HS2

July 2020

Construction noise and vibration Monthly Report – May 2020

London Borough of Ealing

gov.uk/hs2

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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) and London Borough of Hammersmith and Fulham (LBHF) during the month of May 2020.

The report presents data from noise and vibration monitoring installations at five worksites within LBE and LBHF.

In the vicinity of the Atlas Road worksite (ref.: S001-WS02) works included site setup, concrete breaking/crushing and excavation of trial holes.

At Willesden EuroTerminal worksite (ref.: S001-WS03) main activities included site setup, excavation of trial holes, fitting out, excavation works, concrete breaking and utility works.

At the Victoria Road worksite (ref.: S002-WS01) main activities included earthworks, removal of foundations, concrete breaking, setup of additional dust control measures and mains power works.

At the Old Oak Common depot worksite (ref.: S004-WS01) groundworks and remediation works were carried out.

Noise monitoring was undertaken in proximity of all the above worksites, with vibration monitoring being carried out near worksite ref. S004-WS01. Noise data is also presented from monitoring in the vicinity of Mandeville Road Badminton Close compound (ref.: BC Compound).

Additional works were undertaken at Green Park Way Ventilation Shaft including site setup, road repairs, drilling of boreholes and deliveries.

The measured noise levels in May did not exceed guideline criteria for significant adverse effects due to HS2 related works at any monitoring location. No exceedances of Section 61 trigger levels due to HS2 related works were measured during the monitoring period. There were seven complaints during the monitoring period.

Abbreviations and descriptions

The abbreviations, descriptions and project terminology used within this report can be found in Table 1.

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.
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 31st May 2020.

1.1.2 Active construction sites in the local authority area during this period include:

- Atlas Road worksite (ref.: S001-WS02), where works included continuation of setting up welfare facilities, commencement of slab breakout including coring of ground slabs to take samples for laboratory testing, continuation of installing barriers for walking routes, stockpiling broken out concrete for crushing, which commenced during the last week of May and excavation of trial holes for conveyor routes. Utility works were also undertaken along Atlas Road to provide power supply for tunnel boring machine;
- Willesden EuroTerminal worksite (ref.: S001-WS03), where works included setting up of new welfare cabins and var parking, improving acoustic screening around generator, excavation of trial holes for services, fitting out works, general site clearance including removal of surplus materials and spoil, localised excavation works including some breaking out of patches of redundant ground slabs and foundations, hoarding works including to strengthen existing hoardings and utility works for site welfare facilities/offices;
- Victoria Road worksite (ref.: S002-WS01), where works included continued earthworks operations including construction of working platforms and haul roads, removal of localised foundations/obstructions including breaking out in south-western part of the site, mains power works in the south-eastern part of the site, deliveries and setting up additional dust control measures;

- Flat Iron compound (within worksite ref.: S002-WS01) where works included continued movement of materials to Victoria Road site and deliveries;
- Old Oak Common depot worksite (ref.: S004-WS01), where groundworks and remediation works were carried out.

Relocation of site welfare units and stores, continuation of site clearance / clean-up, site fencings works, localised road repairs, delivery of materials for future works, commencement of hoarding / fencing works including relocation of existing site gates, removal of concrete bollards, clearance of vegetation, drilling of boreholes and excavation of trial holes was also undertaken for the Green Park Way ventilation shaft.

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 May 2020. 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
	N049	Flat Iron compound railway fence, Victoria Rd North Acton
S004-WS01	N027	Old Oak Common Lane
	N028	Old Oak Common Lane, Hilltop Works
	V045	Old Oak Common Lane
BC 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.

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
	N049	Flat Iron compound	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
BC Compound	N040	Badminton Close	All days	All periods	No exceedance

2.1.4 For this monitoring period no exceedances of the SOAEL were recorded.

2.1.5 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 LAeq,T is presented for each of the relevant time periods averaged over the calendar month, along with the highest single period LAeq,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, groundworks, 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_{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	62.9 (64.6)	64.9 (72.6)	63.7 (75.8)	62.9 (76.8)	58.7 (65.0)	60.1 (60.9)	63.0 (64.7)	62.5 (62.8)	63.8 (74.6)	57.4 (61.0)	61.7 (70.2)	58.9 (63.1)
	N033	Outside The Collective, Atlas Road/Victoria Road	Free field	65.6 (66.9)	66.3 (67.6)	64.9 (67.1)	64.3 (72.7)	60.5 (69.7)	62.0 (63.6)	64.7 (68.3)	63.8 (64.2)	65.6 (74.6)	59.3 (63.8)	63.3 (68.0)	61.4 (65.9)
S001-WS03	N034	Stephenson Street (north)	Free field	52.7 (63.3)	53.8 (58.6)	51.4 (59.4)	50.9 (55.9)	47.2 (61.8)	50.3 (57.8)	51.9 (54.5)	50.5 (54.3)	52.3 (58.7)	45.1 (52.7)	53.1 (62.2)	48.5 (60.2)
	N035	Stephenson Street (south)	Free field	53.6 (61.0)	54.9 (66.1)	51.7 (66.5)	51.0 (66.7)	47.5 (57.0)	48.1 (53.9)	51.9 (60.8)	51.5 (63.4)	52.4 (64.3)	46.4 (55.8)	50.4 (55.5)	47.0 (53.6)
	N041	Junction of Stephenson Street/Goodhall Street	Free field	57.4 (60.8)	56.6 (58.2)	55.3 (60.3)	54.3 (61.4)	51.0 (59.9)	55.0 (56.4)	55.4 (56.3)	56.4 (58.6)	56.9 (63.7)	49.8 (55.6)	55.2 (61.0)	50.6 (57.6)
S002-WS01	N029	Braitrim House, Victoria Road	Free field	51.1 (57.7)	56.0 (60.1)	52.8 (56.4)	53.2 (58.9)	50.6 (60.4)	52.0 (66.9)	52.6 (55.5)	51.7 (52.6)	53.6 (59.0)	49.5 (61.0)	52.9 (61.3)	50.6 (59.5)
	N030	Bodens car park	Free field	54.8 (60.9)	57.8 (64.6)	54.1 (57.9)	53.3 (58.8)	50.3 (56.3)	51.7 (53.3)	53.5 (56.2)	53.0 (54.9)	54.5 (60.3)	49.5 (54.6)	55.3 (64.6)	52.4 (63.0)
	N031	School Road, outside Acton Business Centre	Free field	61.7 (63.7)	62.9 (65.6)	61.4 (63.8)	59.2 (62.7)	54.3 (67.1)	57.1 (60.7)	60.5 (64.1)	60.7 (62.1)	61.3 (69.2)	53.1 (61.3)	60.0 (68.1)	54.9 (61.8)
	N049	Flat Iron compound	Free field	52.0 (60.0)	56.4 (59.8)	52.4 (56.0)	53.2 (58.3)	52.4 (61.4)	49.6 (53.1)	52.5 (56.7)	51.8 (53.2)	53.1 (63.4)	49.7 (67.5)	52.2 (62.2)	50.4 (58.4)

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	65.4	66.9	65.2	64.5	59.9	62.1	64.7	64.4	64.5	59.7	63.6	60.5
				(66.5)	(69.7)	(68.2)	(73.2)	(65.6)	(63.2)	(66.8)	(65.0)	(66.9)	(67.2)	(71.7)	(66.4)
	N028	Old Oak Common Lane, Hilltop Works	Free field	66.5	68.0	65.8	64.5	60.8	63.1	65.7	65.0	65.3	60.3	64.3	61.7
				(68.4)	(69.5)	(67.0)	(67.3)	(67.5)	(63.9)	(68.4)	(66.1)	(69.3)	(68.3)	(71.7)	(70.5)
BC Compound	N040	Badminton Close	Free field	53.8	53.9	52.7	52.6	50.5	53.0	53.9	54.6	53.8	49.3	52.4	50.3
				(65.2)	(59.9)	(55.8)	(56.0)	(63.5)	(58.7)	(56.9)	(57.1)	(59.5)	(53.5)	(57.5)	(58.7)

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	2.00 (Z-axis)

2.3 Exceedances of trigger level

2.3.1 Table 6 provides a summary of exceedances of the Section 61 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.

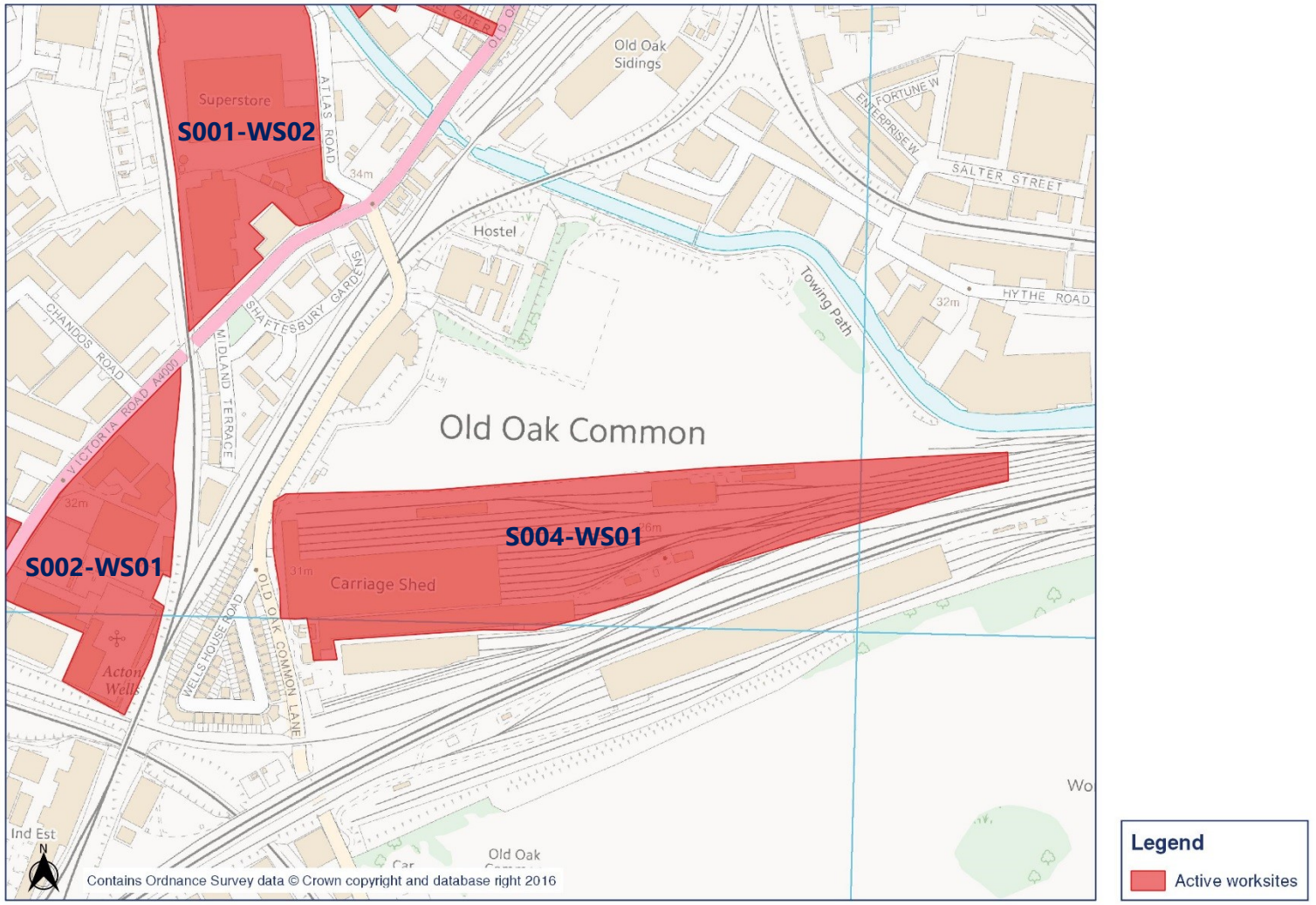
Table 7: Summary of complaints

Complaint reference number	Worksite reference	Description of complaint	Results of investigation	Actions taken
HS2-20-40036-C	S004-WS01	Complaint due to construction noise.	Noise was associated with activities at Old Oak Common Lane worksite. Noise levels were within Section 61 limits.	A response was provided to the complainant, who was also informed of the programme of works.

