

Construction noise and vibration Monthly Report – November 2019

London Borough of Ealing

Non-technical summary	1
Abbreviations and descriptions	2
1 Introduction	3
1.2 Measurement Locations	4
2 Summary of results	4
2.1 Exceedances of SOAEL	4
2.2 Summary of measured noise levels	6
2.3 Exceedances of trigger level	10
2.4 Complaints	10
Appendix A Site Locations	12
Appendix B Monitoring Locations	16
Appendix C Data	21

List of tables

Table 1: Table of abbreviations	2
Table 2: Monitoring locations	4
Table 3: Summary of exceedances of SOAEL.	5
Table 4: Summary of total exceedances of SOAEL.	6
Table 5: Summary of measured dB L_{Aeq} data over the monitoring period.	8
Table 6: Summary of measured PPV data over the monitoring period.	10
Table 7: Summary of exceedances of trigger levels.	10
Table 8: Summary of complaints.	11

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 November 2019.

The report presents data from noise monitoring installations in the vicinity of Atlas Road (ref.: S001-WS02) worksite where demolition, backfill and works at the substation were carried out and Old Oak Common depot (ref.: S004-WS01) where demolition and groundworks were being carried out, along with installation of a retaining wall structure on Old Oak Common Lane. Noise monitoring was also undertaken in the vicinity of Victoria Road (ref.: S002-WS01), the Willesden EuroTerminal (ref.: S001-WS03) and the Badminton Close compound. Utility trial works and surveys were also undertaken at various locations including Victoria Road, Atlas Road and Old Oak Common Lane.

Given the location of works currently being undertaken and the high ambient noise in many locations, the measured noise levels are largely dominated by existing ambient noise sources (including road traffic, railway and neighbourhood noise), rather than being attributable to HS2 construction activities.

During the monitoring period two complaints were received regarding vibration perceived from demolition works. Site operatives were re-briefed to minimise any impacts from the works and an additional vibration monitor (V045) was installed at Old Oak Common Lane. No exceedances of the SOAEL and no exceedances of S61 trigger levels due to HS2 related works were measured 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 1st to 30th November 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 demolition, backfill and works at the power substation (including excavations and installation of ducts) were undertaken; and
- Old Oak Common depot worksite (ref.: S004-WS01), where demolition activities and groundworks were carried out, along with the installation of a retaining wall structure at Old Oak Common Lane

Utility trial holes and surveys were also undertaken at various locations, including Victoria Road, Atlas Road and Old Oak Common Lane.

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 A new vibration monitor was installed at Old Oak Common Lane on the 27th of November to monitor vibration levels arising from demolition activities at Old Oak Common depot.
- 1.2.2 Table 2 summarises the position of noise and vibration monitoring installations within the LBE area in November 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	Weekday	1900-2200	3*
			Night	2200-0700	21*
	N028	Old Oak Common Lane, Hilltop Works	All days	All periods	No exceedance
Badminton Close compound	N040	Badminton Close	All days	All periods	No exceedance

* Due to the significant separation distance and the presence of noise-screening structures, noise levels at the nearest receptor are estimated to be lower and below the SOAEL at any receptor location.

2.1.4 Exceedances of the SOAEL were measured at a location in proximity to worksite S004-WS01 and were associated with emergency works required for the installation of a retaining structure in close proximity to the monitor. In consideration of noise attenuation effects due to the larger distance to the receptor and the presence of structures providing screening, noise levels at any receptor location are estimated to be below the SOAEL.

2.1.5 For the purpose of assessing eligibility for noise insulation or temporary rehousing, multiple exceedances of the SOAEL in a 24-hour period would be counted as a single exceedance during that day. Over the reporting period, the overall number of SOAEL exceedances at each measurement location is shown in Table 4 and may be lower than the total sum of individual exceedances reported in Table 3 for each location.

Table 4: Summary of total exceedances of SOAEL.

Worksite Reference	Measurement Reference	Monitor Address	Total of SOAEL exceedances in the month
S004-WS01	N027	Old Oak Common Lane	5*

* Due to the significant separation distance and the presence of shielding structures, noise levels at the nearest receptor are estimated to be lower and below the SOAEL at any receptor location.

2.1.6 HS2 construction activities at all HS2 worksites were mostly undertaken between 08:00 and 18:00 on weekdays, however works in the vicinity of the London Underground Central line at the Old Oak Common site were carried out during a limited number of night time London Underground engineering possession periods, due to the proximity to the railway. Emergency works on Old Oak Common Lane were undertaken during a limited number of evening and night-time periods.

2.1.7 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 5 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 noise audible beyond the site boundary from time to time.

Table 5: Summary of measured dB L_{Aeq} data over the monitoring period.

Worksite Reference	Measurement Reference	Site Address	Free-field or Façade measurement	Weekday Average L _{Aeq,T} (highest day L _{Aeq,T})					Saturday Average L _{Aeq,T} (highest day L _{Aeq,T})					Sunday / Public Holiday Average L _{Aeq,T} (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
S001-WS02	N032	Shaftesbury Gardens	Free field	65.1 (67.3)	65.9 (71.1)	64.3 (67.2)	64.2 (71.7)	61.1 (66.4)	63.0 (63.7)	64.7 (66.5)	63.2 (66.3)	64.0 (69.0)	61.2 (64.0)	63.8 (67.4)	60.8 (66.0)
	N033	Outside The Collective, Atlas Road / Victoria Road	Free field	67.4 (70.2)	69.4 (72.4)	66.6 (71.2)	65.2 (69.6)	62.5 (69.2)	64.1 (66.0)	67.0 (68.5)	66.0 (66.8)	66.0 (70.3)	62.0 (66.3)	64.3 (68.3)	61.6 (68.0)
S001-WS03	N034	Stephenson Street (north)	Free field	53.7 (60.0)	57.0 (65.6)	55.2 (58.5)	54.8 (59.9)	50.2 (60.1)	51.6 (52.5)	57.2 (59.6)	58.0 (60.7)	55.6 (67.3)	48.9 (54.8)	52.6 (59.9)	47.3 (52.7)
	N035	Stephenson Street (south)	Free field	56.0 (64.0)	57.1 (68.1)	54.1 (58.2)	54.0 (59.6)	49.5 (57.3)	52.3 (53.6)	56.5 (58.9)	57.4 (60.5)	55.0 (68.2)	49.5 (58.6)	51.5 (59.6)	47.8 (56.4)
	N041	Junction of Stephenson Street / Goodhall Street	Free field	55.7 (61.6)	58.4 (64.4)	56.9 (61.1)	57.0 (65.6)	52.3 (64.2)	54.6 (58.4)	57.4 (59.2)	58.2 (60.1)	58.1 (67.6)	51.6 (56.4)	56.6 (71.7)	51.0 (54.7)
S002-WS01	N029	Braitrim House, Victoria Road	Free field	53.3 (60.2)	59.7 (66.9)	53.1 (56.8)	58.0 (70.0)	55.1 (69.3)	49.5 (52.5)	56.0 (59.4)	55.0 (57.7)	53.8 (65.0)	47.8 (51.9)	50.3 (56.7)	49.3 (57.2)
	N030	Bodens car park	Free field	58.2 (62.8)	65.3 (78.3)	56.3 (58.7)	56.6 (58.7)	54.0 (60.7)	55.8 (60.5)	60.0 (62.3)	58.2 (59.8)	57.3 (65.2)	53.0 (56.4)	55.5 (58.9)	53.0 (57.1)
	N031	School Road, outside Acton Business Centre	Free field	63.8 (65.9)	64.9 (67.4)	63.5 (65.4)	60.9 (65.1)	57.5 (63.9)	60.9 (66.0)	62.7 (63.2)	64.7 (65.4)	61.9 (68.5)	55.7 (60.6)	60.9 (64.6)	56.2 (61.4)

Worksite Reference	Measurement Reference	Site Address	Free-field or Façade measurement	Weekday Average $L_{Aeq,T}$ (highest day $L_{Aeq,T}$)					Saturday Average $L_{Aeq,T}$ (highest day $L_{Aeq,T}$)					Sunday / Public Holiday Average $L_{Aeq,T}$ (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	69.9 (72.4)	70.2 (75.3)	69.7 (83.0)	68.3 (80.7)	65.2 (73.8)	67.1 (70.1)	69.8 (71.2)	70.8 (71.5)	69.6 (72.4)	64.9 (68.7)	67.7 (72.2)	64.0 (69.7)
	N028	Old Oak Common Lane, Hilltop Works	Free field	70.5 (72.3)	70.5 (72.0)	69.5 (73.0)	68.0 (72.5)	64.4 (70.0)	66.6 (67.5)	69.3 (71.2)	69.5 (69.8)	68.9 (72.3)	64.4 (68.0)	67.7 (71.0)	64.0 (69.1)
Badminton Close compound	N040	Badminton Close	Free field	54.8 (59.2)	55.1 (57.3)	54.3 (55.9)	54.8 (62.0)	52.1 (58.6)	54.4 (56.9)	55.1 (59.6)	54.1 (57.2)	55.5 (61.9)	52.1 (56.6)	54.3 (57.4)	51.6 (56.5)

2.2.4 Table 6 presents a summary of the measured vibration levels at monitoring locations V045 over the reporting period. The highest PPV measured during the monitoring along any axis is presented in the table.

Table 6: 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	1.25 (Z-axis)

2.3 Exceedances of trigger level

2.3.1 Table 7 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 7: 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.

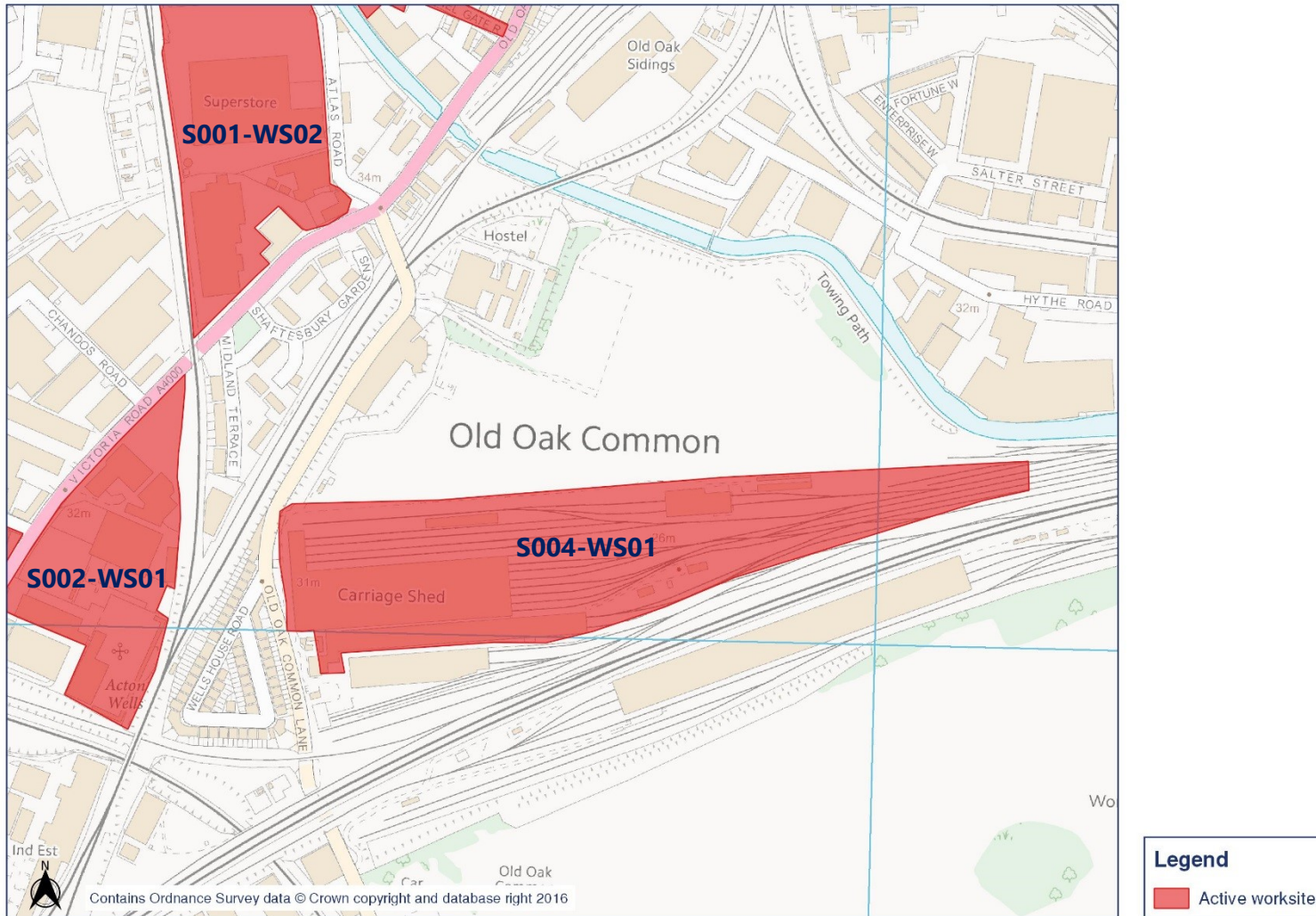
2.4 Complaints

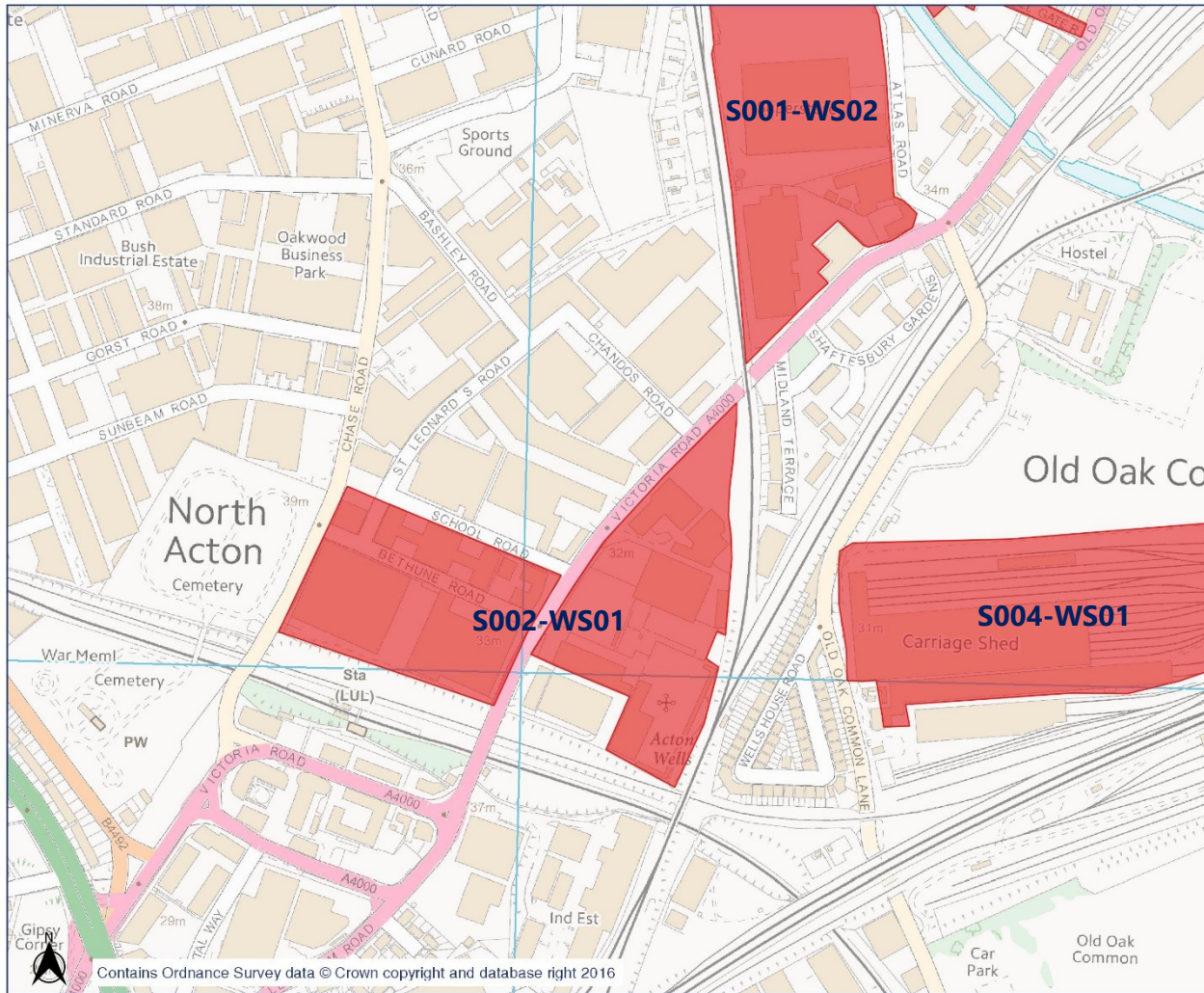
2.4.1 Table 8 provides a summary of complaint information related to noise and vibration received during the reporting period, along with the findings of any investigation.

Table 8: Summary of complaints.

Complaint reference number	Worksite reference	Description of complaint	Results of investigation	Actions taken
HS2-19-12208-C	S004-WS001	Complaint from resident adjacent to the Old Oak Common depot regarding high noise from a digger working on Old Oak Common Lane.	Likely attributable to the deconstruction of fuel farm tanks/steelwork, cutting/shearing of steelwork and subsequent loading for removal from site. The methodology was in line with s61 and noise and vibration monitoring indicate compliance with s61 trigger levels and below levels considered to give rise to significant adverse effects.	Site operatives were re-briefed to minimise any impacts from the works and an additional vibration monitor was installed at Old Oak Common Lane.
HS2-19-12275-C	S004-WS001	Complaint from resident regarding vibration perceived within the property and concern about potential for building damage.	Works taking place include demolition of HST superstructure (west end). Occasional transient vibration events noted on site as concrete frame was brought down - such events may potentially give rise to perceptible vibration within residential premises, however below levels considered to give rise to significant adverse effects on human comfort or risks of building damage.	Site operatives were re-briefed to minimise potential for falling demolition arisings to cause vibration. Long term vibration monitor installed adjacent to premises/retaining wall.
HS2-19-11631-C	S001-WS03	Complaint from resident adjacent to the Willesden EuroTerminal about perceptible vibration within the property during night-time periods.	Vibration was alleged to be due to a lighting generator.	Resident was contacted and advised regarding current working hours and vibration monitoring regime and offered to meet or to take place to drop in sessions taking place locally. No works activity took place at this location in November, the source of vibration was not able to be identified.

