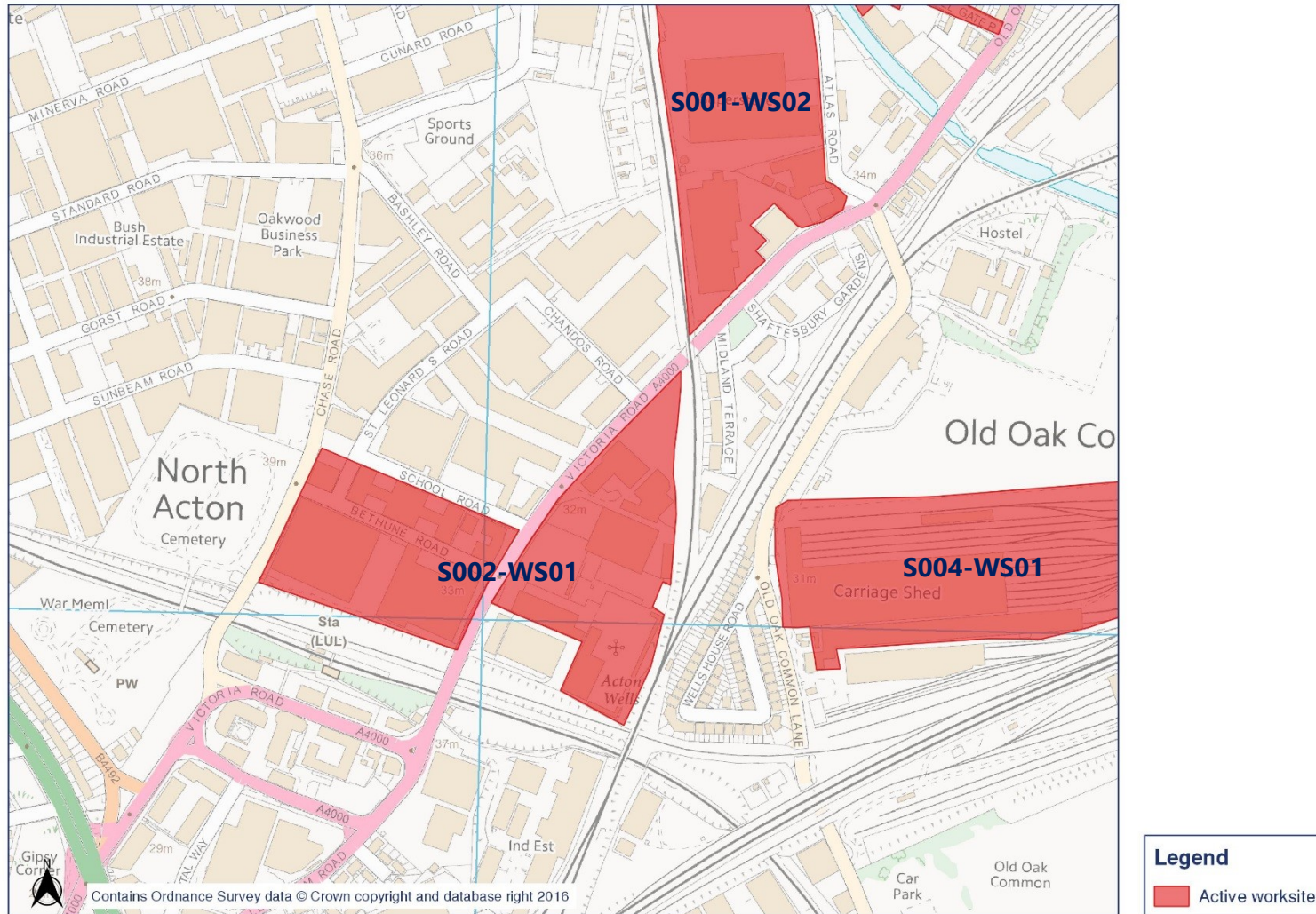
2.4.1 Table 7 provides a summary of complaint information related to noise and vibration received during the reporting period, along with the findings of any investigation. No complaints were received for this monitoring period.

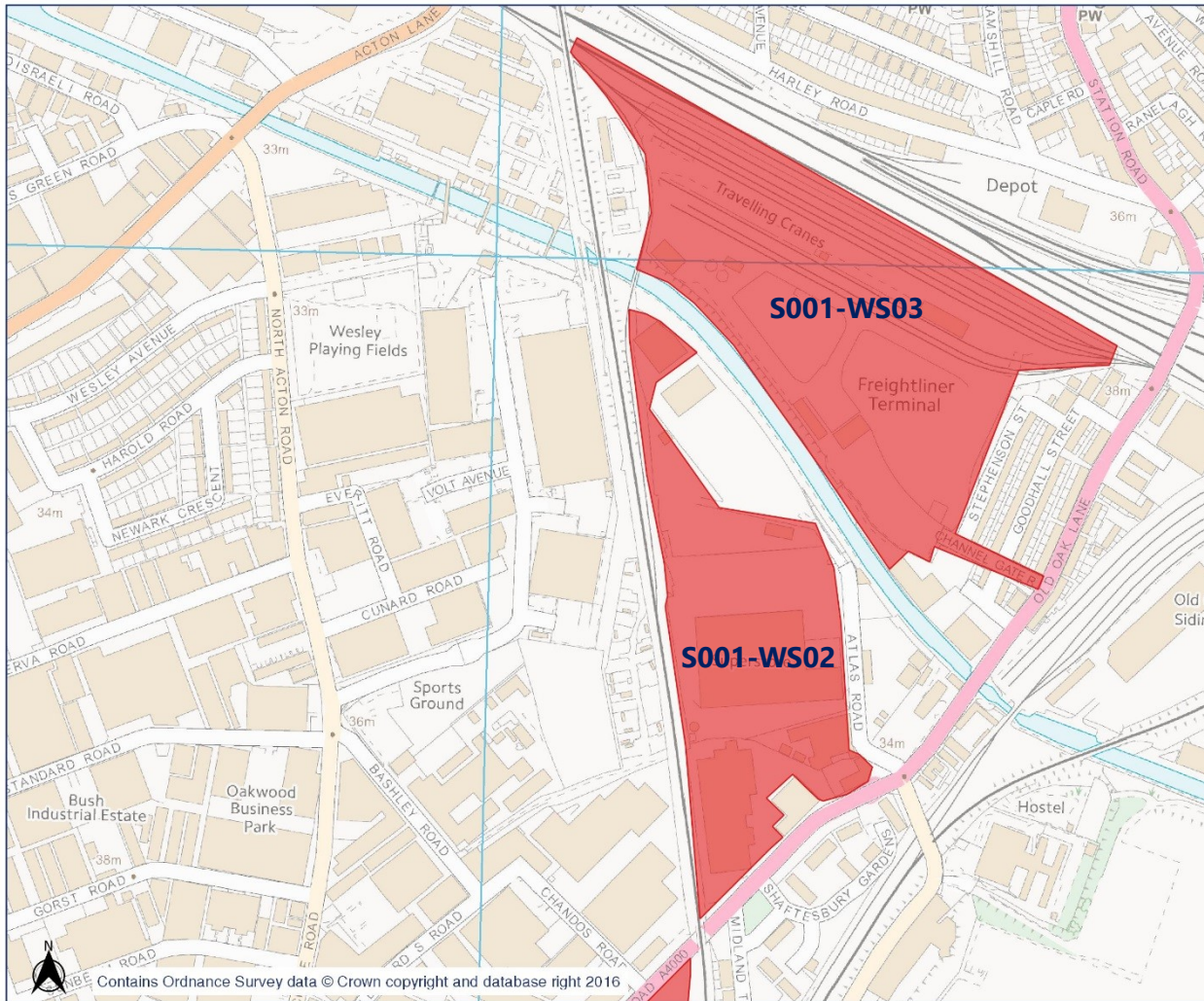
Table 7: Summary of complaints

| Complaint reference number | Worksite reference | Description of complaint | Results of investigation | Actions taken |
|----------------------------|--------------------|--------------------------|--------------------------|---------------|
| -                          | -                  | -                        | -                        | -             |