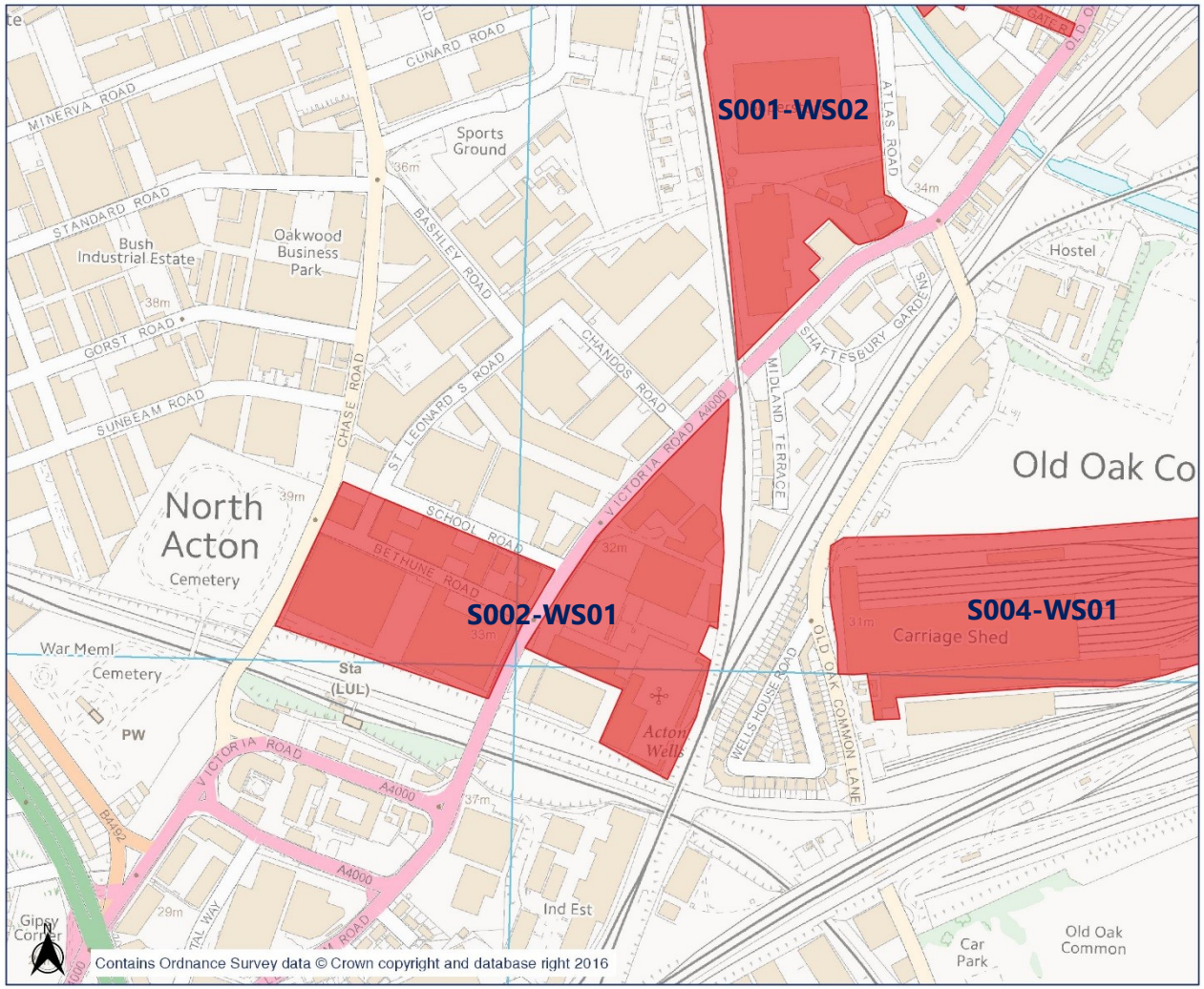
Complaint reference number	Worksite reference	Description of complaint	Results of investigation	Actions taken
HS2-20-40041-C	S004-WS01	Complaint due to noise and vibration from Old Oak Common Lane worksite, continuous throughout daytime and night-time periods.	Noise and vibration levels during periods of construction were within Section 61 limits.	Noise and vibration complaints were being reported 24hrs per day, which is not in line with HS2 construction works. The complainant was informed of the working hours.
HS2-20-40045-C	S004-WS01	Complaint due to noise from Old Oak Common Lane worksite.	Noise and vibration was caused by lorries entering site. Noise levels were within Section 61 limits.	The issue has been raised with the contractors.
HS2-20-40062-C	S004-WS01	Complaint from resident regarding noise and vibration perceived within property.	Works include removal of temporary road surface and groundworks. Methodology is in line with Section 61 and noise and vibration monitoring indicates compliance with Section 61 and substantially below significant effect levels.	Information was provided to the complainant.
HS2-20-40079-C	S004-WS01	Complaint due to noise and vibration caused by HGVs.	Noise and vibration was caused by lorries entering site. Noise and vibration levels were within Section 61 limits.	The issue has been raised with the contractors.
HS2-20-40081-C	S004-WS01	Complaint due to noise and vibration from Old Oak Common Lane worksite.	Noise and vibration levels were within Section 61 limits.	A meeting was held with resident to discuss concerns. HS2 have offered to install a vibration monitor within the building.
HS2-20-40083-C	S004-WS01	Complaint due to noise from Old Oak Common Lane worksite.	Noise levels were within Section 61 limits.	A meeting was held with resident to discuss concerns. HS2 have offered to install a vibration monitor within the building.