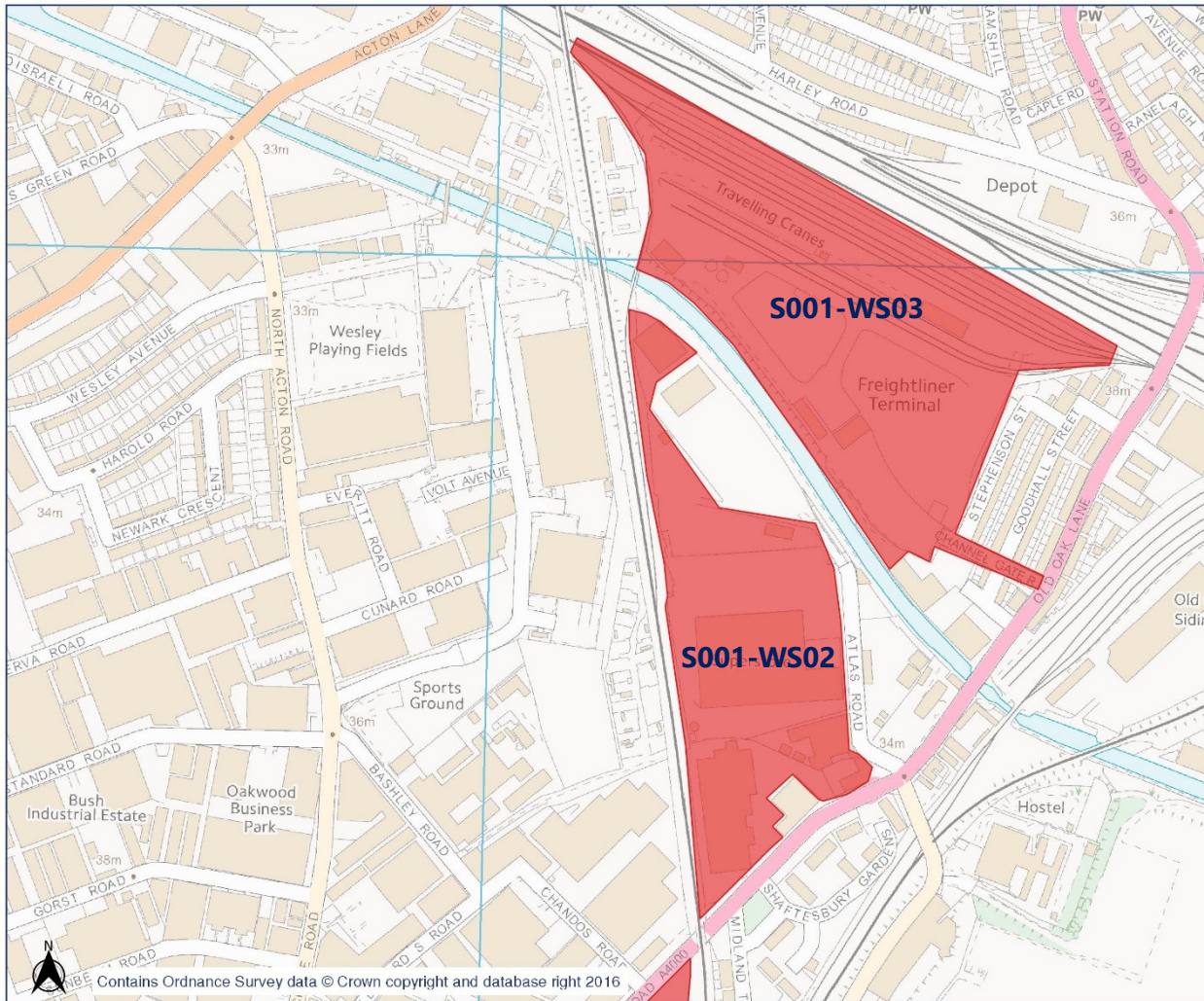
Appendix A Site Locations



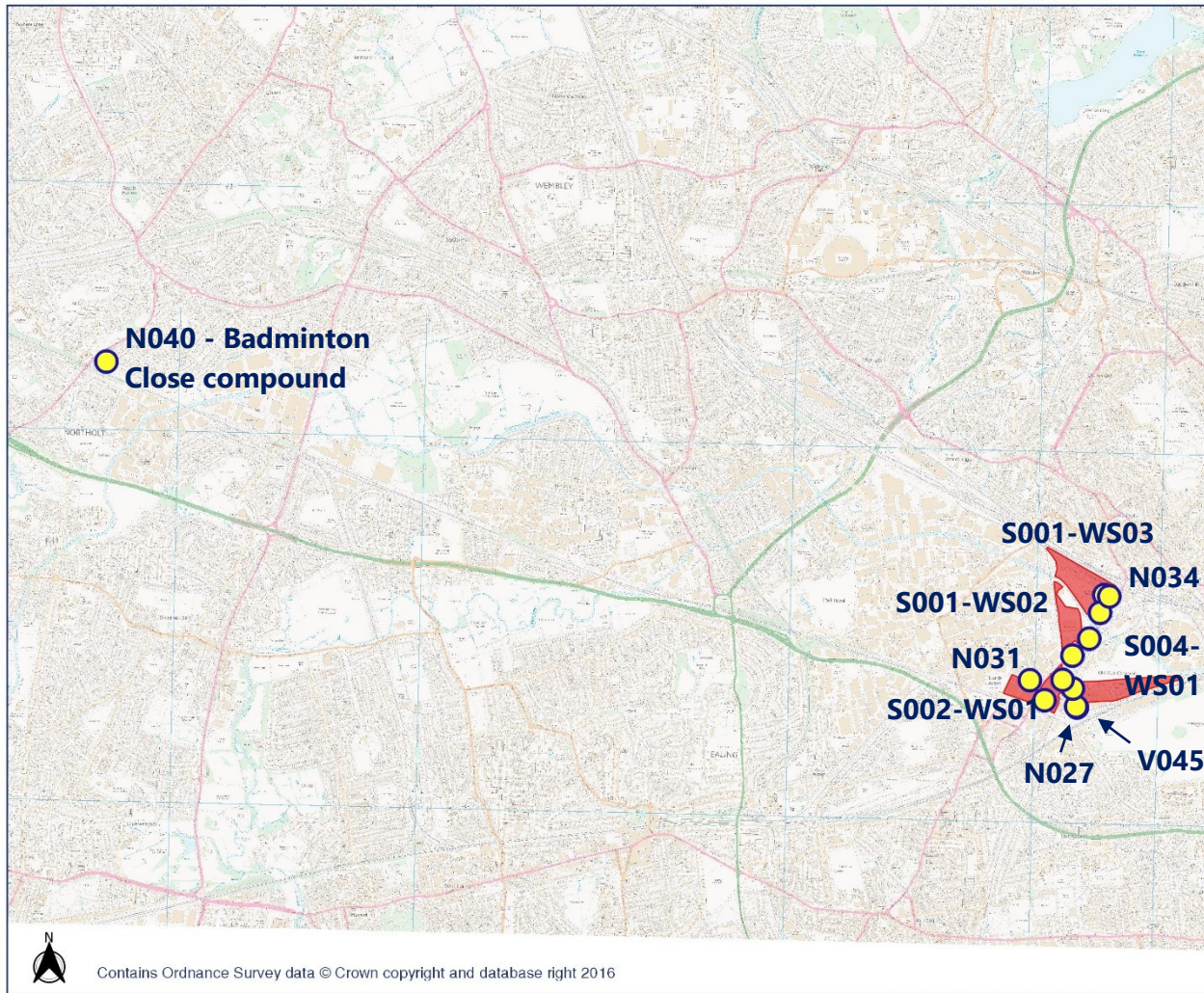


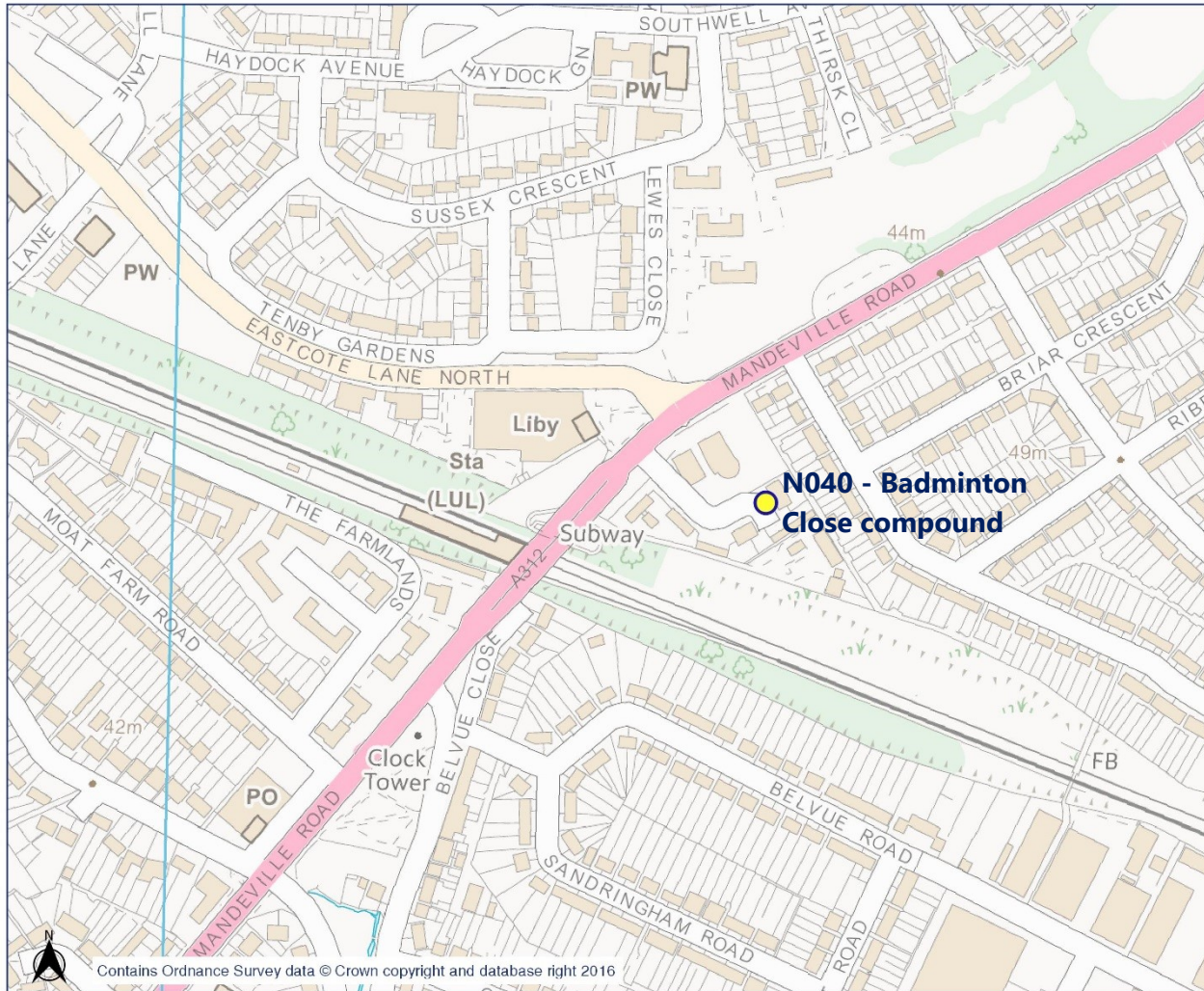
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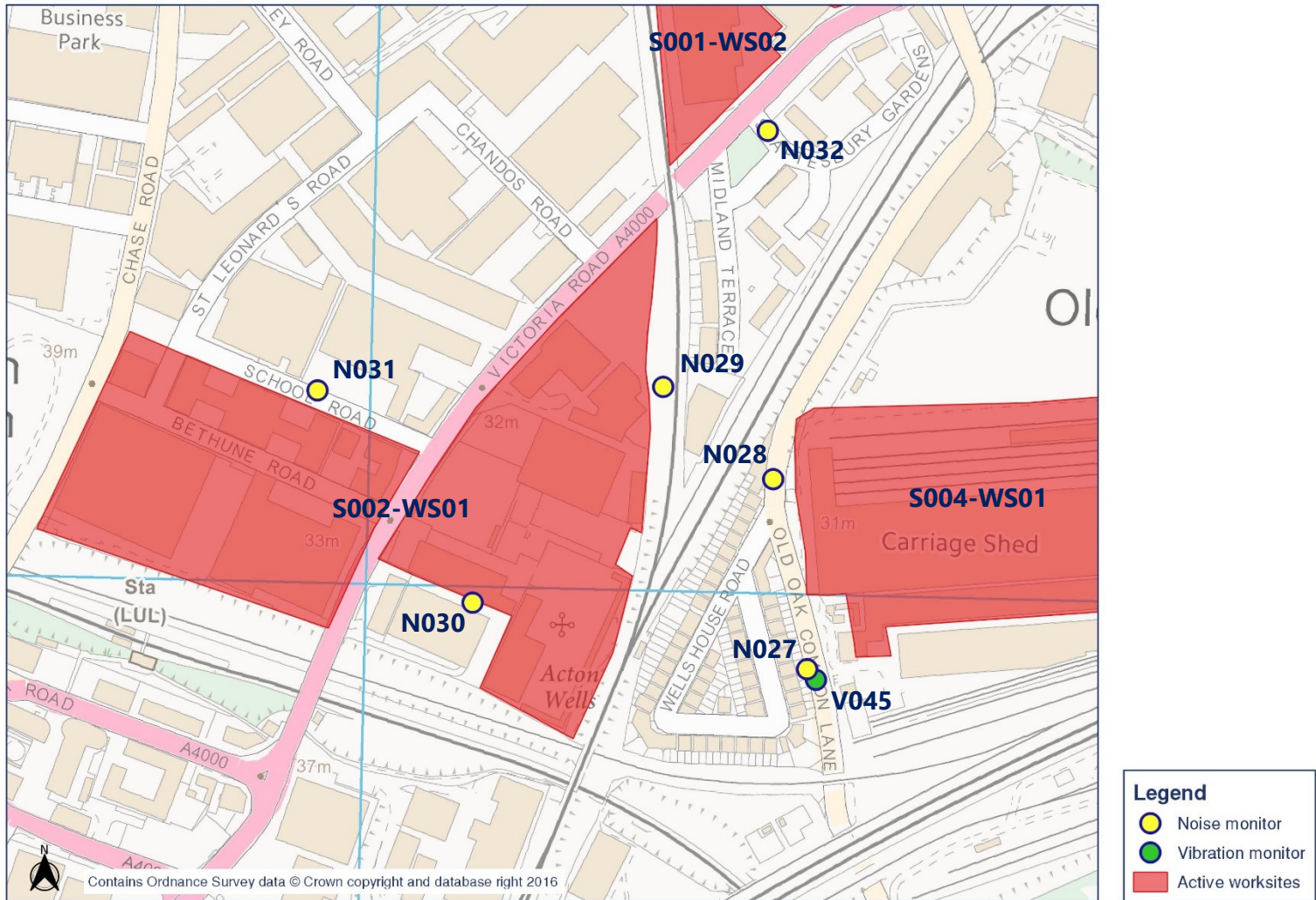
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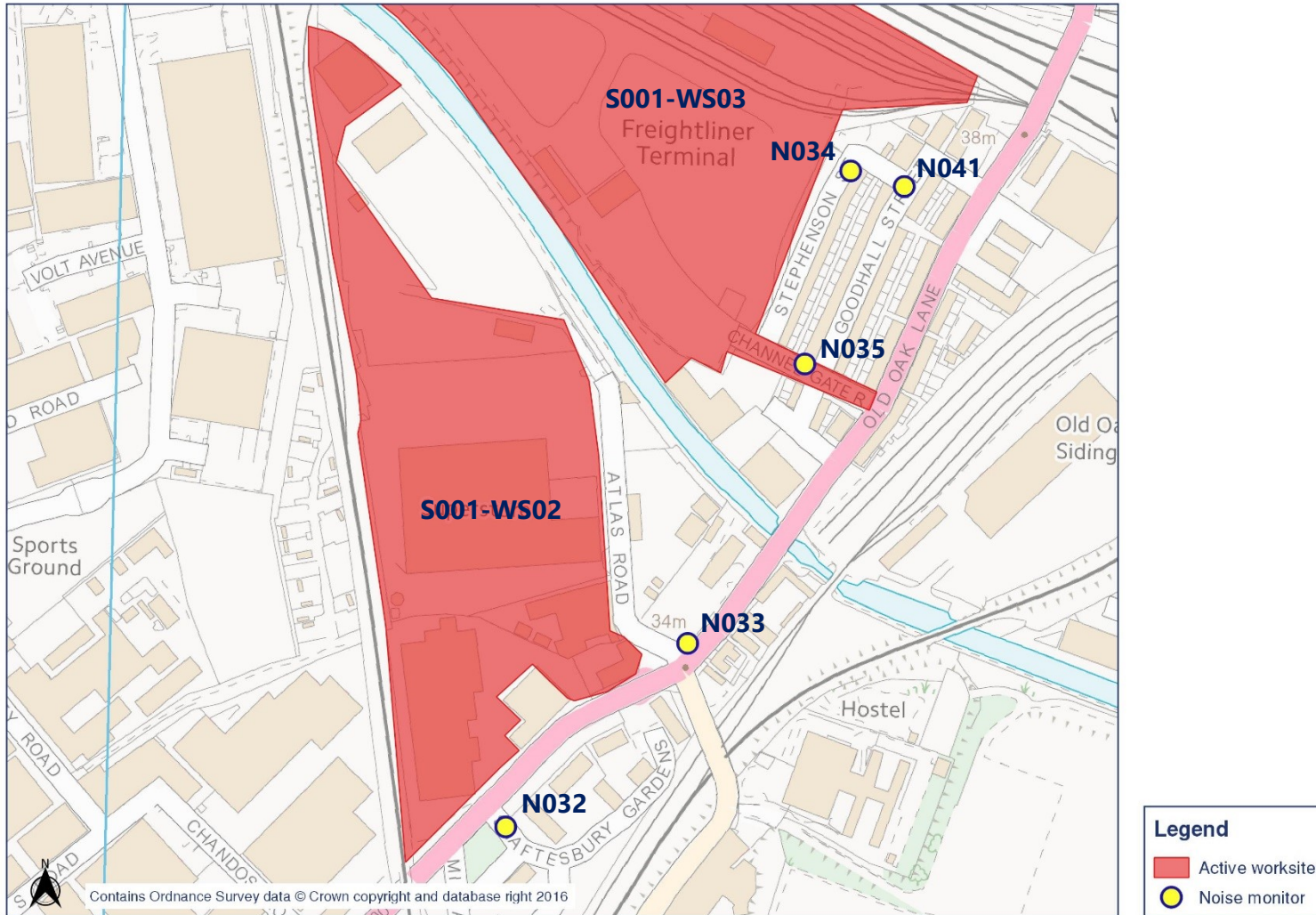


Appendix B Monitoring Locations





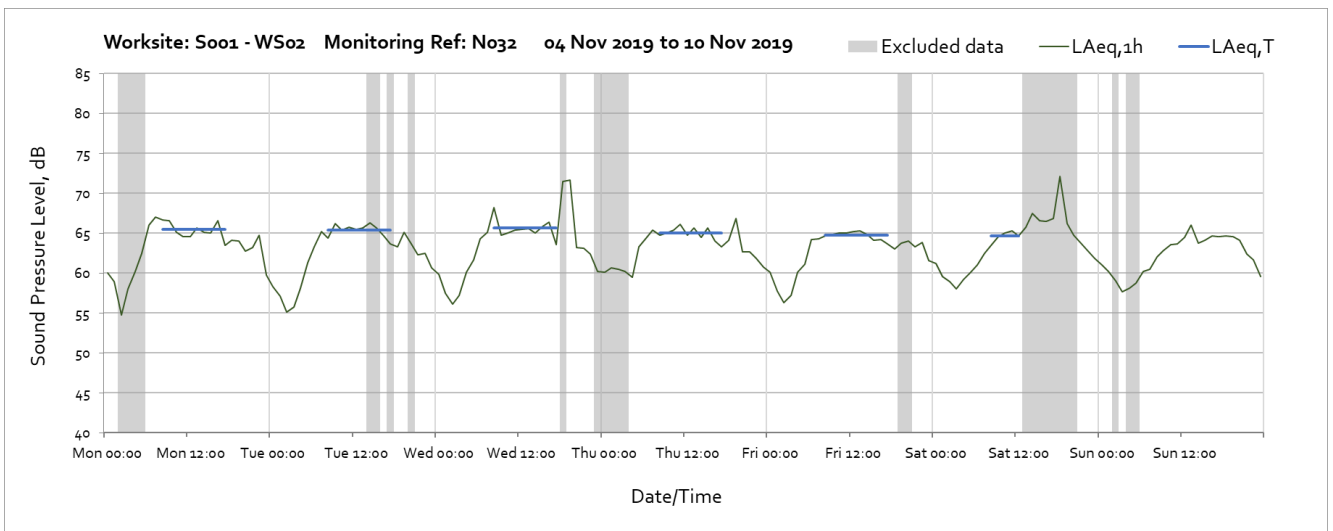
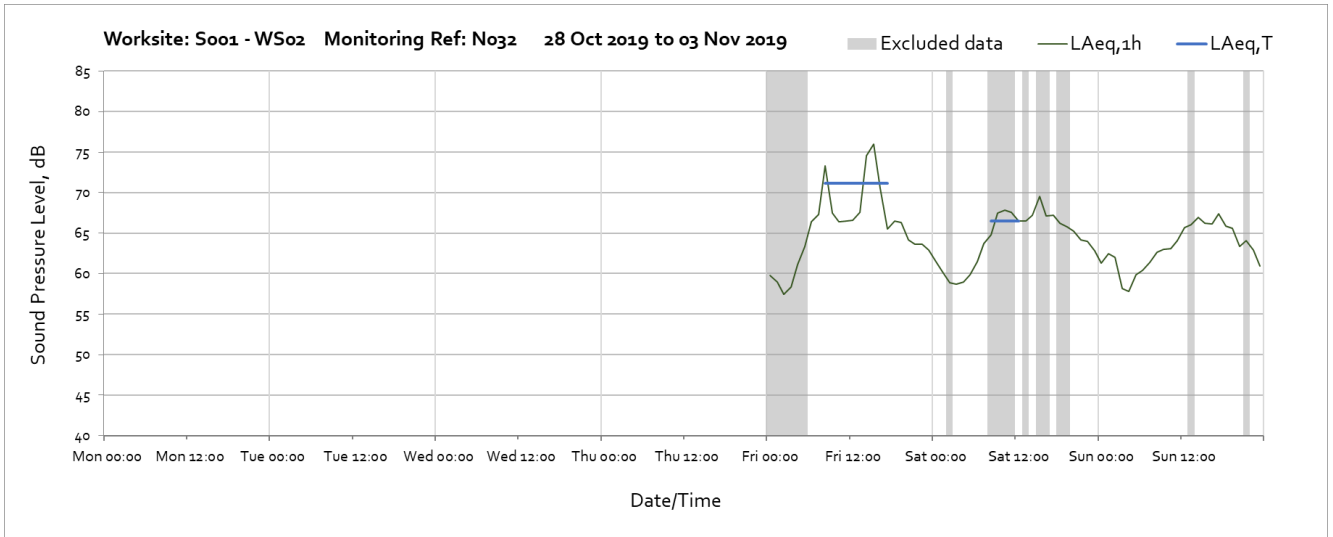