# Appendix A Site Locations

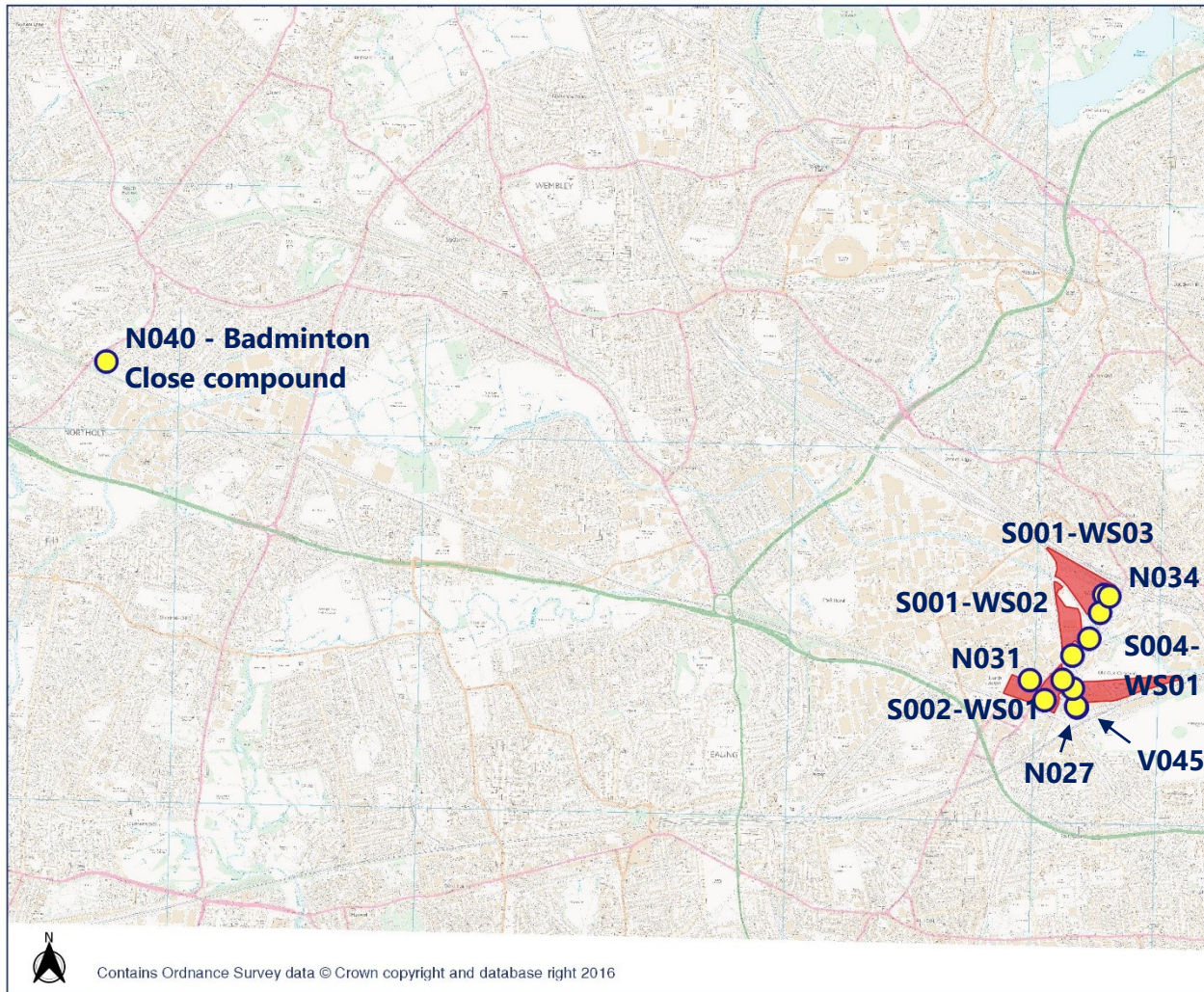


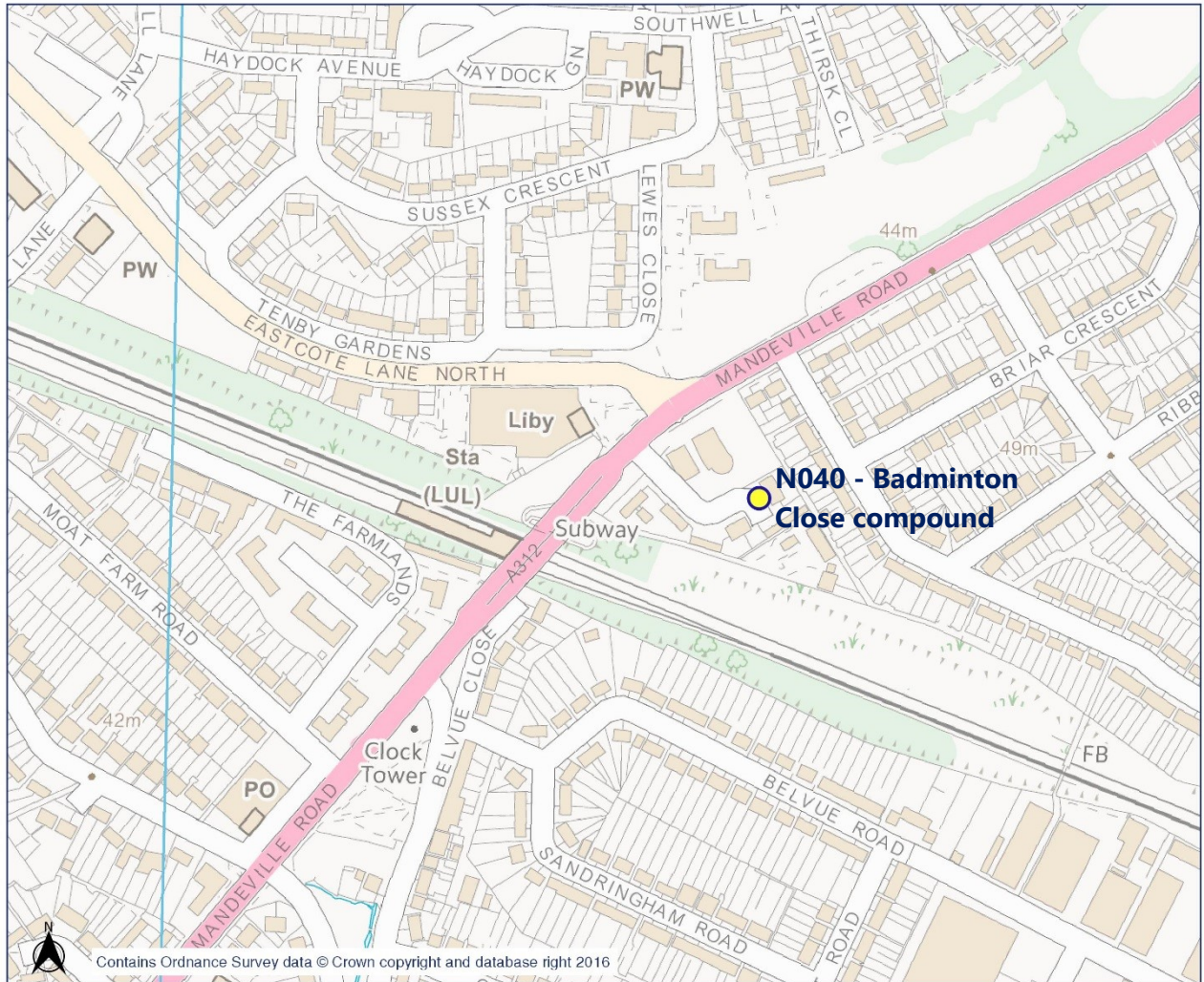




# Appendix B Monitoring Locations

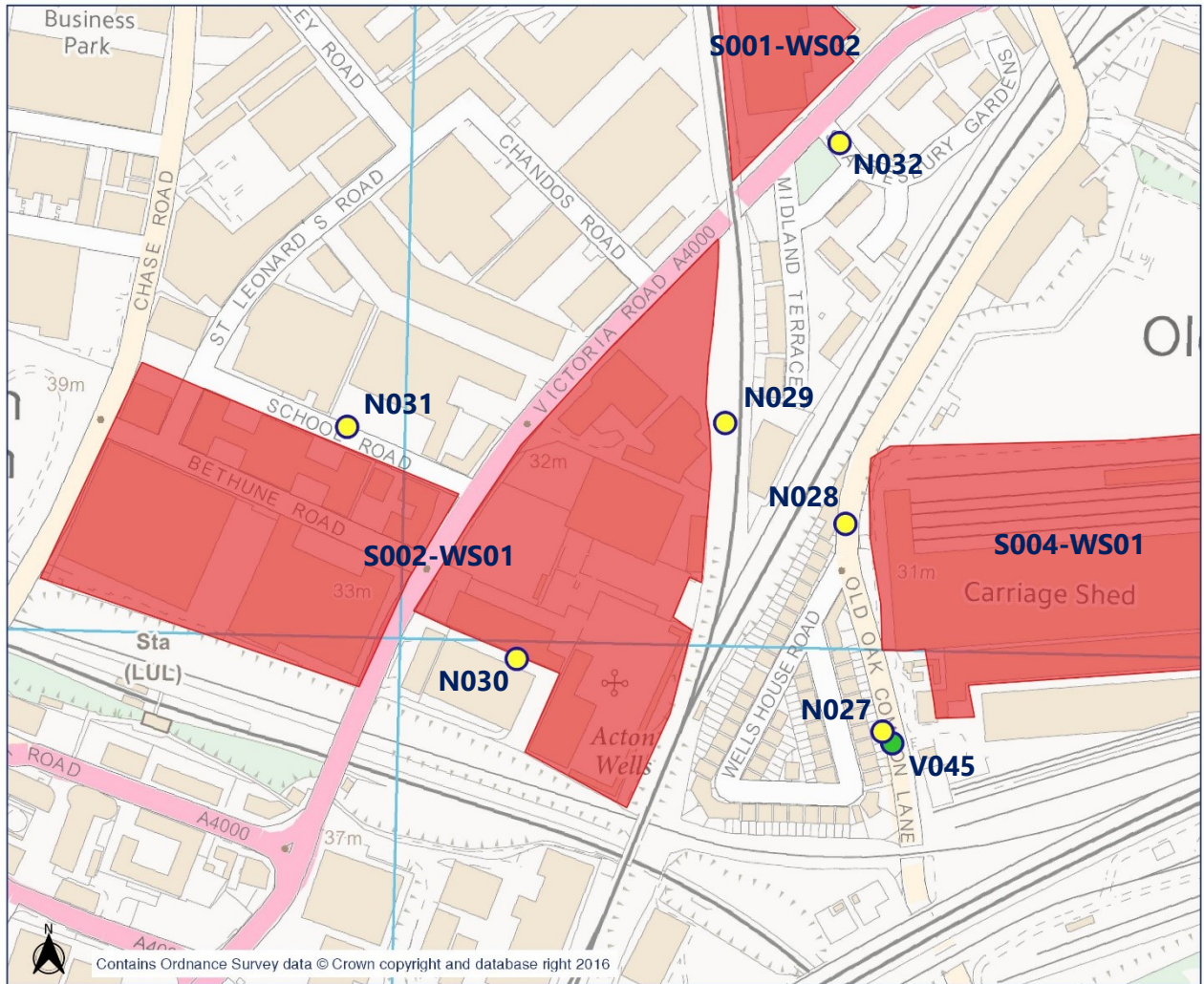


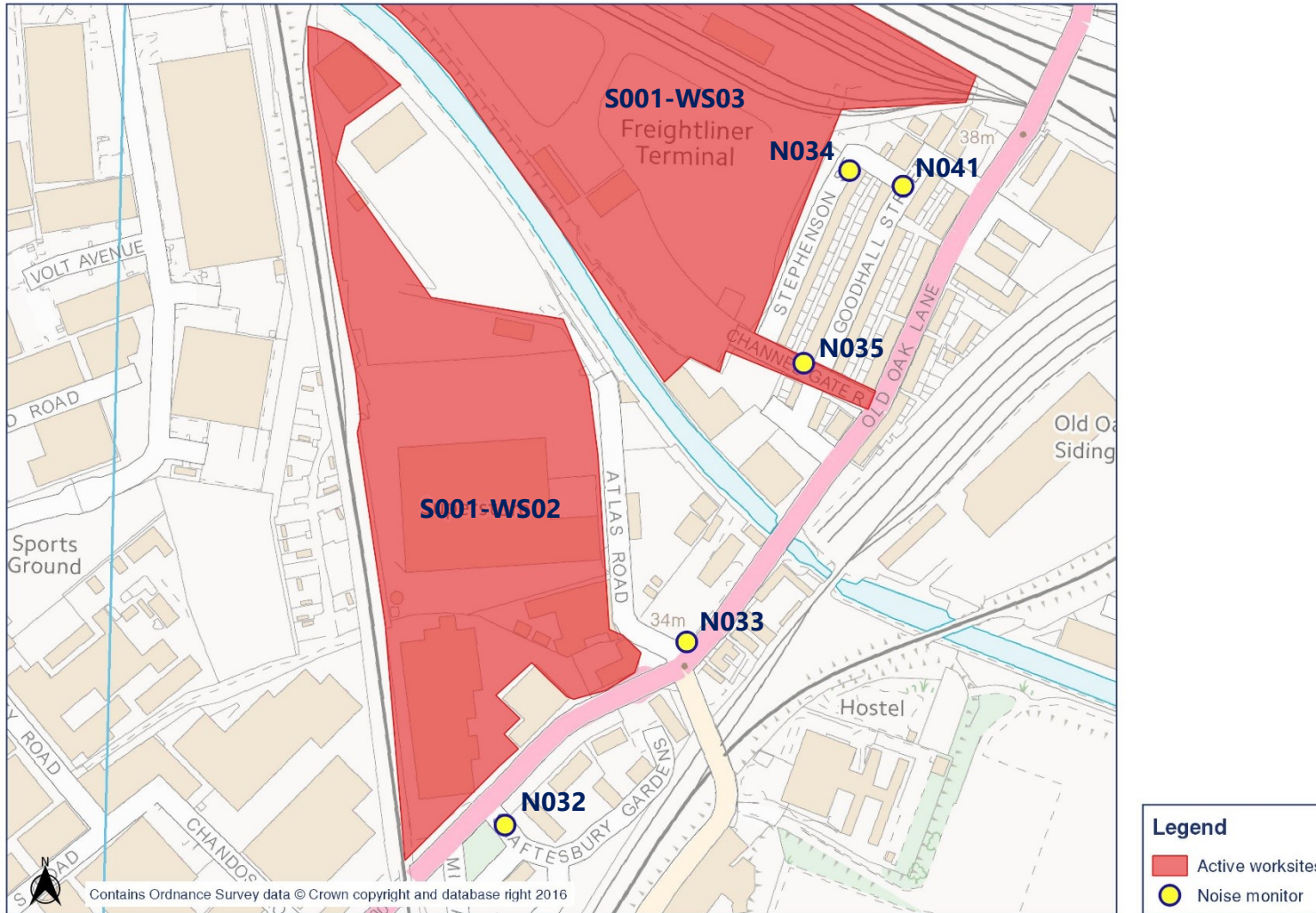




**Legend**

- Active work sites
- Noise monitor

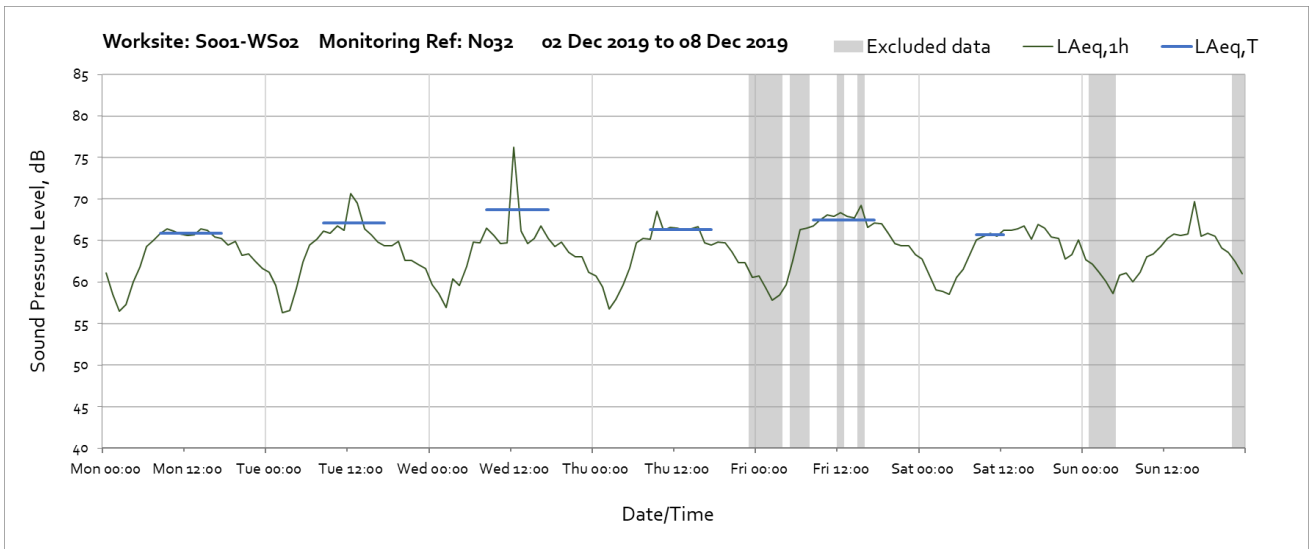
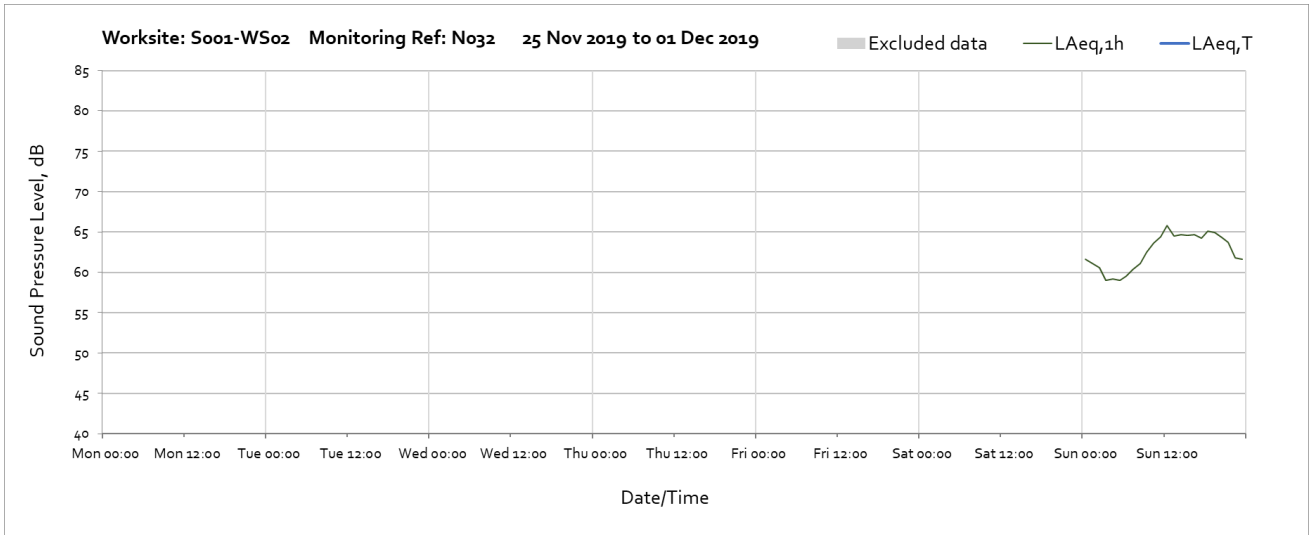


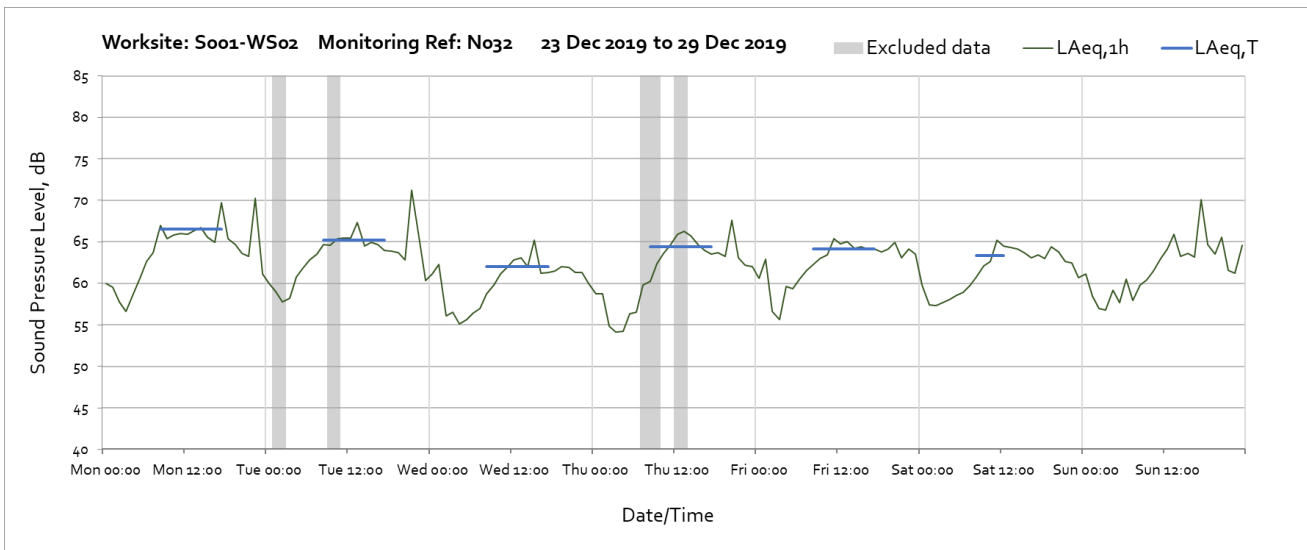
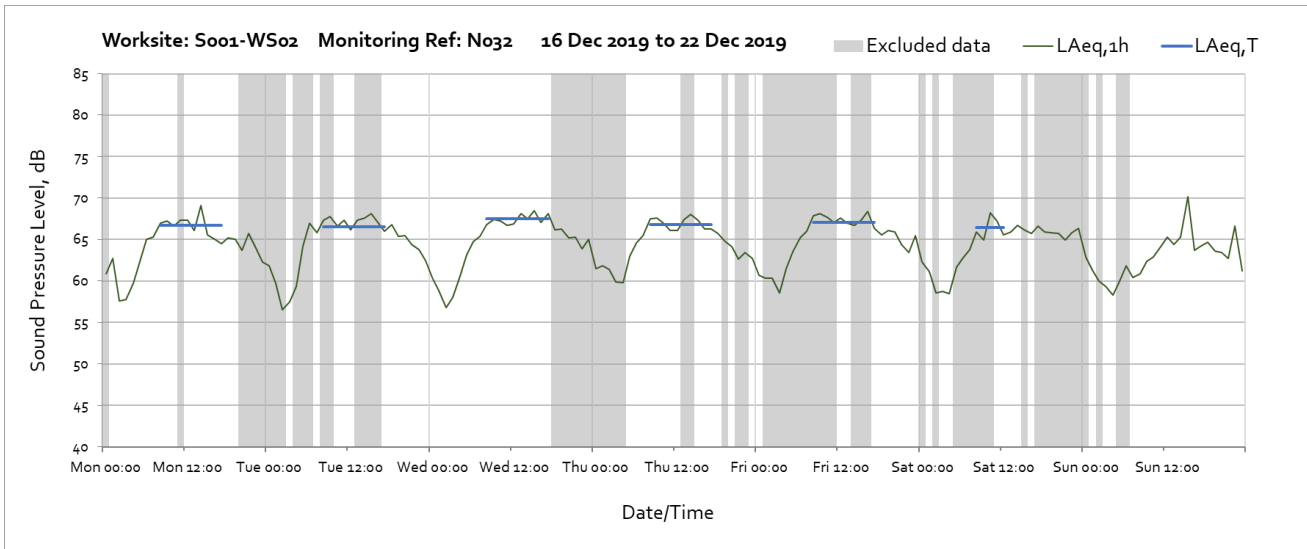
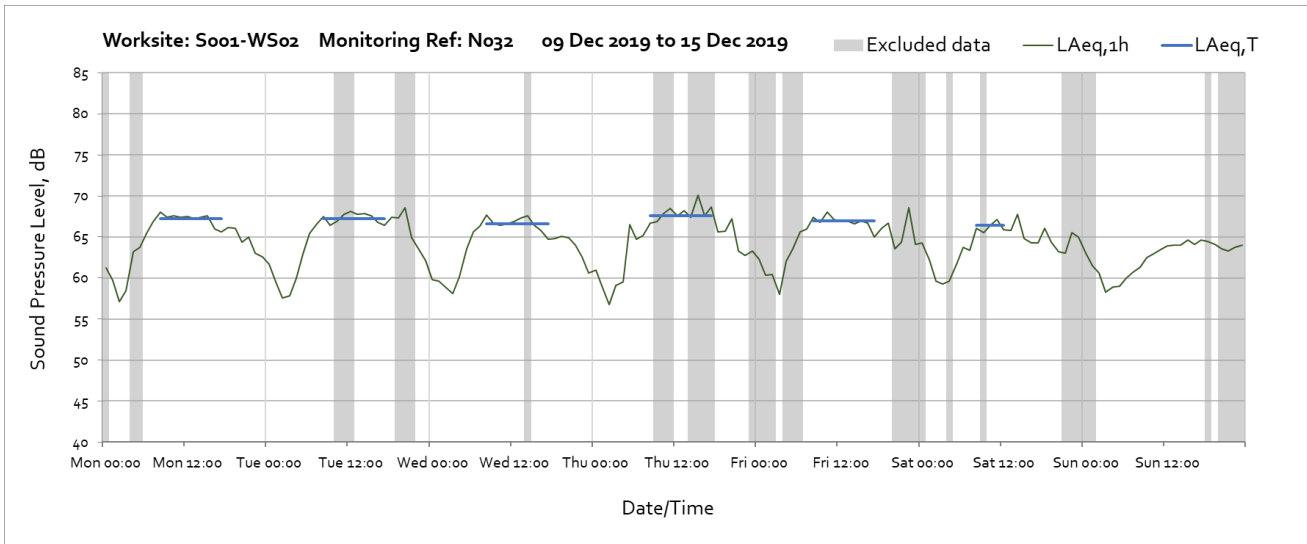


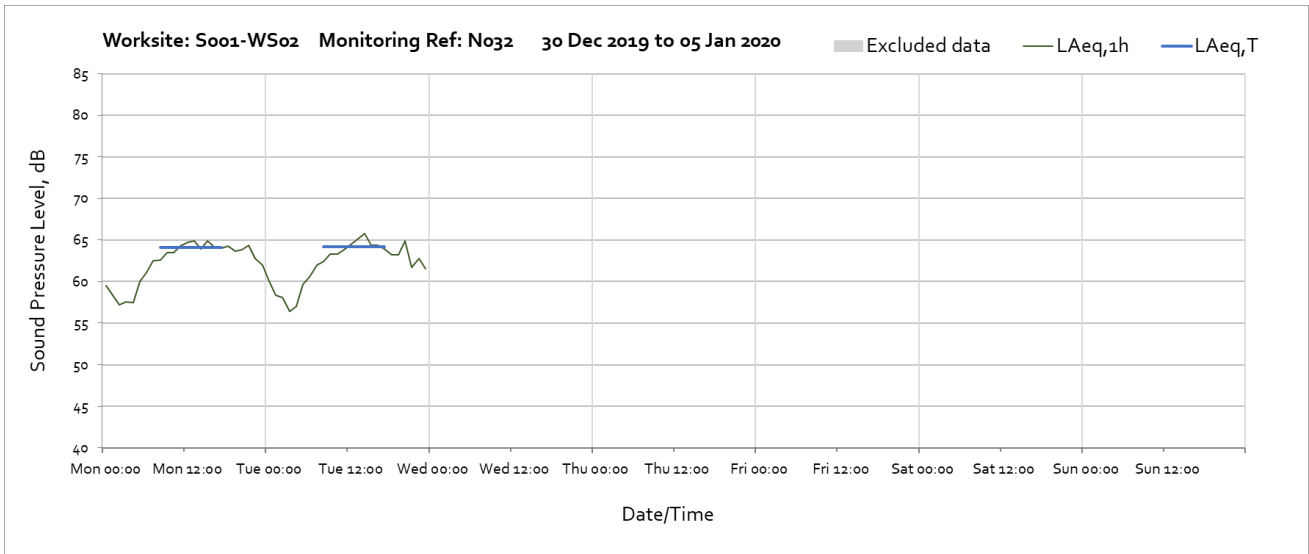
# Appendix C Data

The following graphs show the hourly measured ambient noise level  $L_{Aeq,1h}$  and, where relevant, the averaged noise level  $L_{Aeq,T}$  values, where the time period T is as specified in Table 1 of HS2 Information Paper E23. Periods with adversely weather affected noise levels are greyed out and have been excluded from the calculation of the  $L_{Aeq,T}$  values.

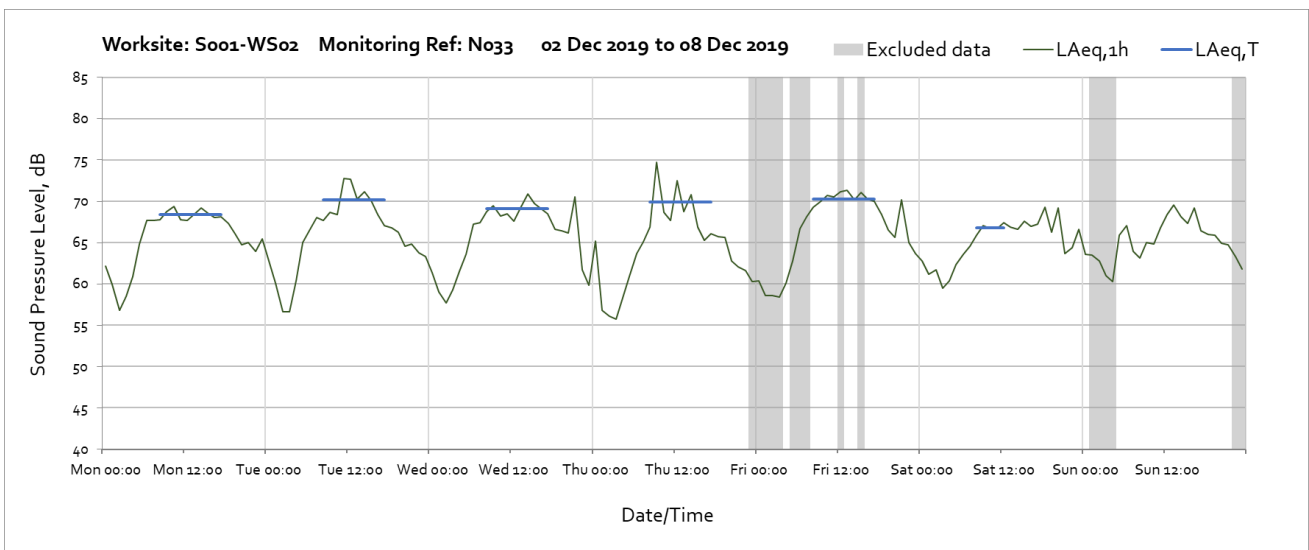
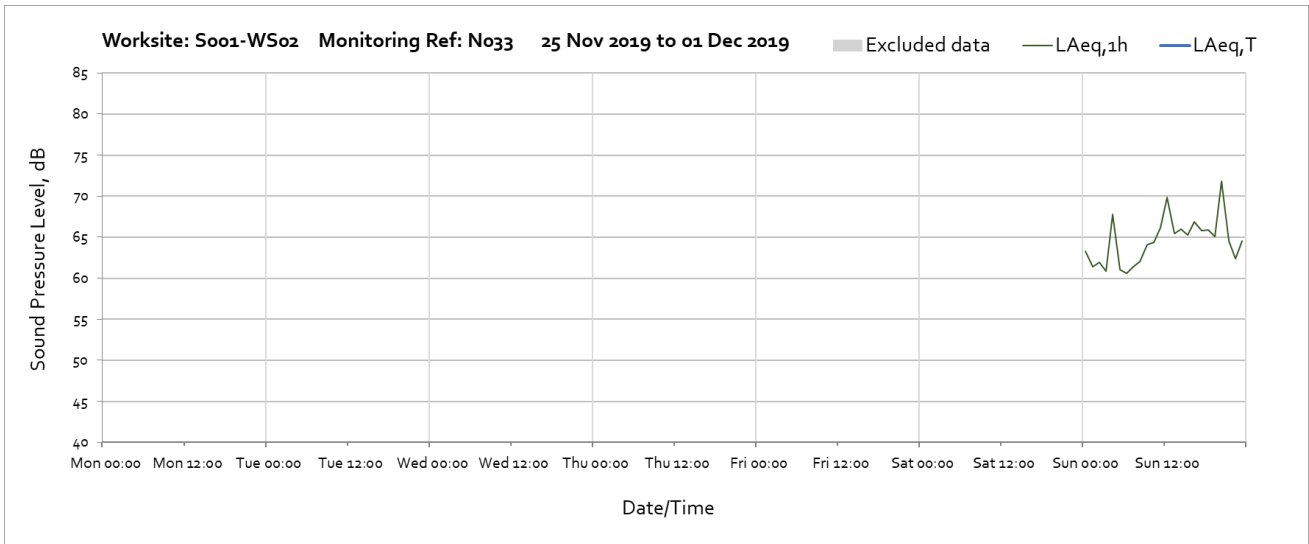
## Worksite: S001-WS02 – Monitoring Ref: N032

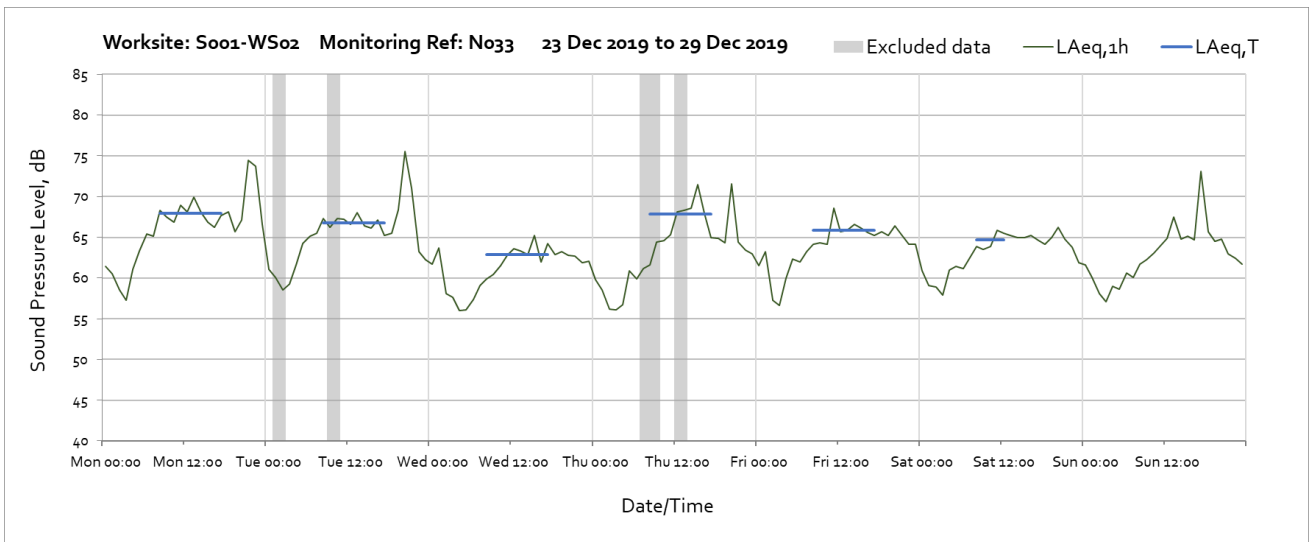
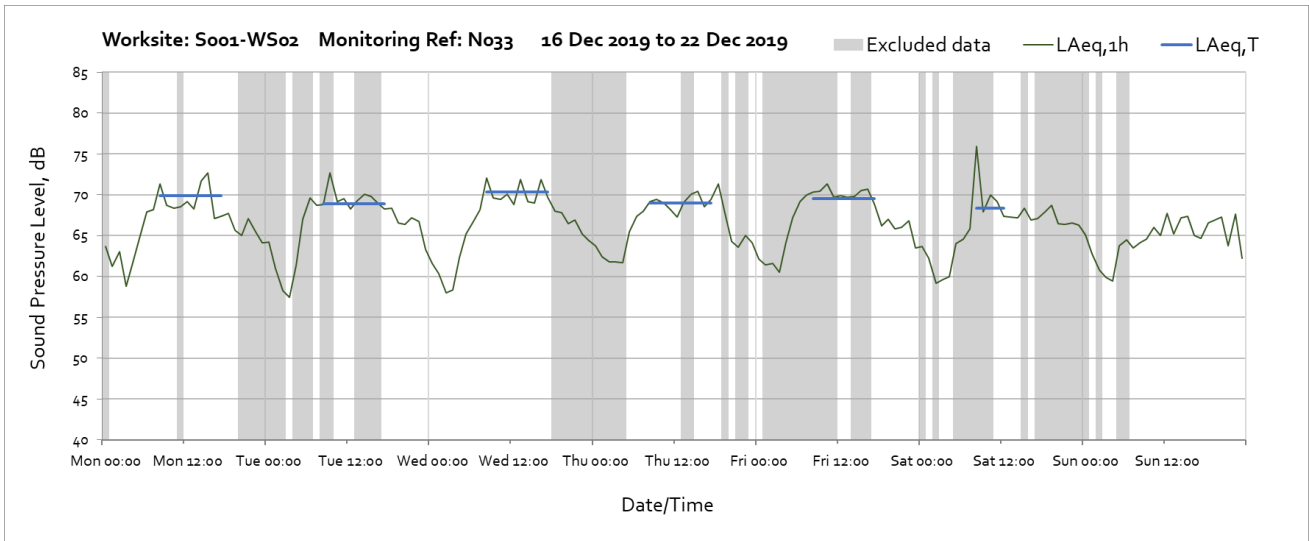
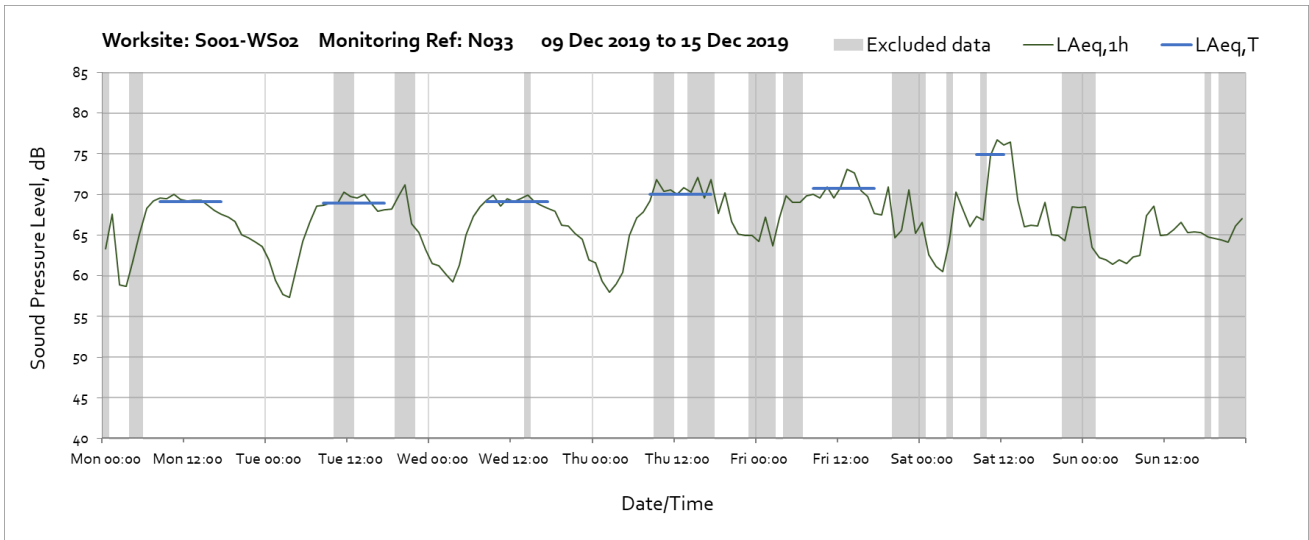