Appendix A Site Locations

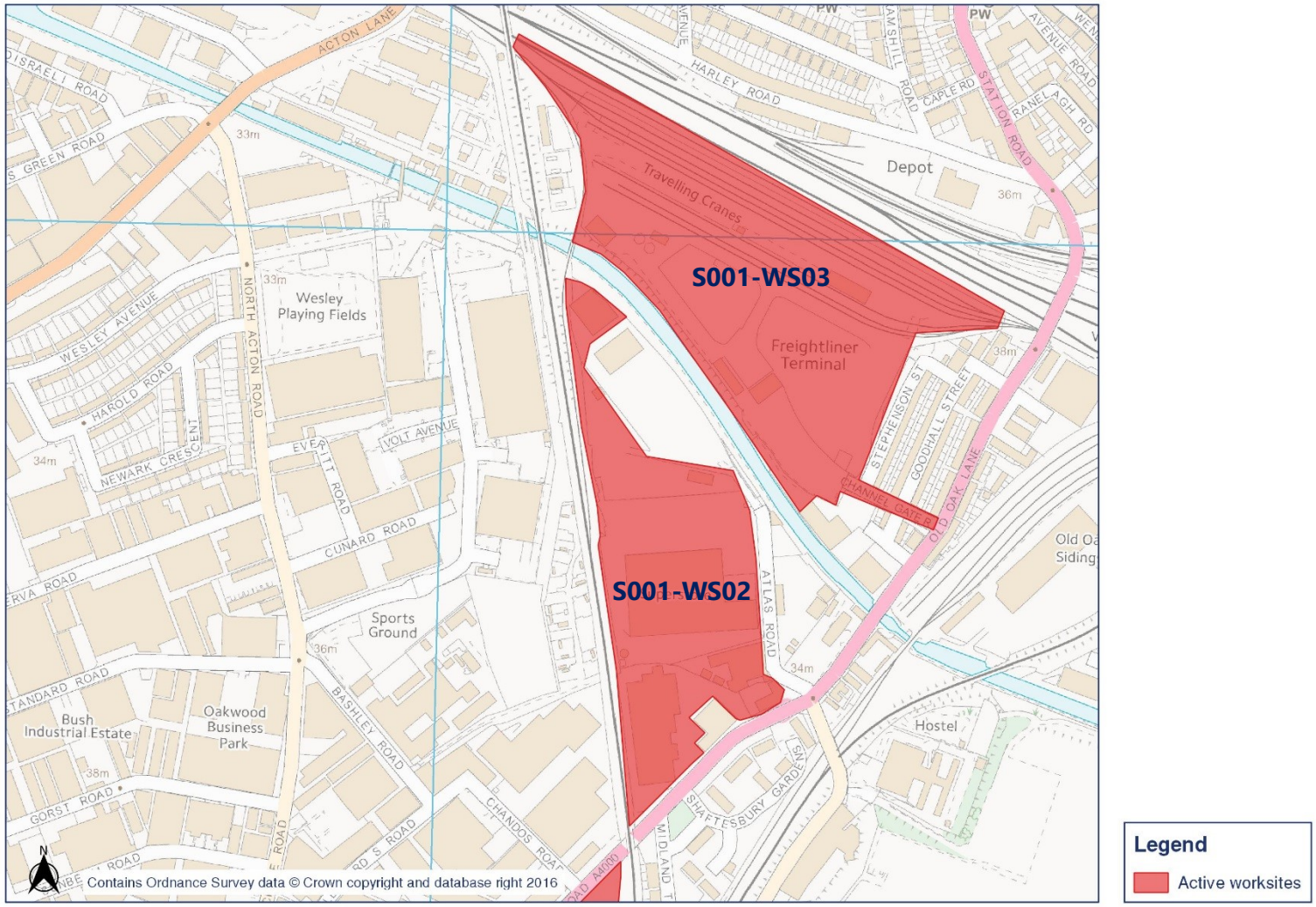
Worksite identification plan - 1



Worksite identification plan - 2

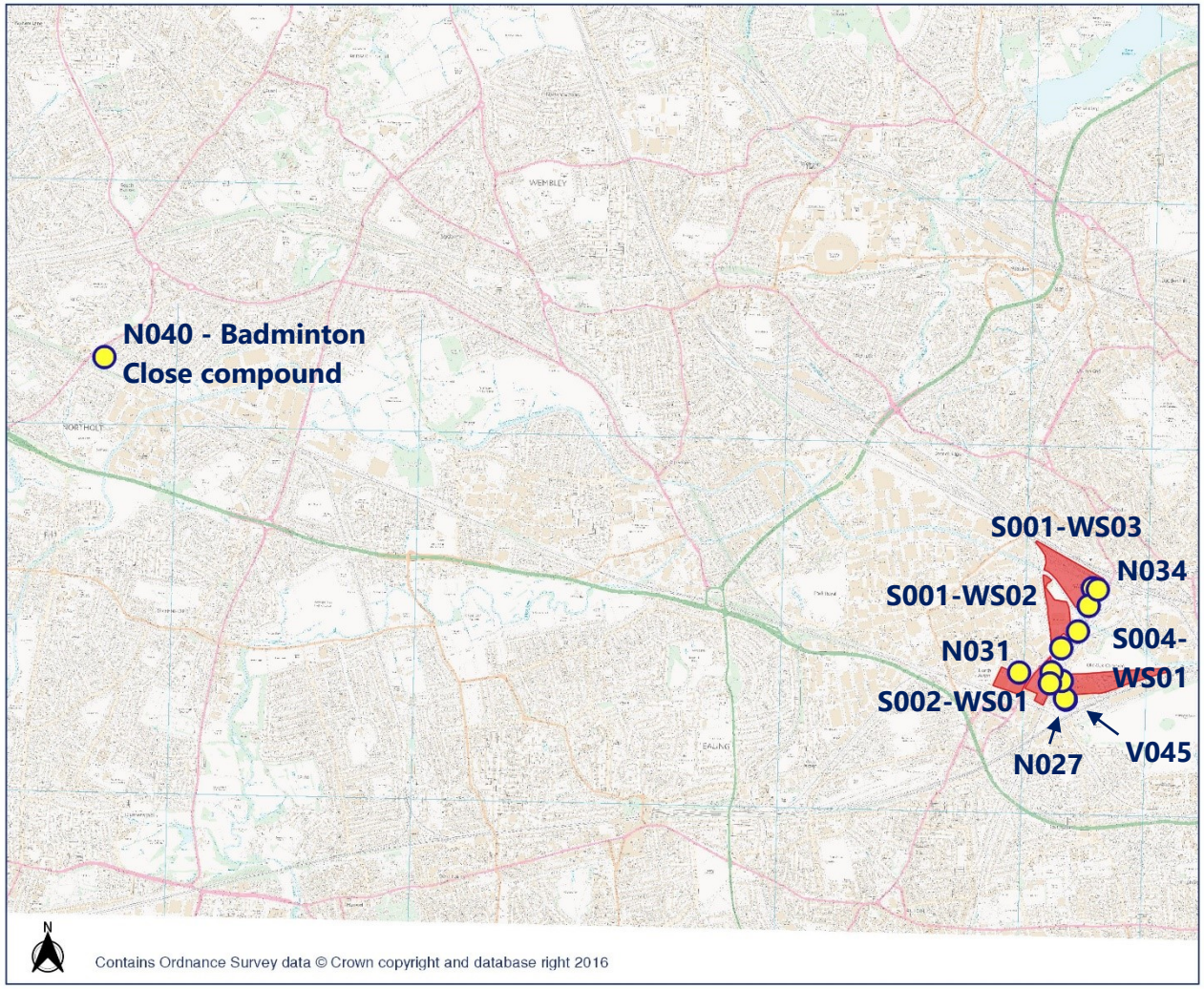


Worksite identification plan - 3

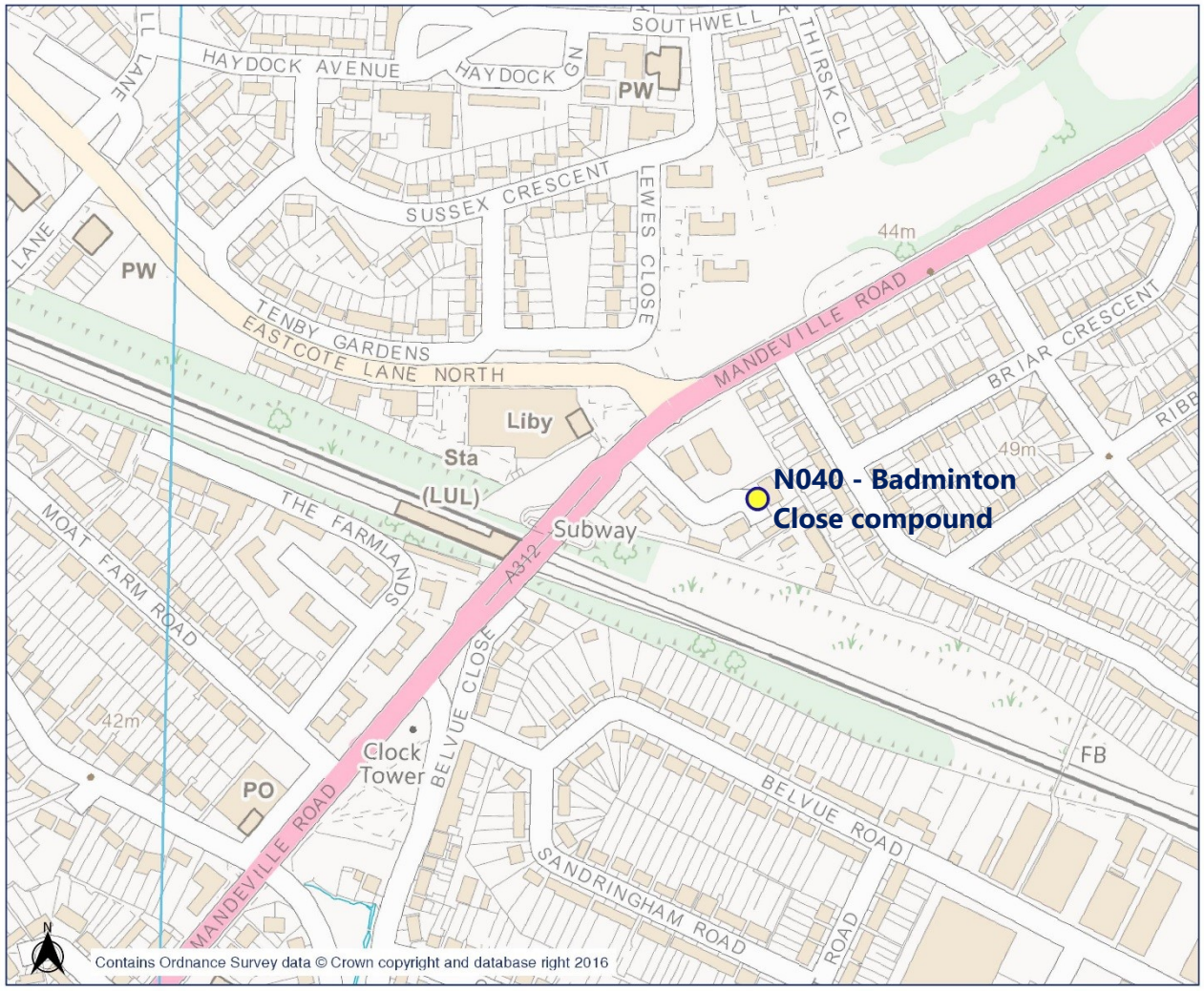


Appendix B Monitoring Locations

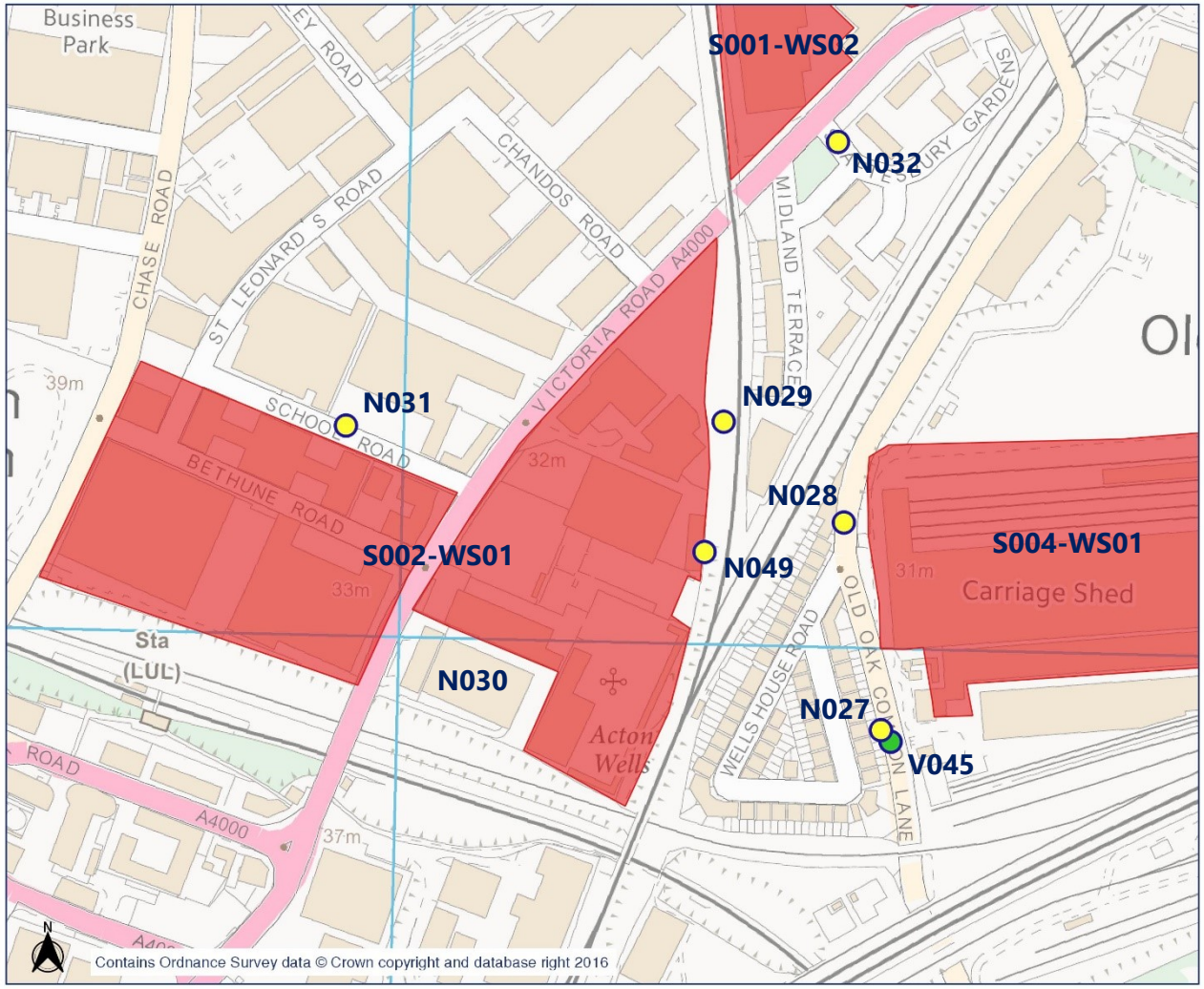
Noise monitoring plan - 1



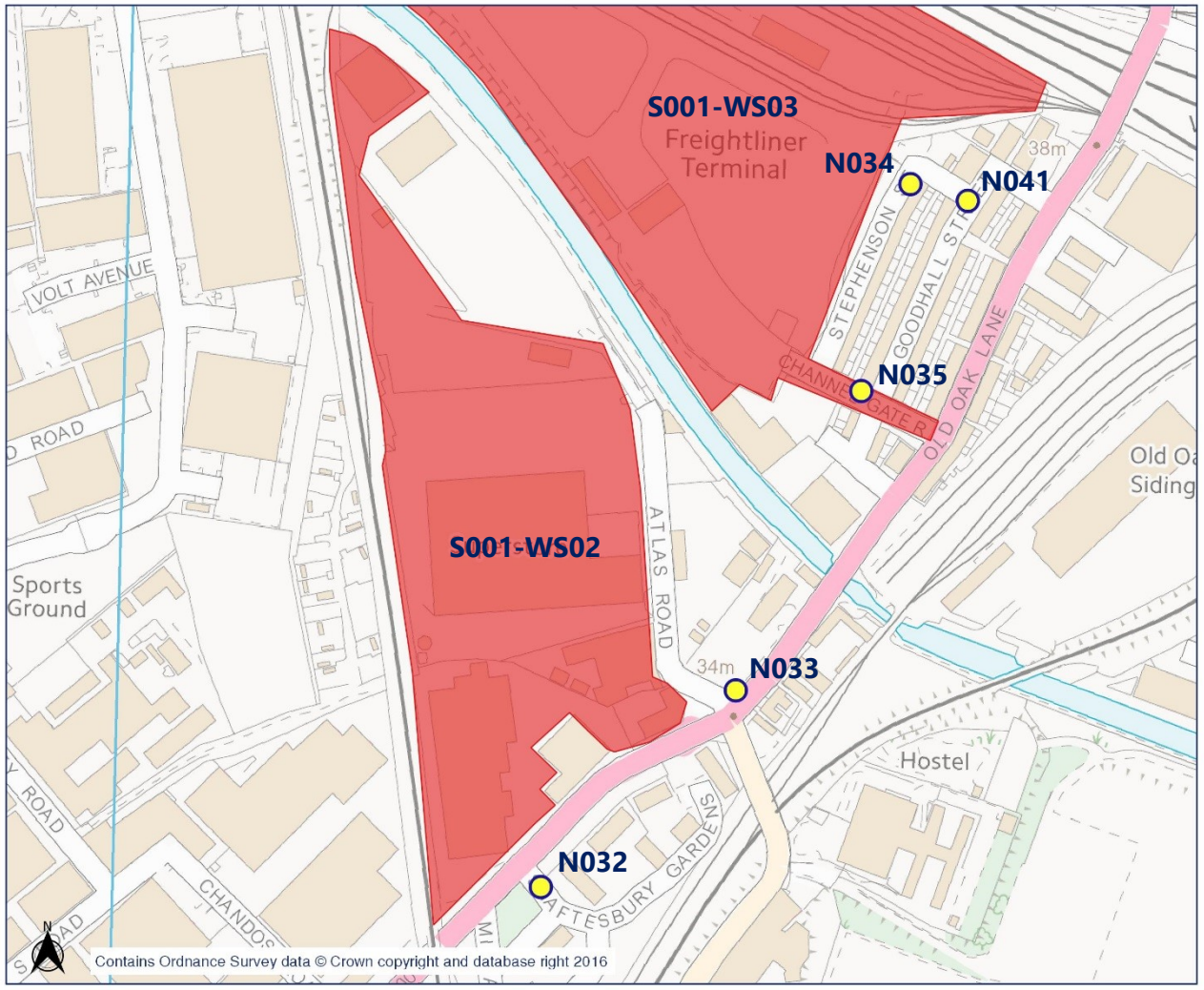
Noise monitoring plan - 2



Noise monitoring plan - 3



Noise monitoring plan - 4



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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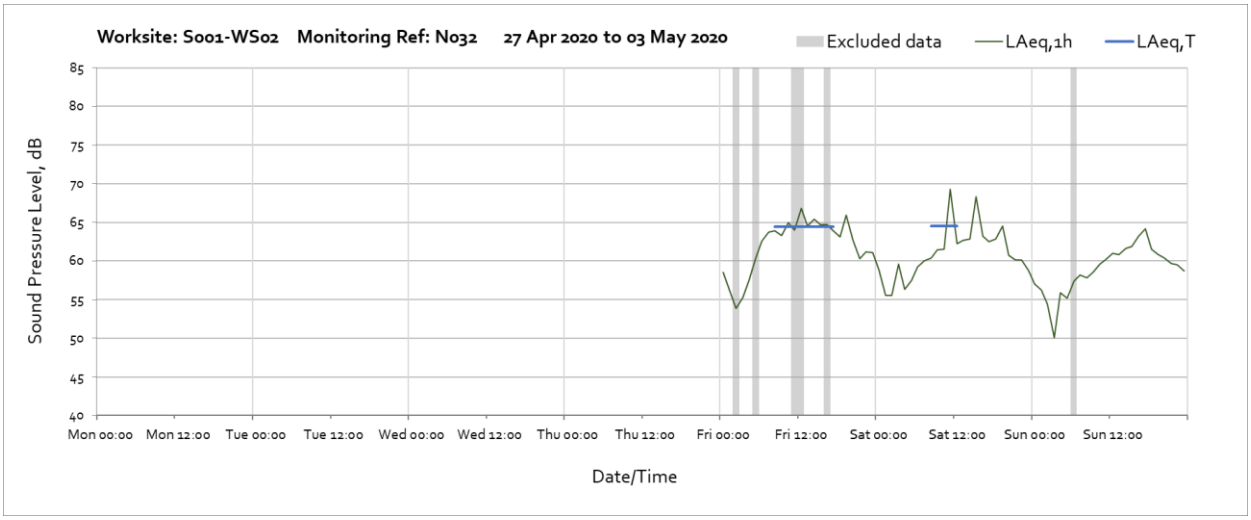