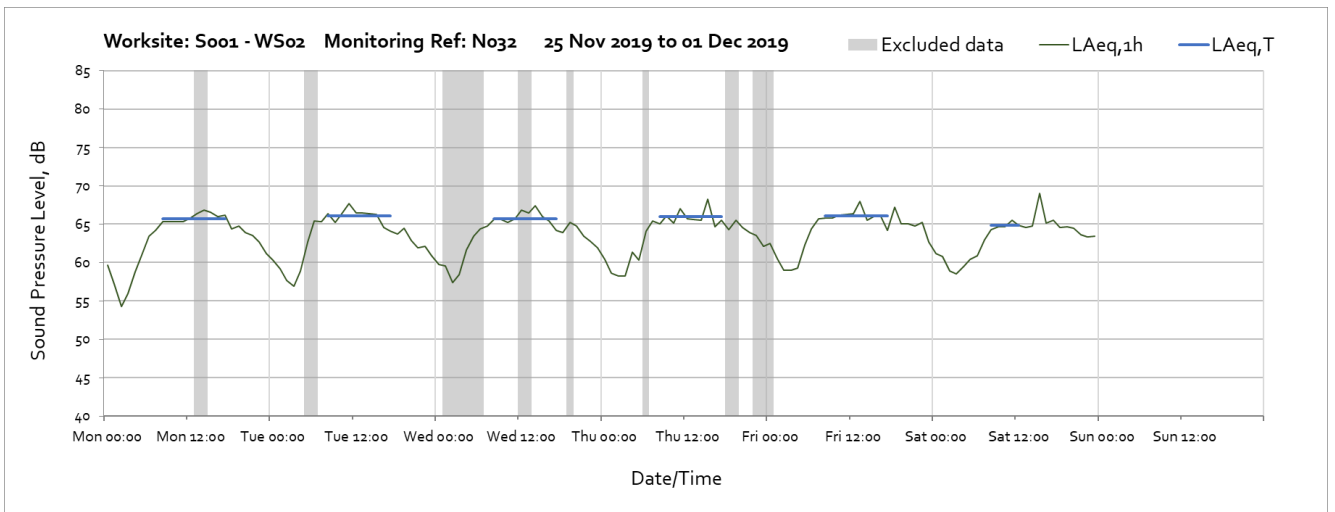
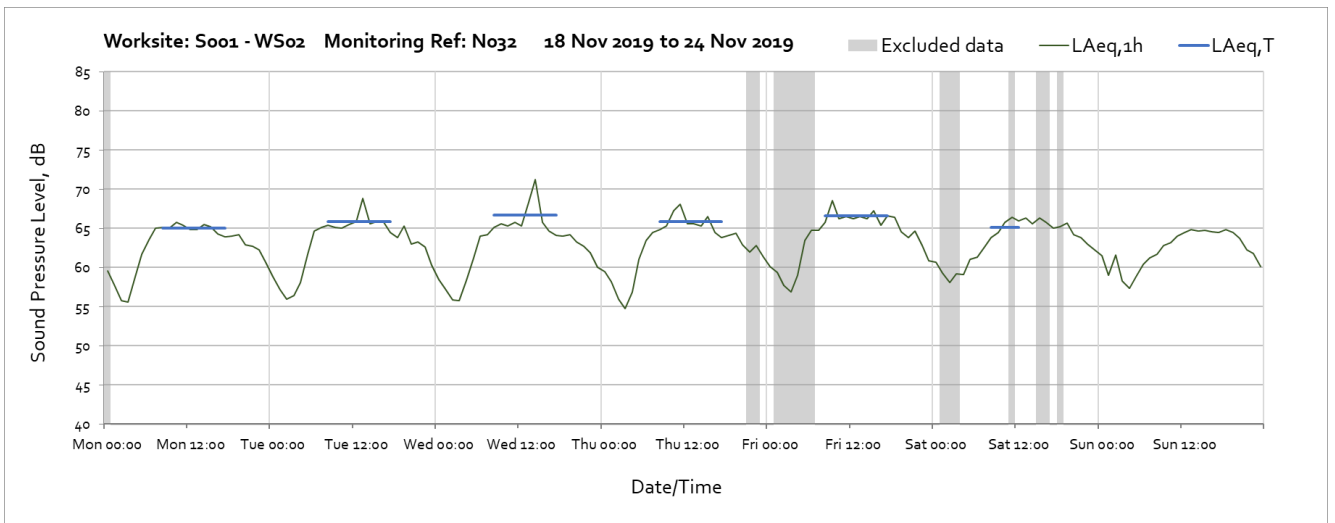
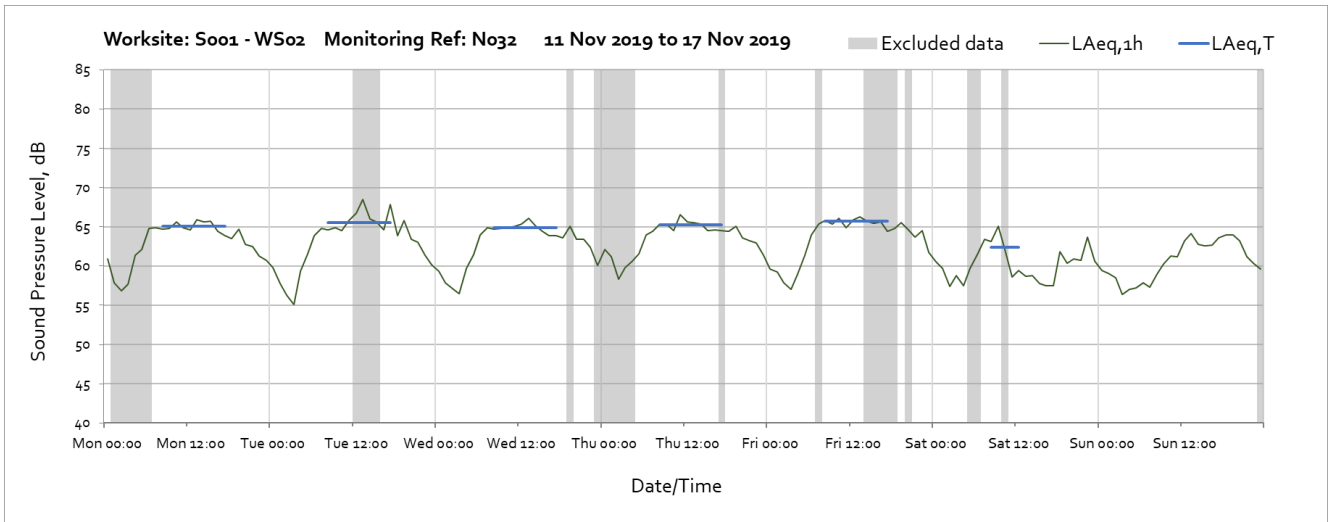


Appendix C Data

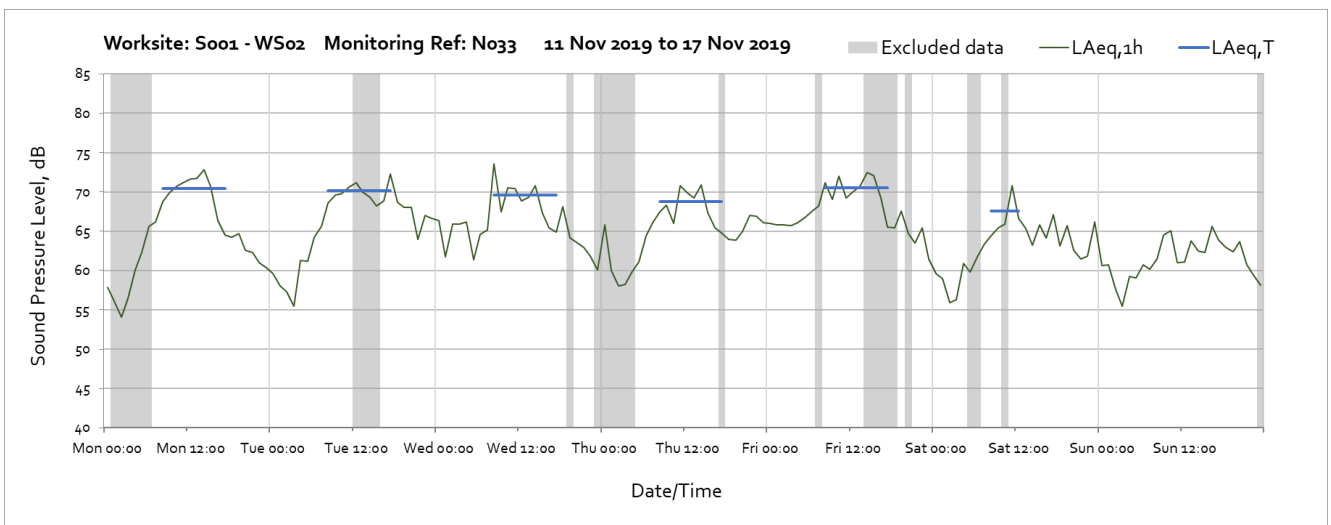
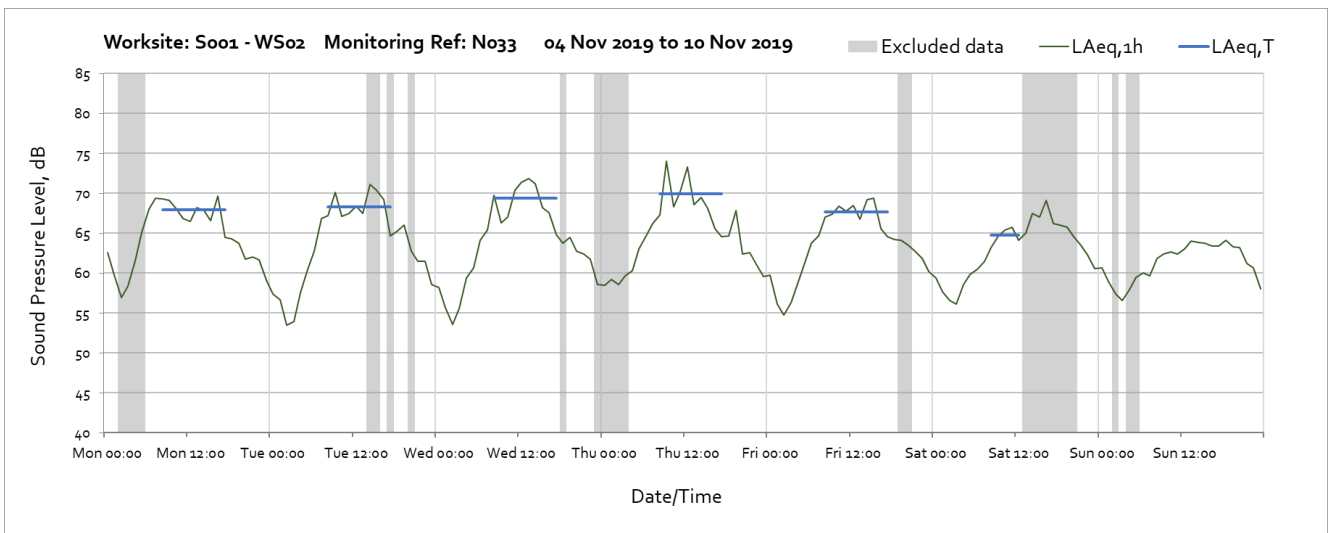
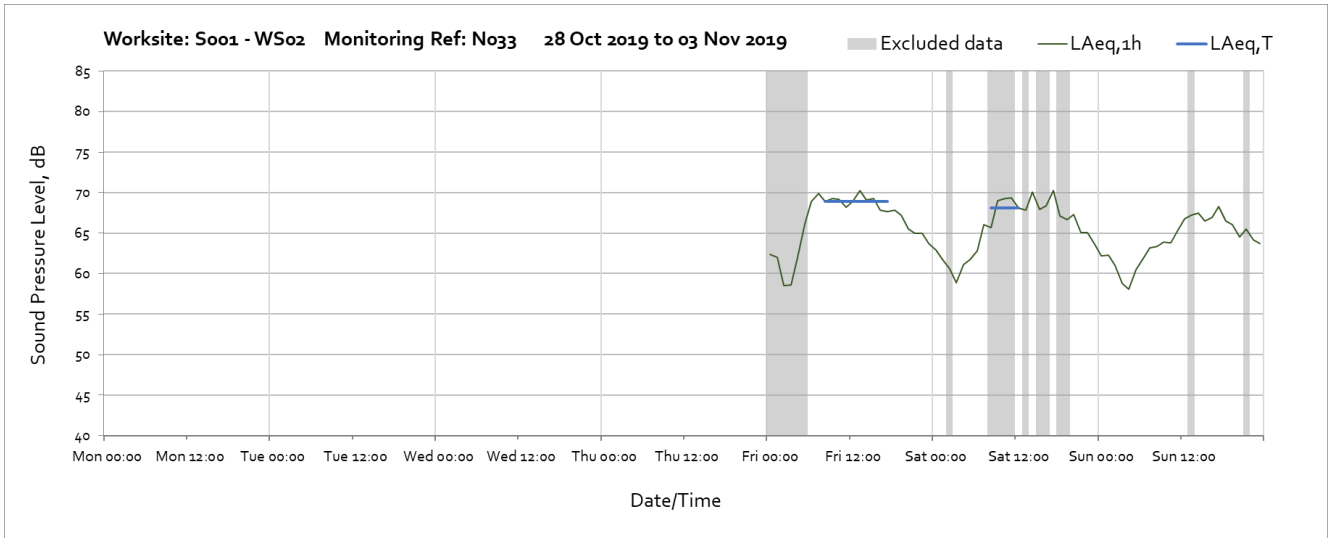
The following graphs show the hourly measured ambient noise level $L_{Aeq,1h}$ and, where relevant, the averaged noise level $L_{Aeq,T}$ values, where the time period T is as specified in Table 1 of HS2 Information Paper E23. Periods with adversely weather affected noise levels are greyed out and have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

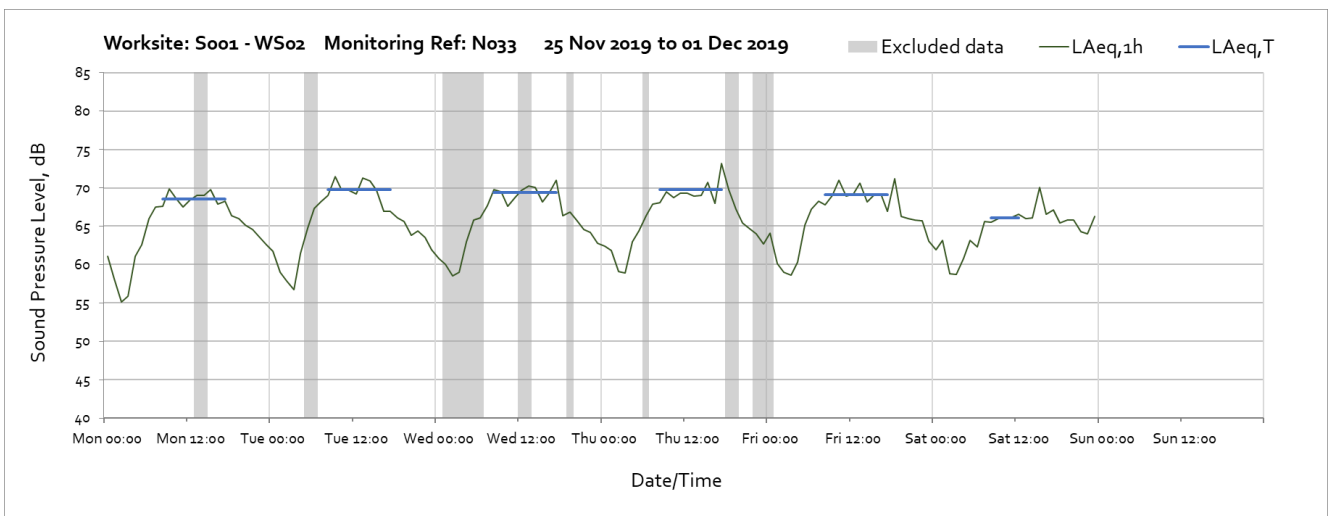
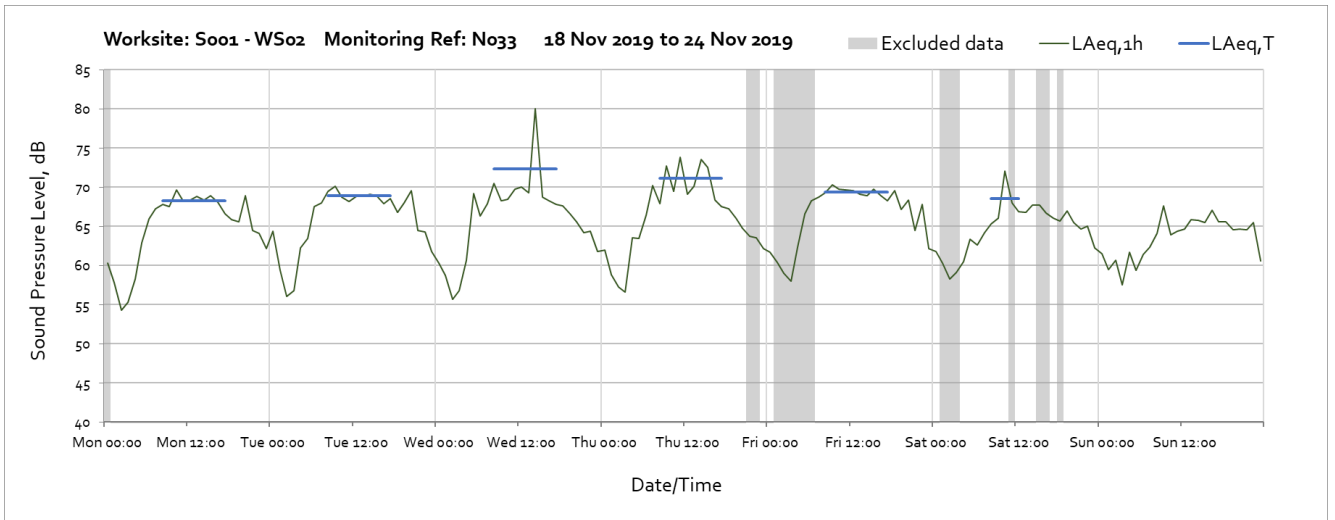
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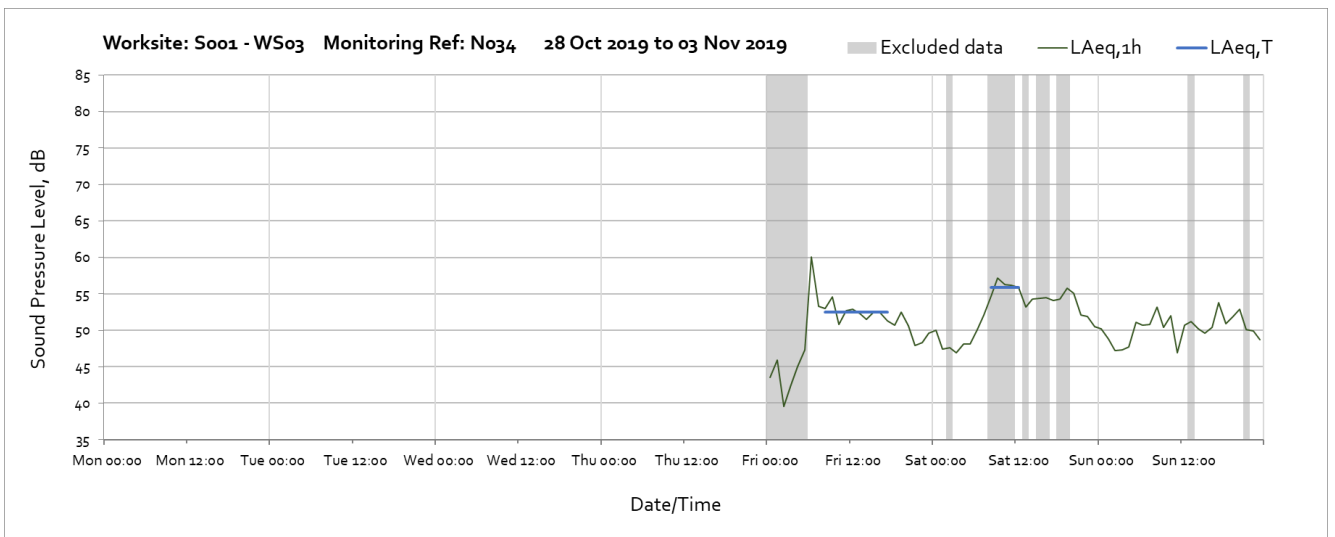