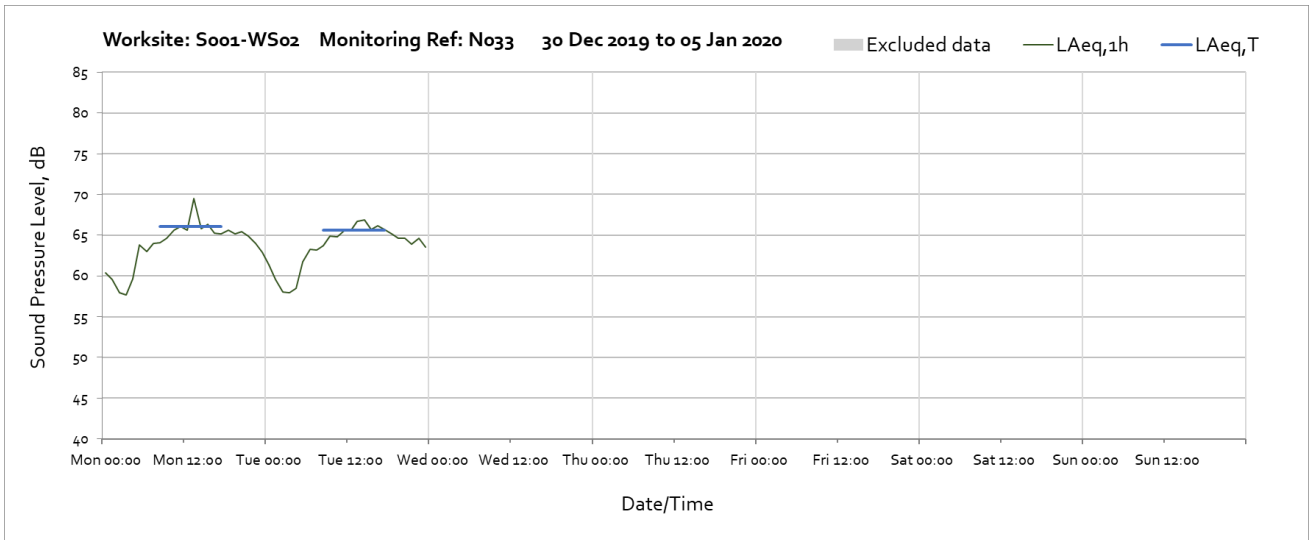


## Worksite: S001-WS02 – Monitoring Ref: N033

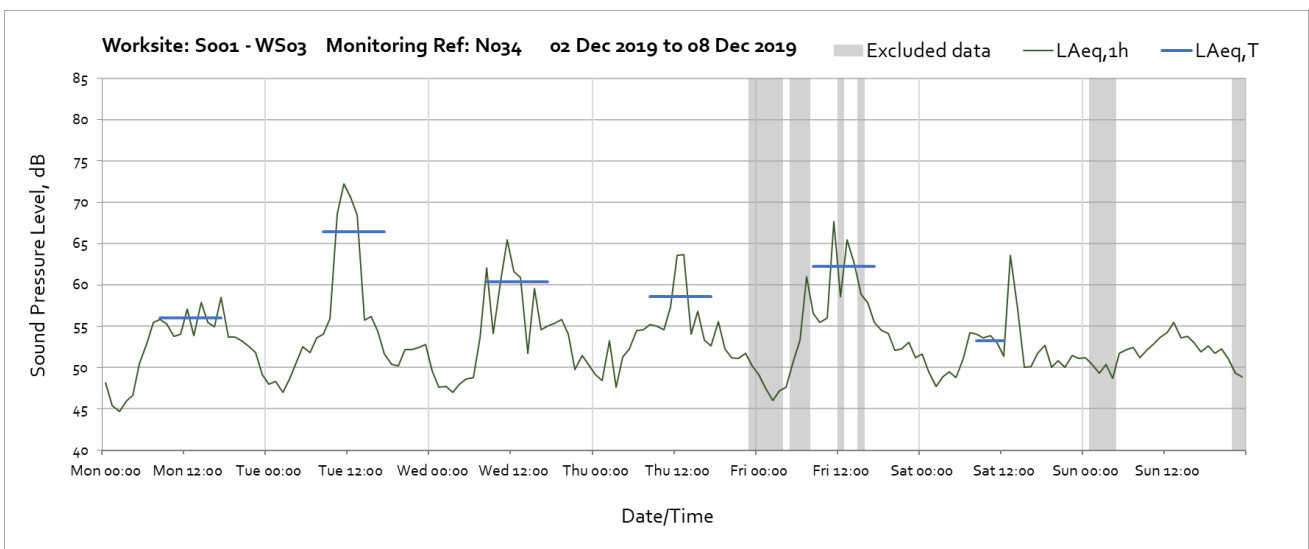
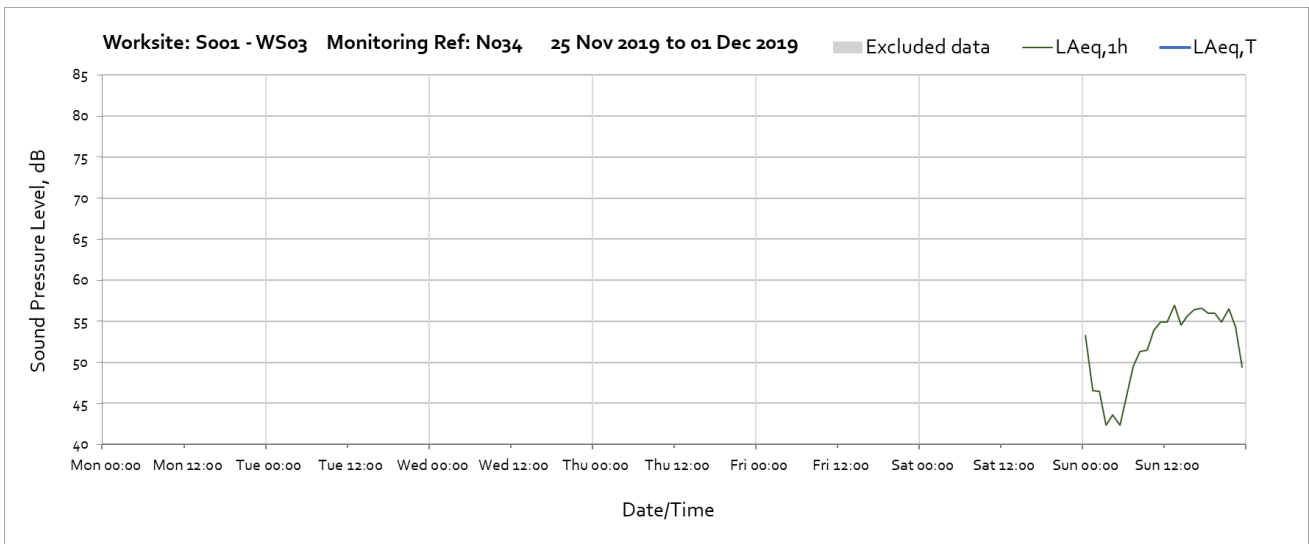


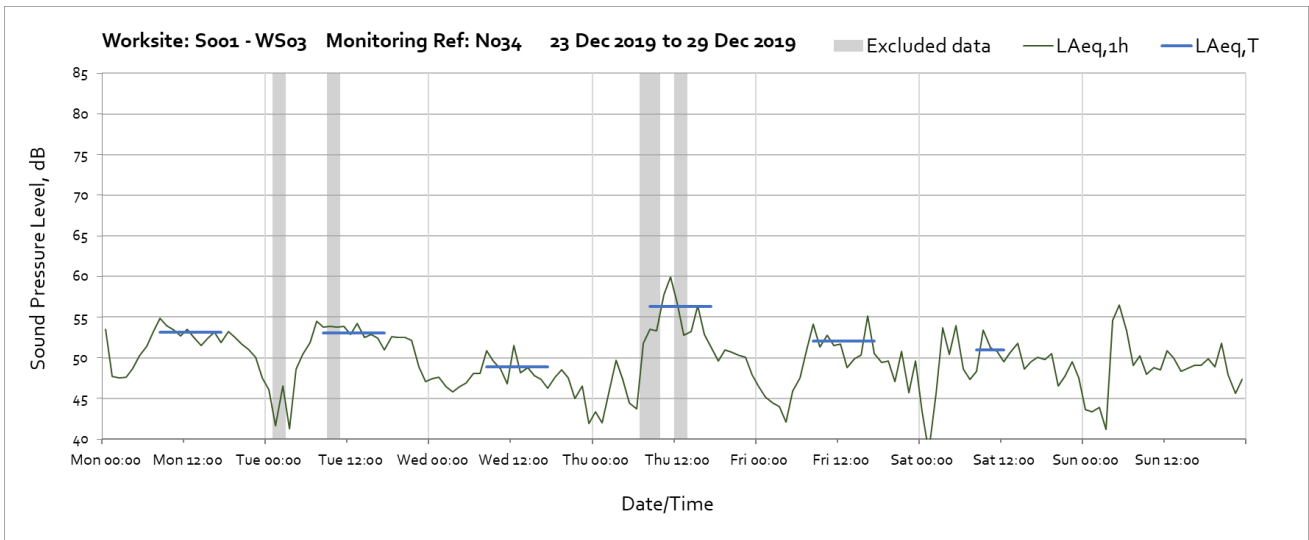
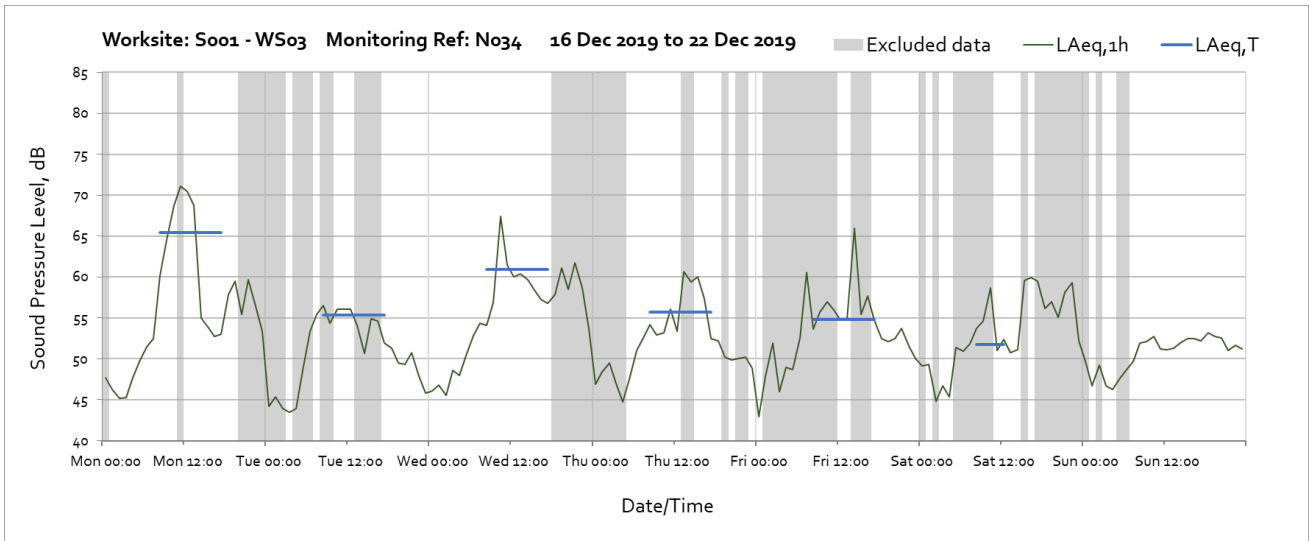
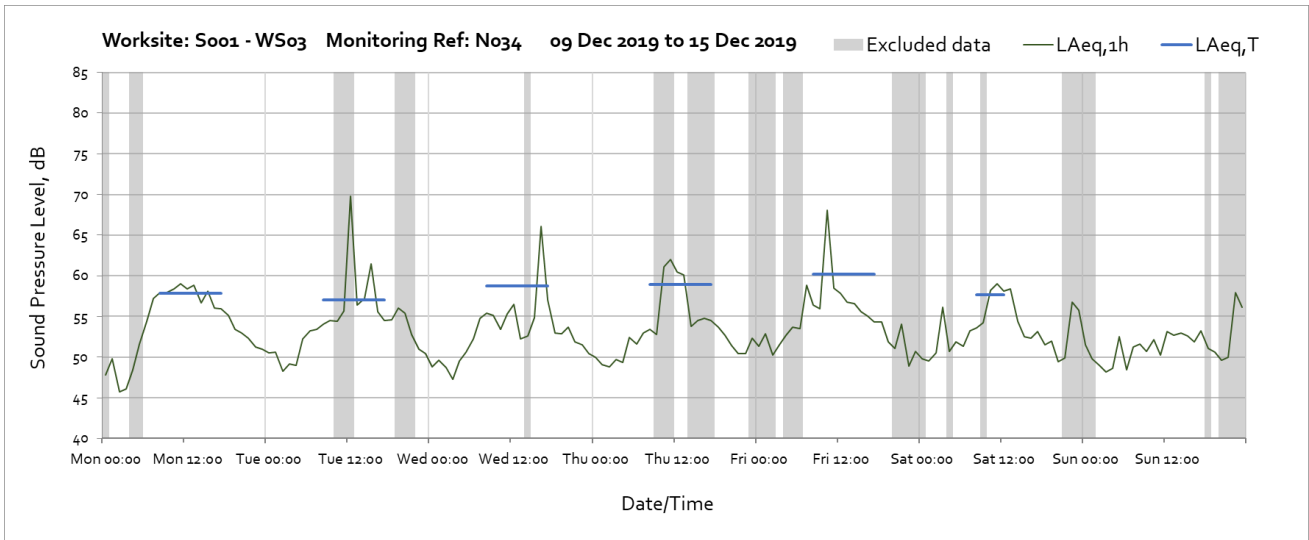


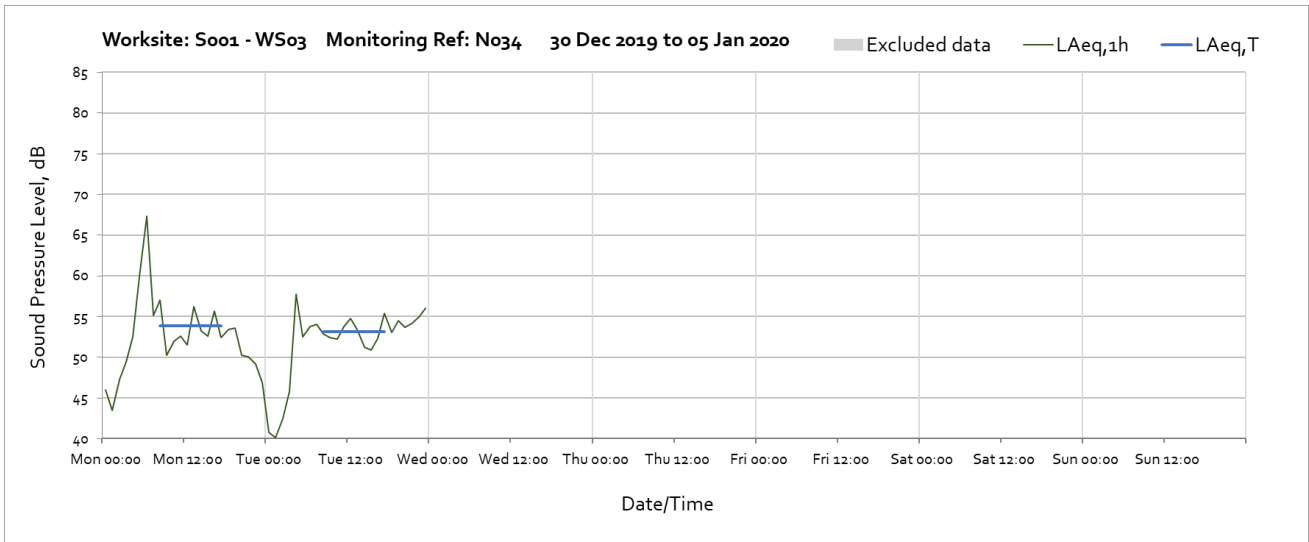




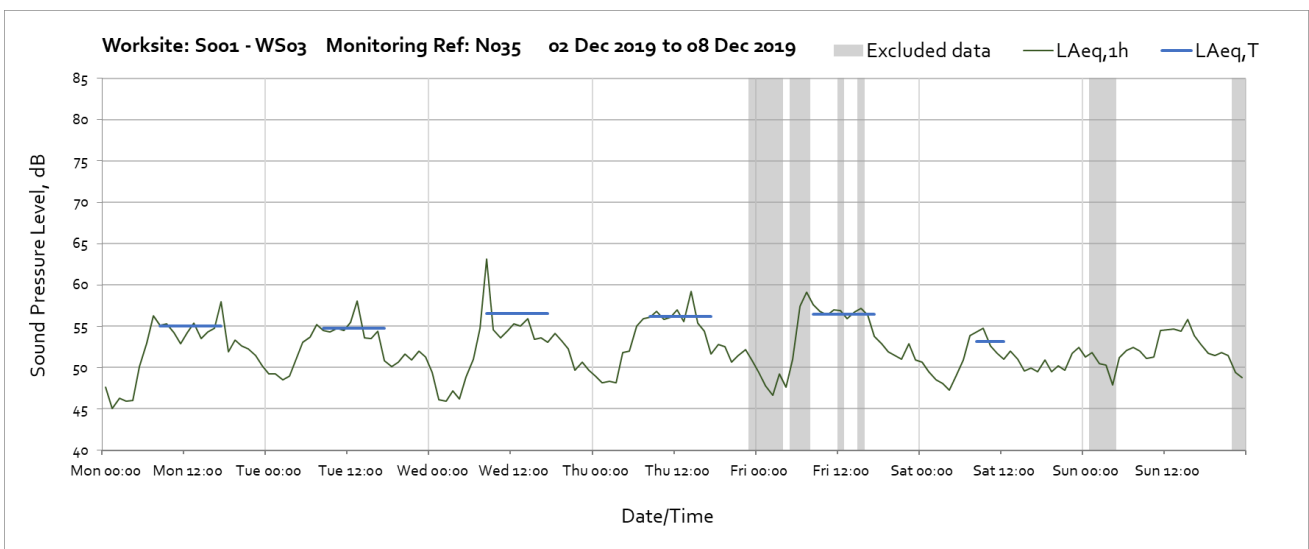
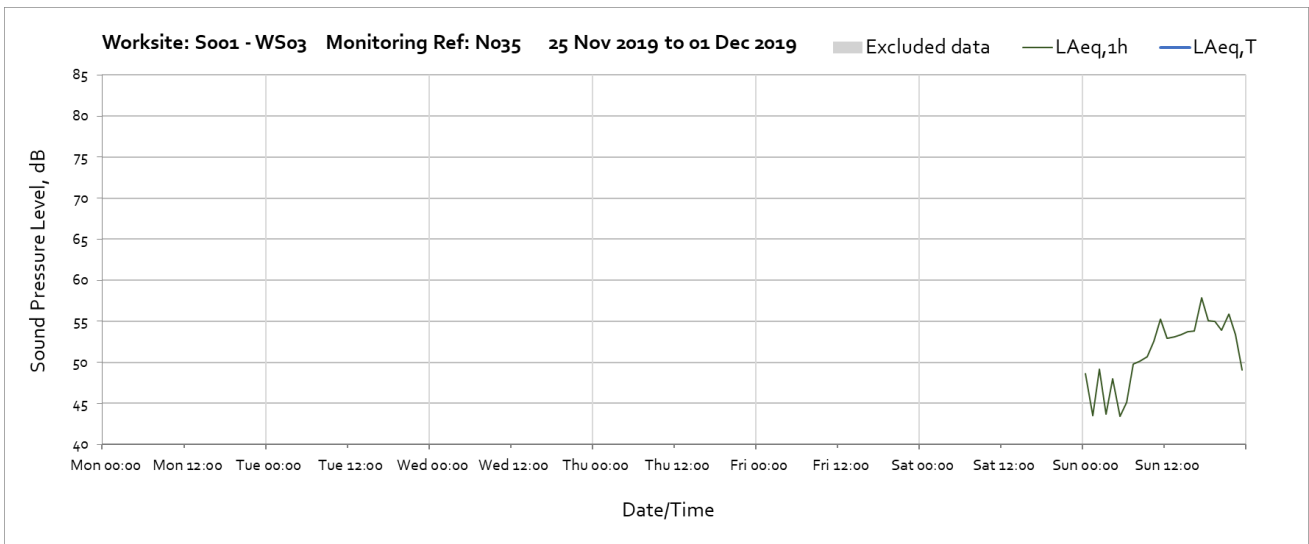
## Worksite: S001-WS03 – Monitoring Ref: N034