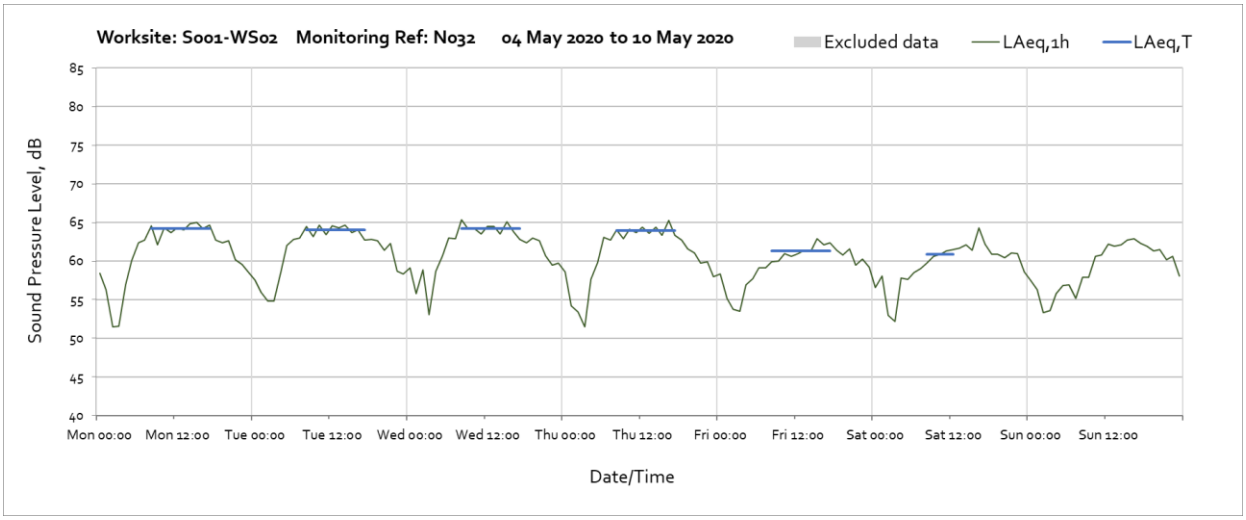

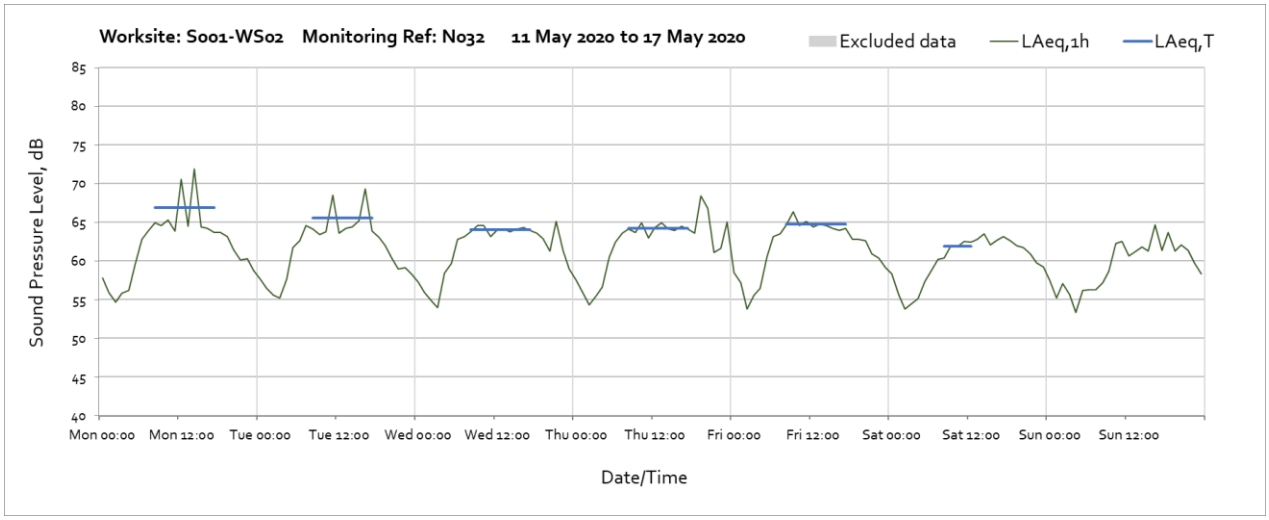
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Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
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80
75
70
65
60
55
50
45
40
Mon 00:00
Mon 12:00
Tue 00:00
Tue 12:00
Wed 00:00
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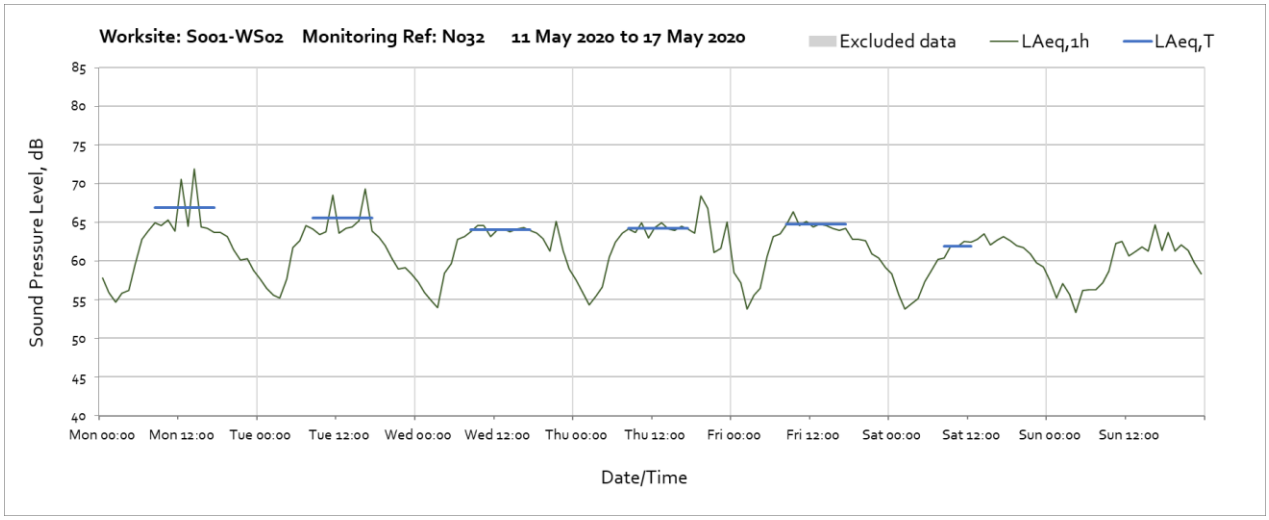
Date/Time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Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
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65
60
55
50
45
40
Mon 00:00
Mon 12:00
Tue 00:00
Tue 12:00
Wed 00:00
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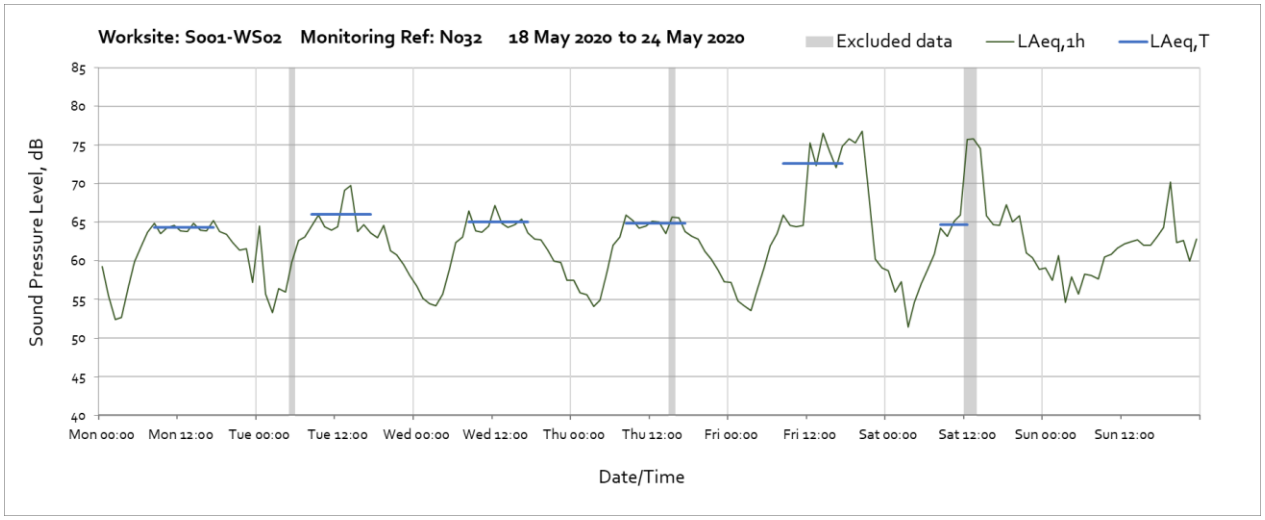
Sun 12:00
Date/Time


Worksite: S001-WS02 Monitoring Ref: N032 18 May 2020 to 24 May 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
70
65
60
55
50
45
40
Mon 00:00
Mon 12:00
Tue 00:00
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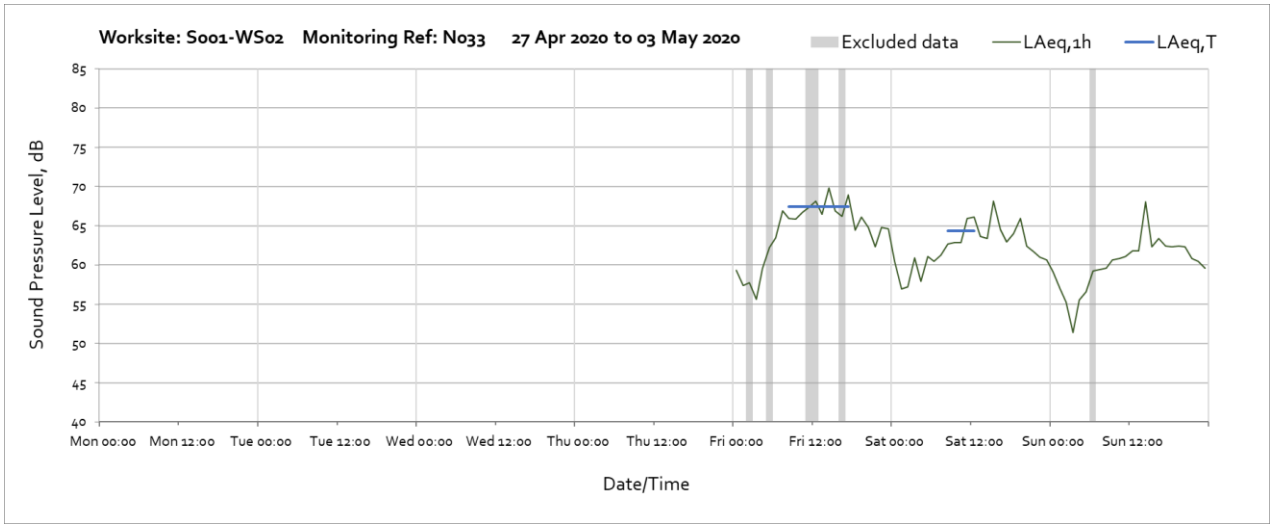
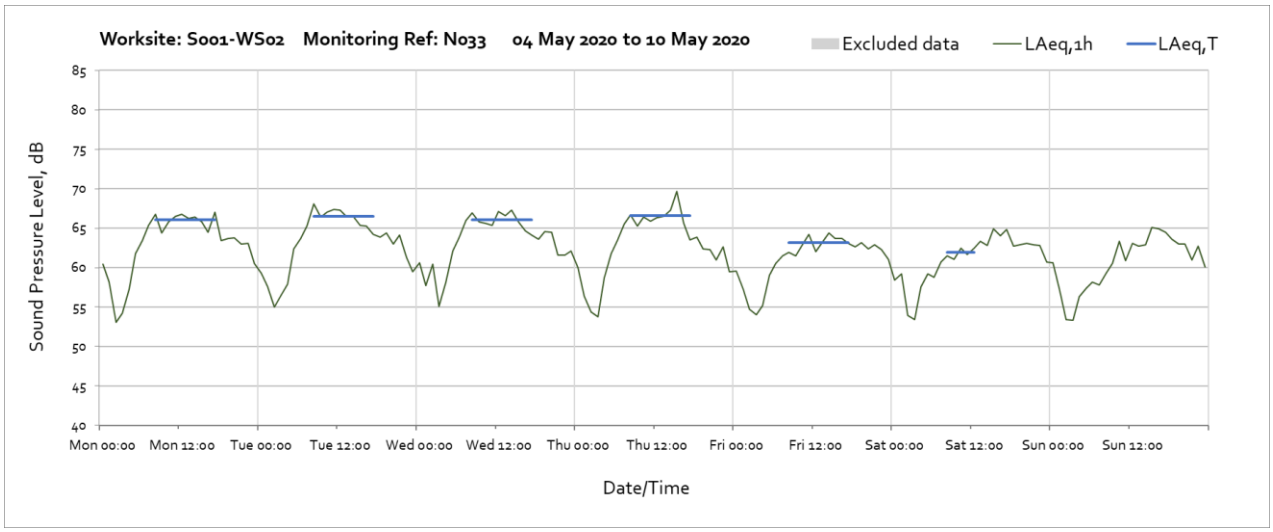
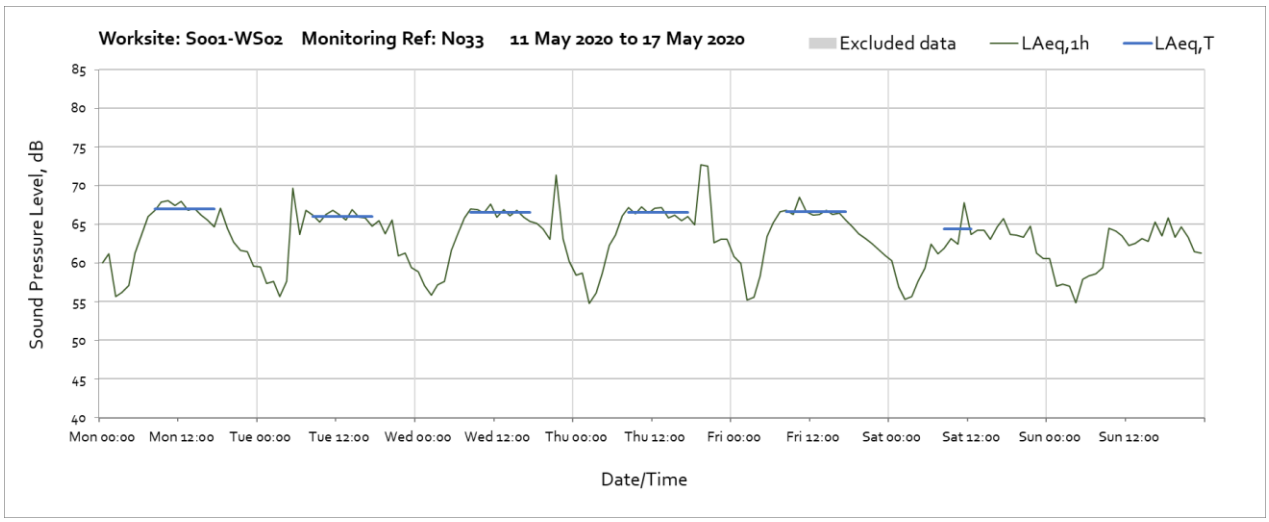
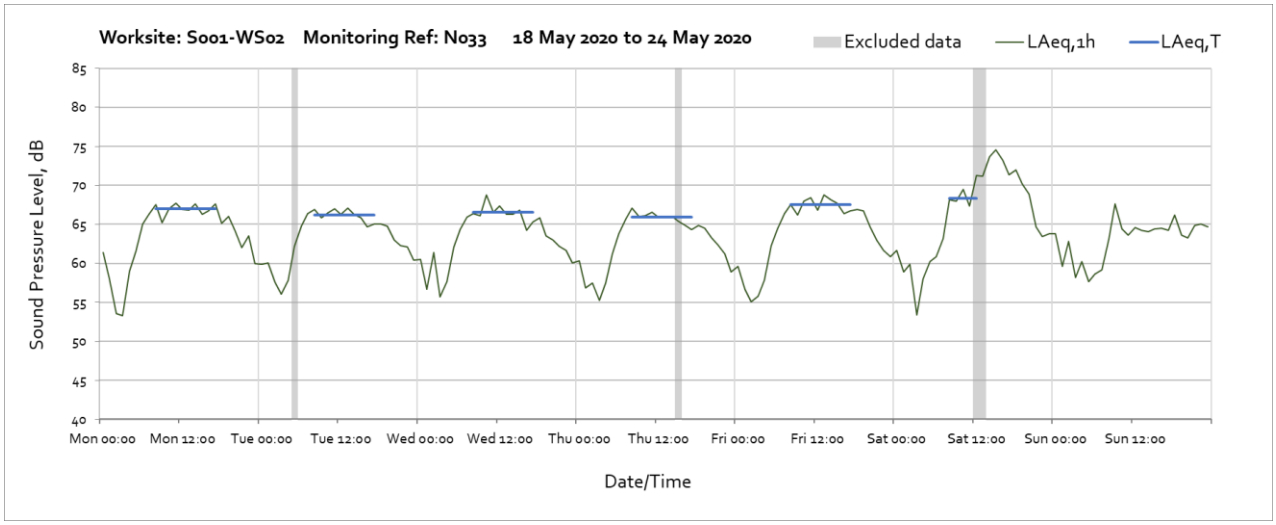
Date/Time