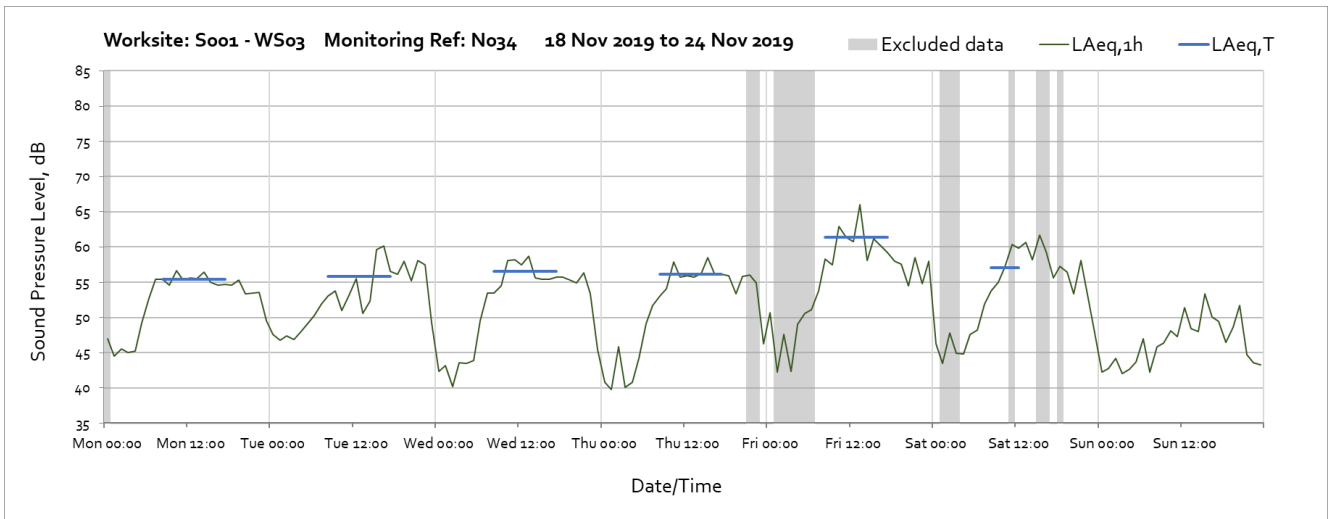
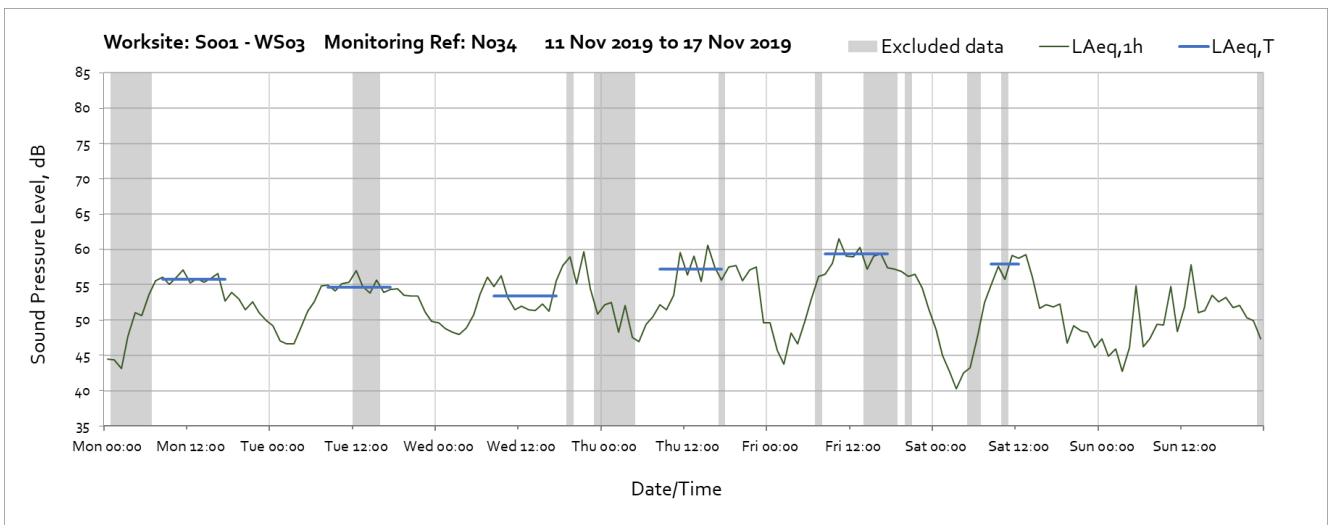
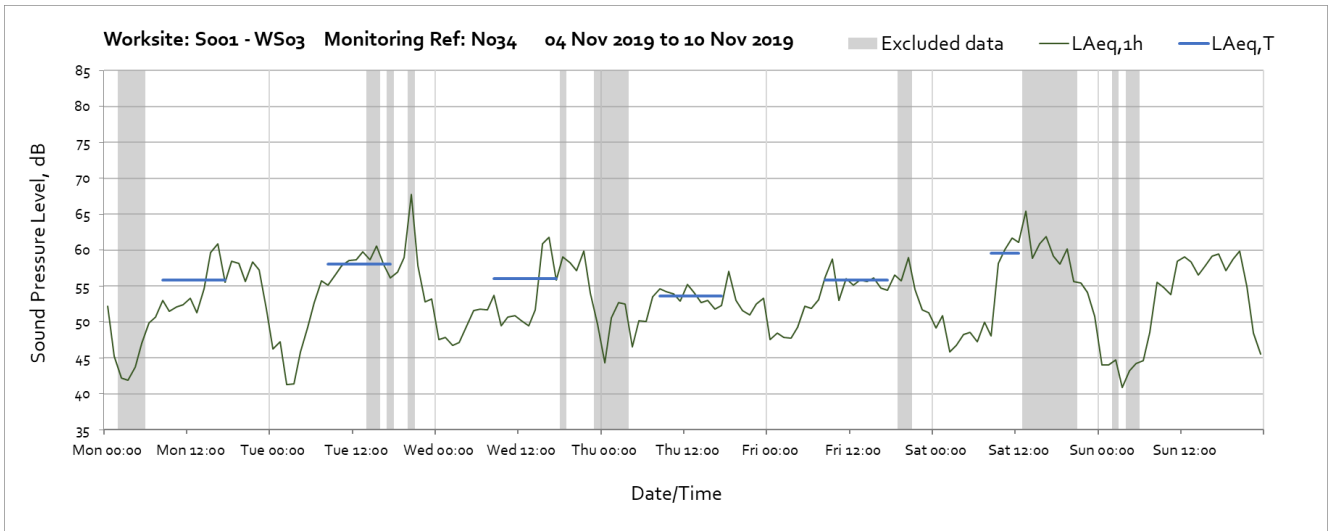
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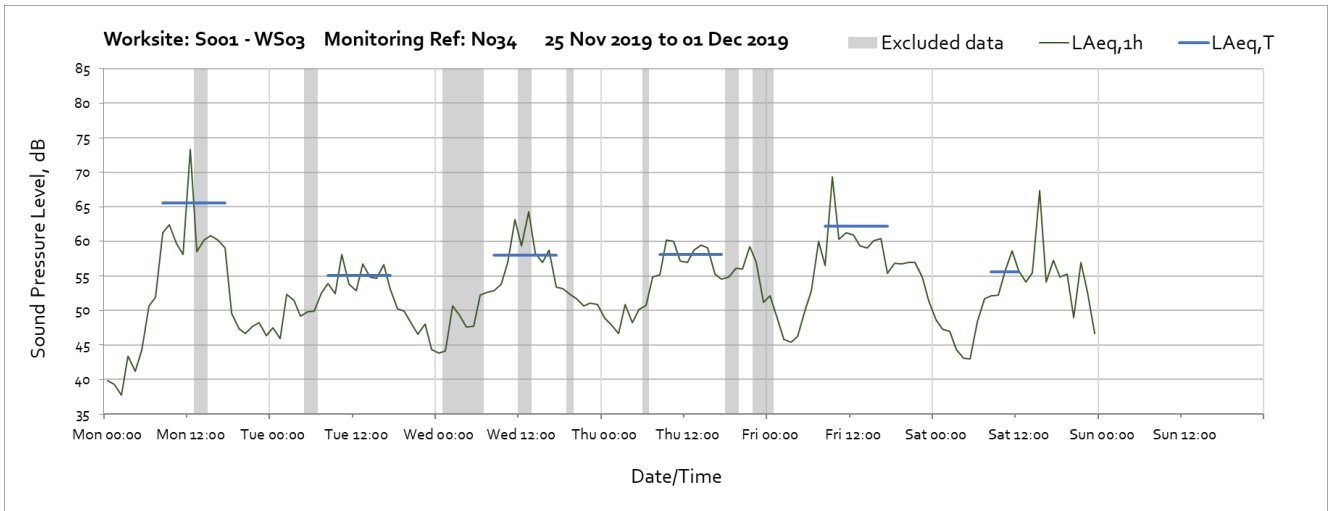




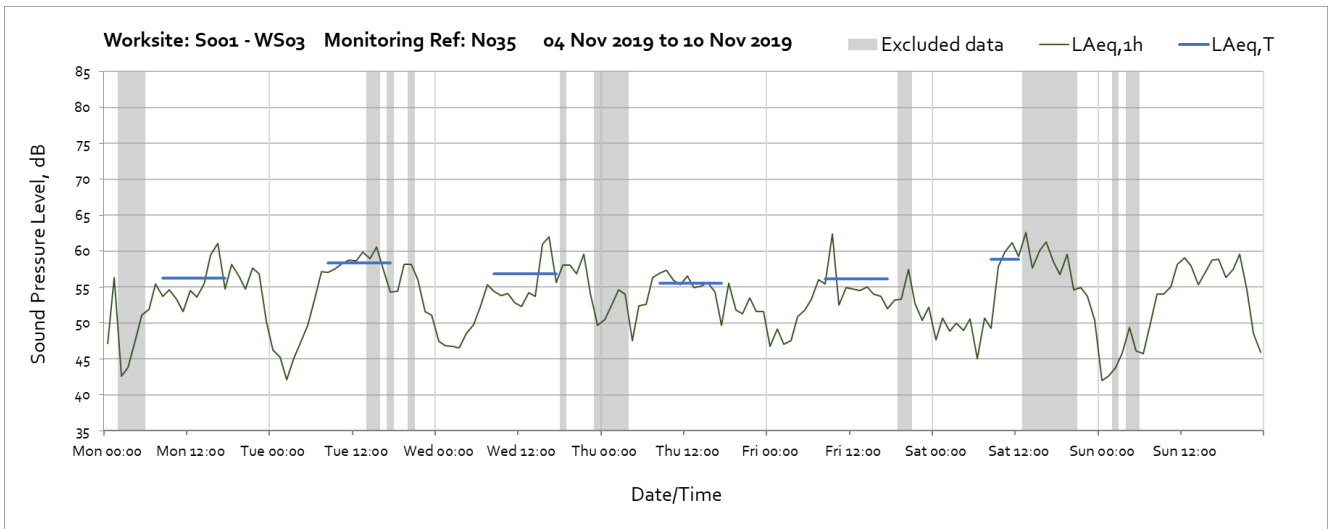
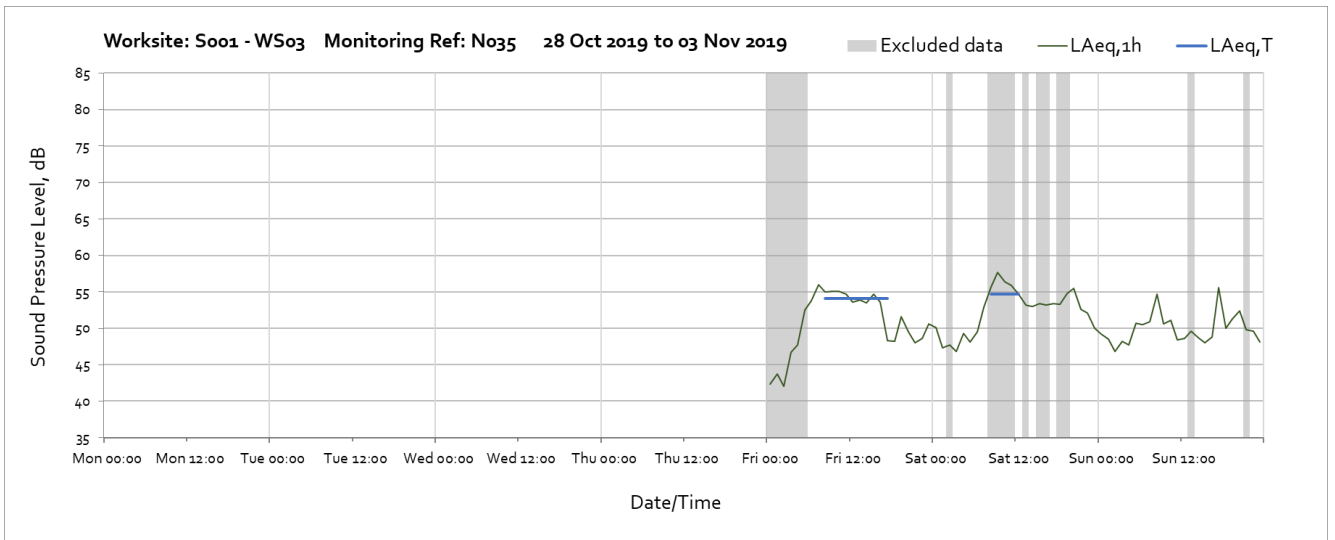
Worksite: S001-WS03 – Monitoring Ref: N034

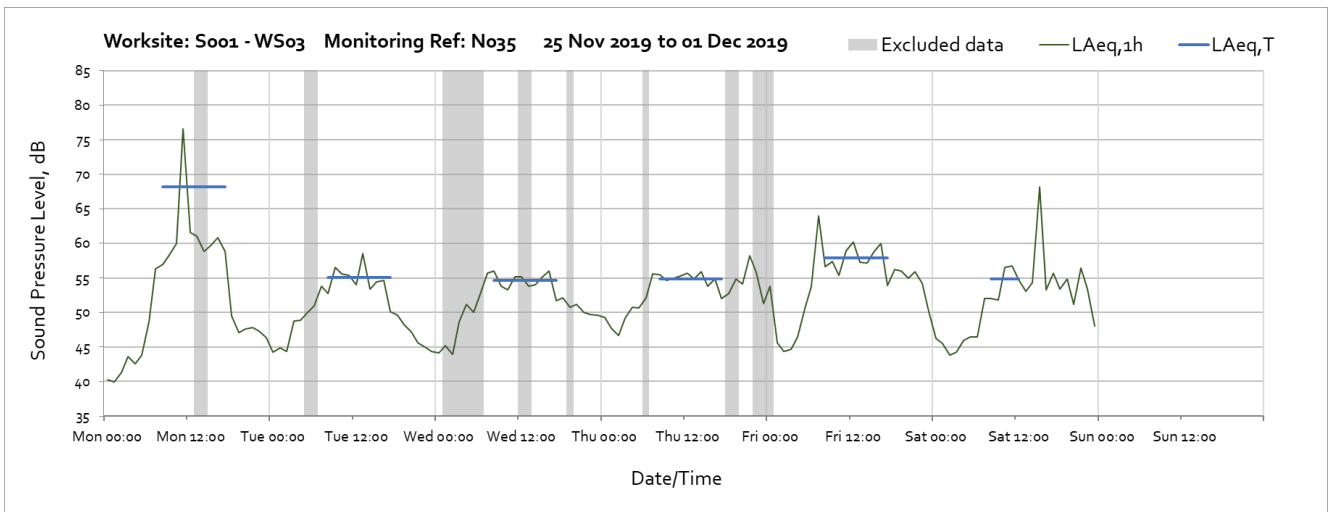
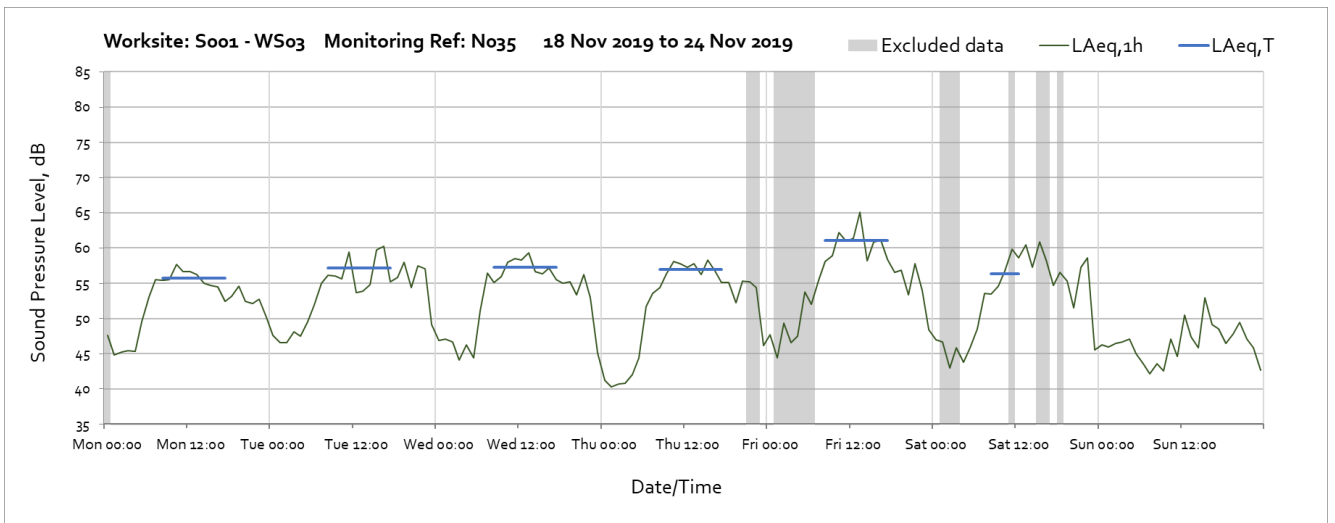
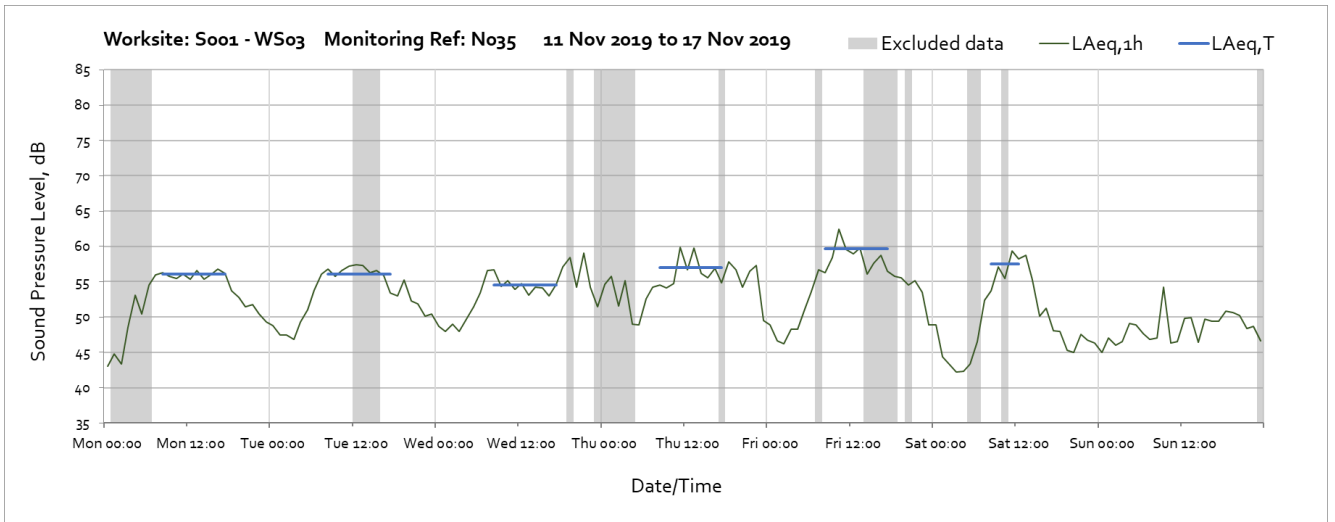