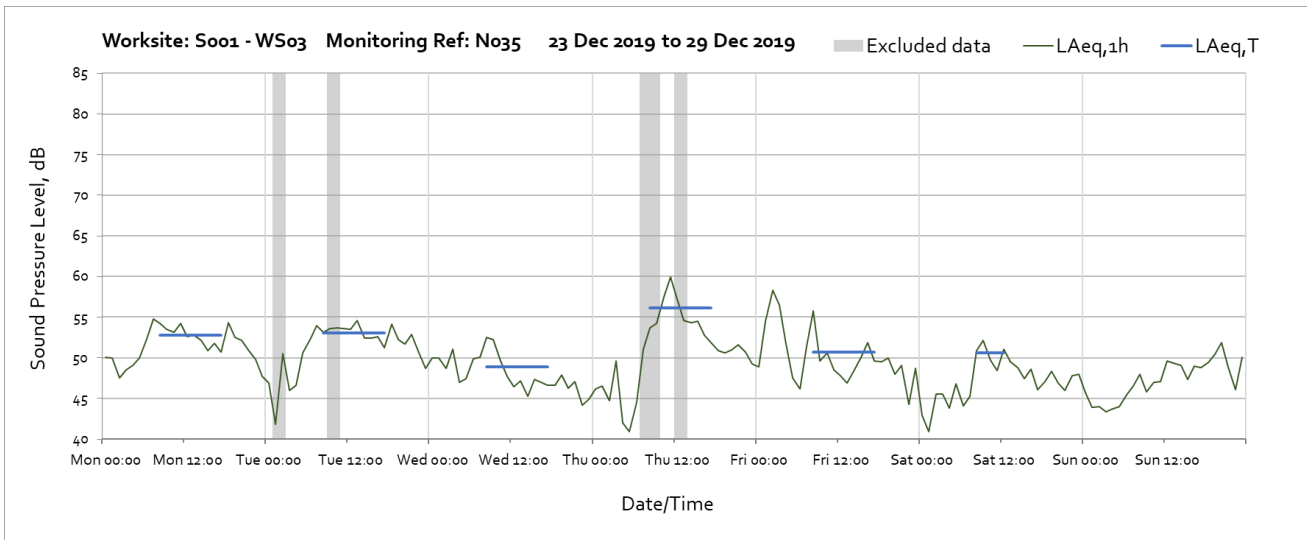
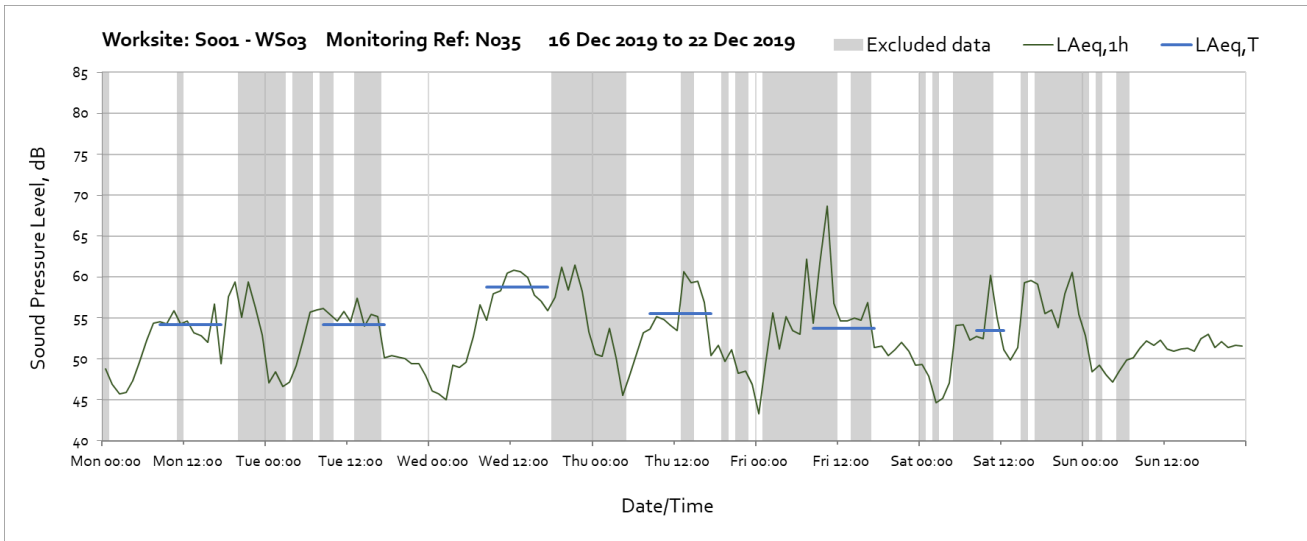
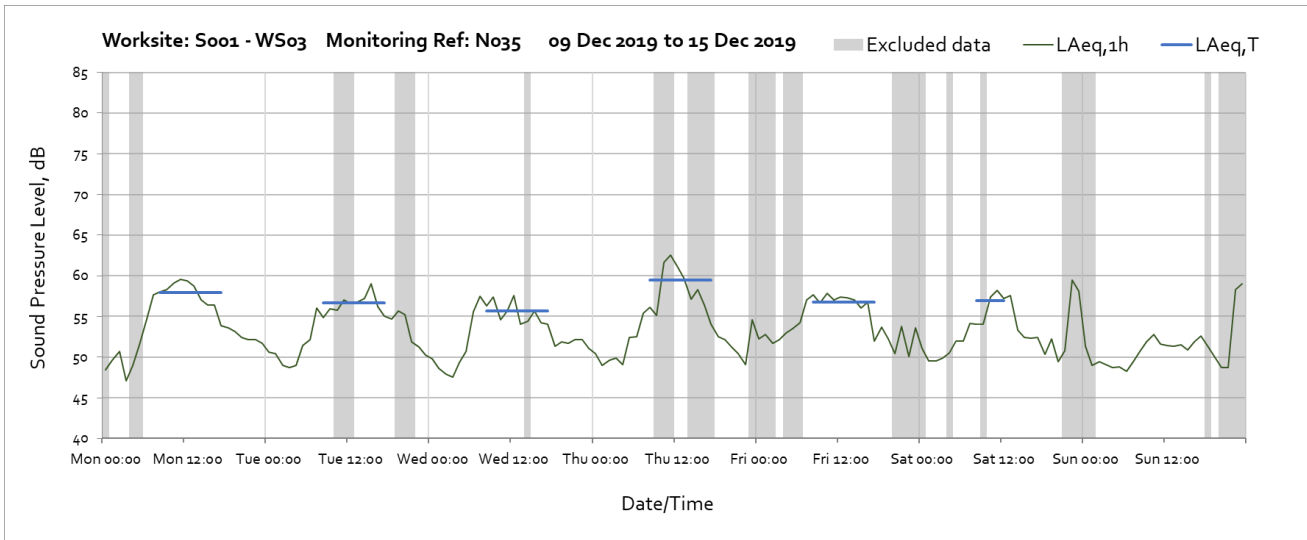


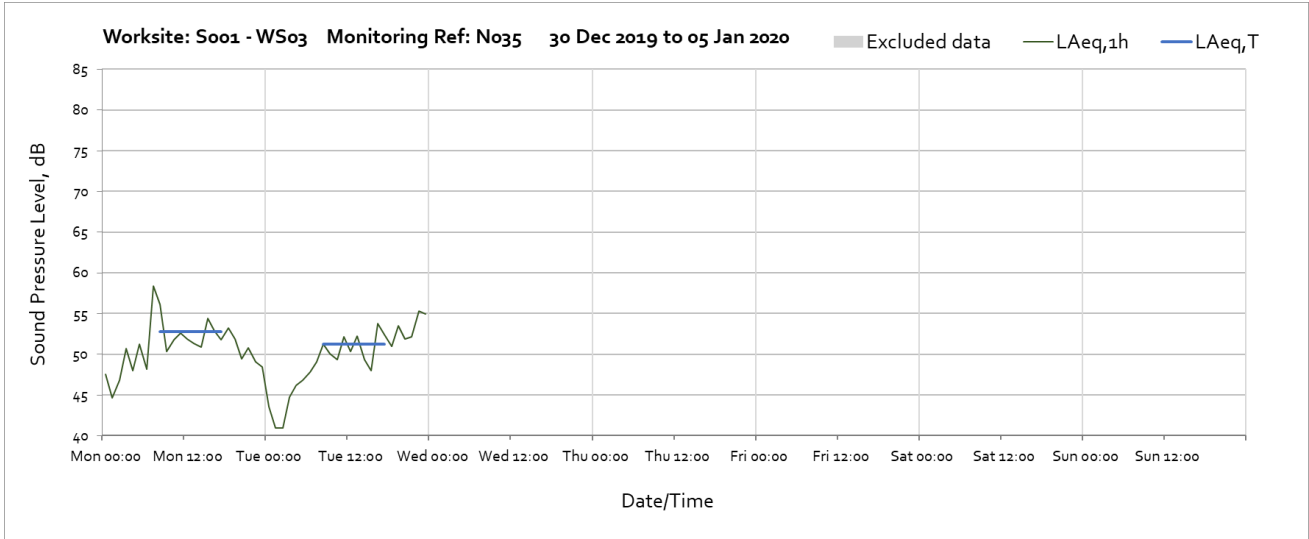




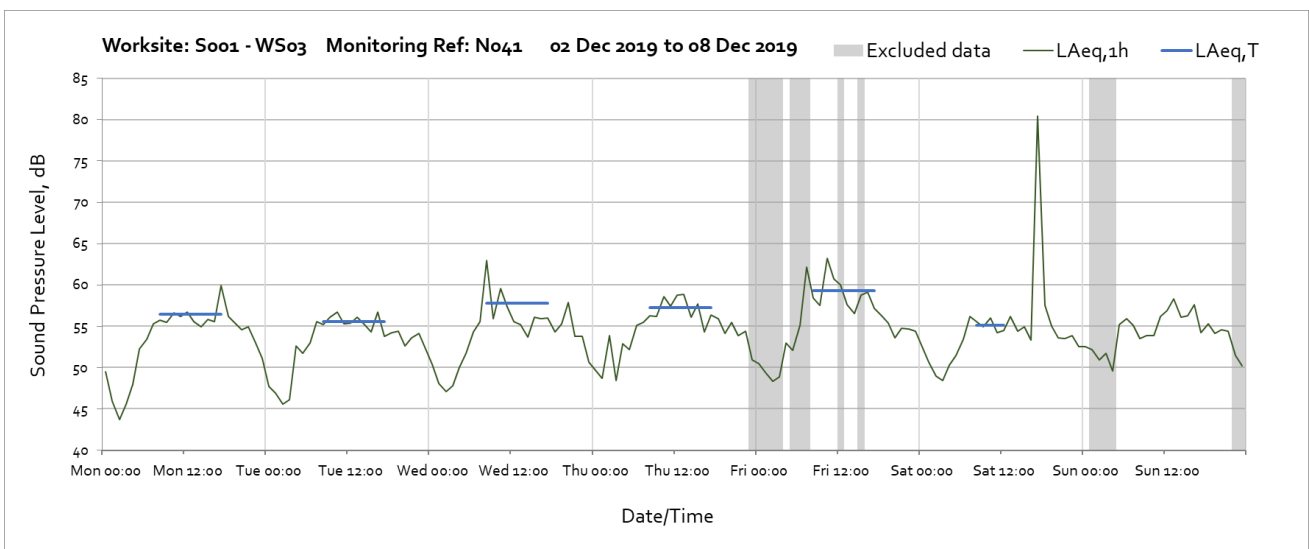
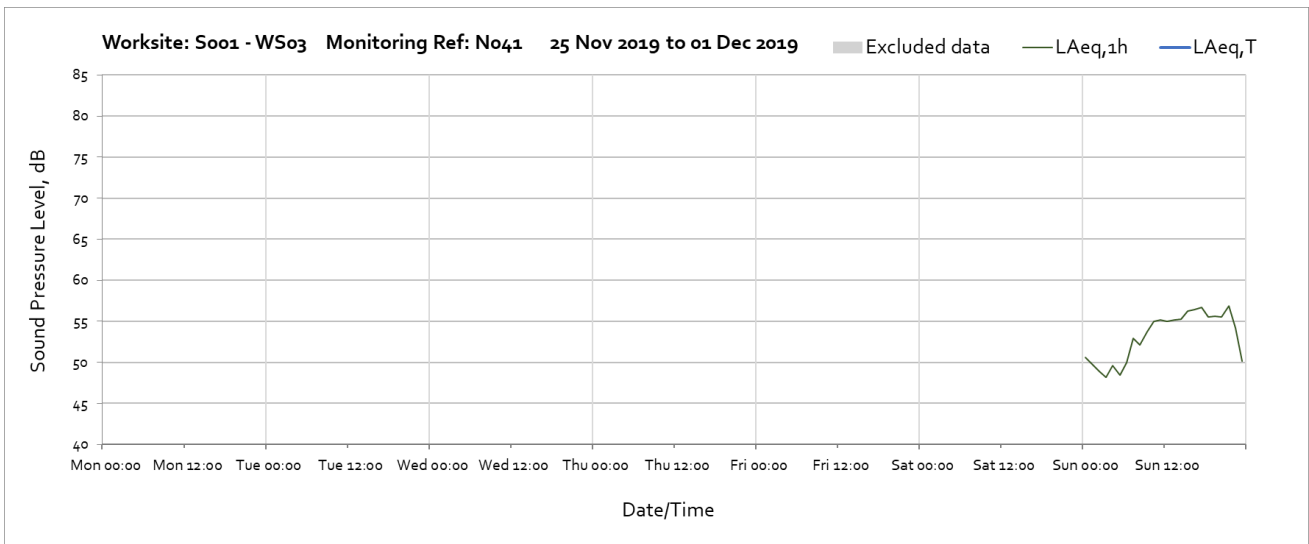
## Worksite: S001-WS03 – Monitoring Ref: N035

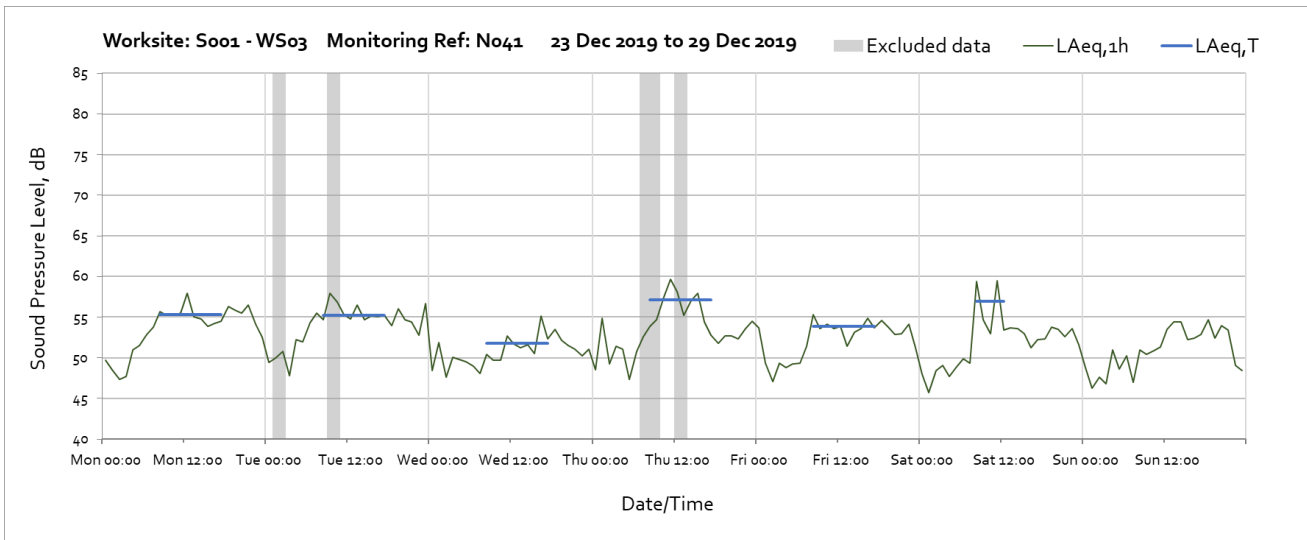
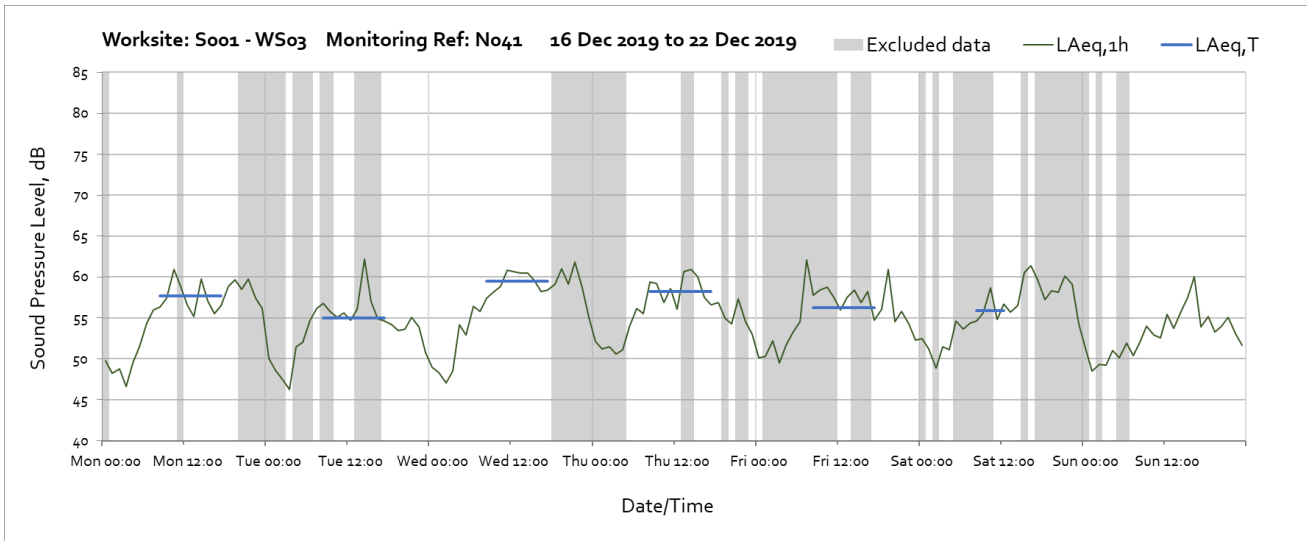
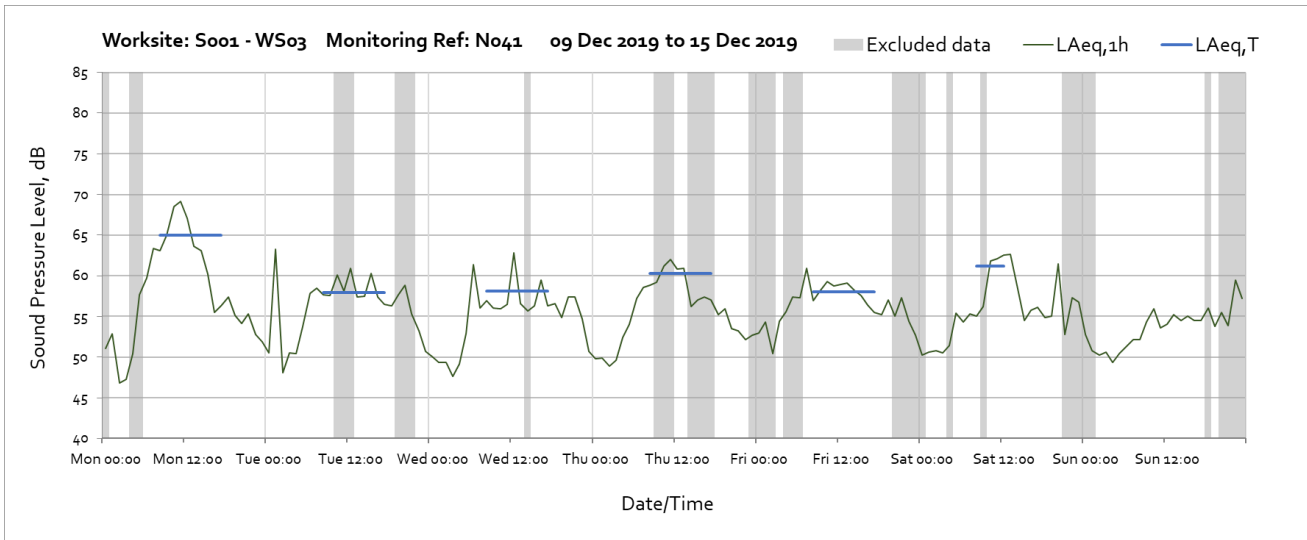