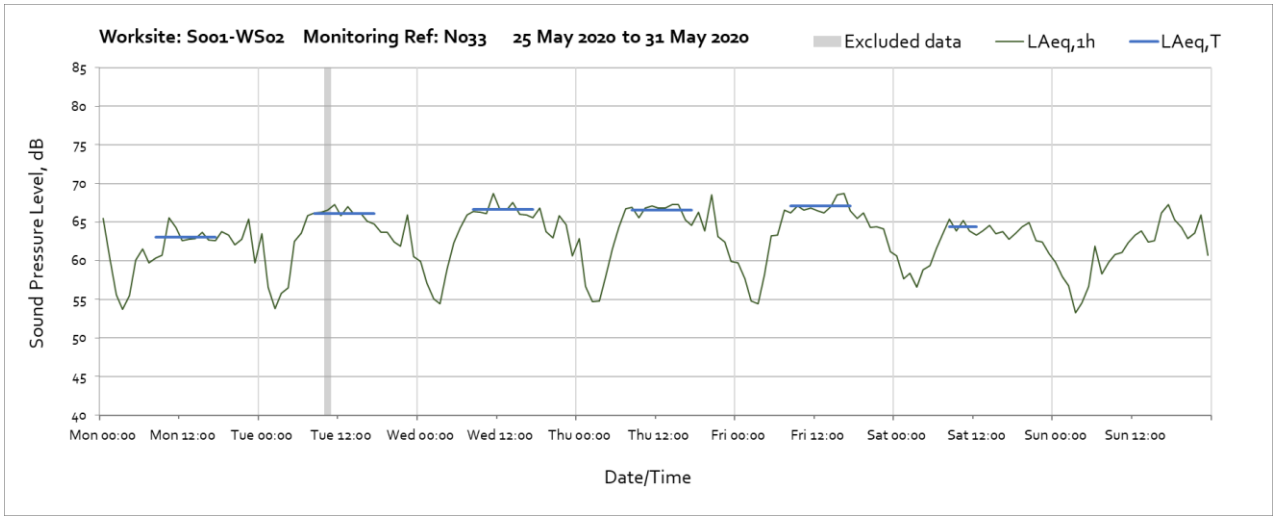
Worksite: S001-WS02 – Monitoring Ref: N033



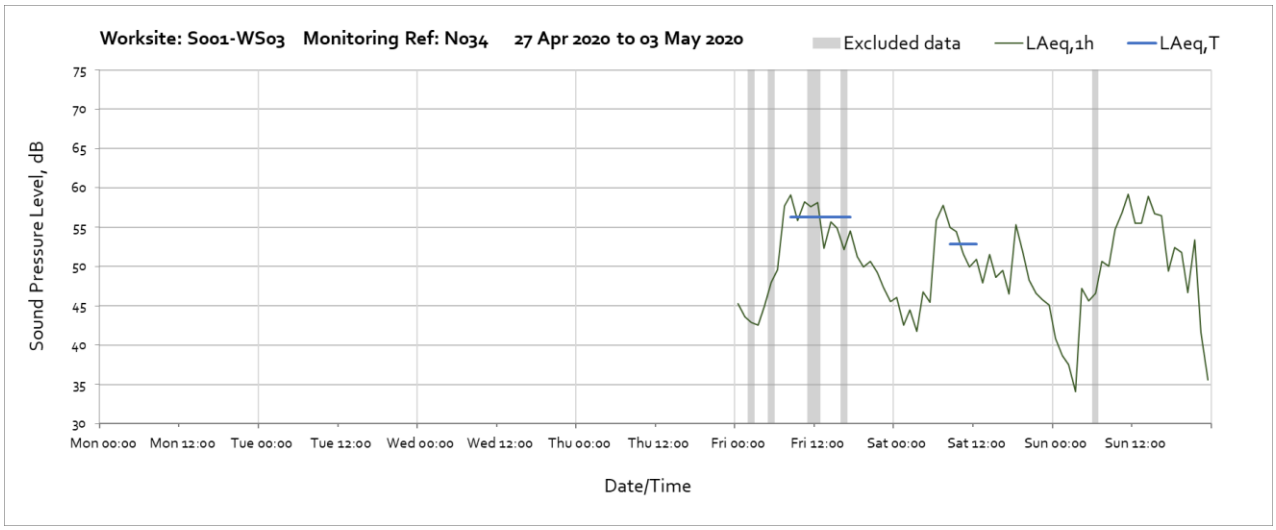


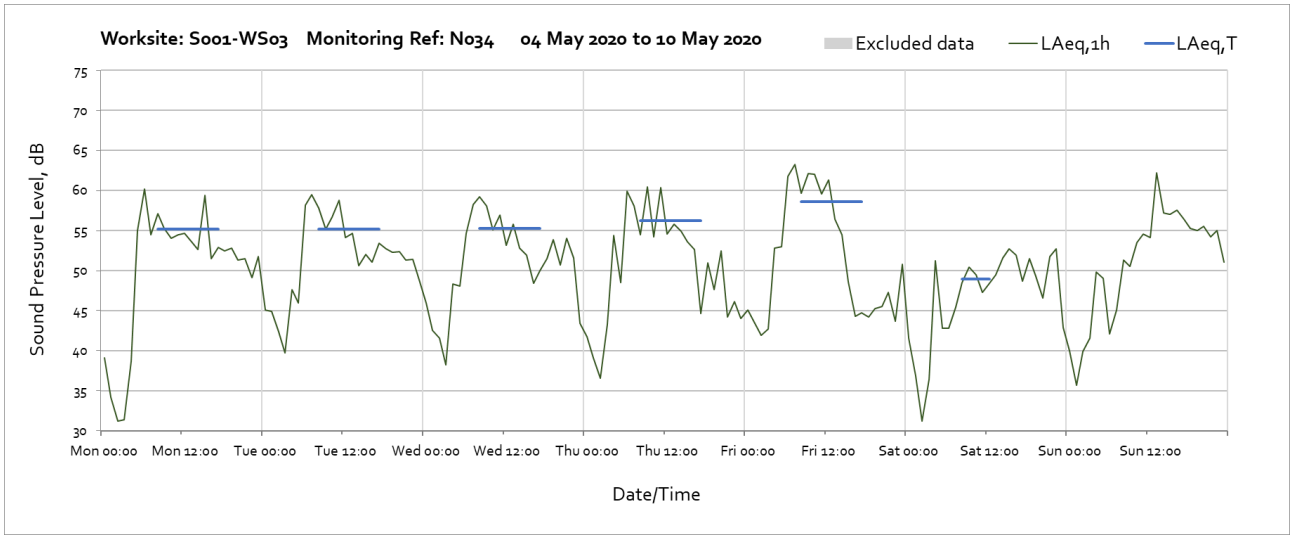






Worksite: S001-WS03 – Monitoring Ref: N034




Worksite: S001-WS03 Monitoring Ref: N034 04 May 2020 to 10 May 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
75
70
65
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Mon 00:00
Mon 12:00
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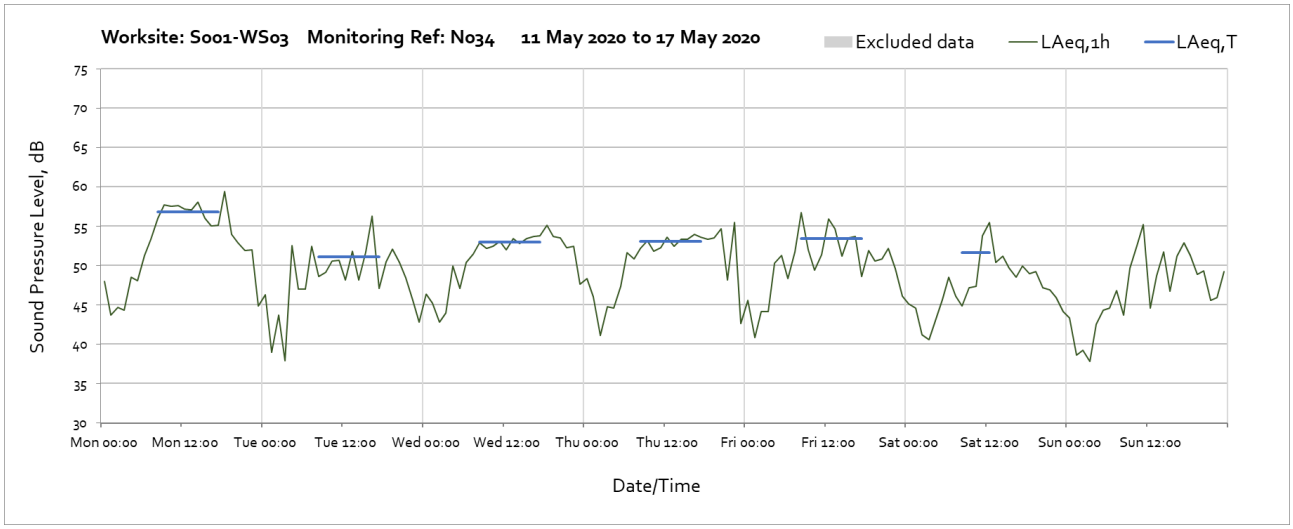
Date/Time


Worksite: S001-WS03 Monitoring Ref: N034 11 May 2020 to 17 May 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
75
70
65
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45
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Mon 12:00
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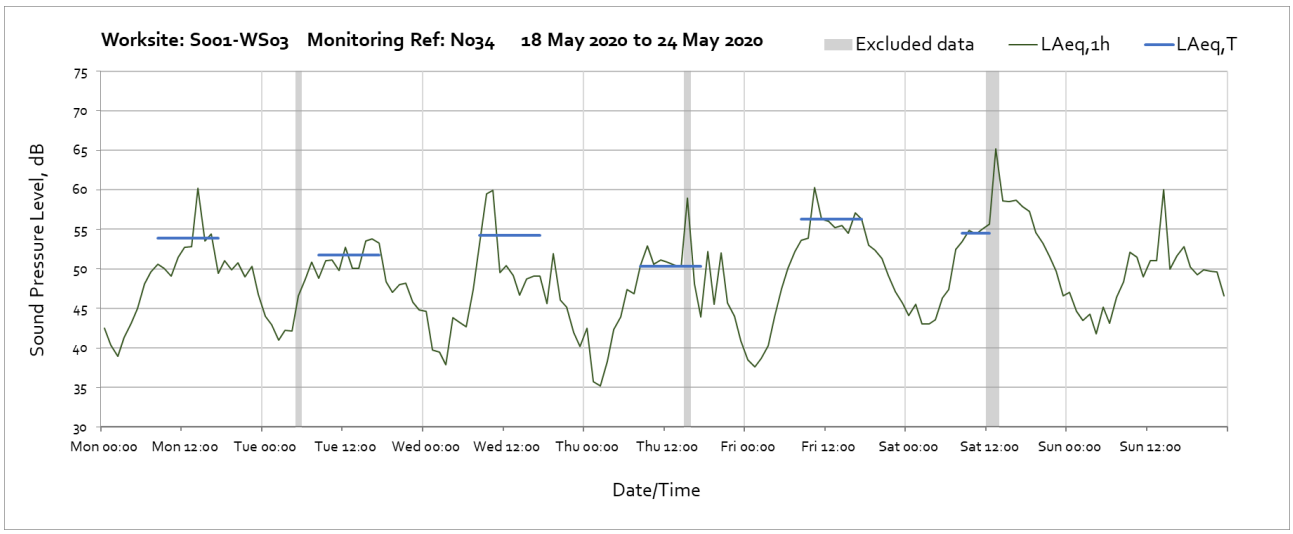
Date/Time