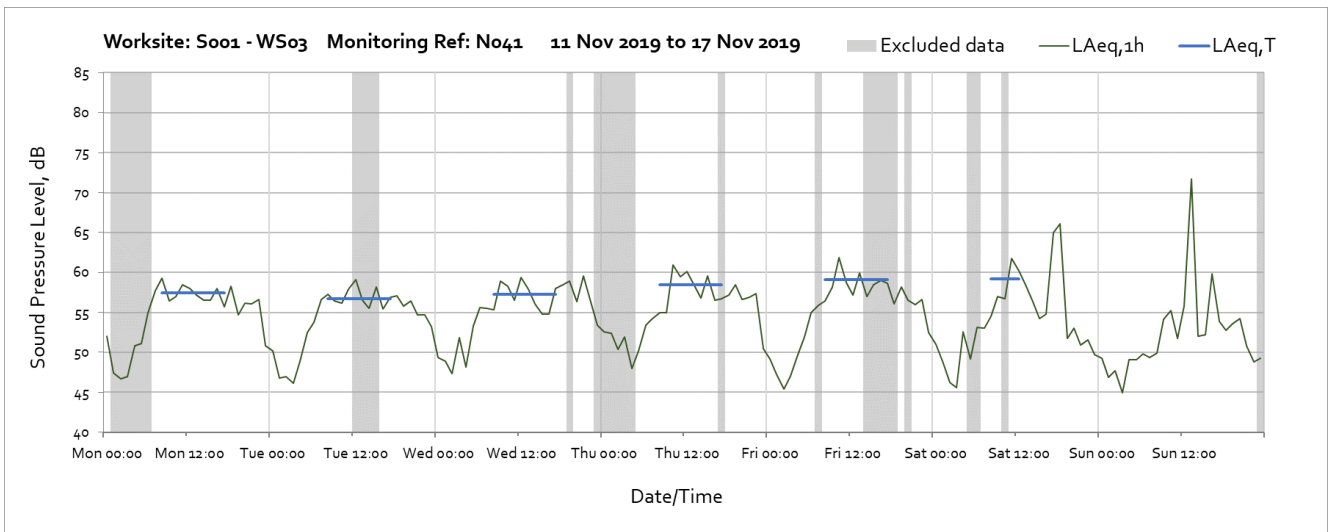
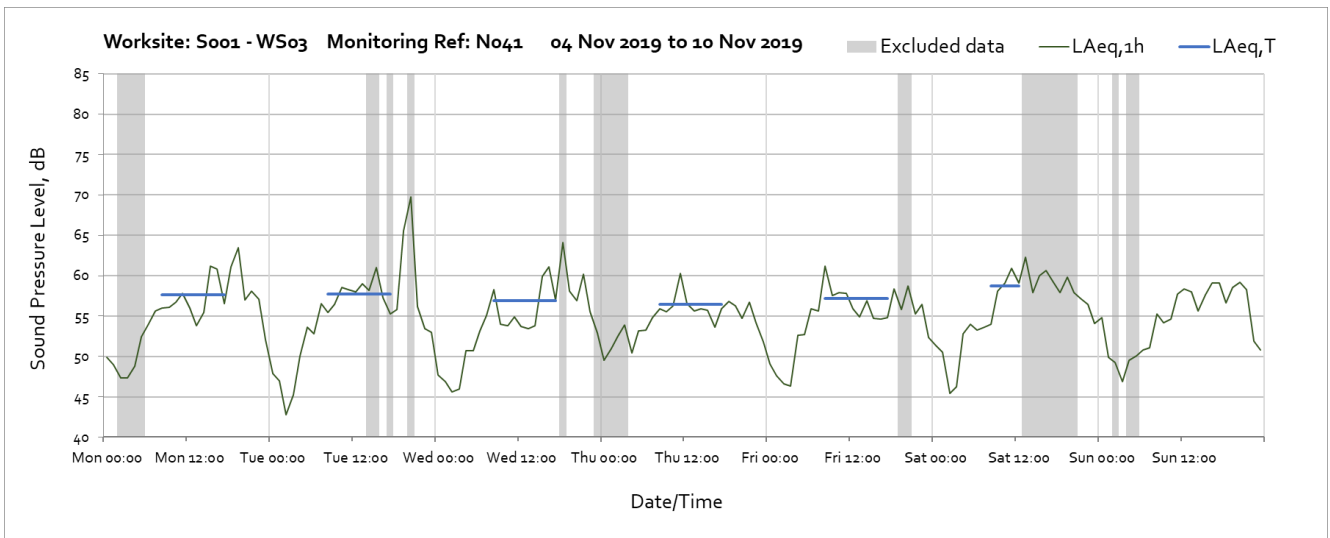
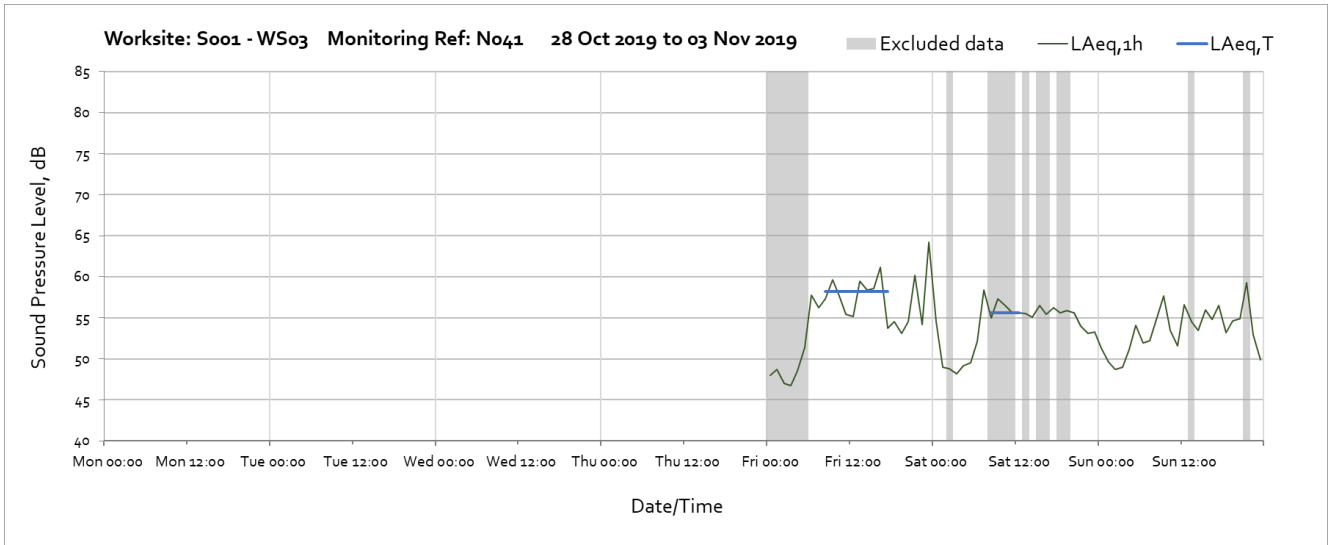


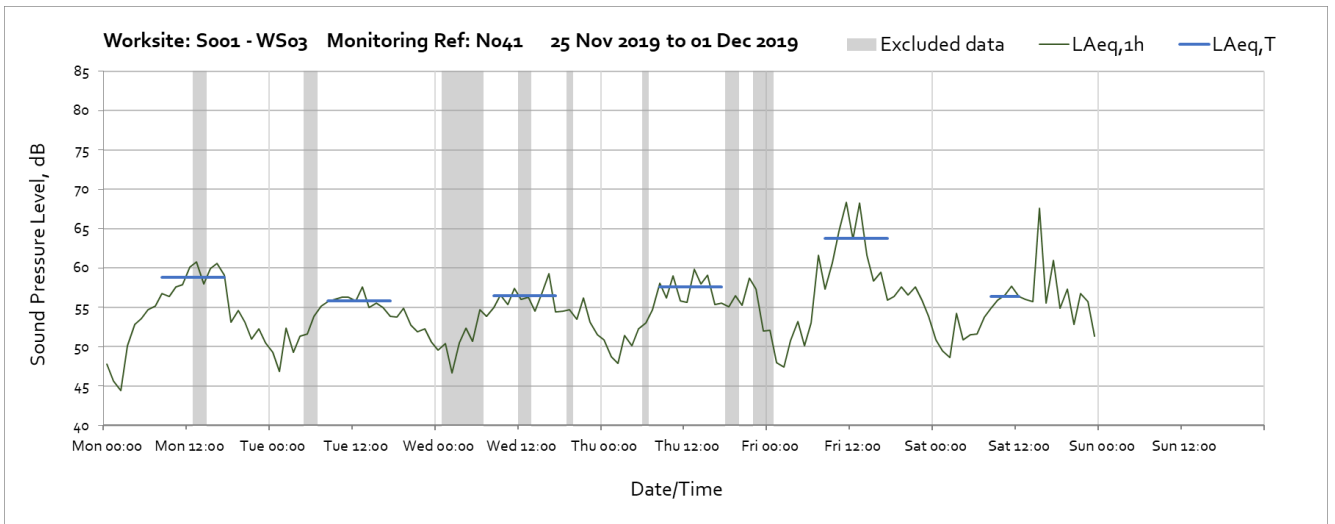
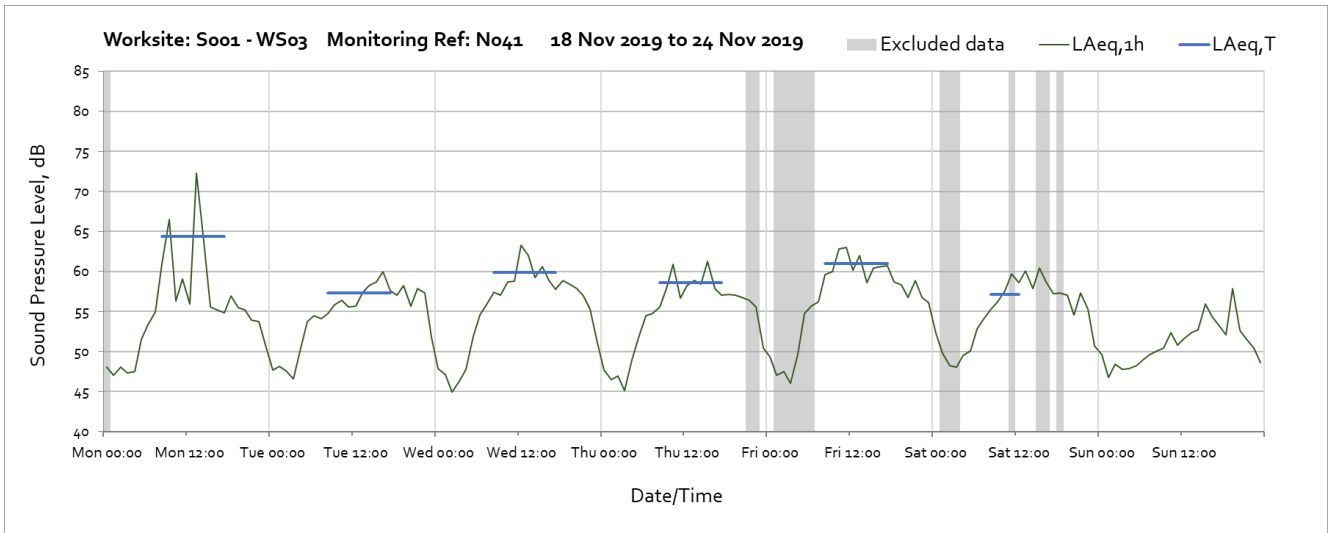
Worksite: S001-WS03 – Monitoring Ref: N035



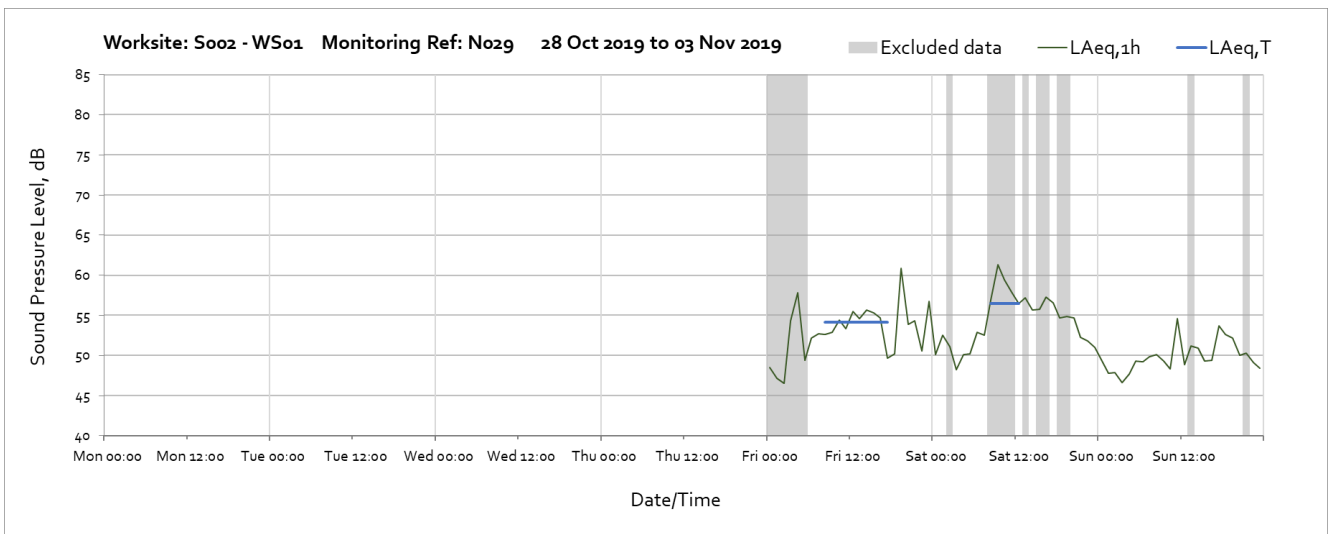


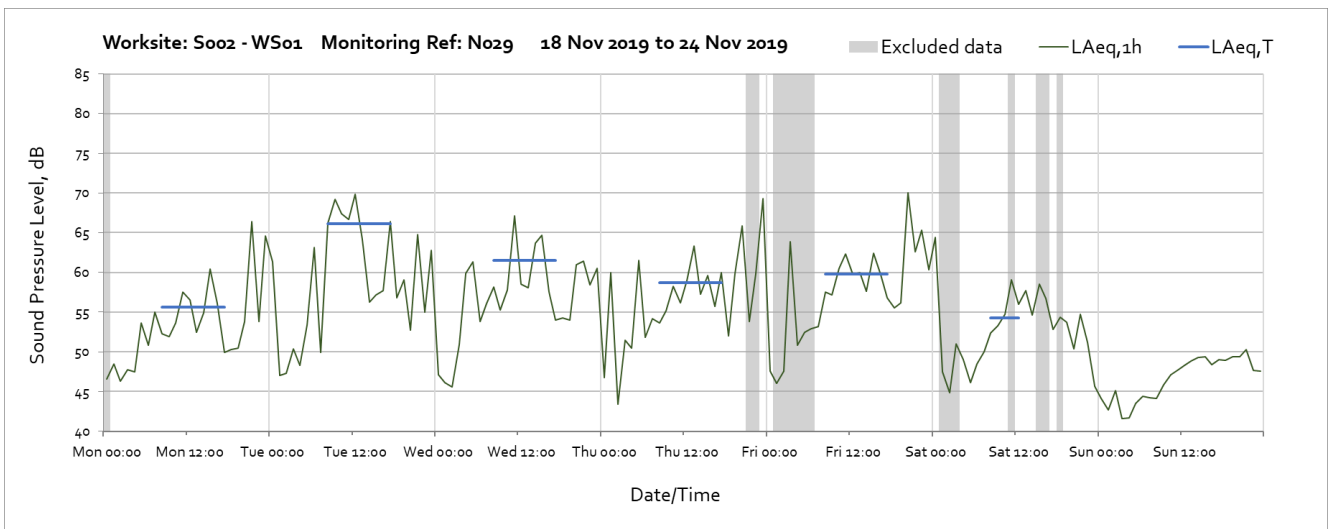
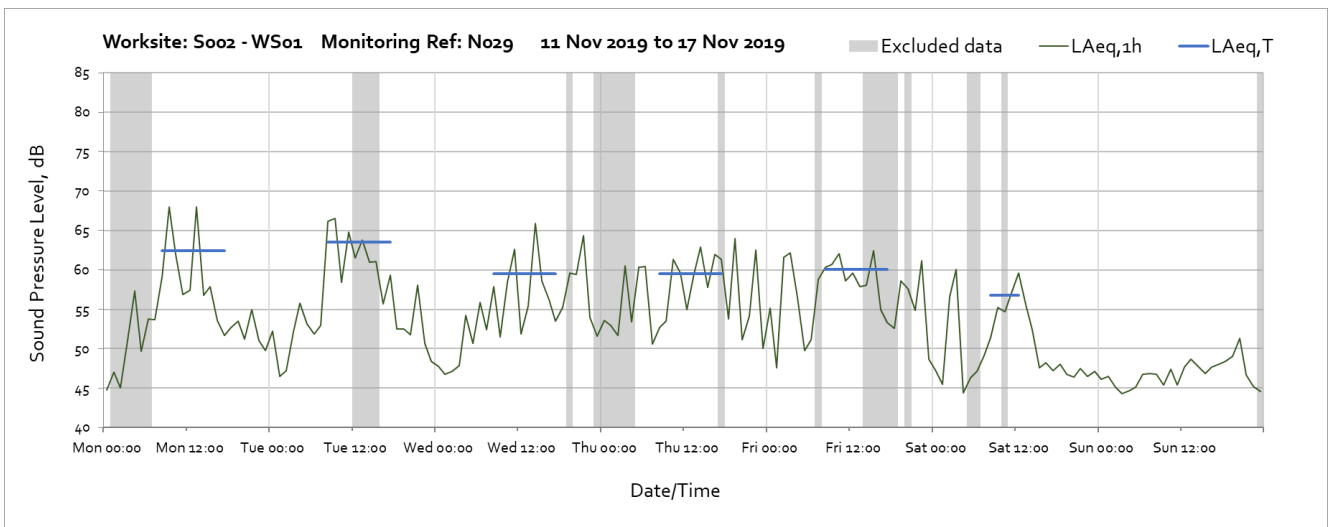
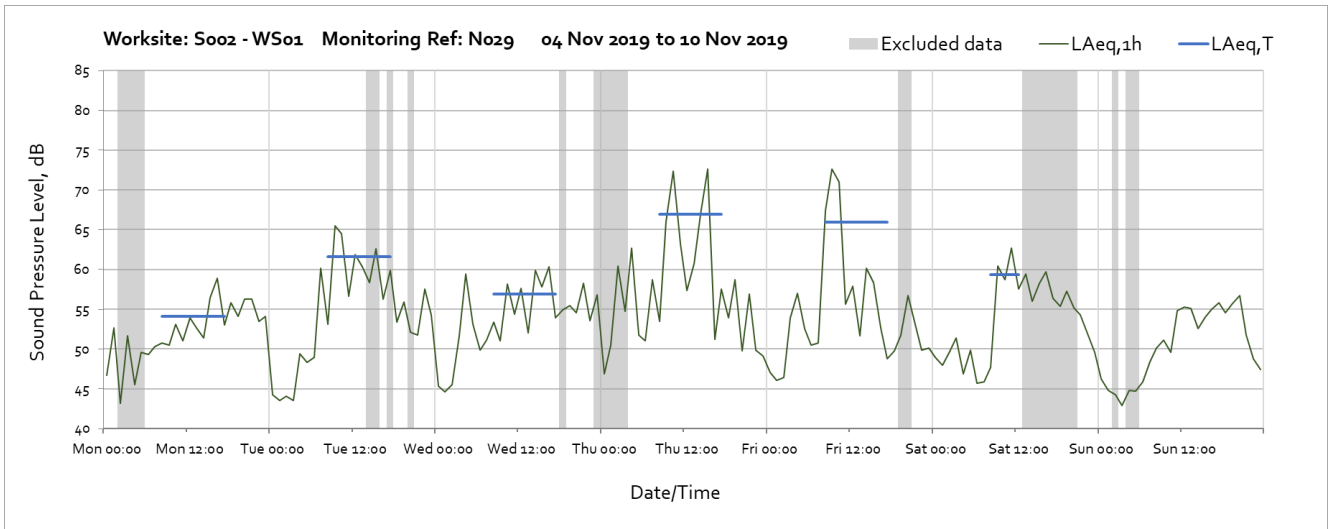
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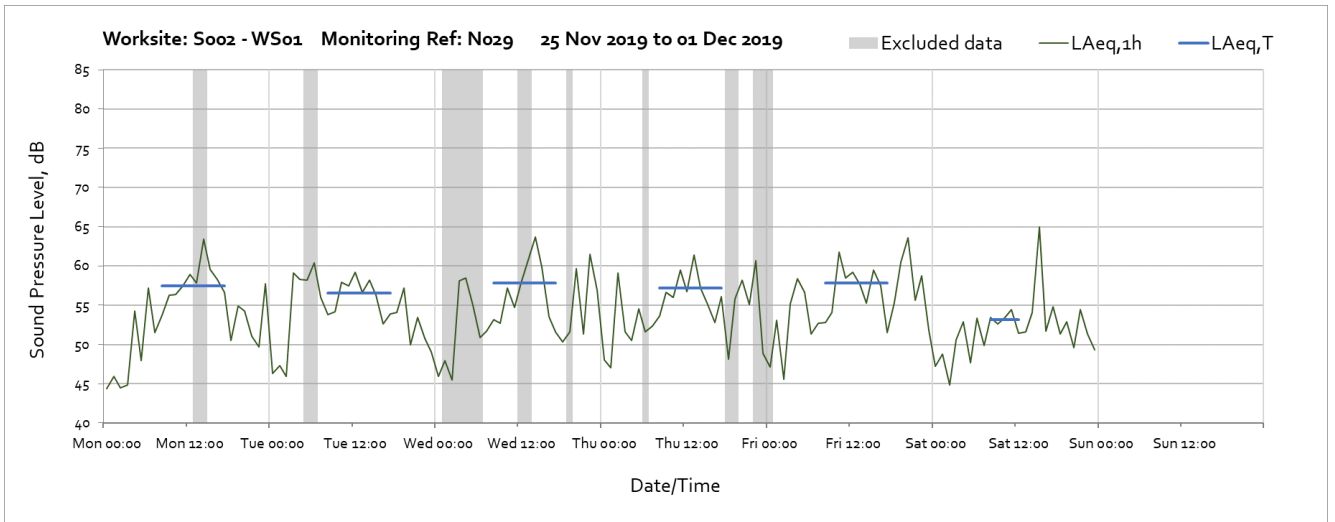