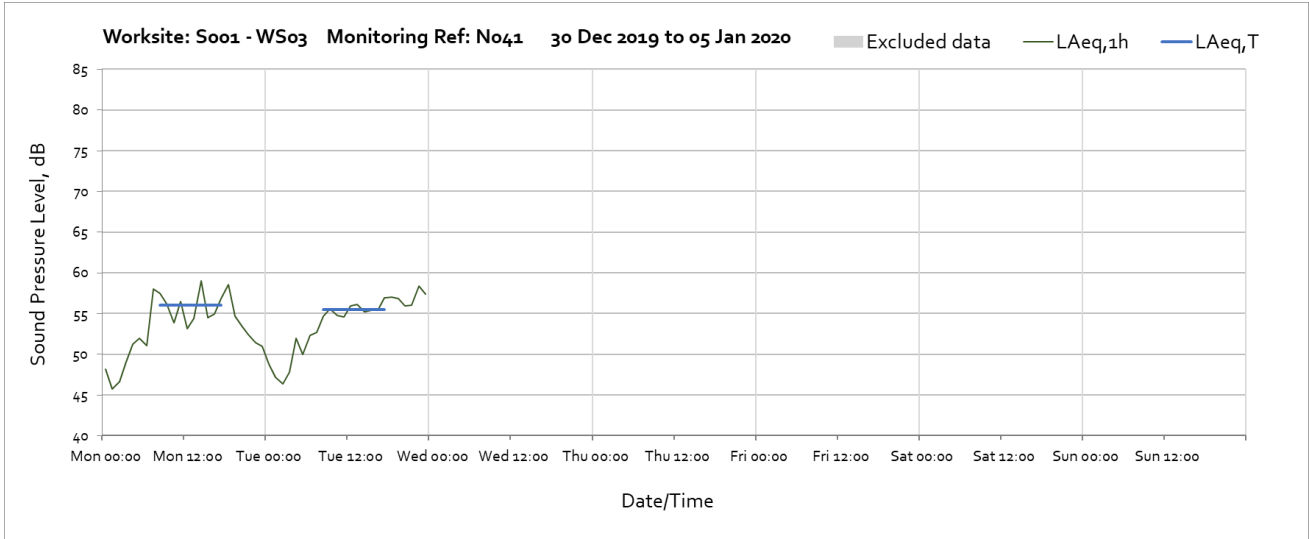




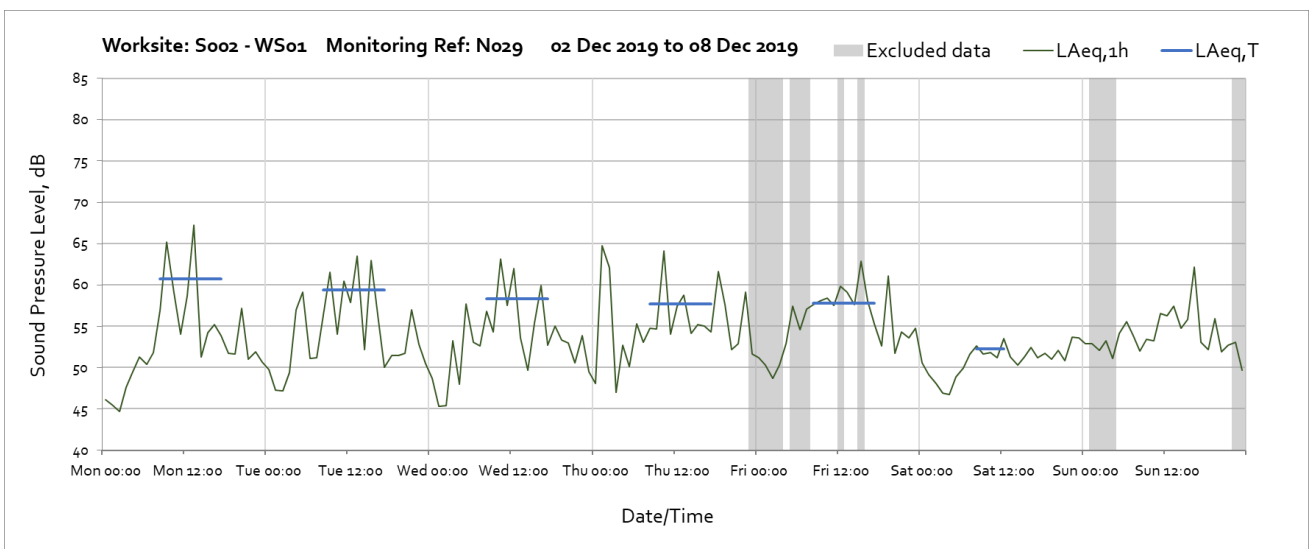
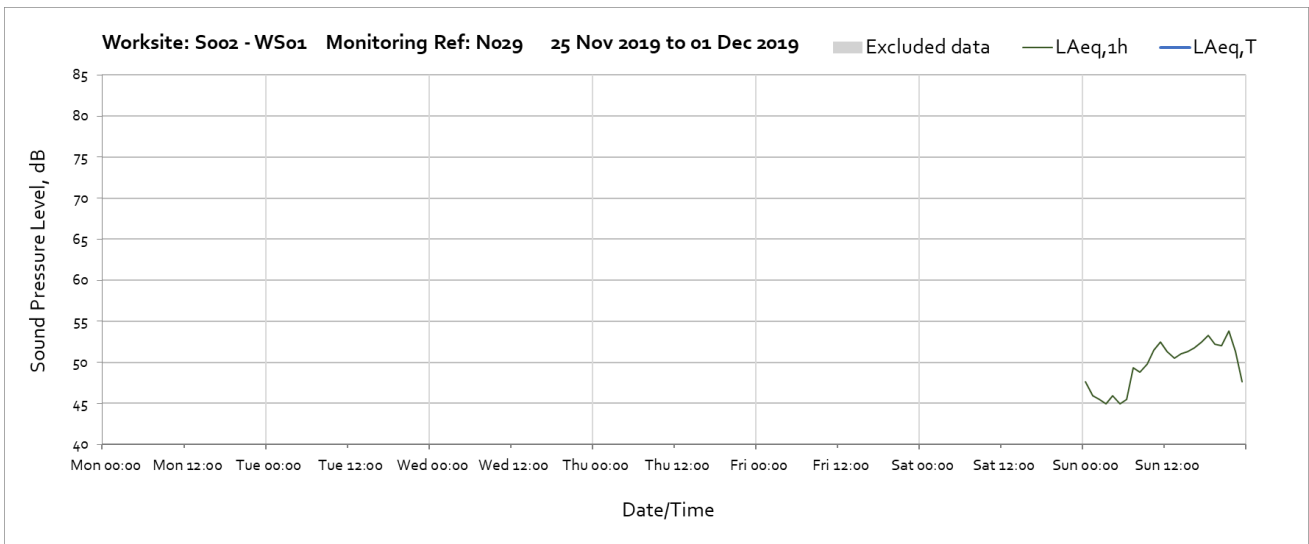
## Worksite: S001-WS03 – Monitoring Ref: N041

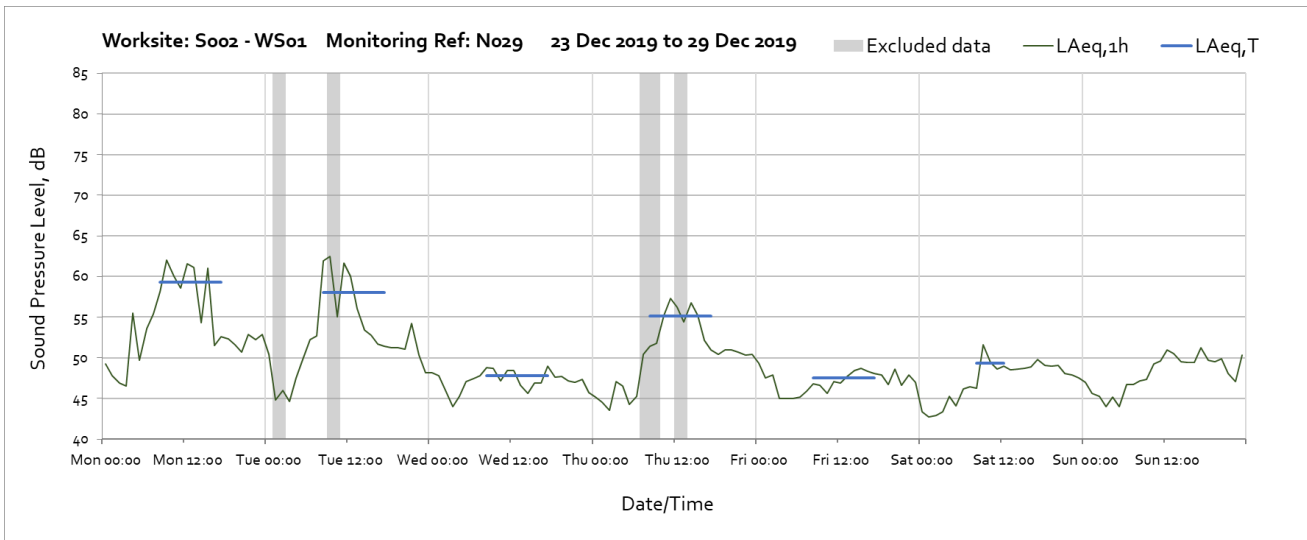
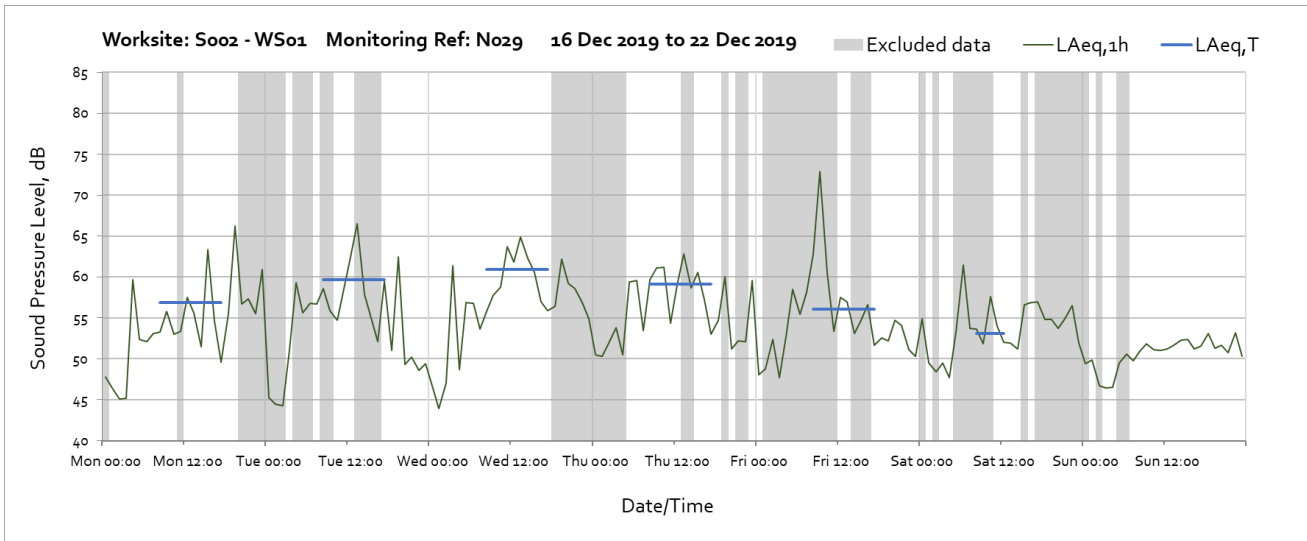
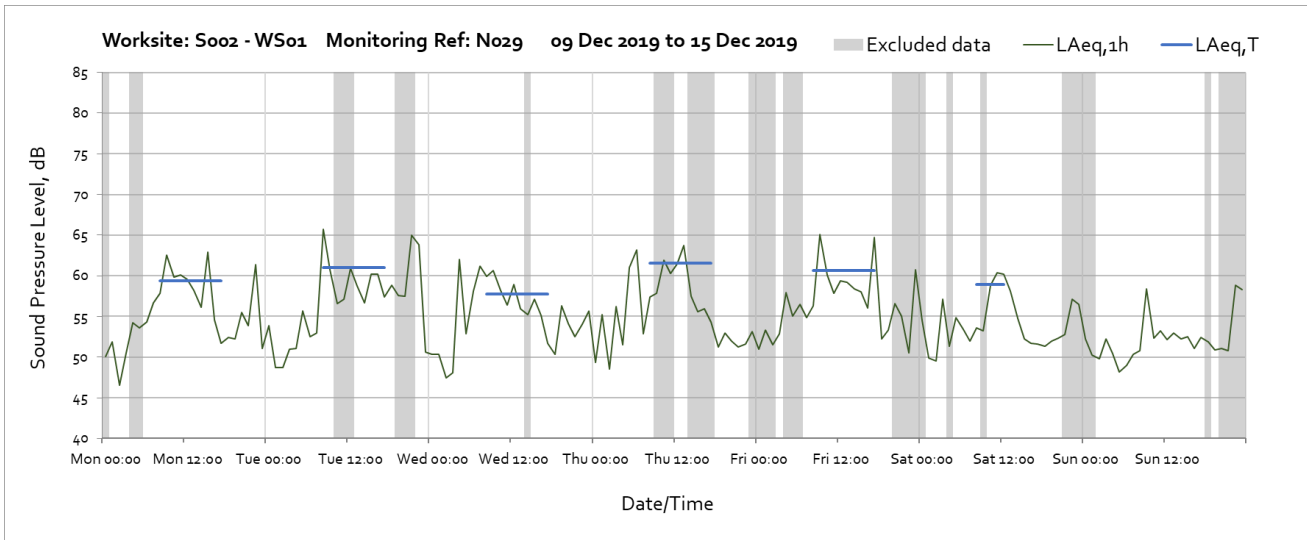




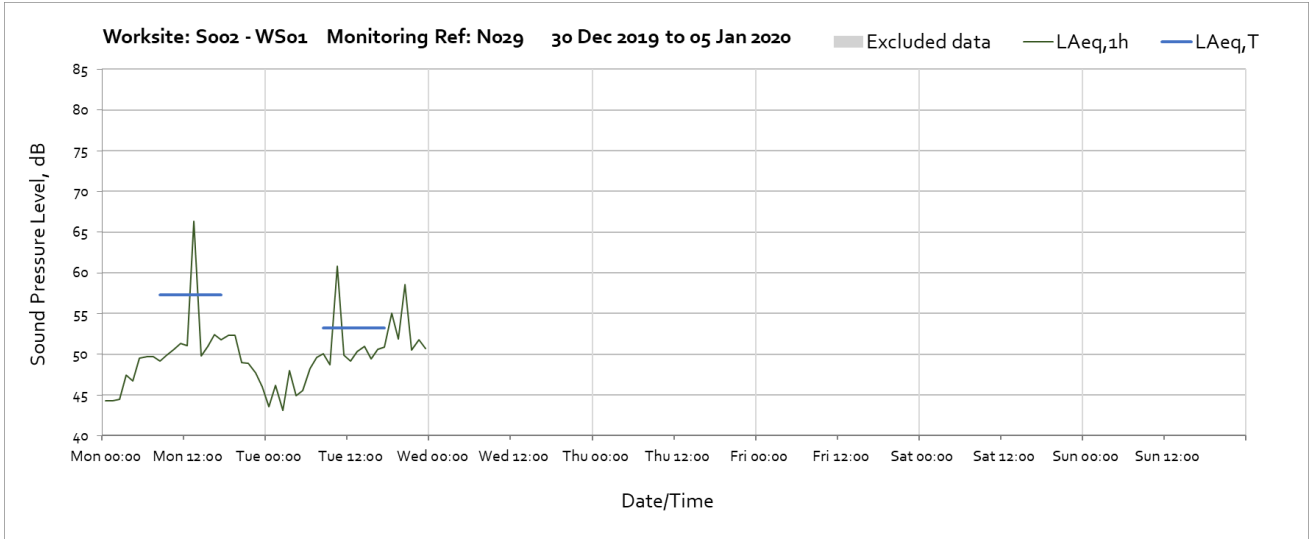


## Worksite: S002-WS01 – Monitoring Ref: N029

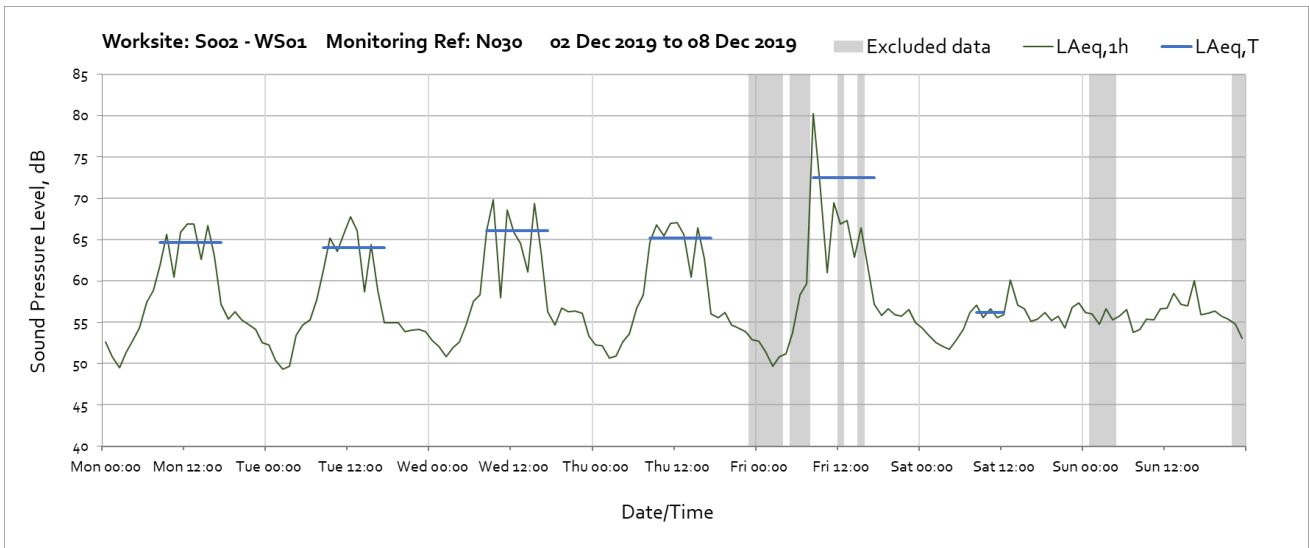
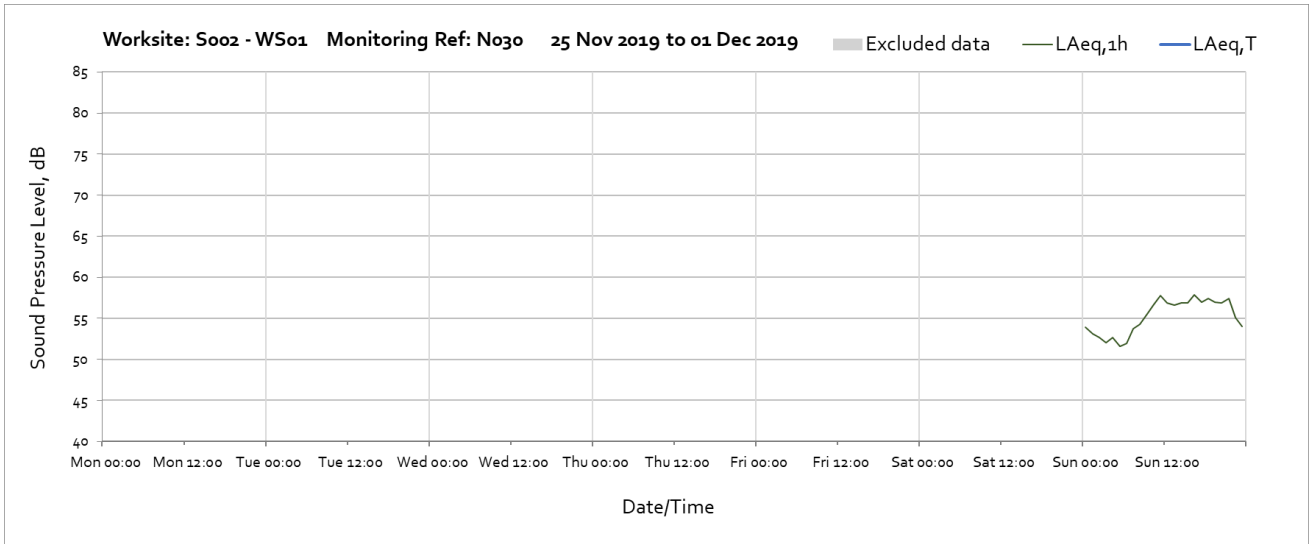


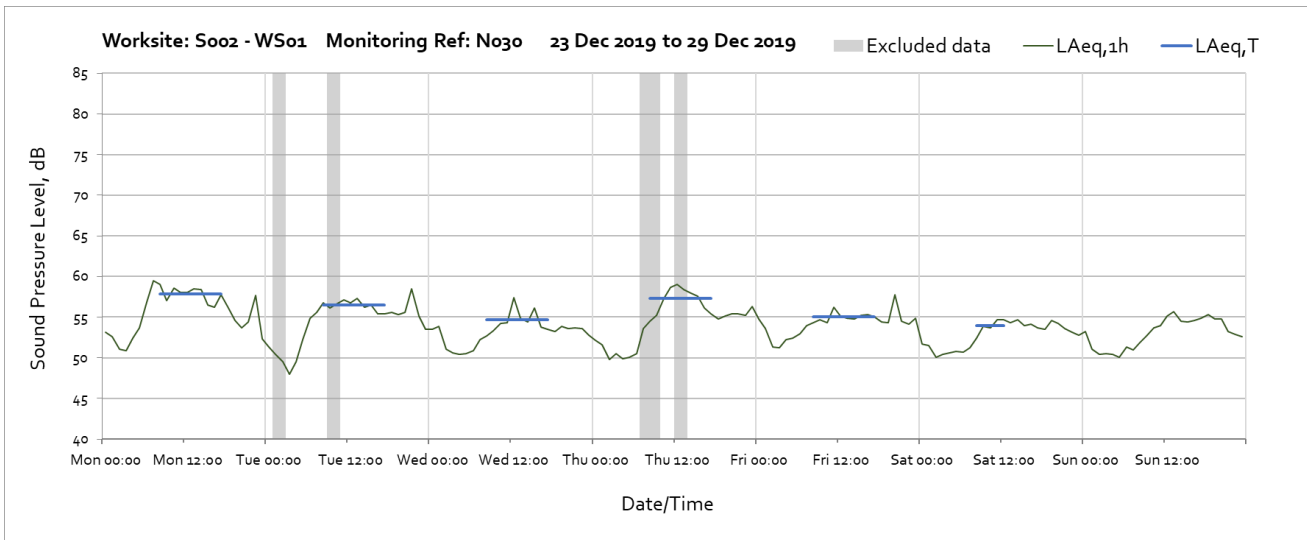
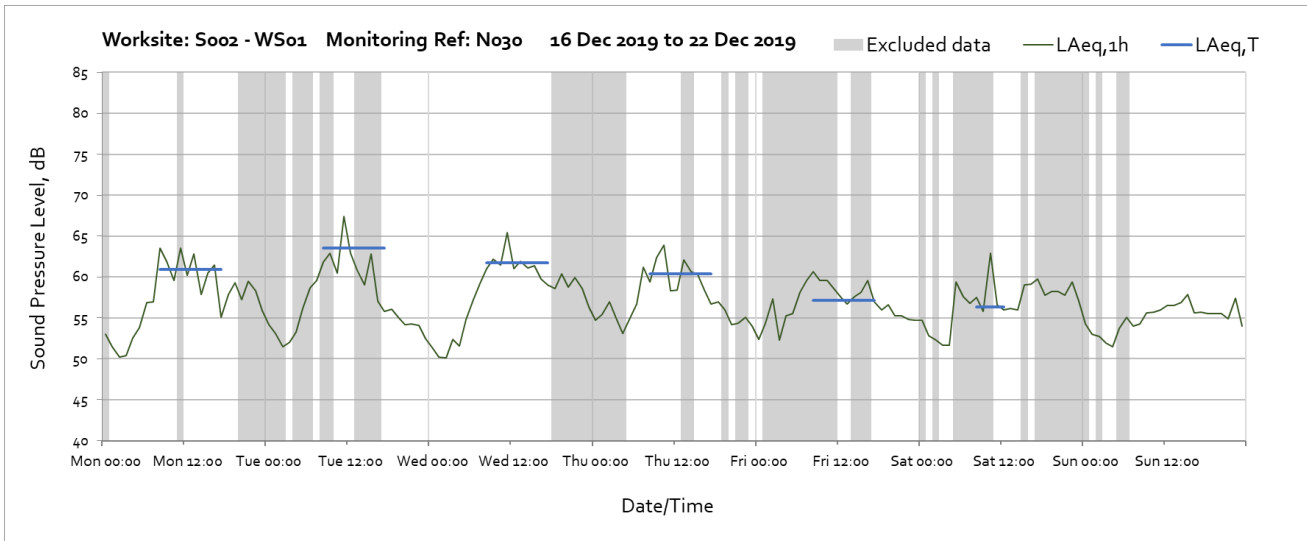
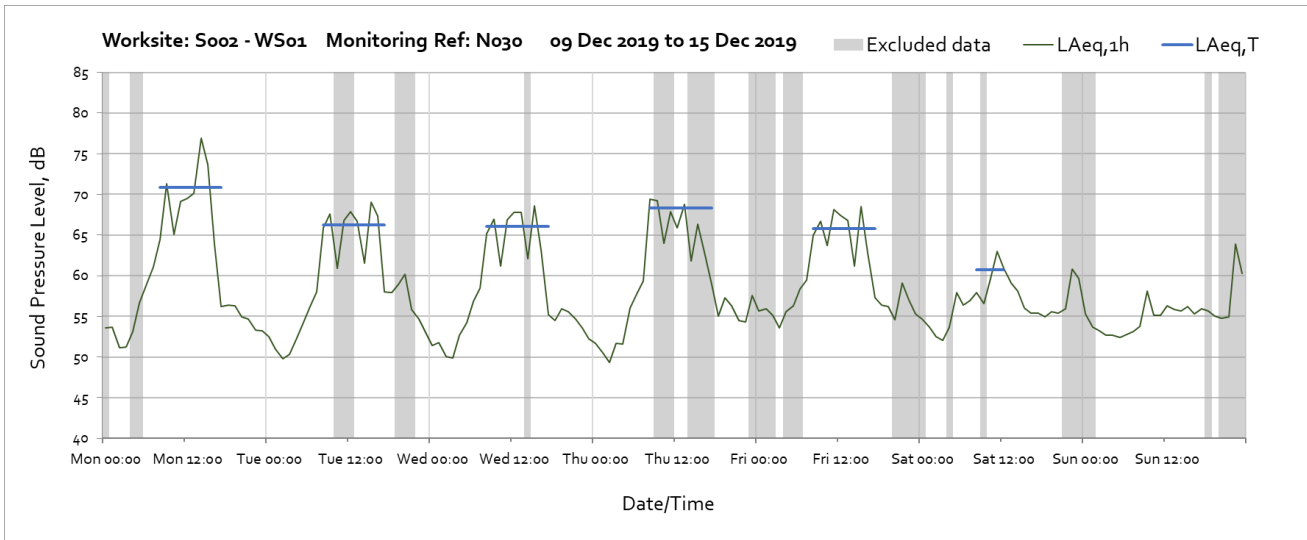