Worksite: S001-WS03 Monitoring Ref: N034 18 May 2020 to 24 May 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
75
70
65
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45
40
35
30
Mon 00:00
Mon 12:00
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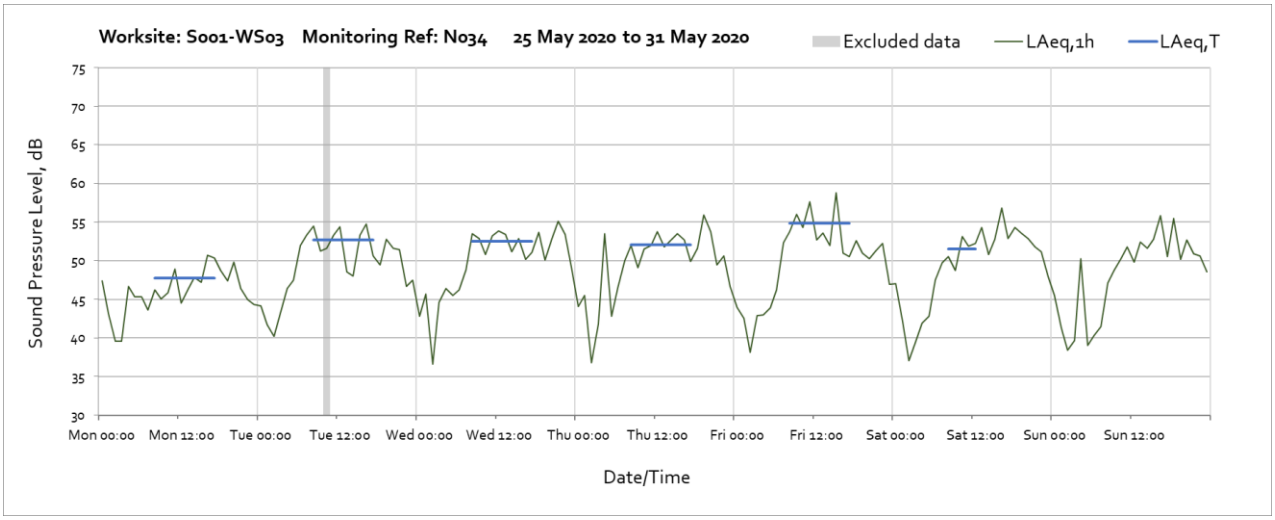
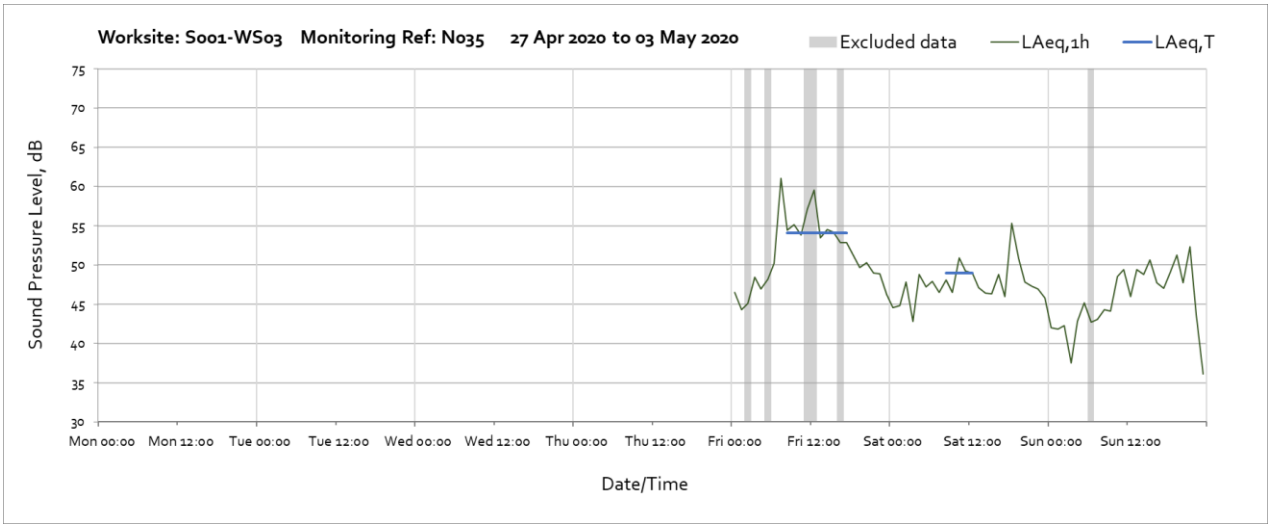
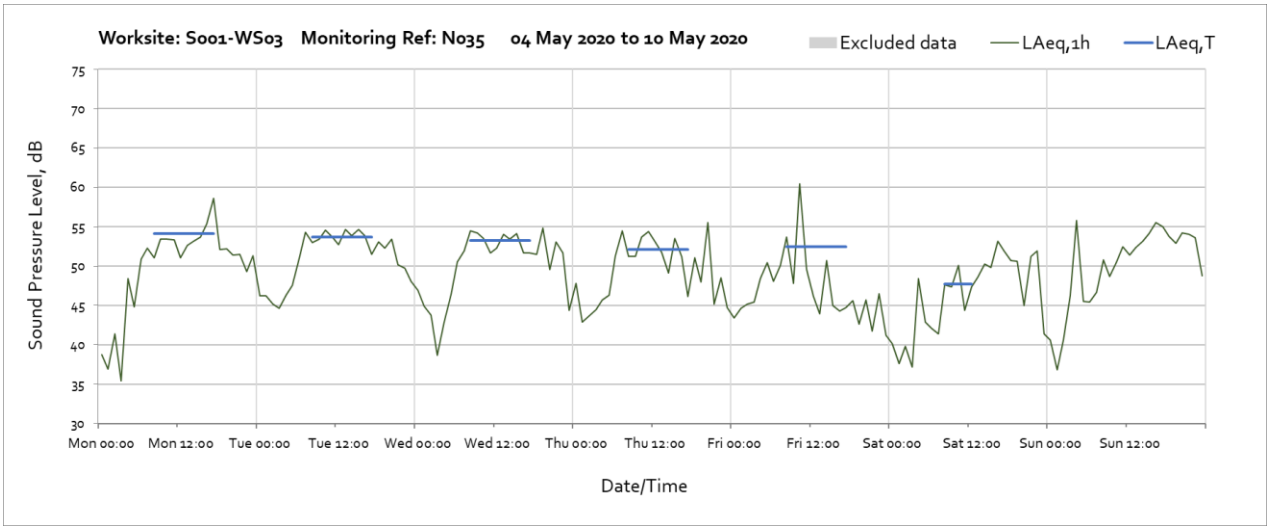
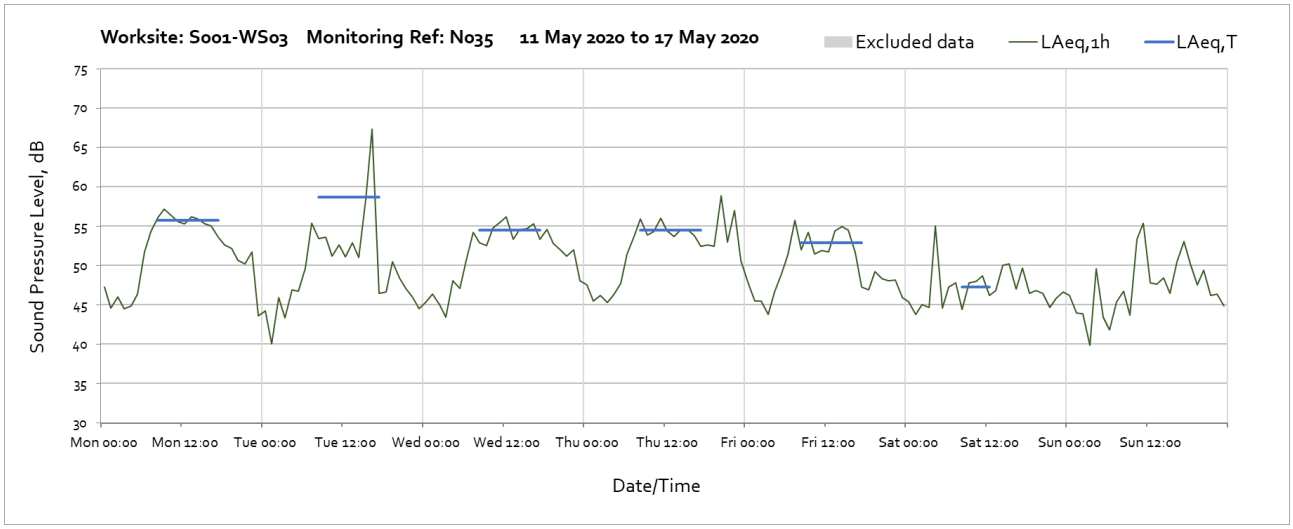
Date/Time



Worksite: S001-WS03 – Monitoring Ref: N035






Worksite: S001-WS03 Monitoring Ref: N035 11 May 2020 to 17 May 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
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70
65
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Mon 12:00
Tue 00:00
Tue 12:00
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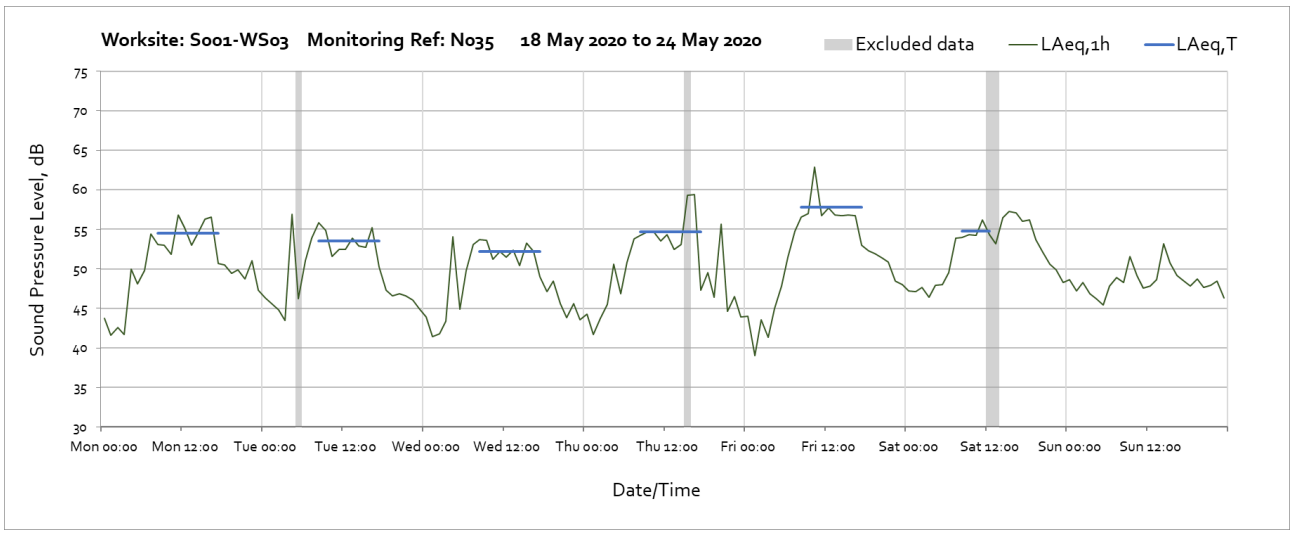
Date/Time


Worksite: S001-WS03 Monitoring Ref: N035 18 May 2020 to 24 May 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
75
70
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45
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30
Mon 00:00
Mon 12:00
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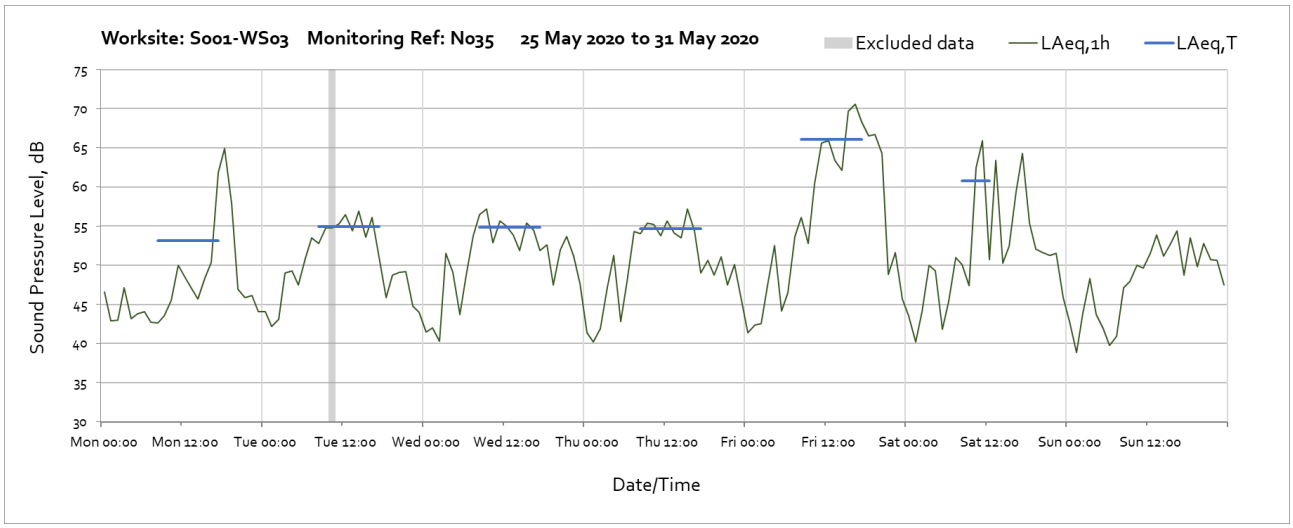
Date/Time