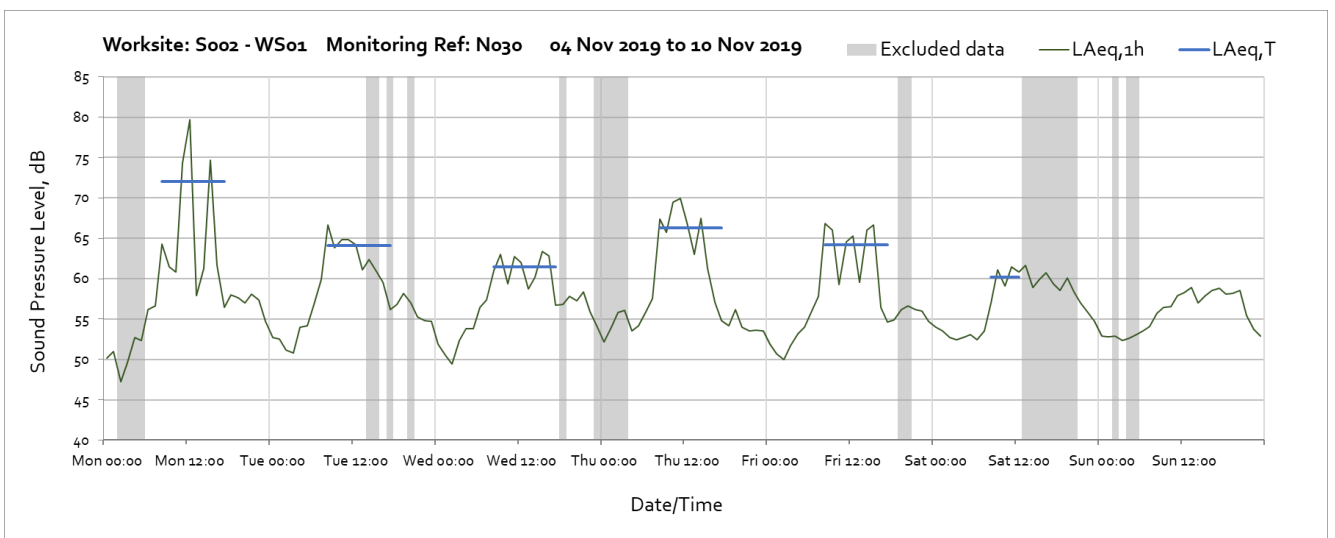
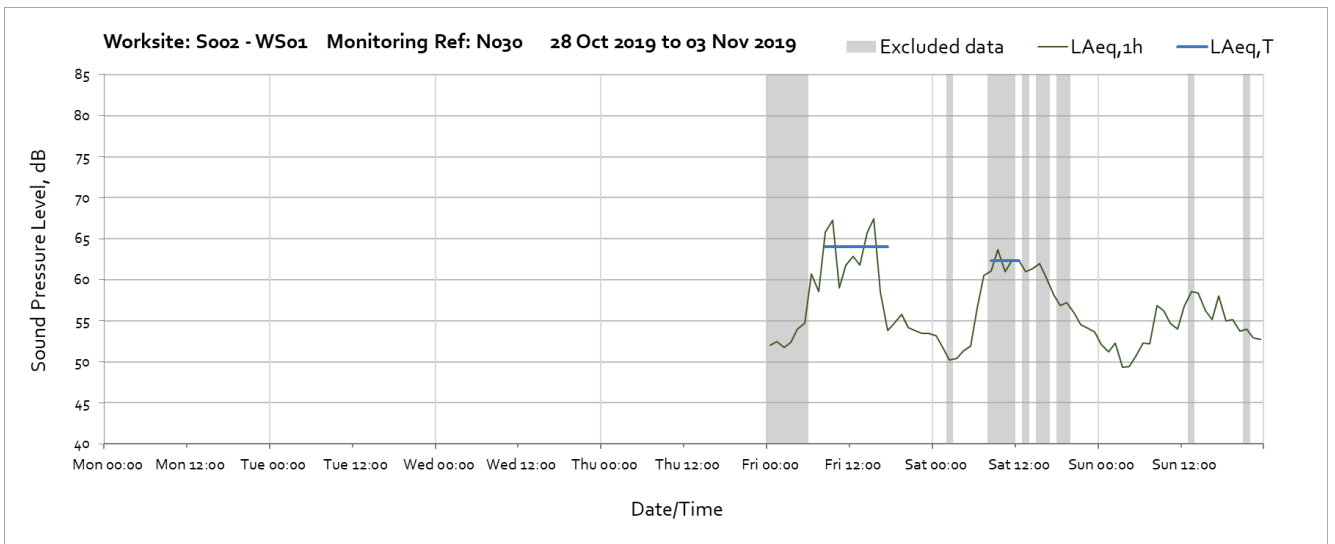
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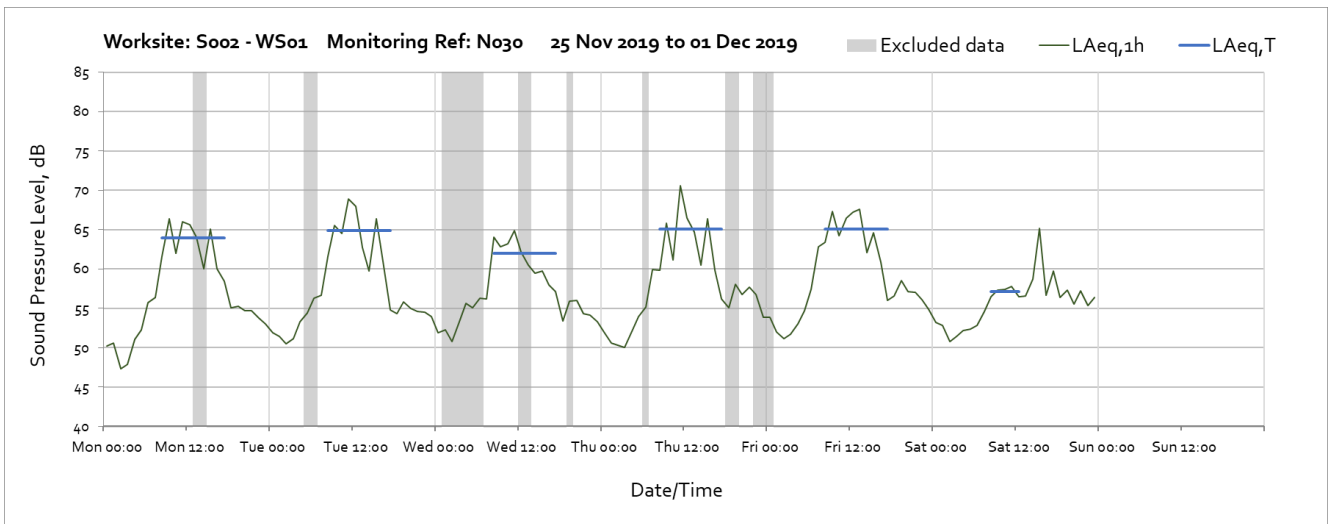
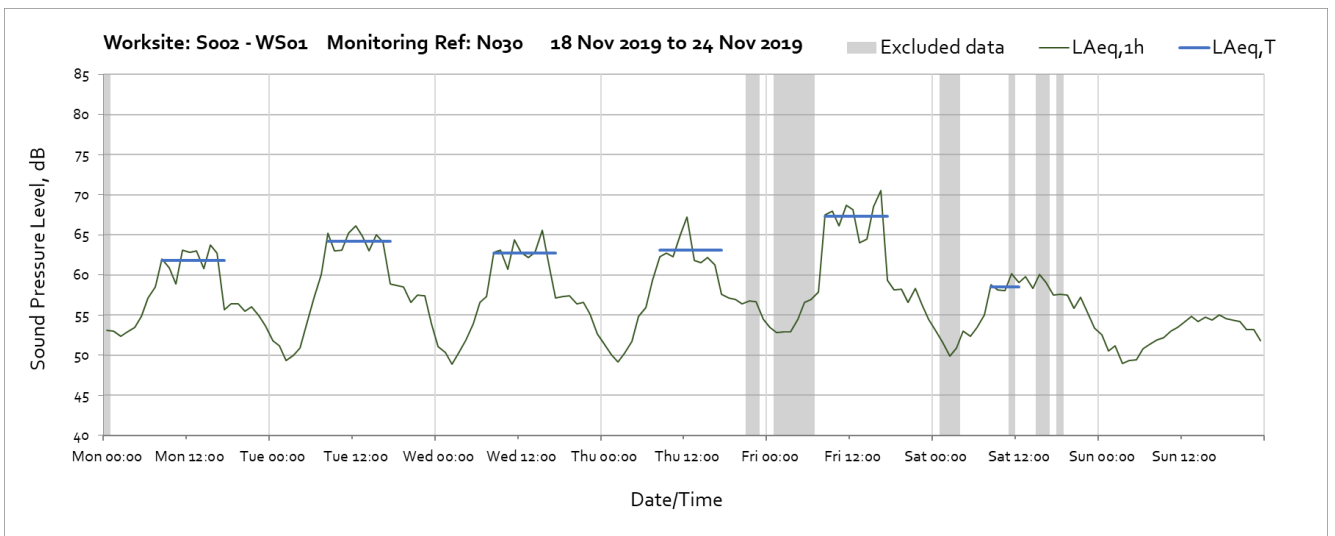
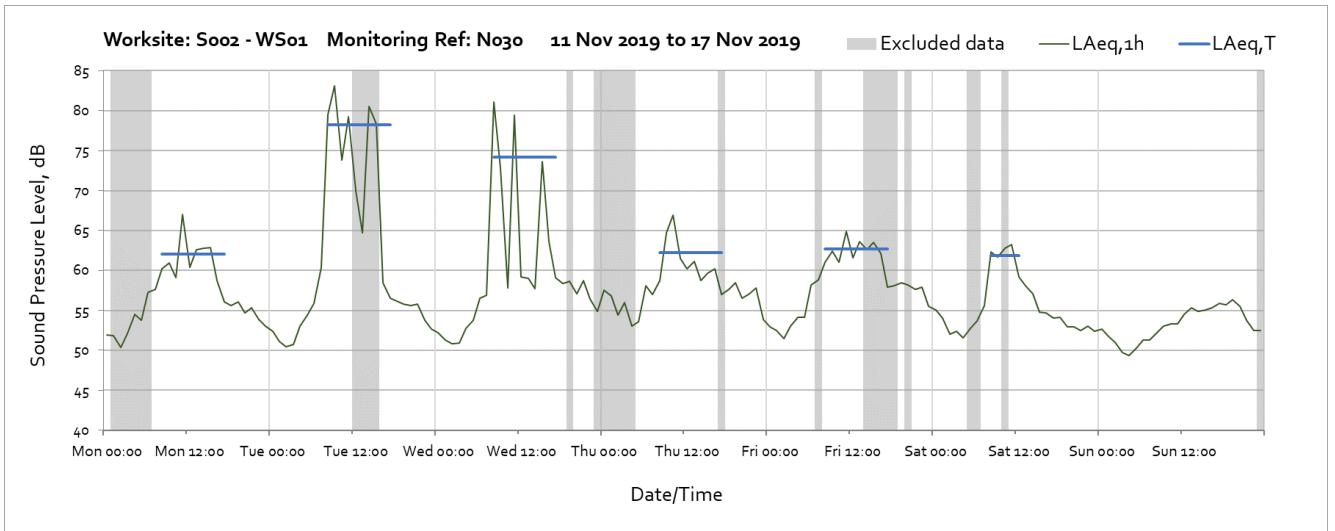




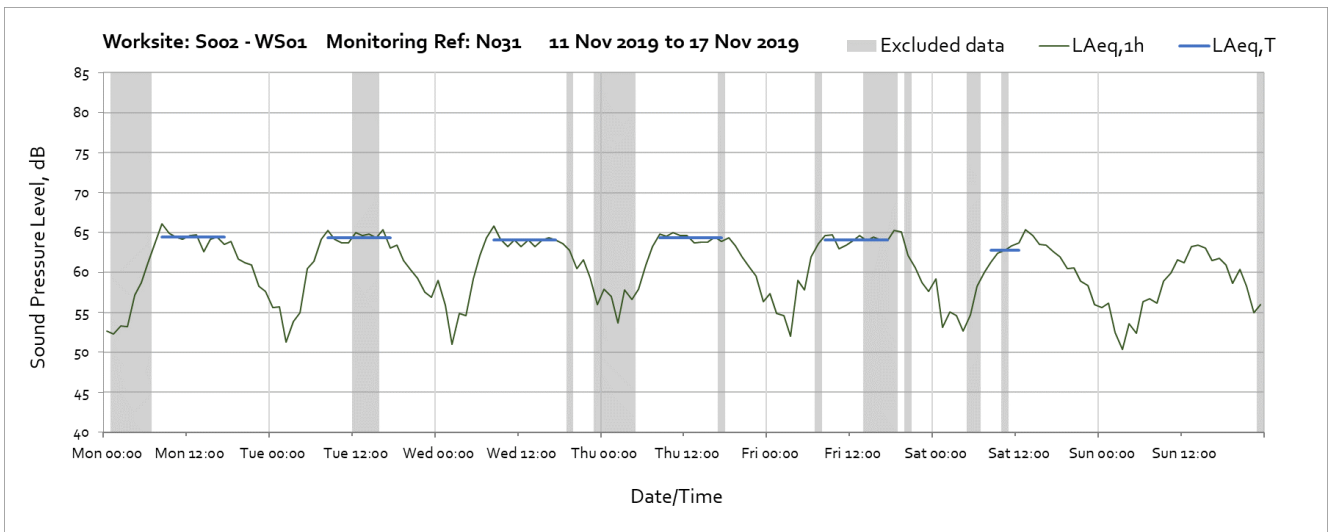
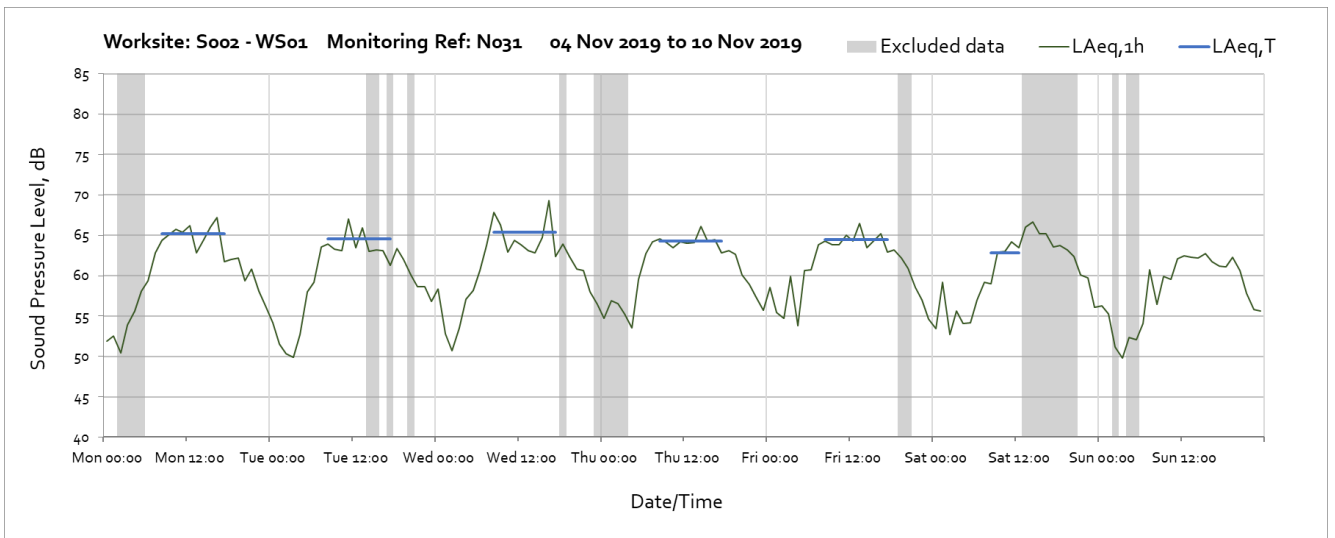
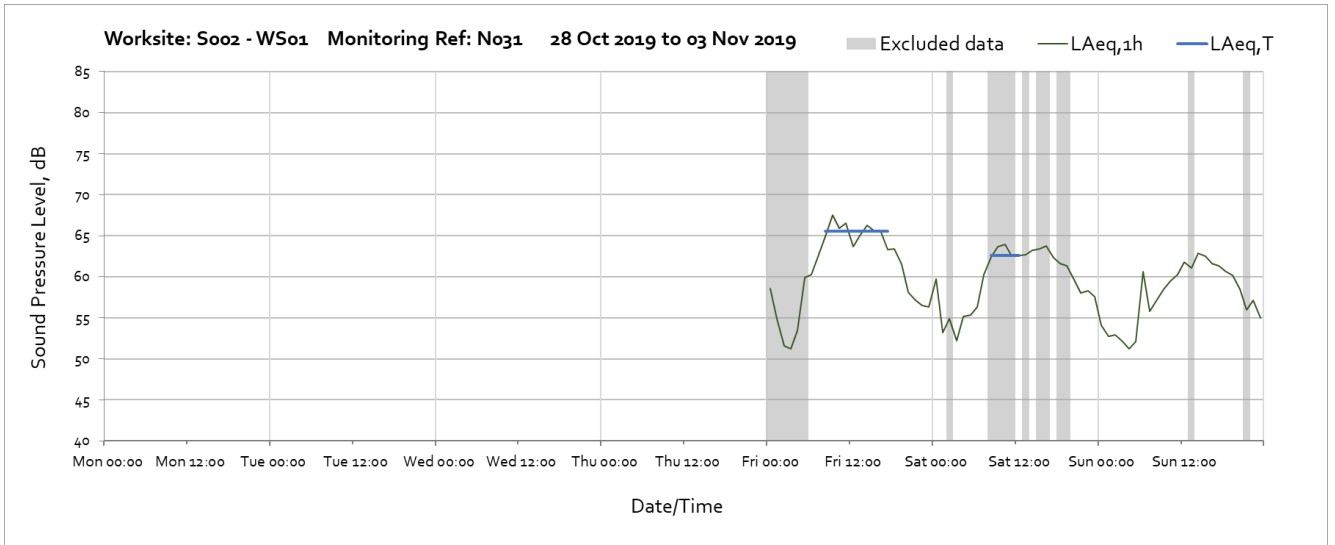