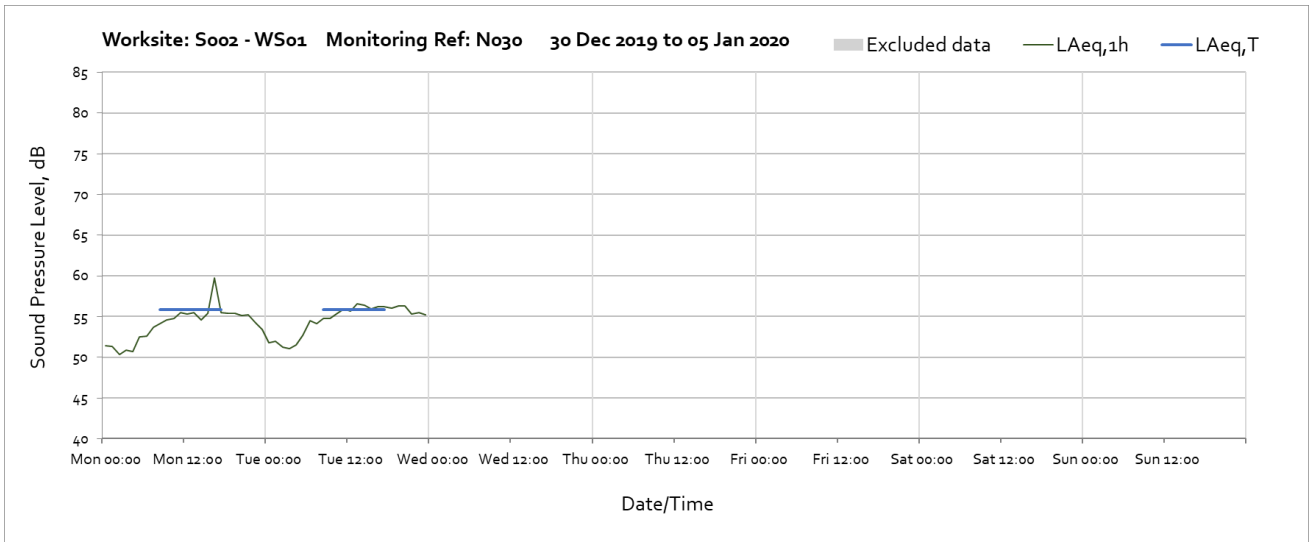




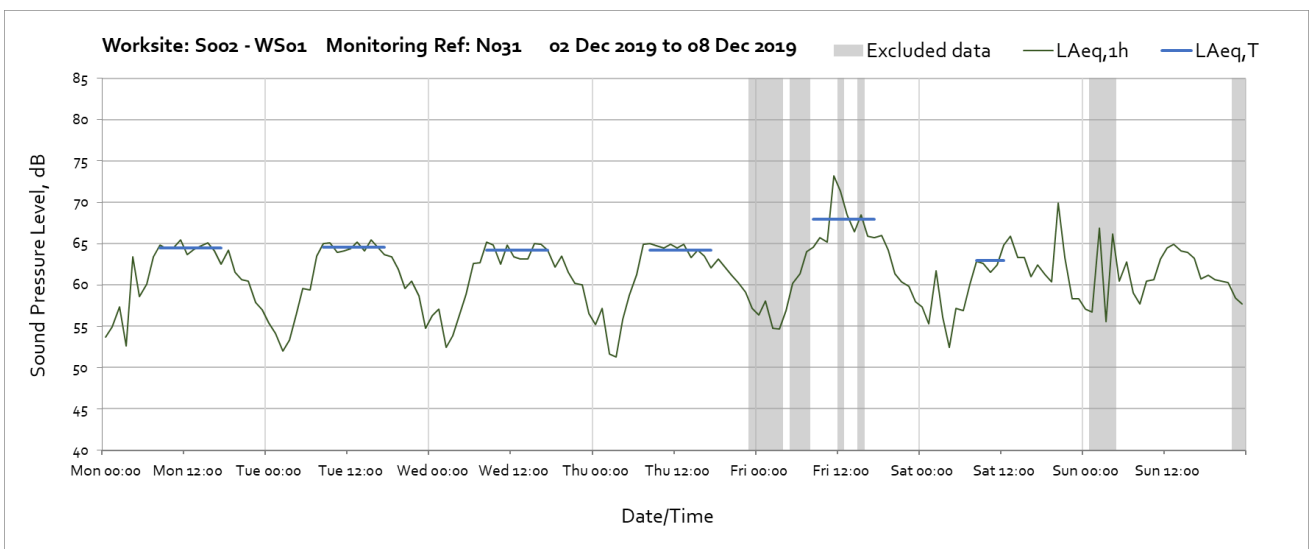
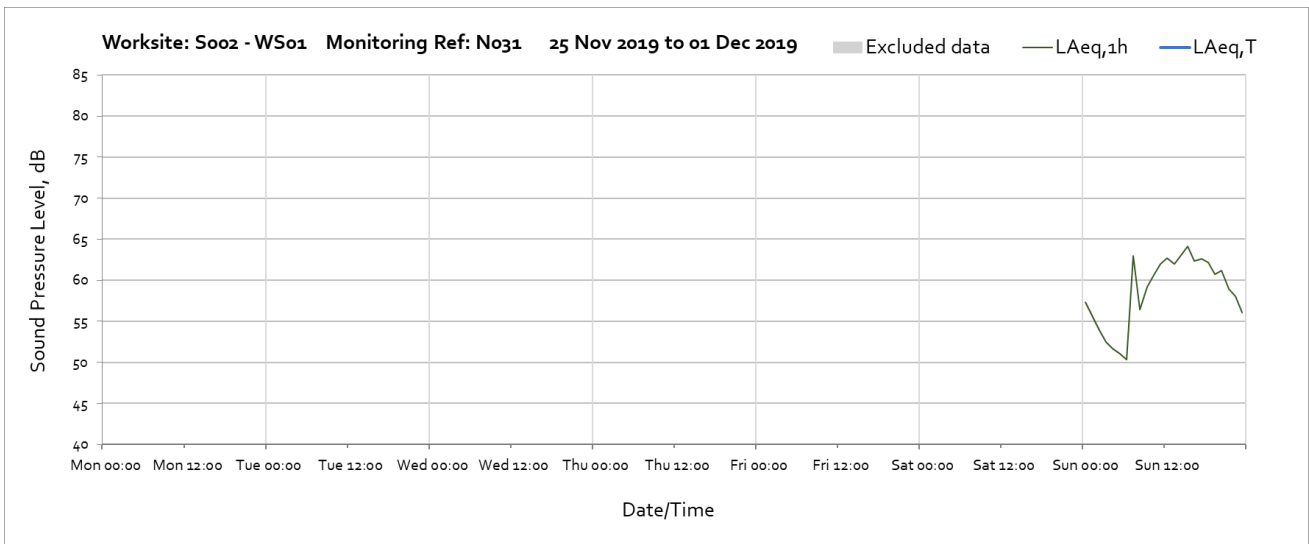
**Worksite: S002-WS01 – Monitoring Ref: N030**

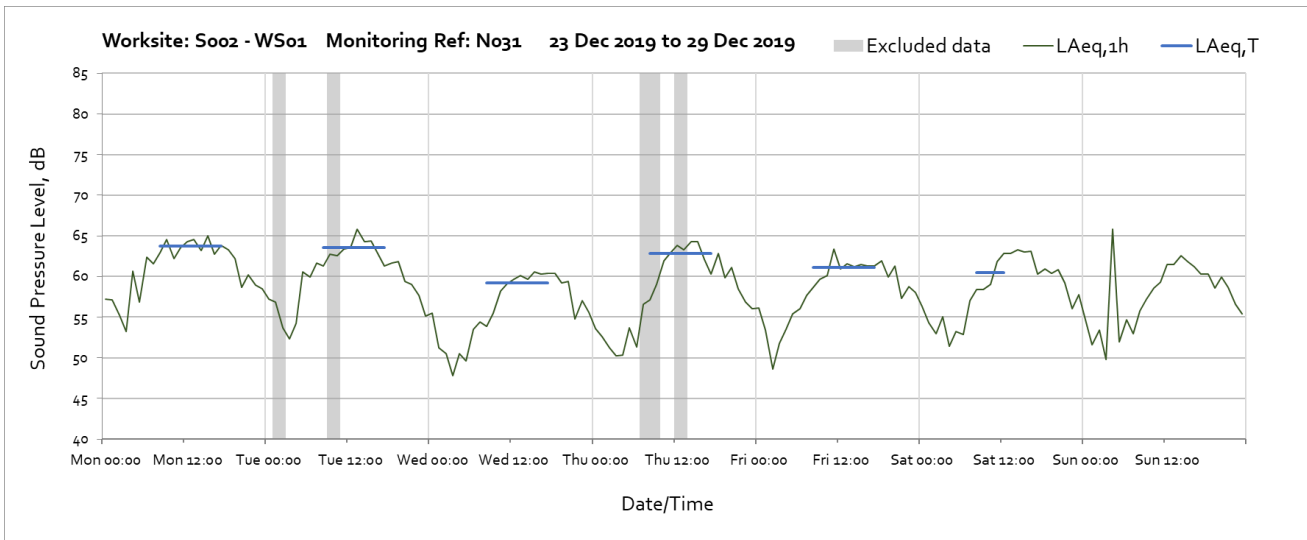
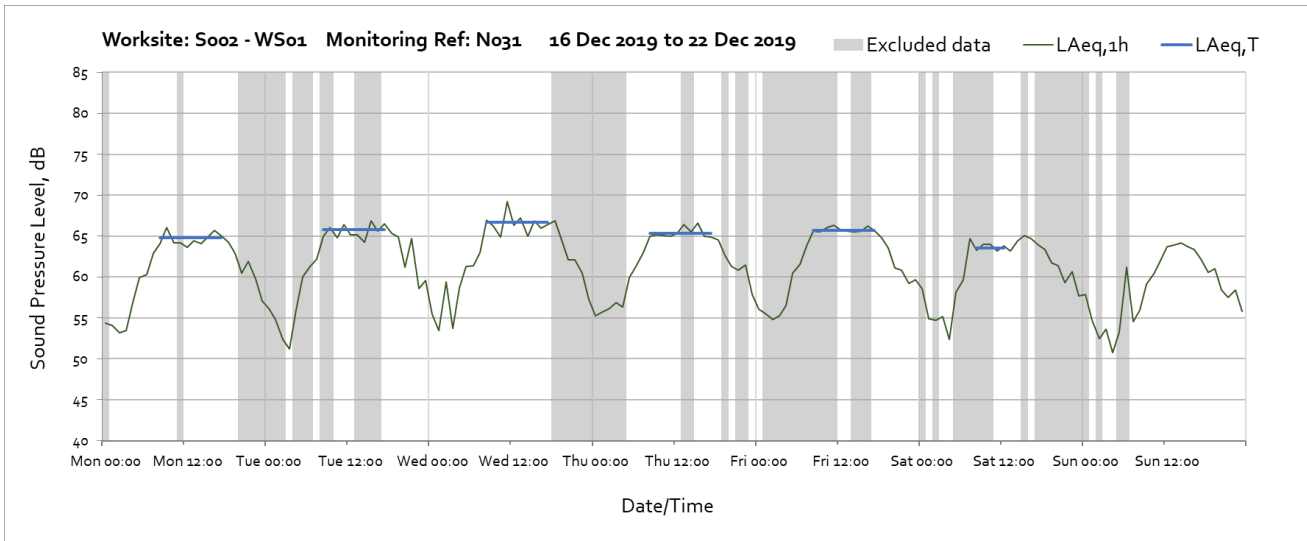
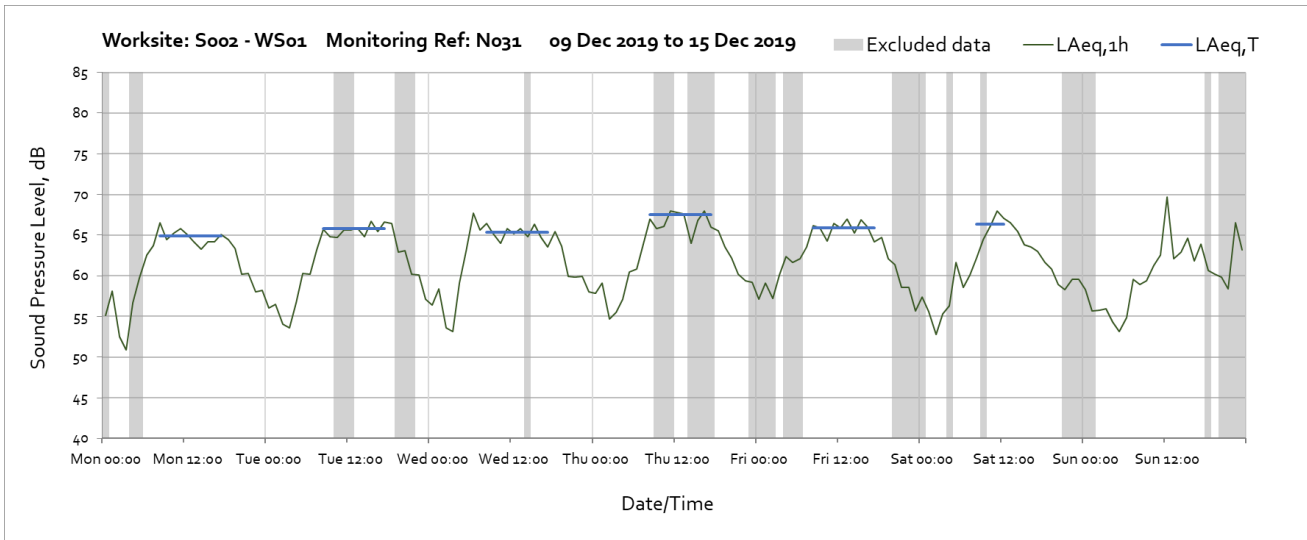


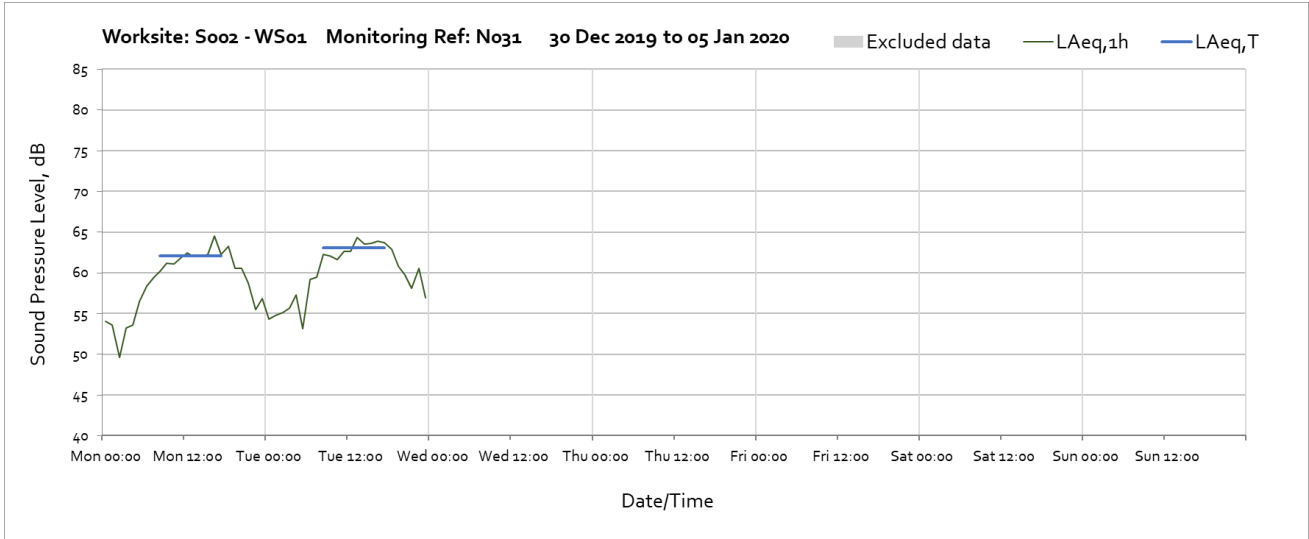




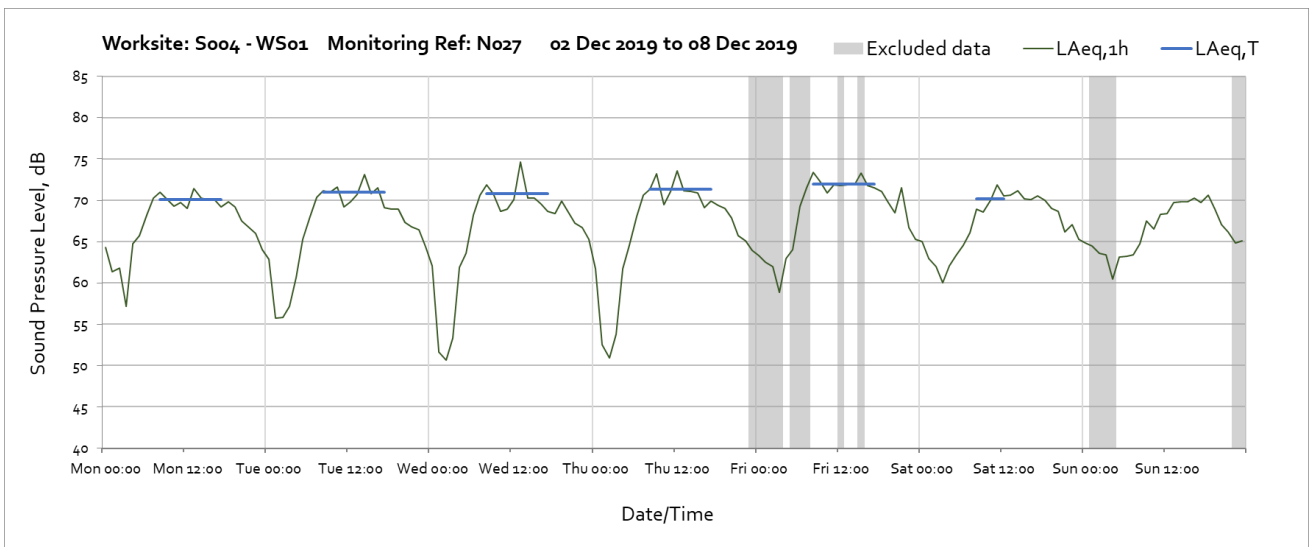
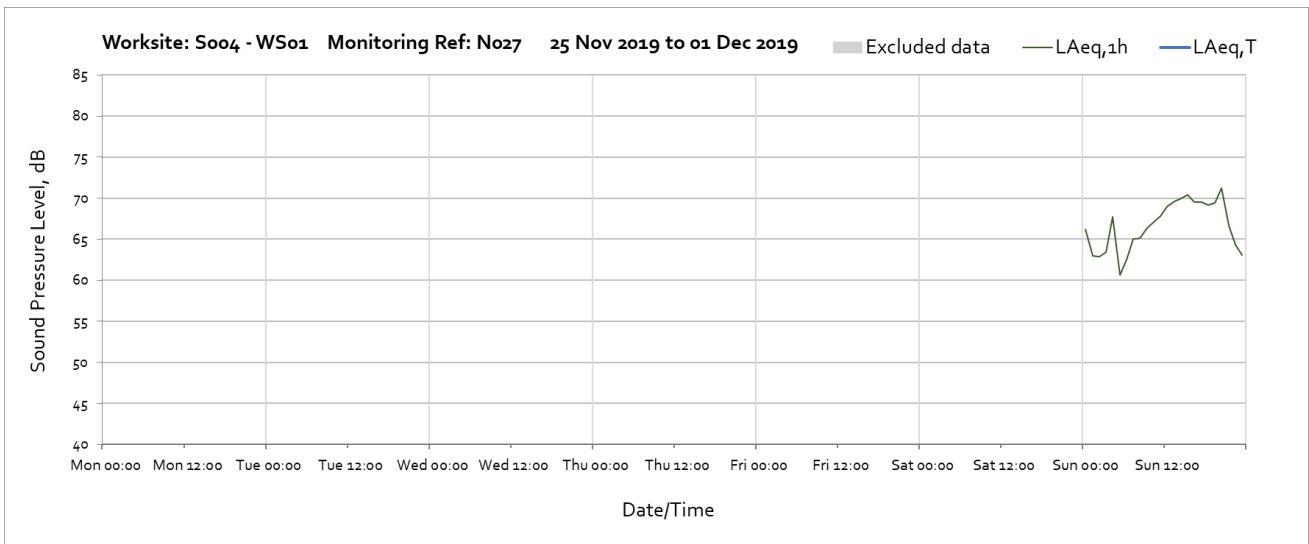
## Worksite: S002-WS01 – Monitoring Ref: N031