Worksite: S001-WS03 Monitoring Ref: N035 25 May 2020 to 31 May 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
75
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65
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Mon 12:00
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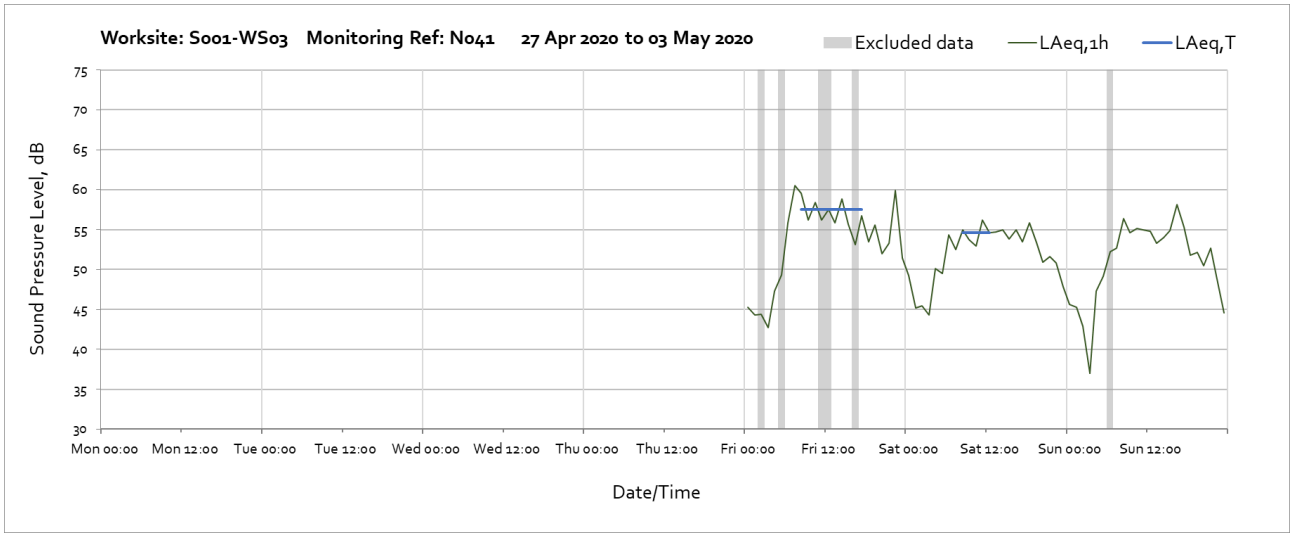
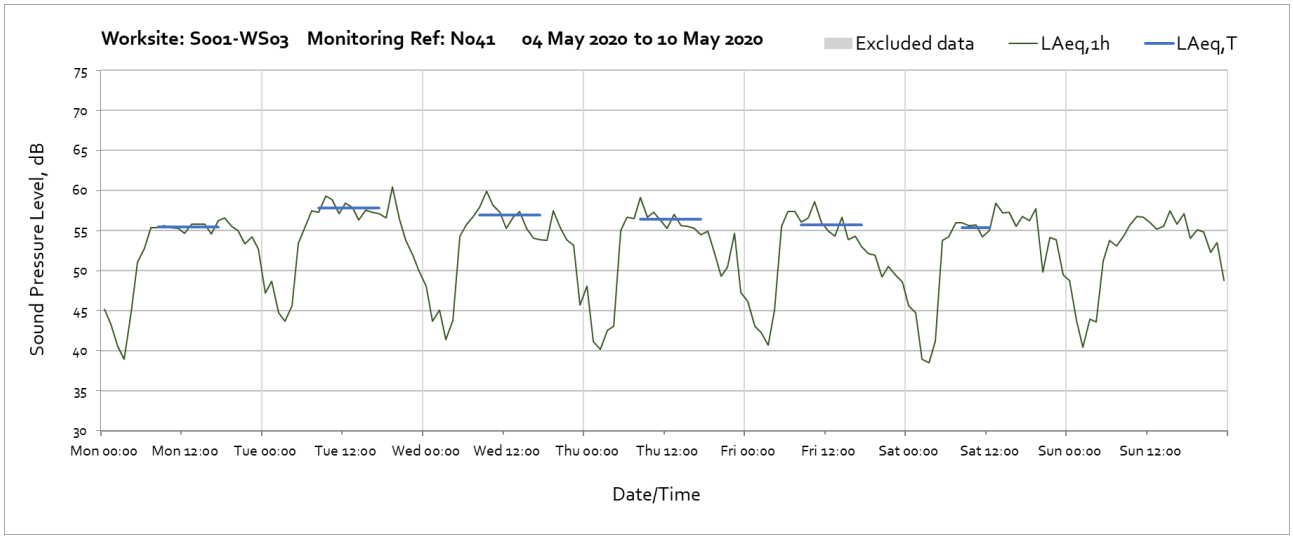
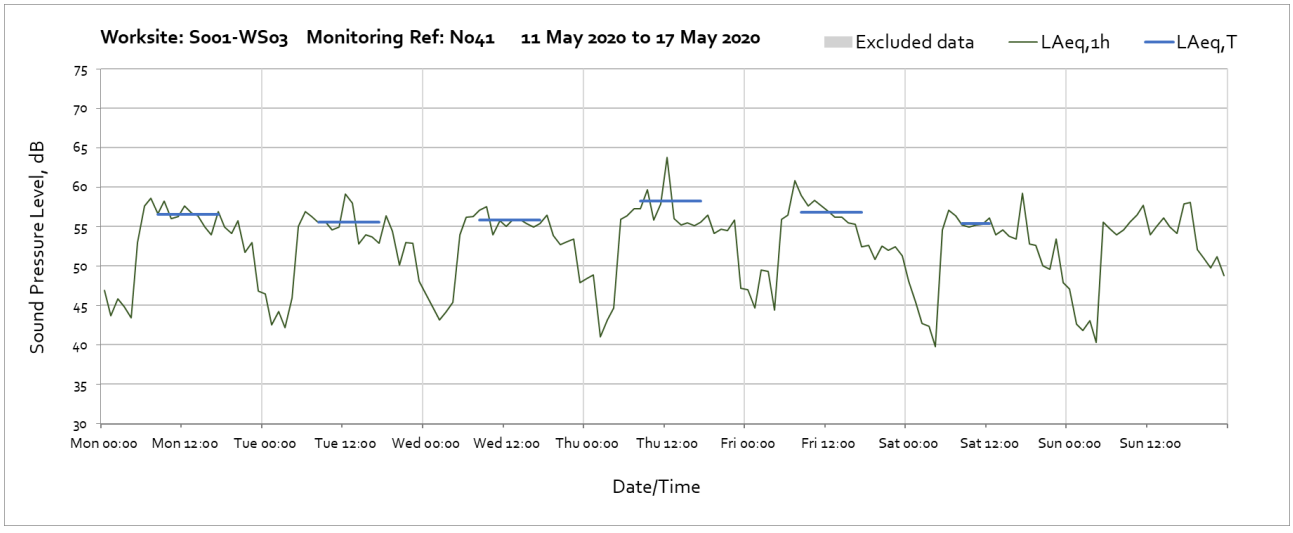
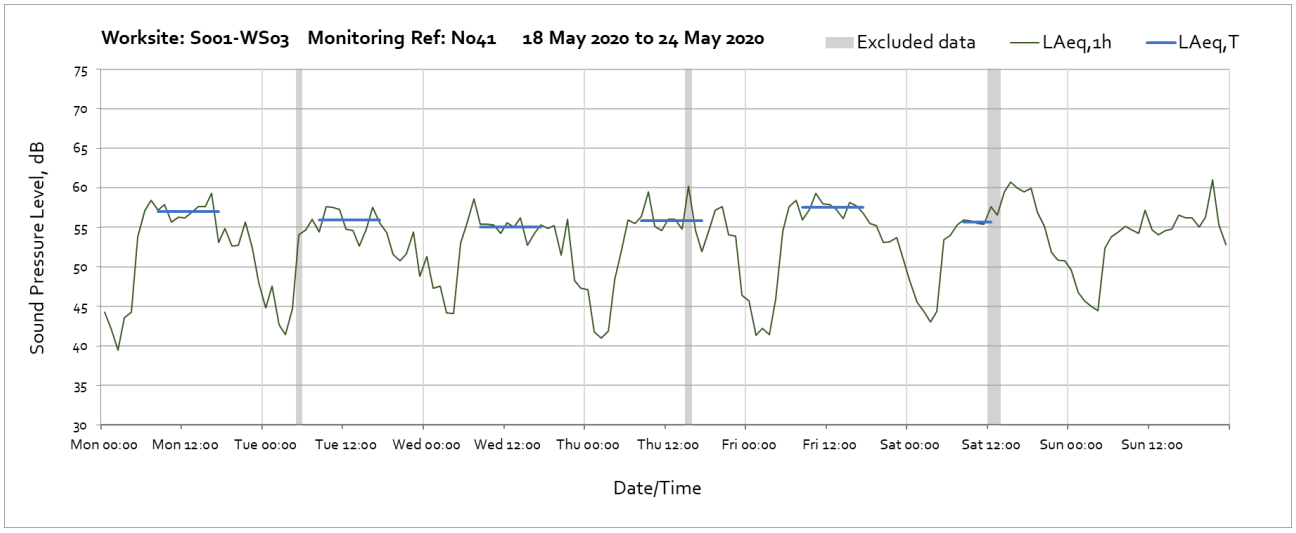
Date/Time

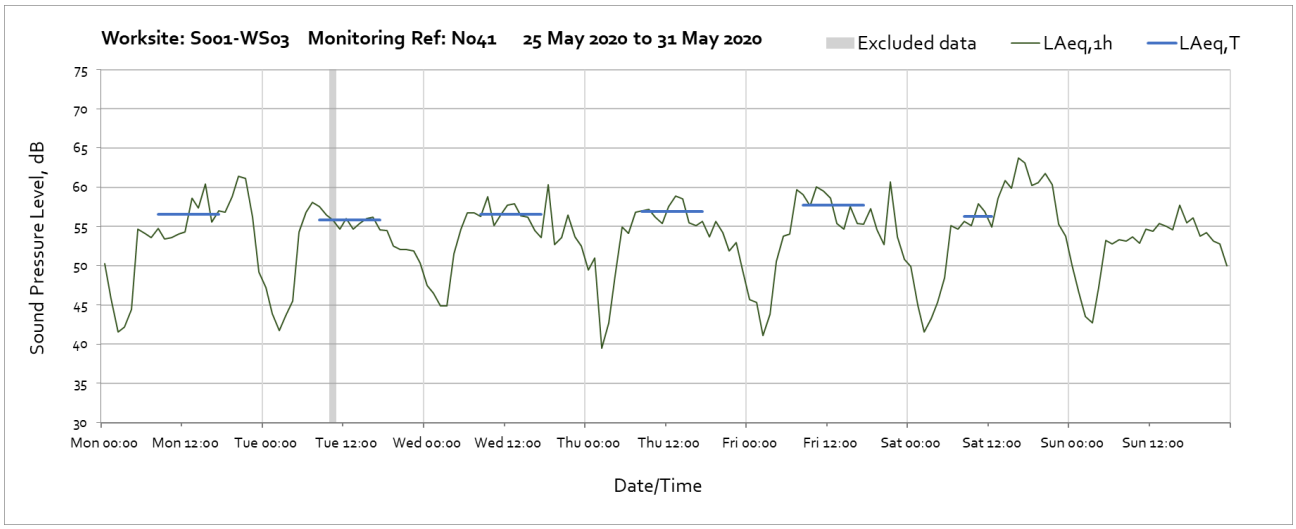
Worksite: S001-WS03 – Monitoring Ref: N041