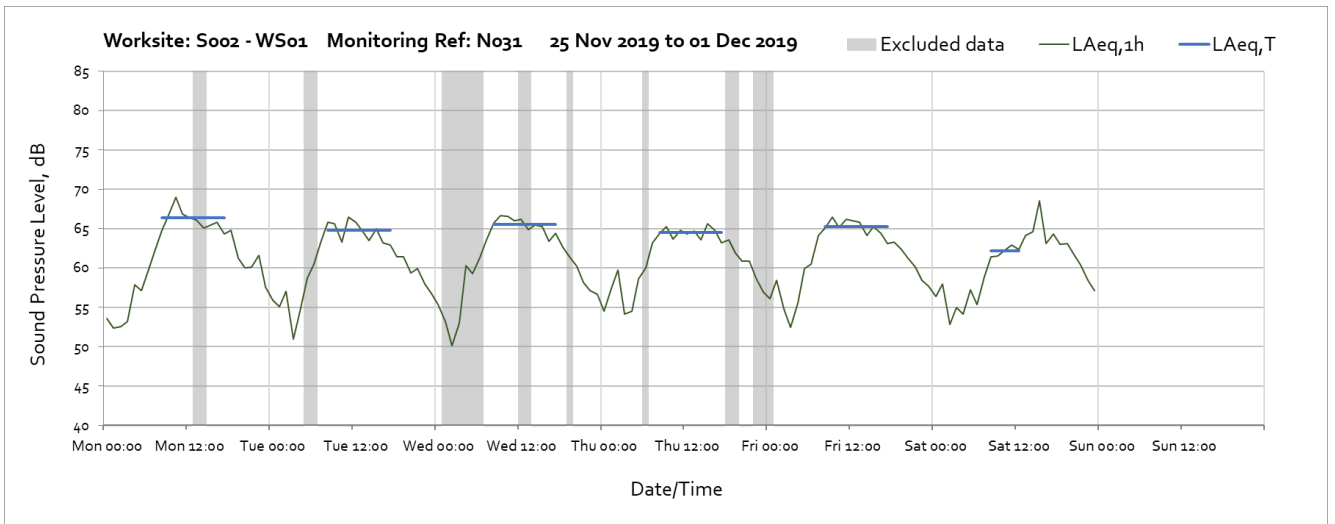
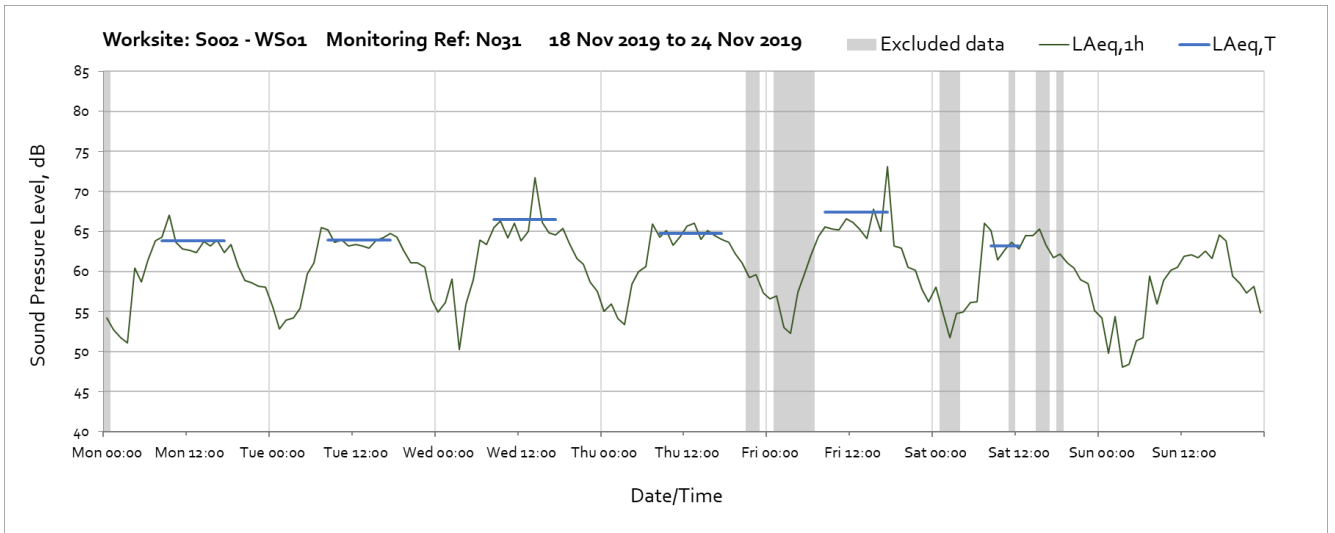
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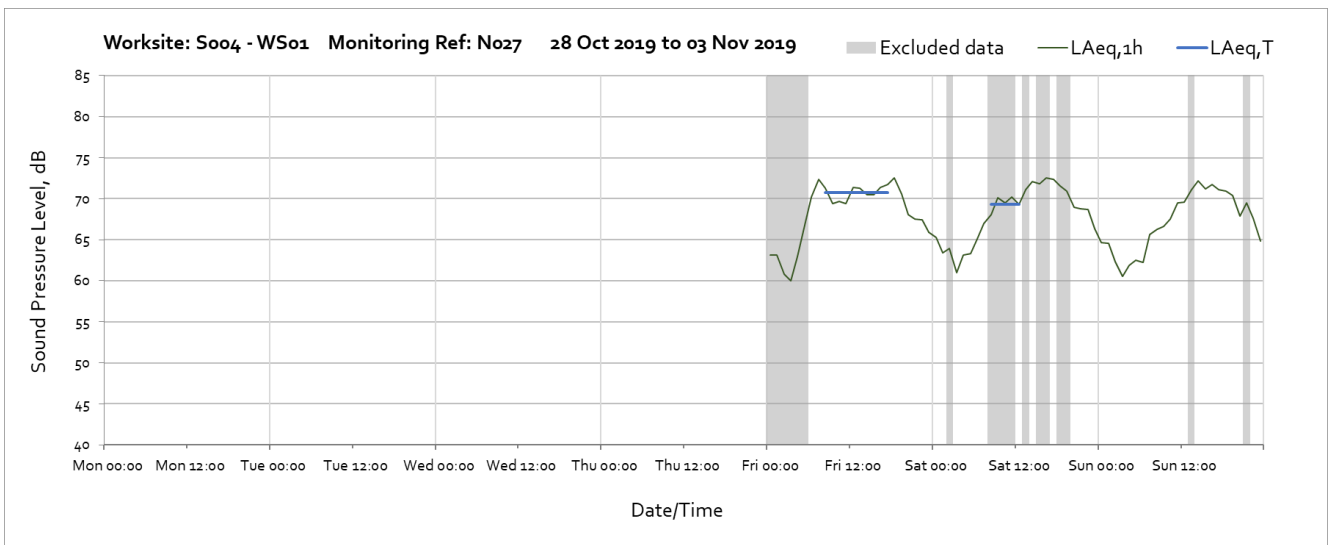


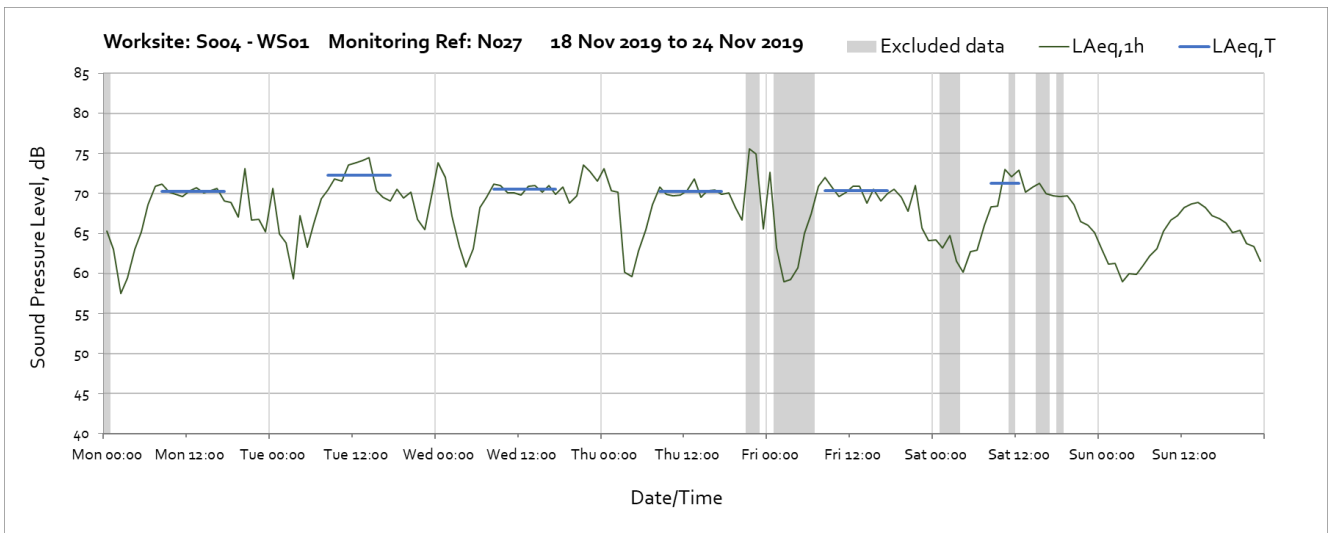
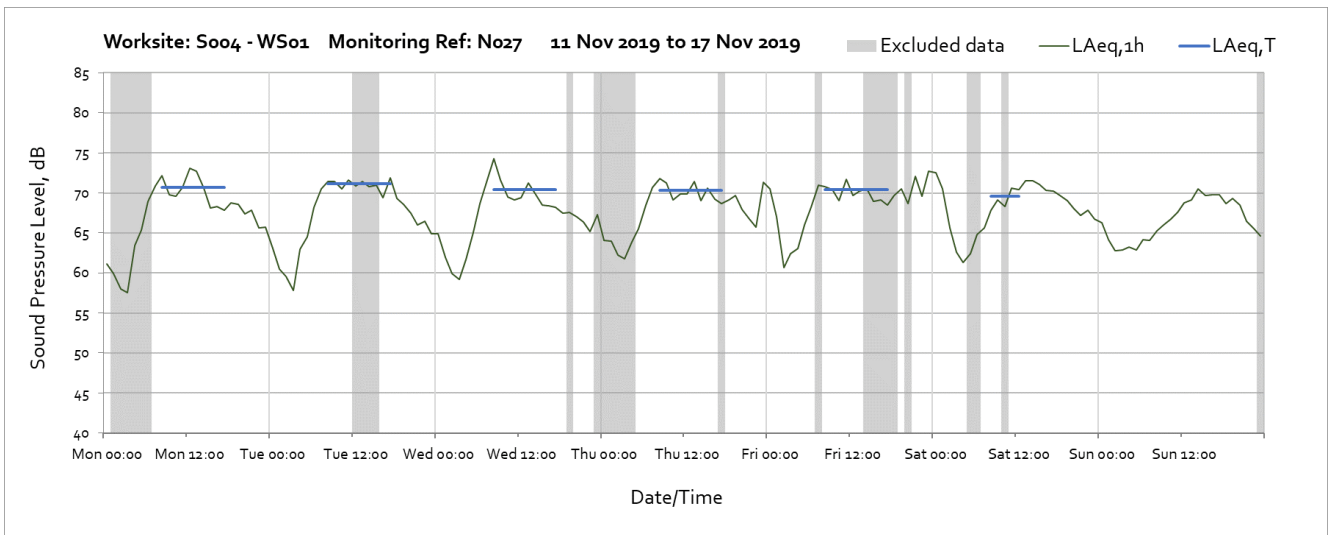
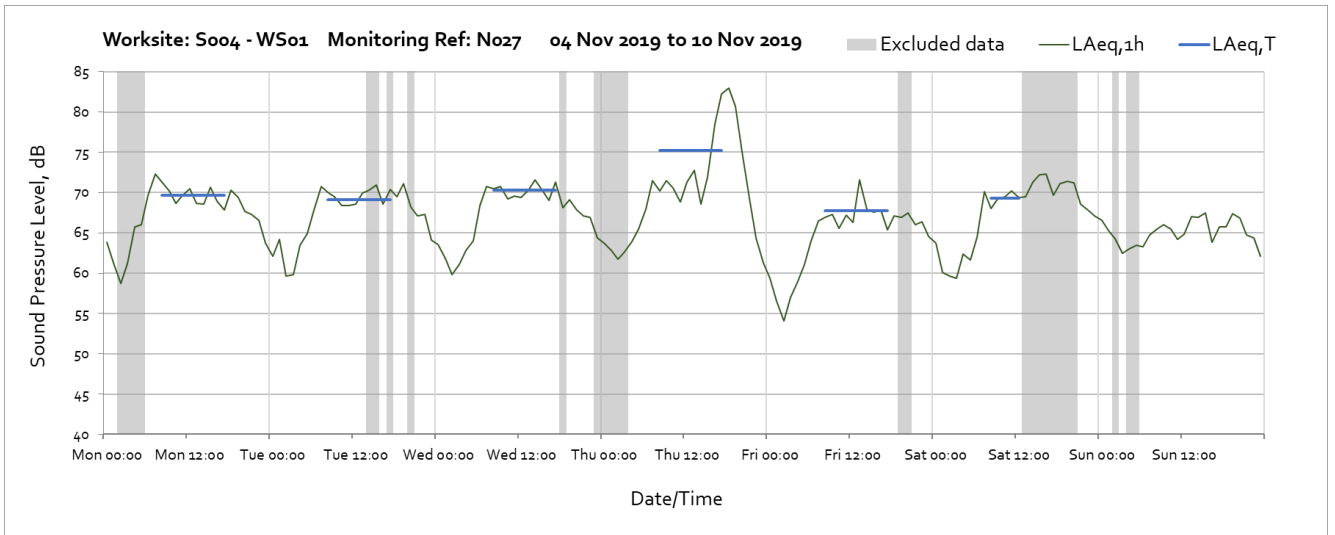
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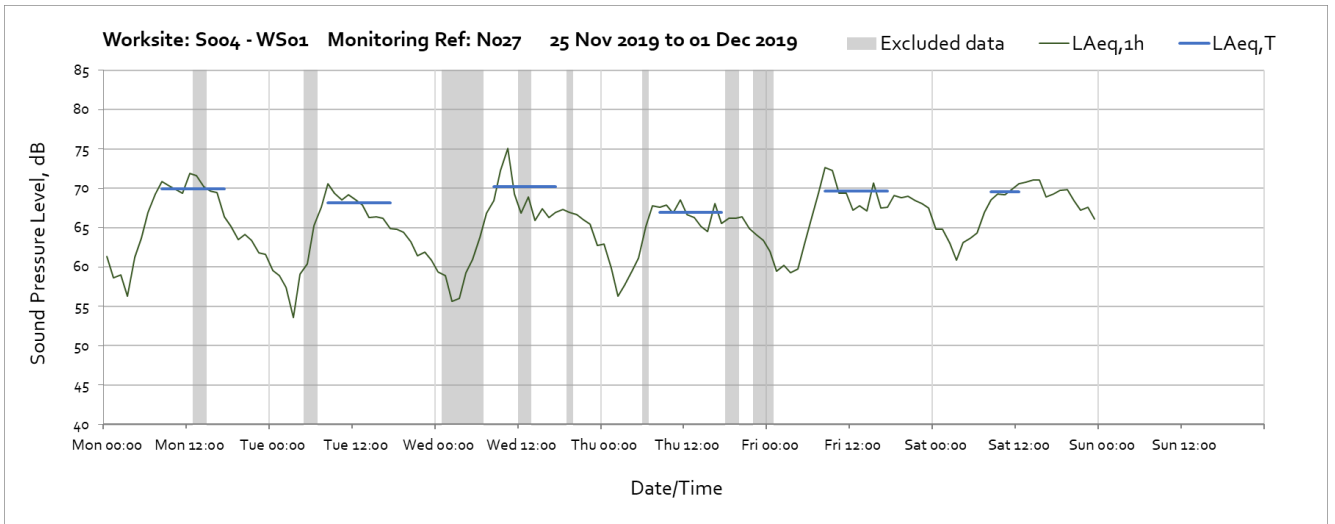




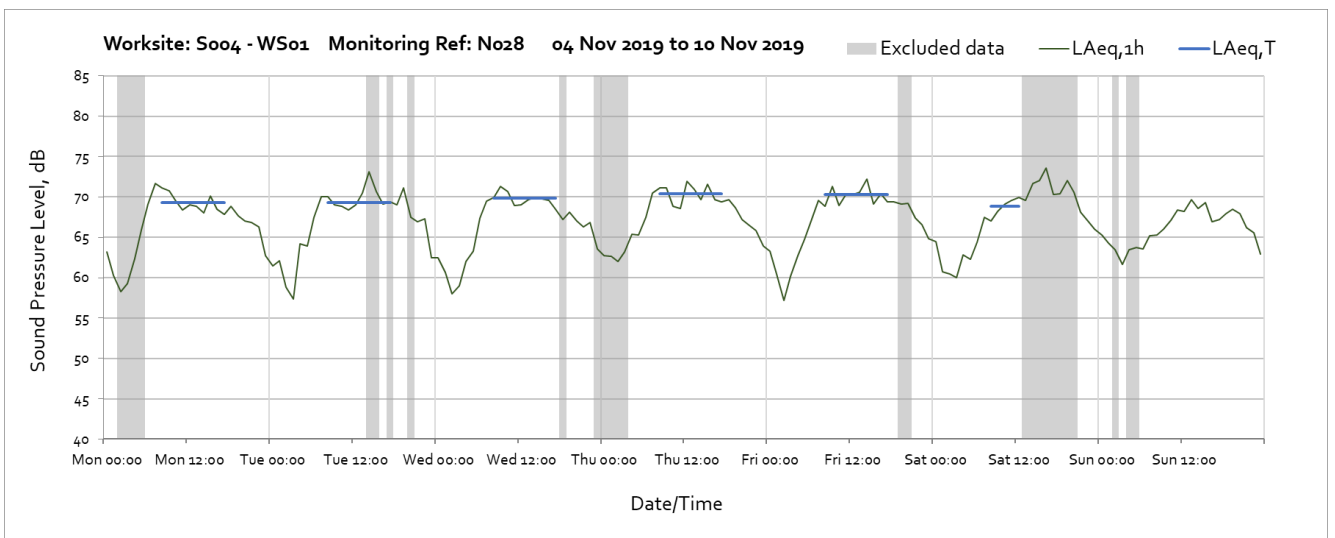
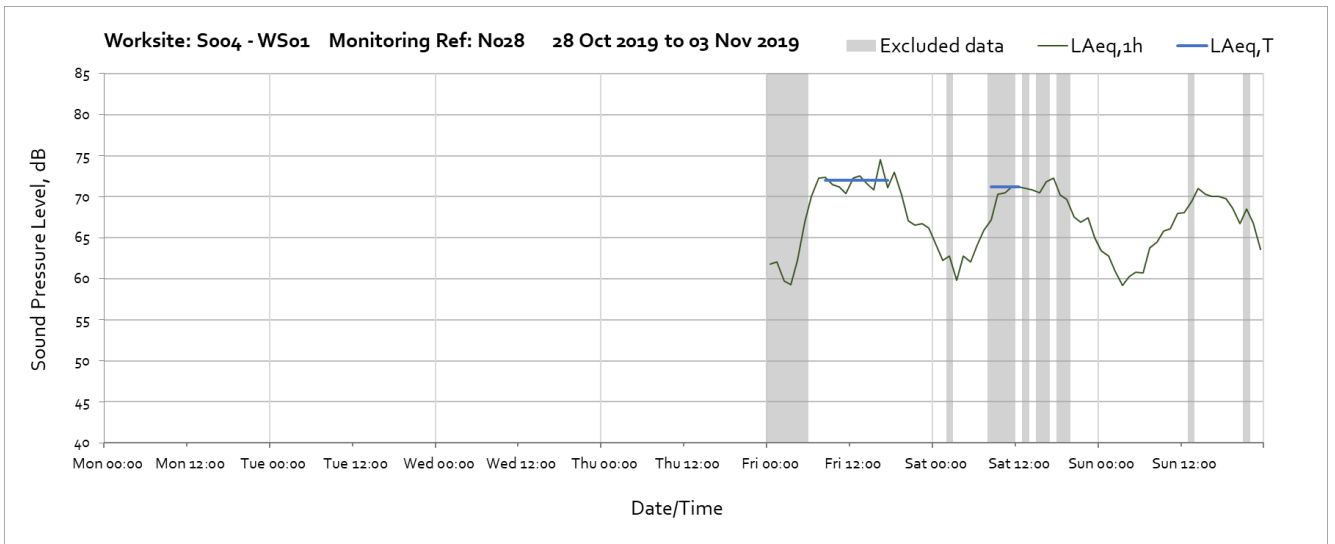
Worksite: S004-WS01 – Monitoring Ref: N027