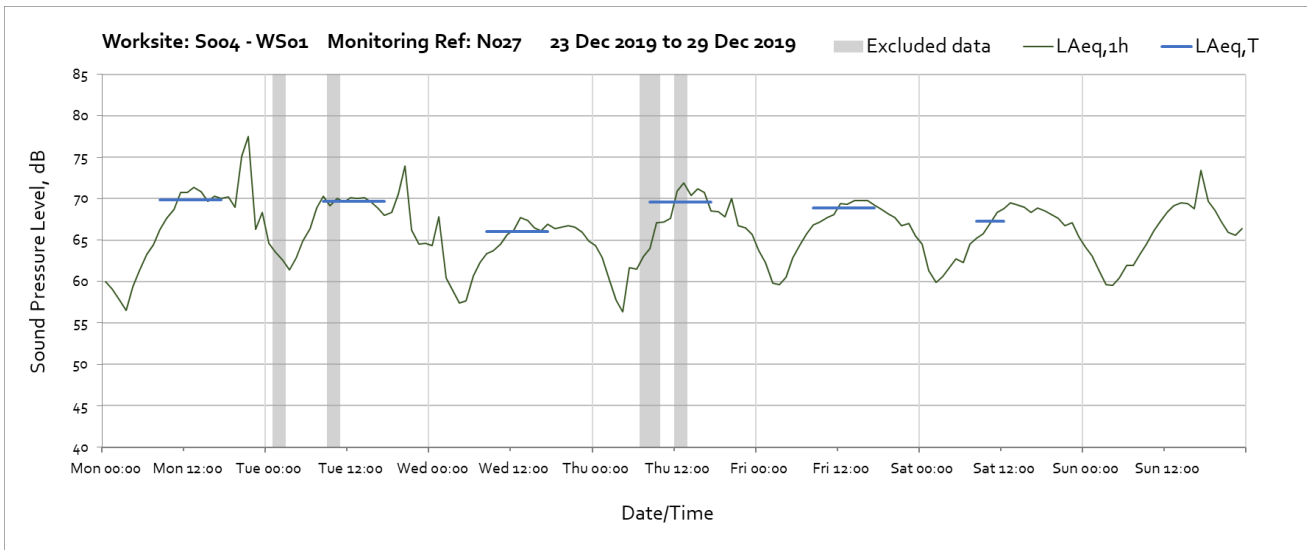
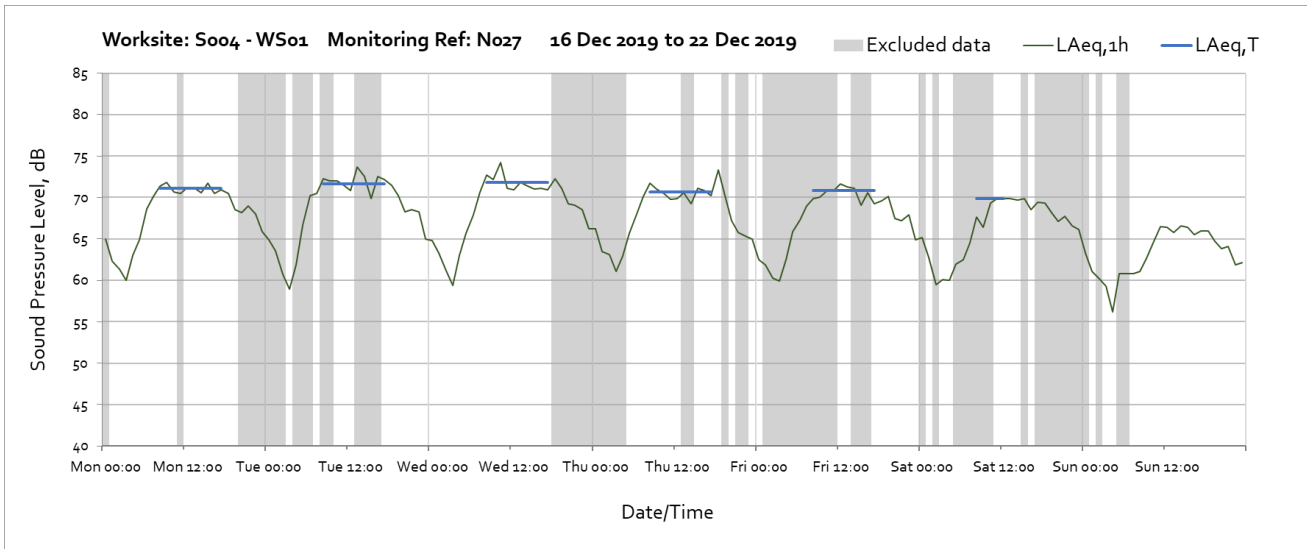
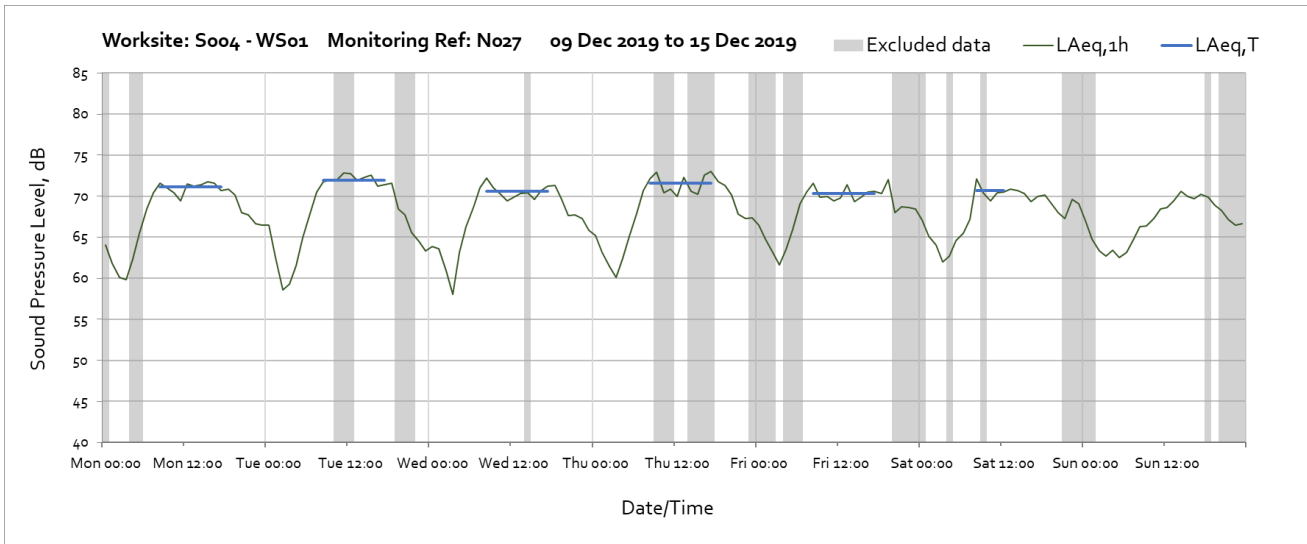


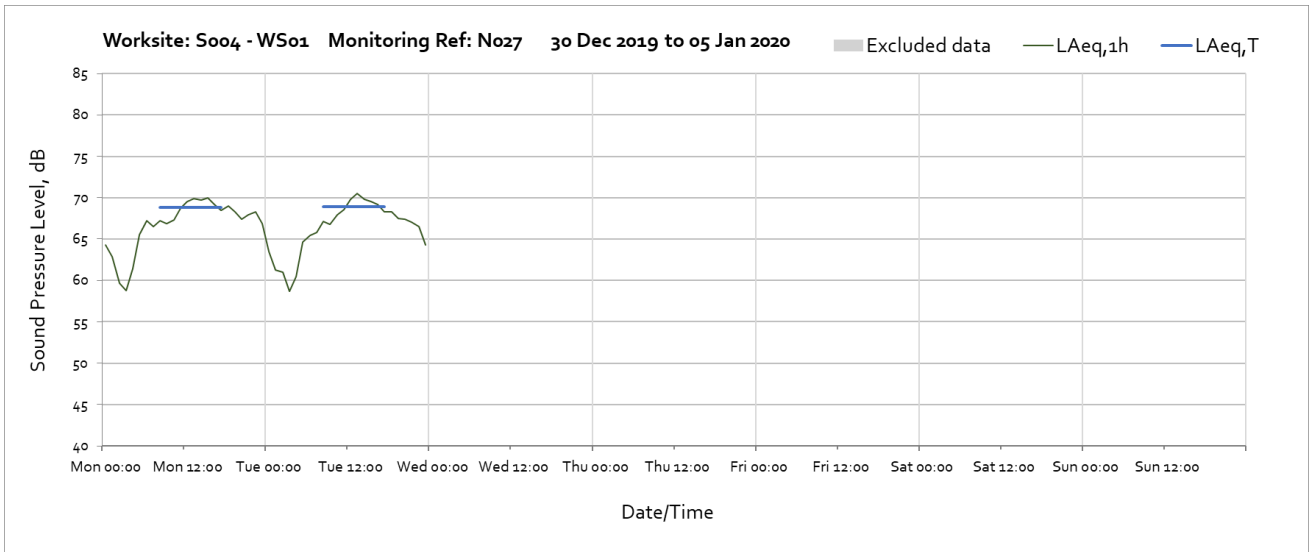




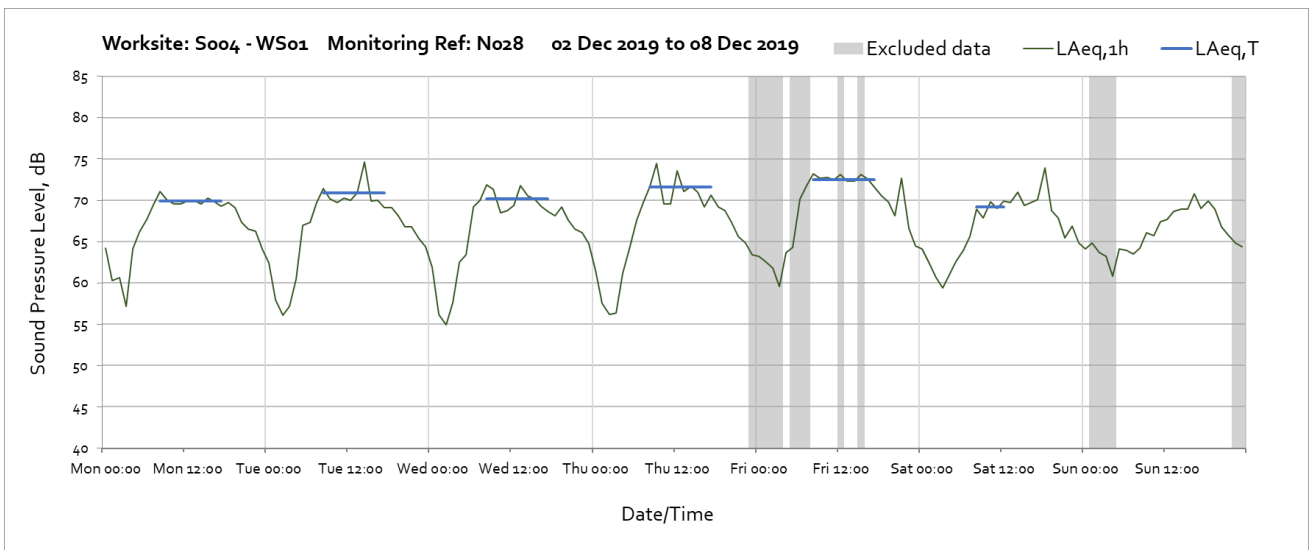
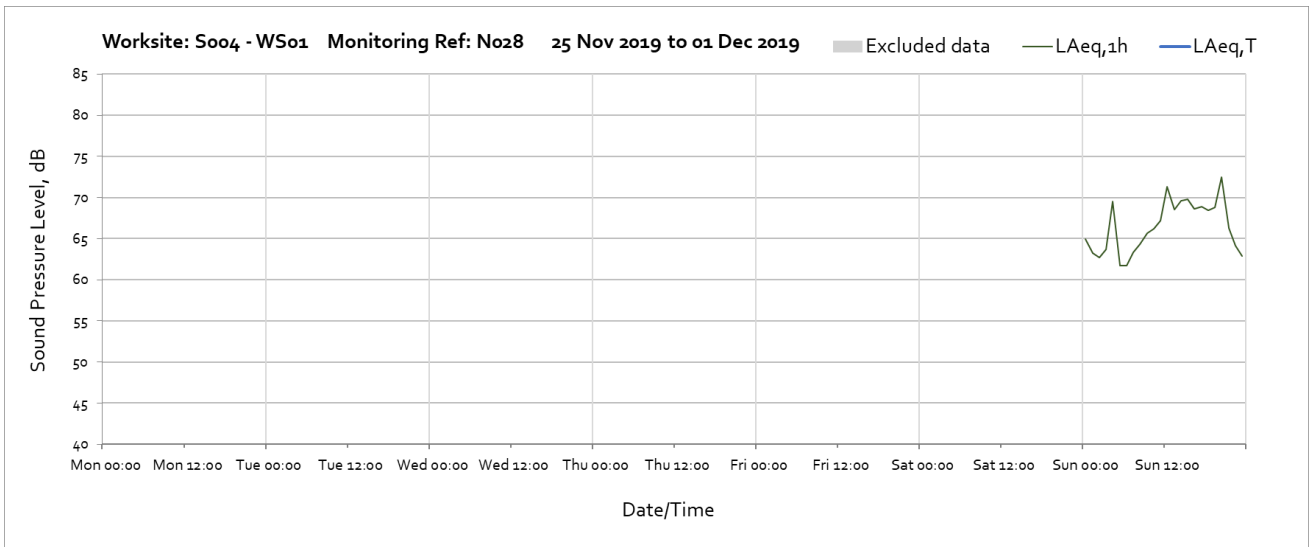
## Worksite: S004-WS01 – Monitoring Ref: N027

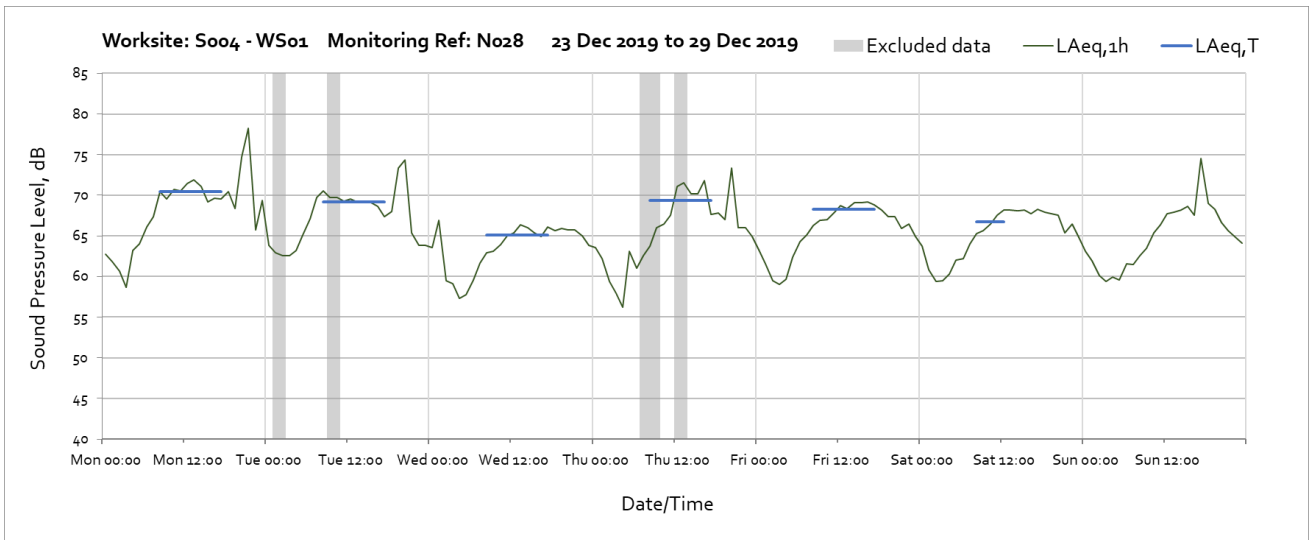
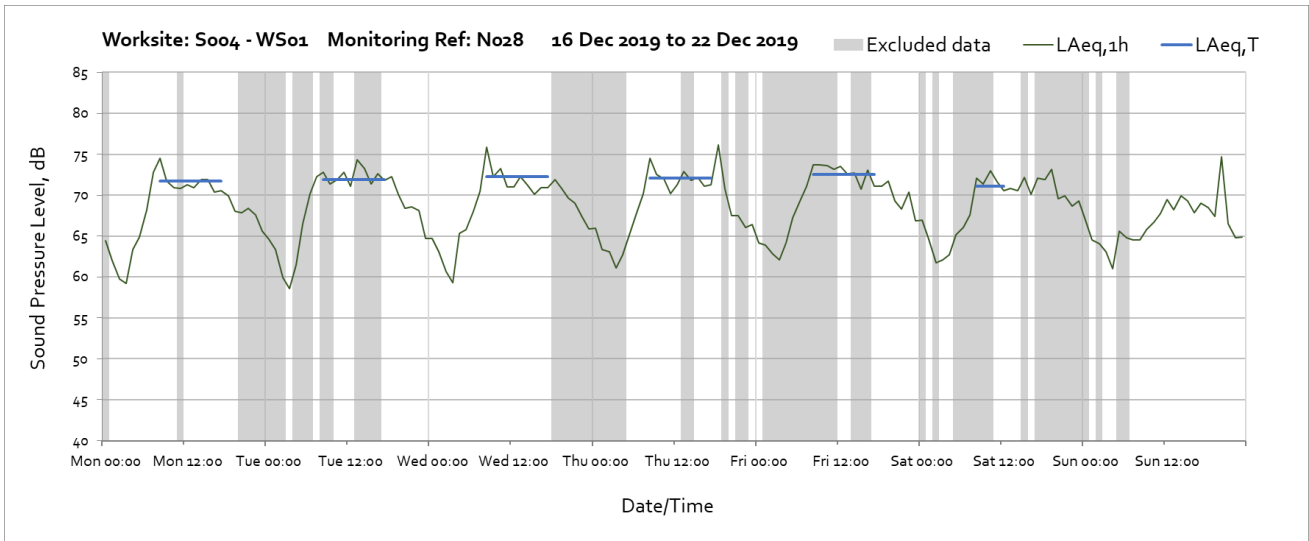
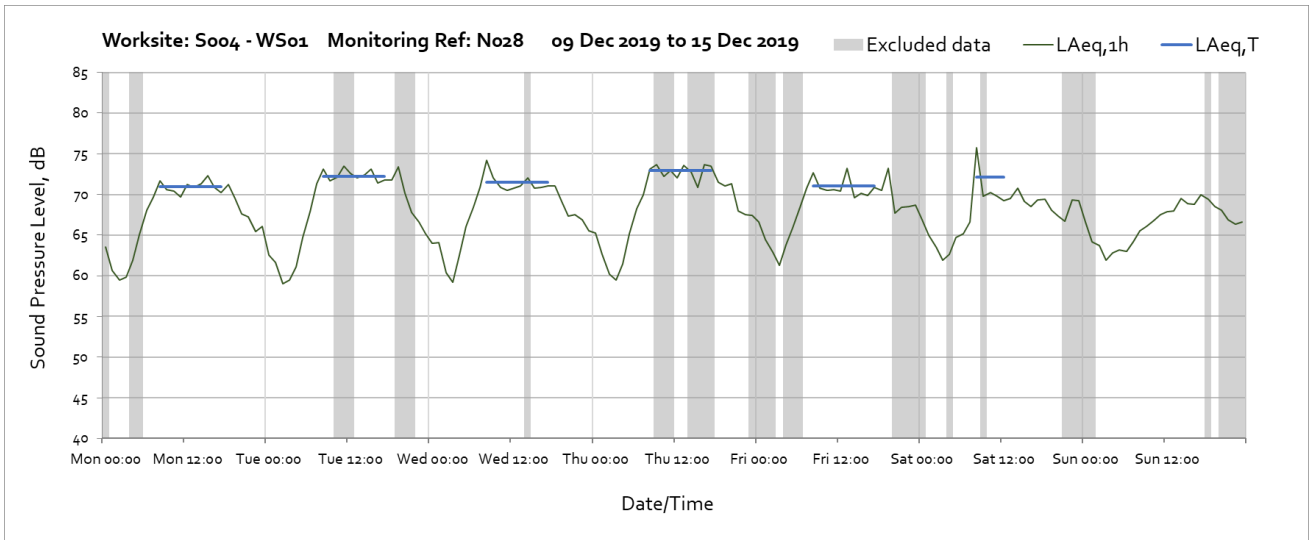




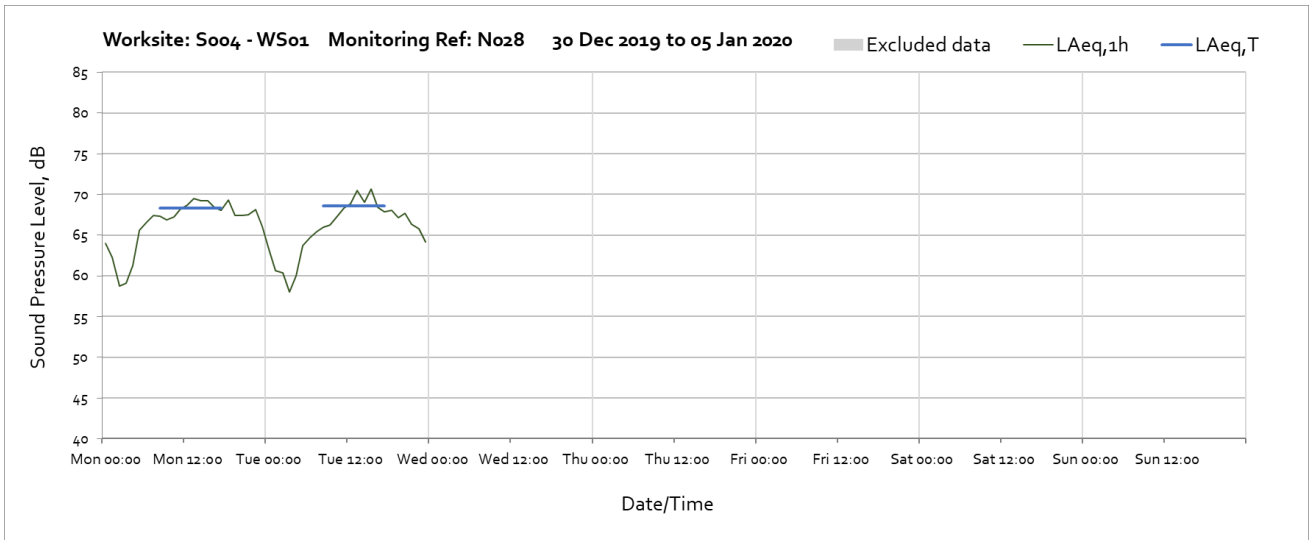


## Worksite: S004-WS01 – Monitoring Ref: N028

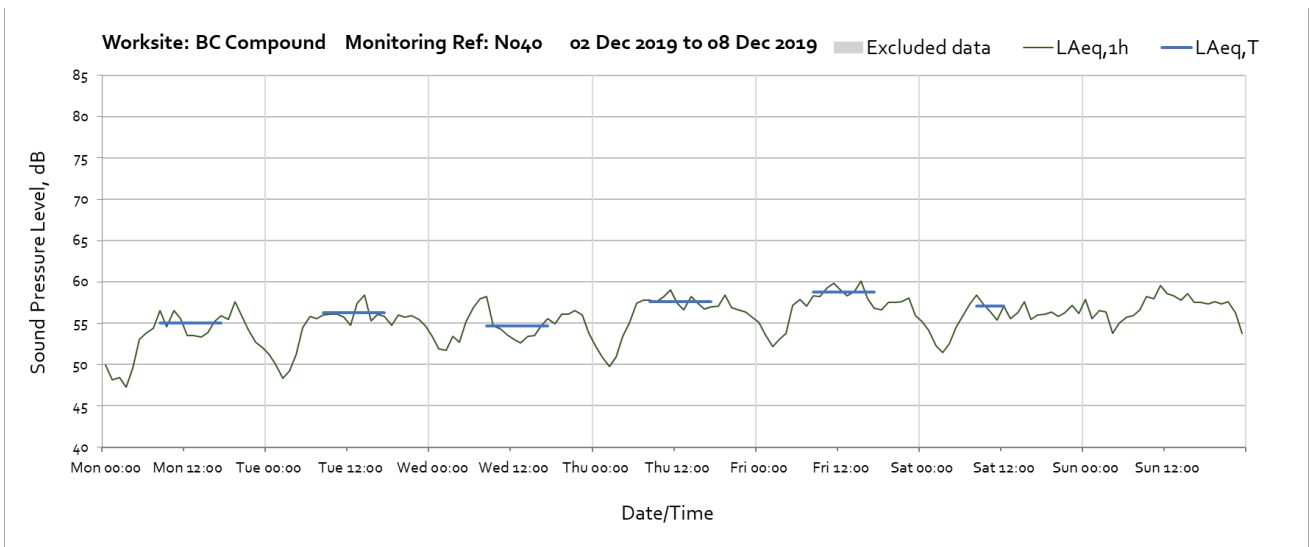
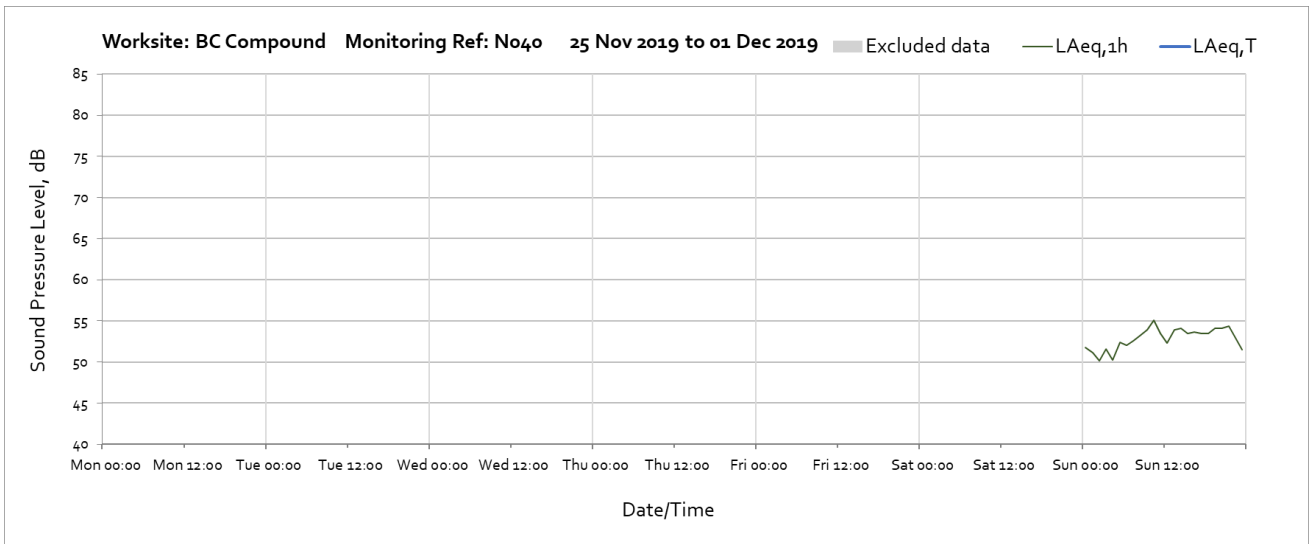