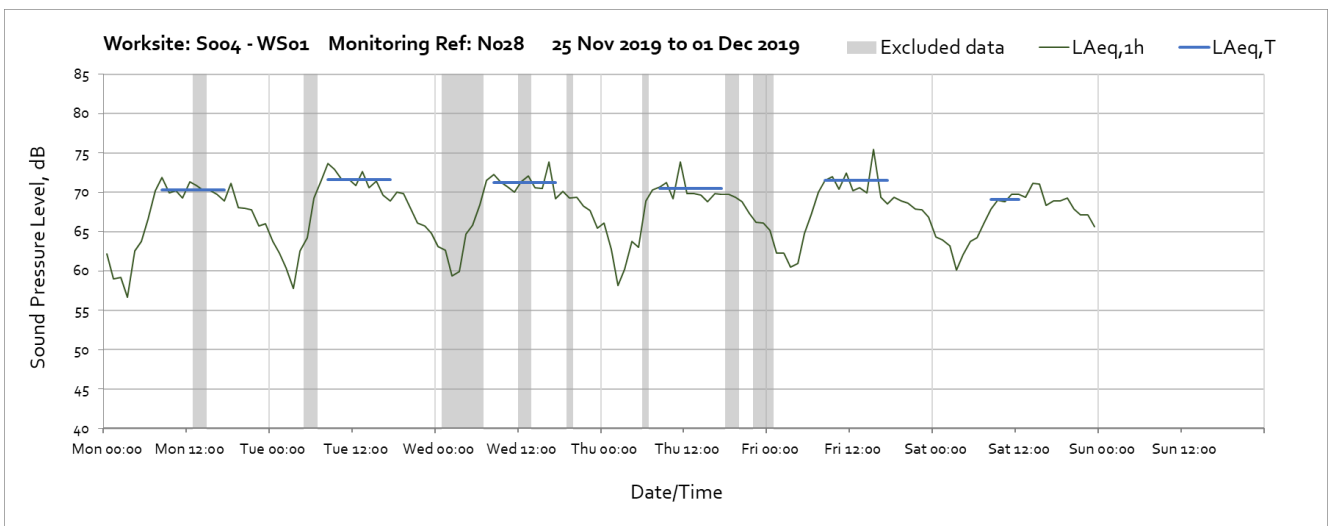
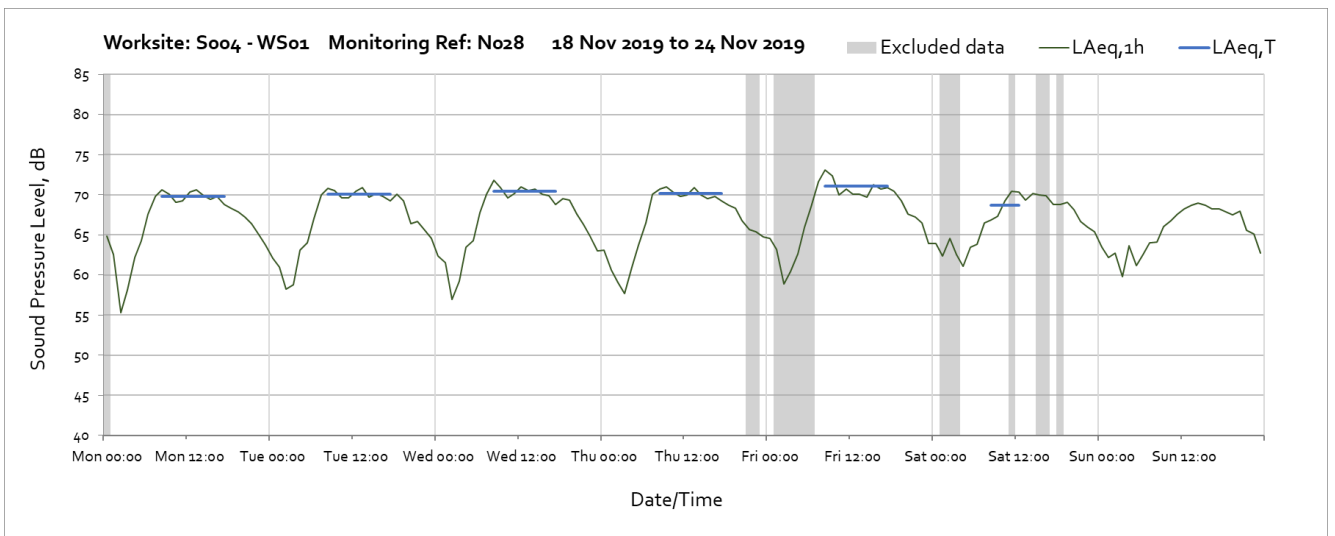
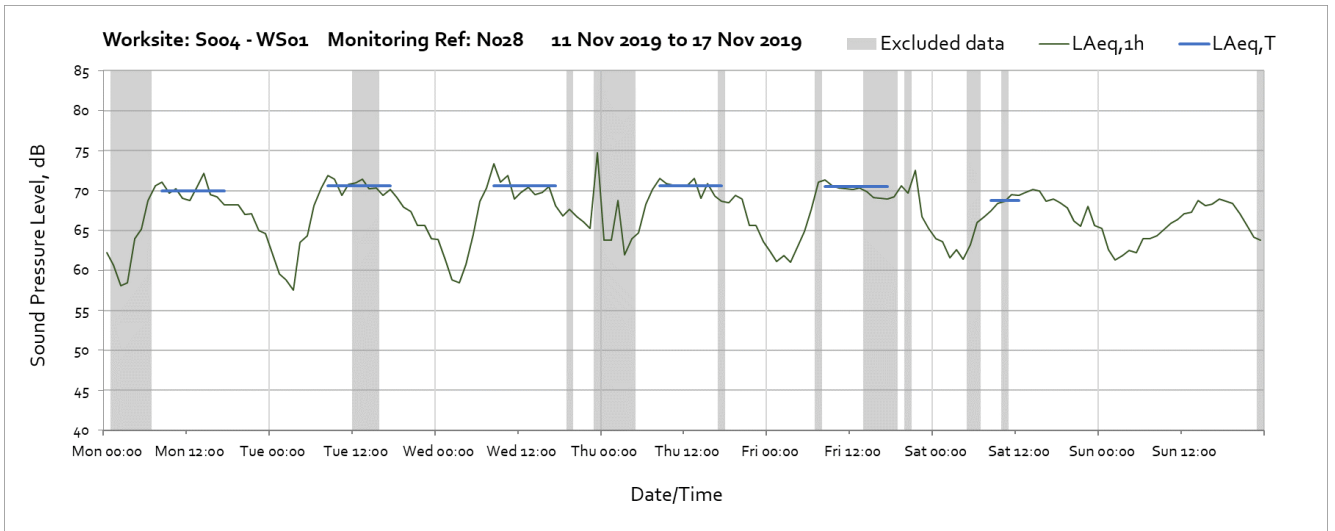




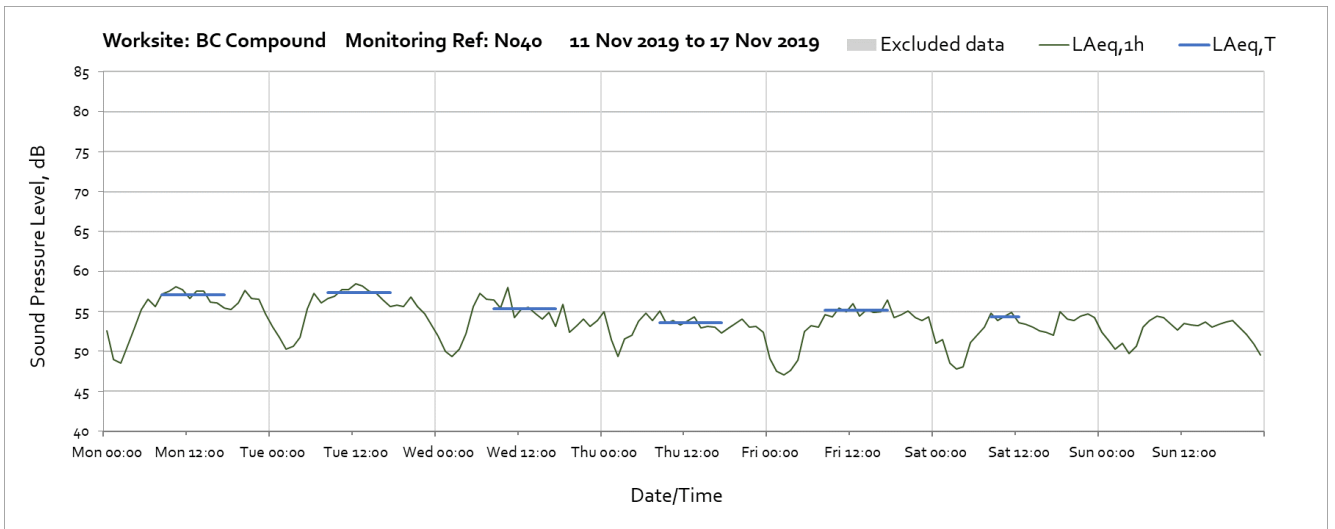
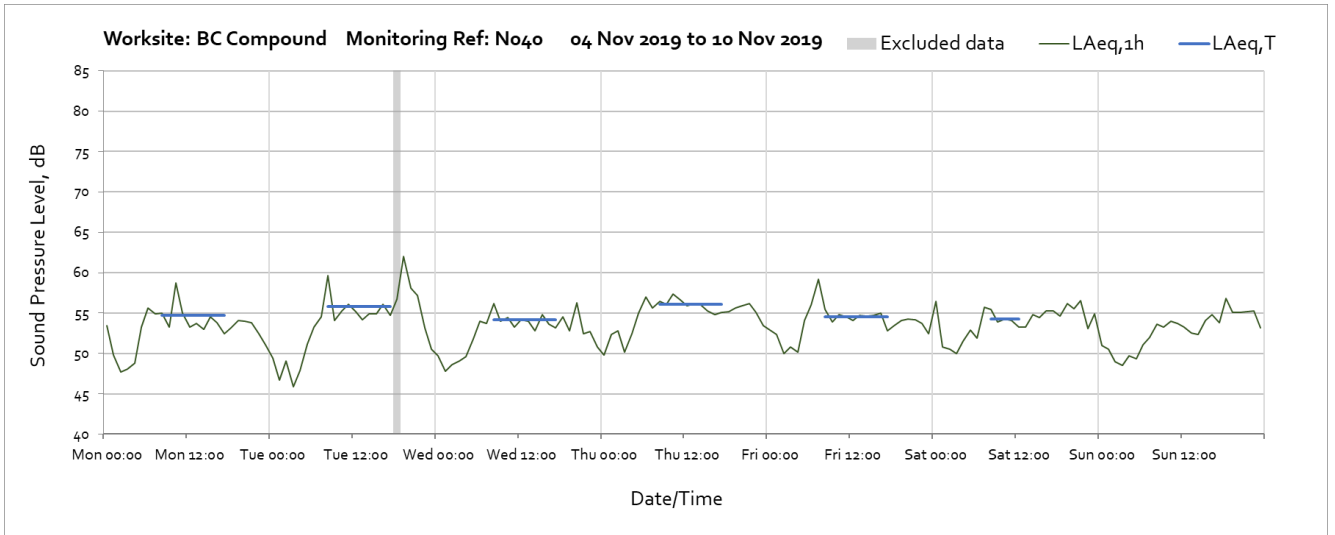
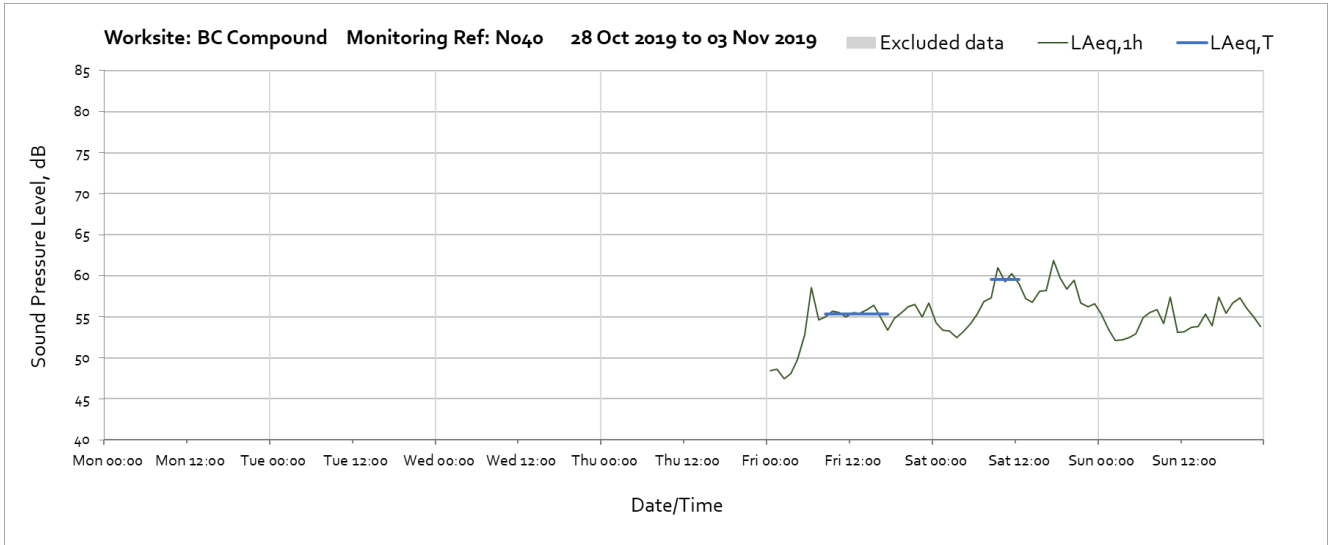


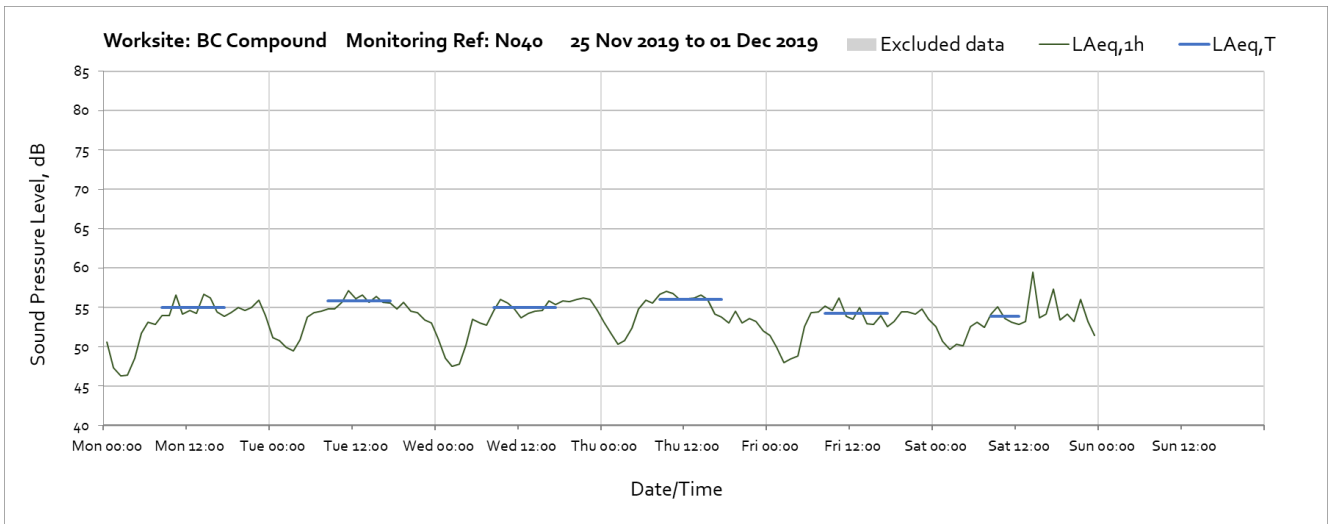
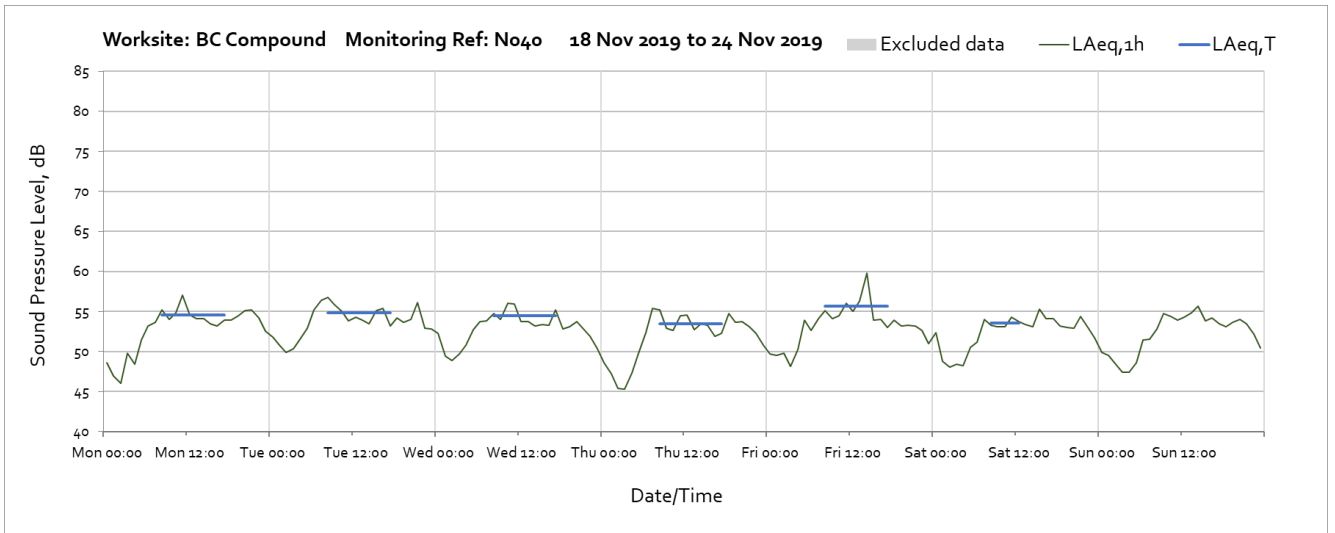
Worksite: S004-WS01 – Monitoring Ref: N028





Worksite: Badminton Close compound – Monitoring Ref: N040

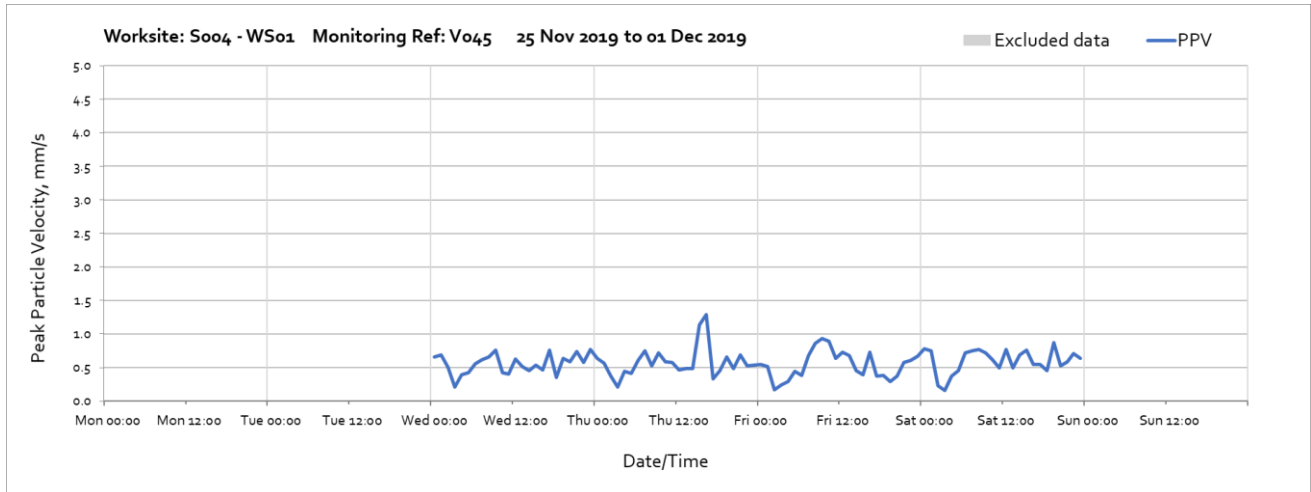




Vibration

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



Note: the vibration monitor was installed on the 25th of November. The high variability in vibration levels inside and outside construction hours were mainly due to road traffic generated vibration rather than being attributable to HS2 construction works.