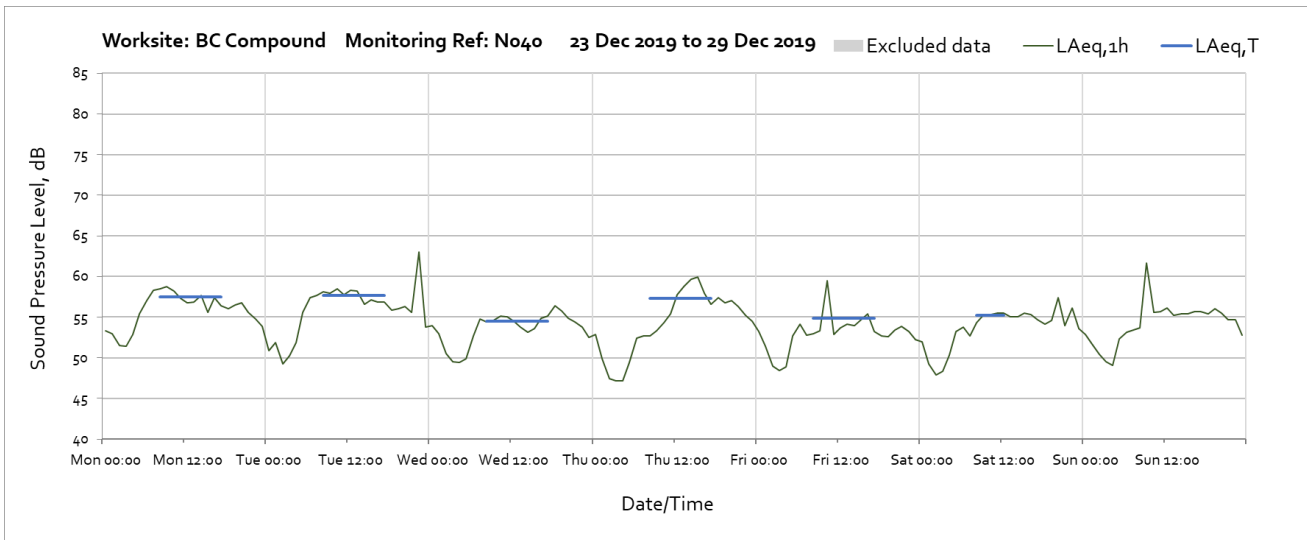
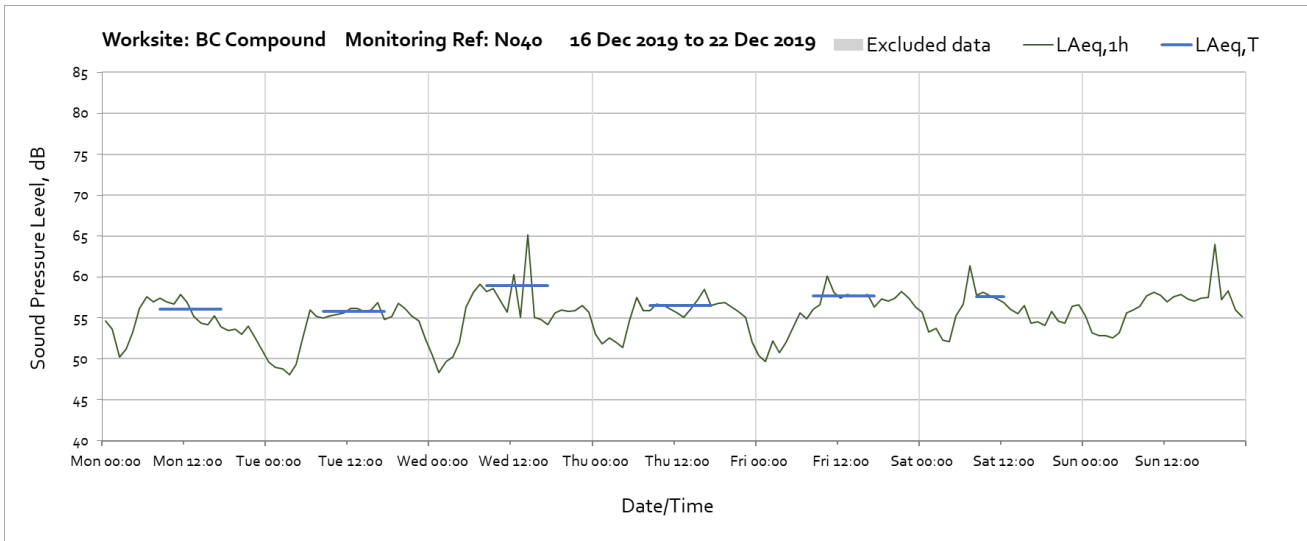
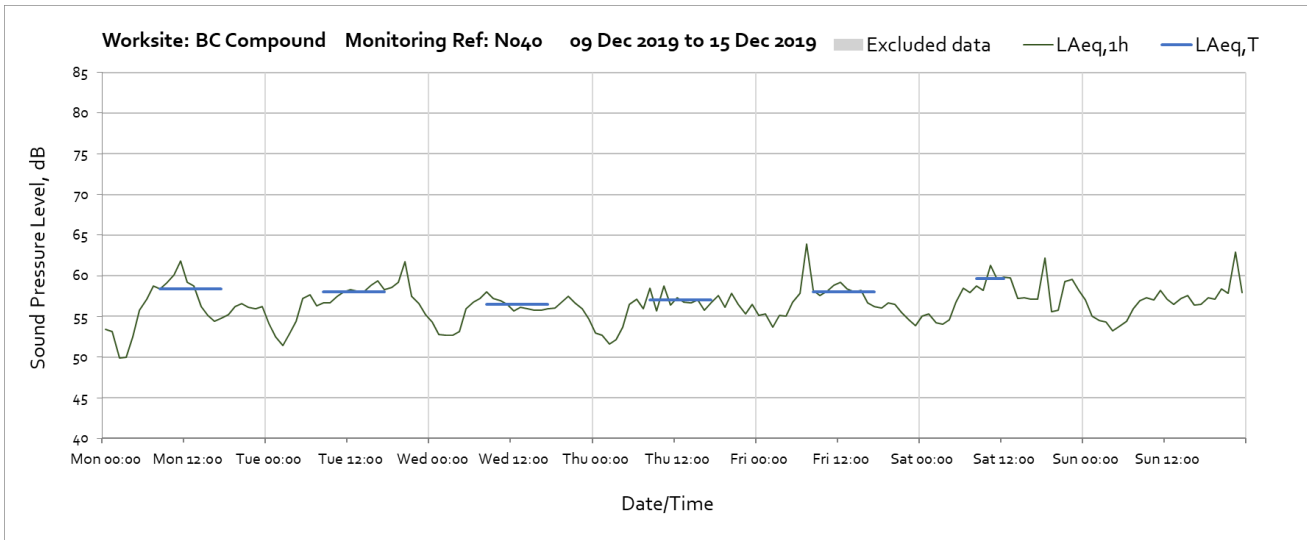


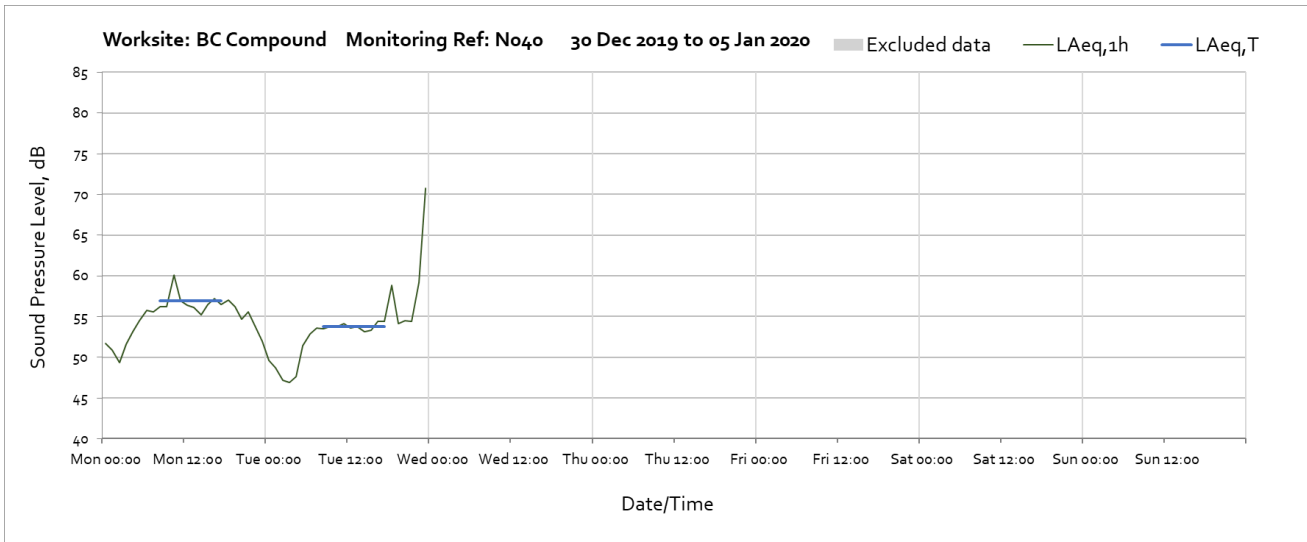




## Worksite: Badminton Close compound – Monitoring Ref: N040



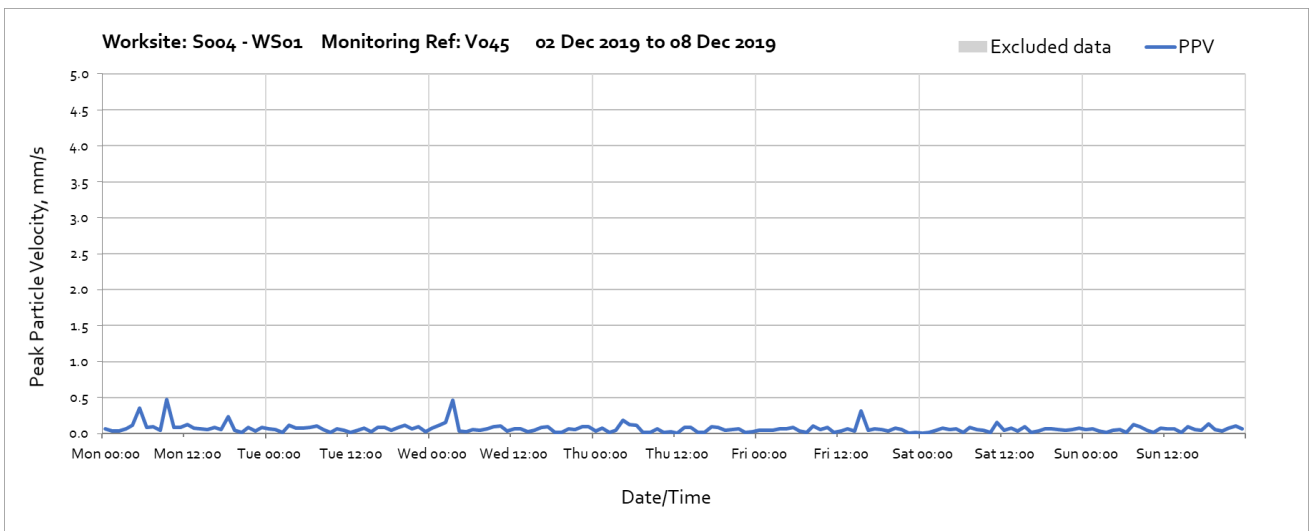
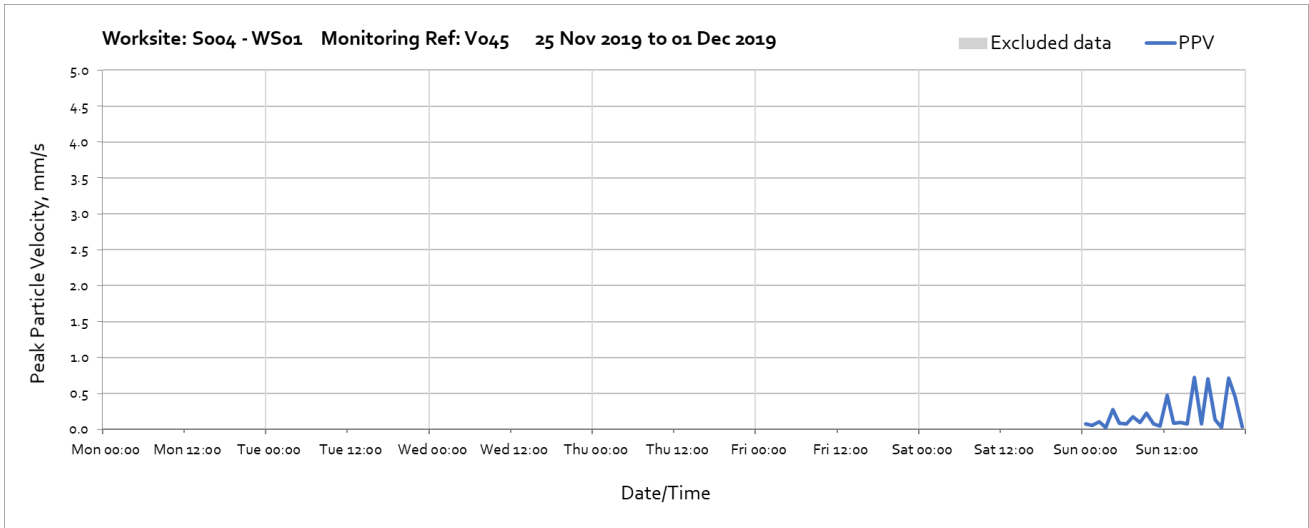


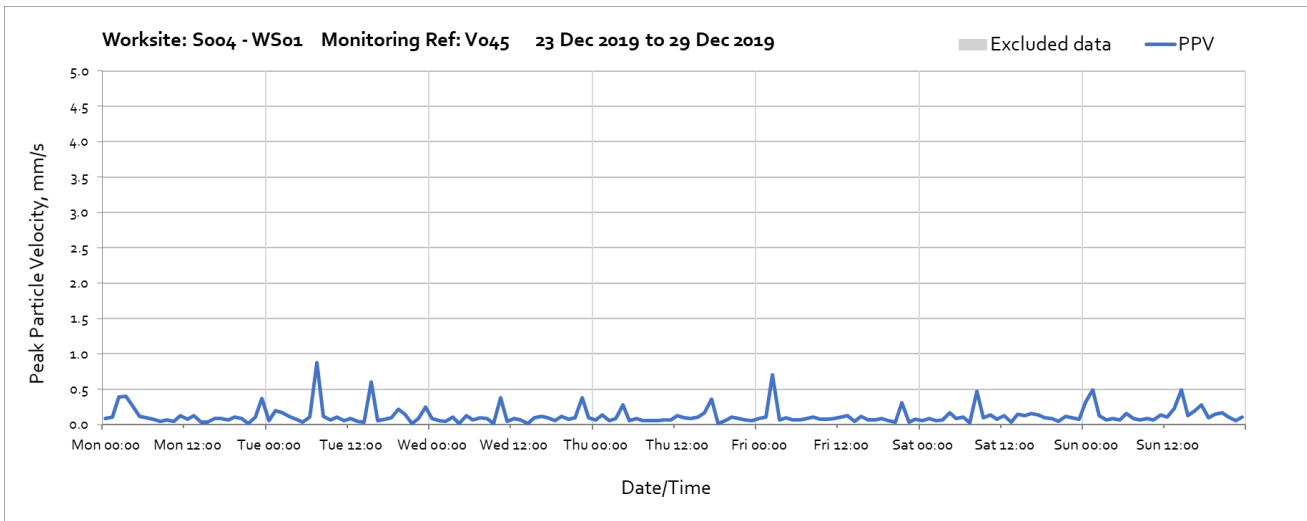
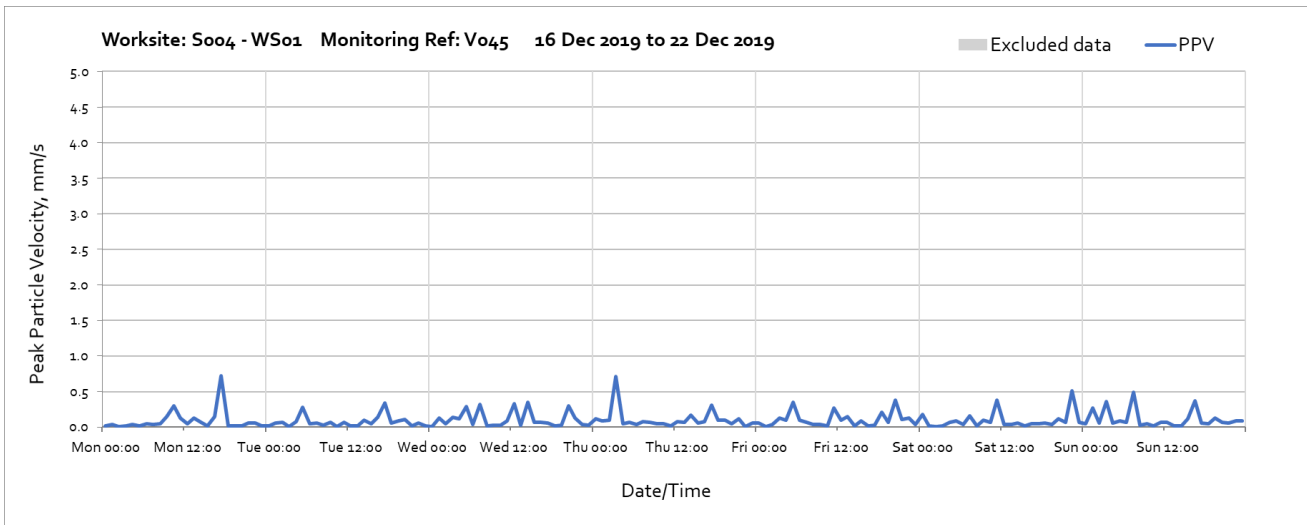
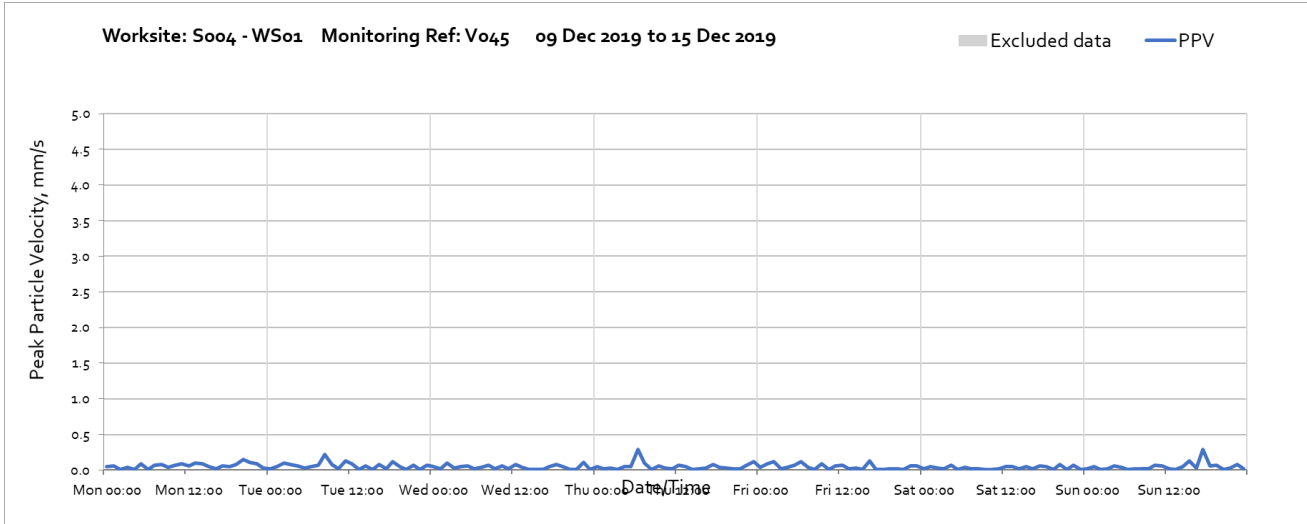


## Vibration

The following graphs show the hourly measured peak particle velocity PPV recorded during the monitoring period. The graphs show the resultant PPV due to vibration components on three orthogonal axis x, y and z.

### Worksite: S004-WS01 – Monitoring Ref: V045





Worksite: S004 - WSo1 Monitoring Ref: V045 30 Dec 2019 to 05 Jan 2020

Excluded data PPV