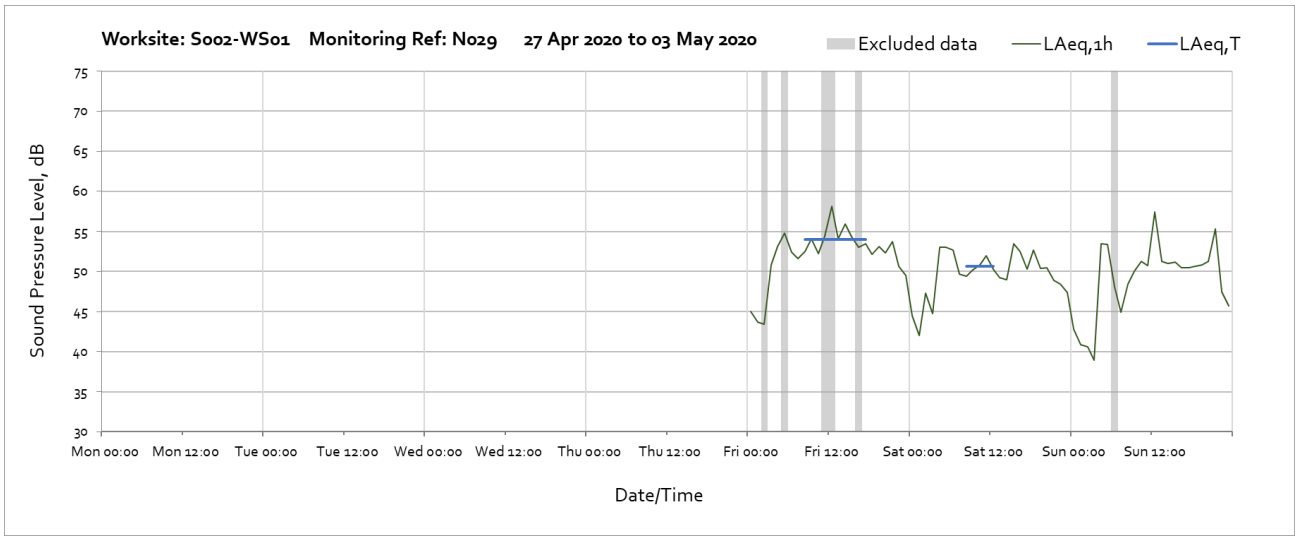


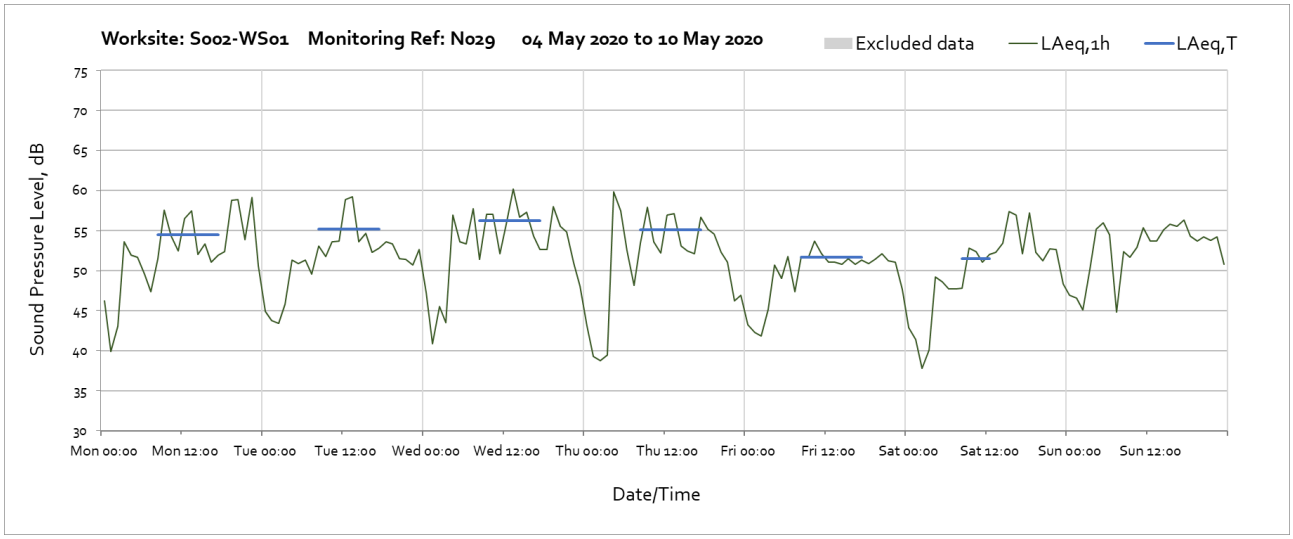






Worksite: S002-WS01 – Monitoring Ref: N029




Worksite: S002-WS01 Monitoring Ref: N029 04 May 2020 to 10 May 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
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70
65
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Mon 12:00
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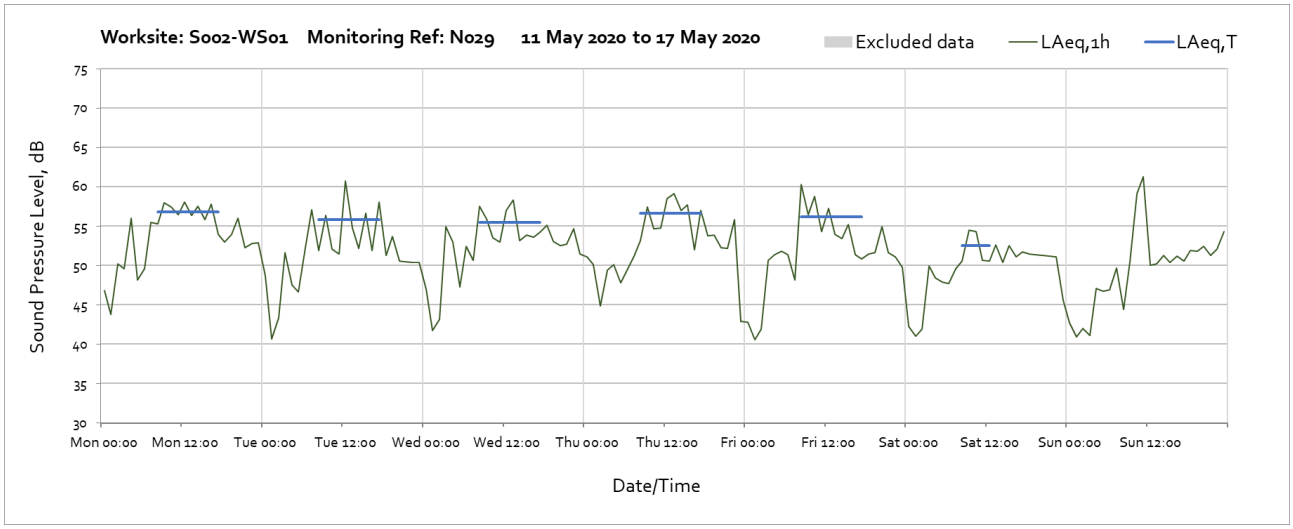
Date/Time


Worksite: S002-WS01 Monitoring Ref: N029 11 May 2020 to 17 May 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
75
70
65
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50
45
40
35
30
Mon 00:00
Mon 12:00
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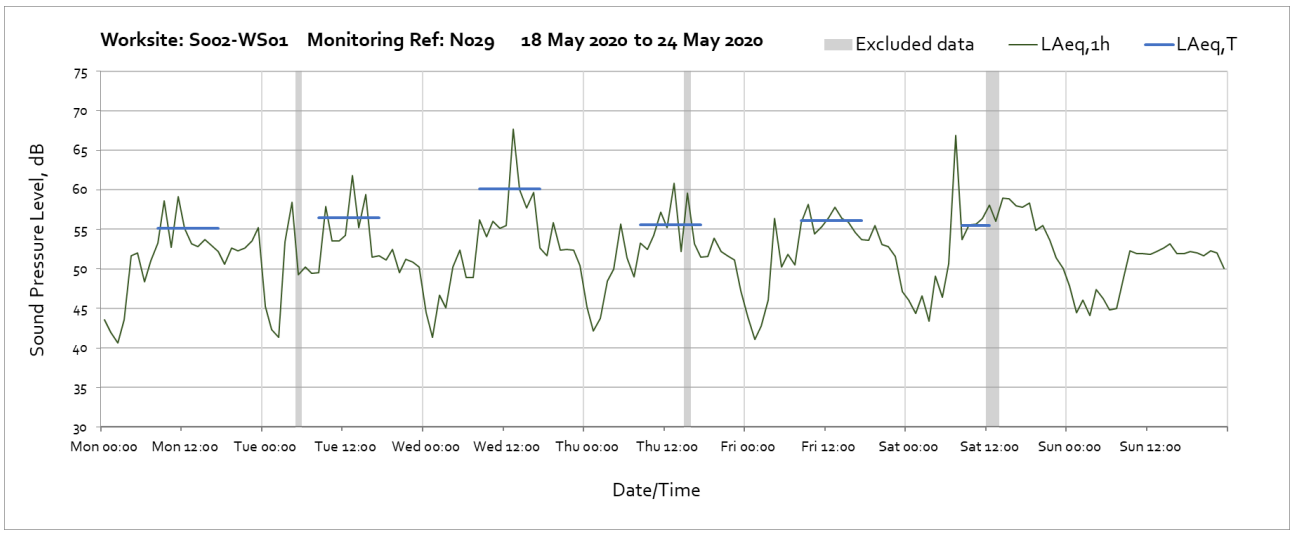
Date/Time


Worksite: S002-WS01 Monitoring Ref: N029 18 May 2020 to 24 May 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
75
70
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55
50
45
40
35
30
Mon 00:00
Mon 12:00
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Tue 12:00
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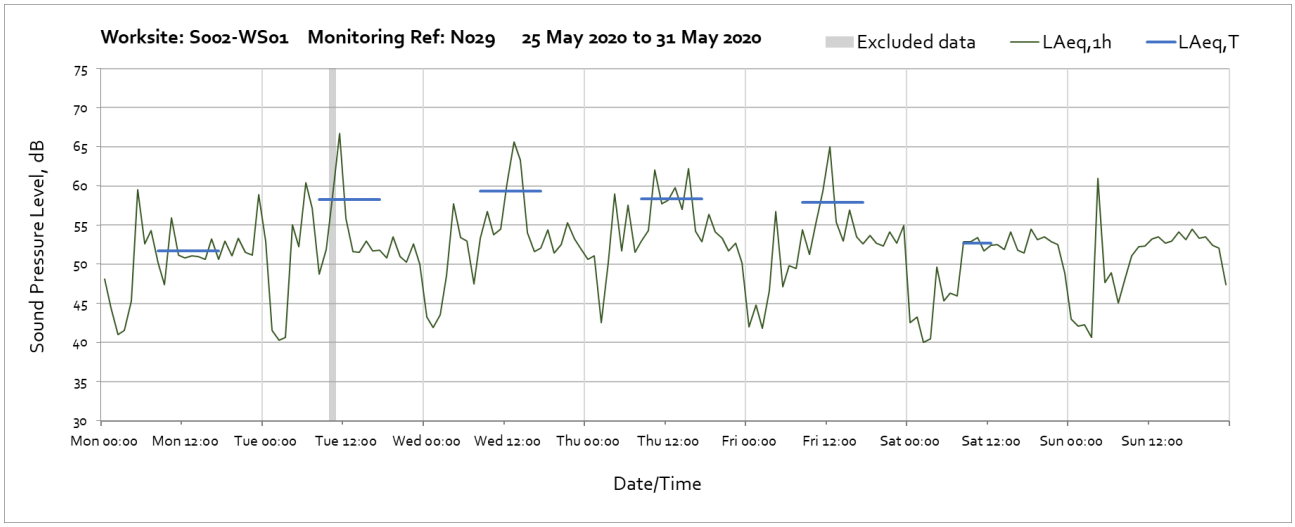
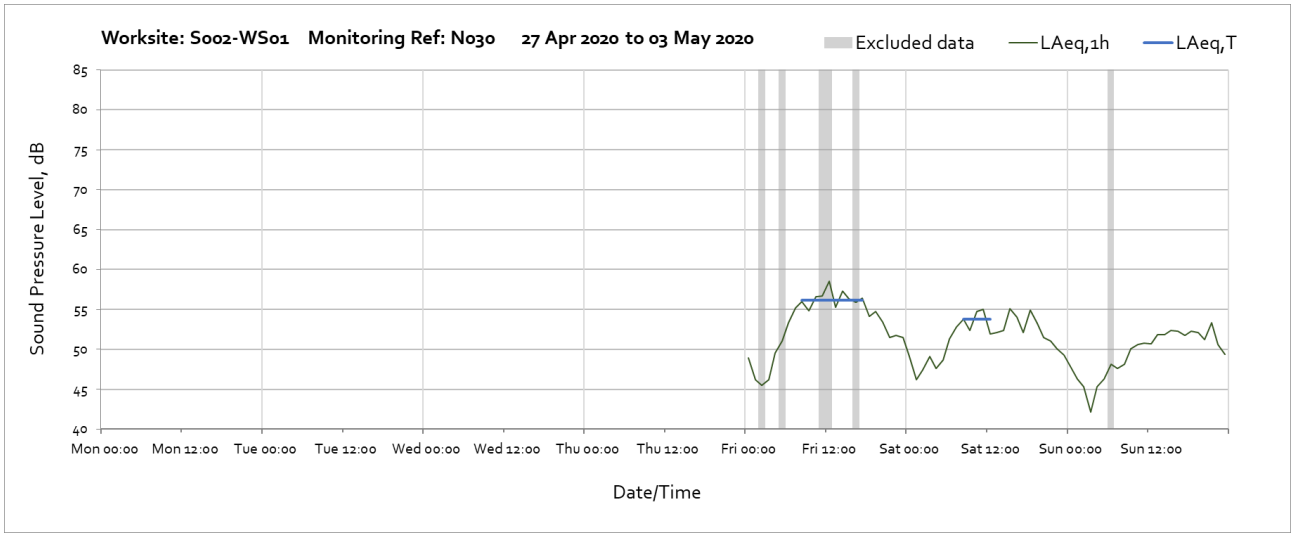
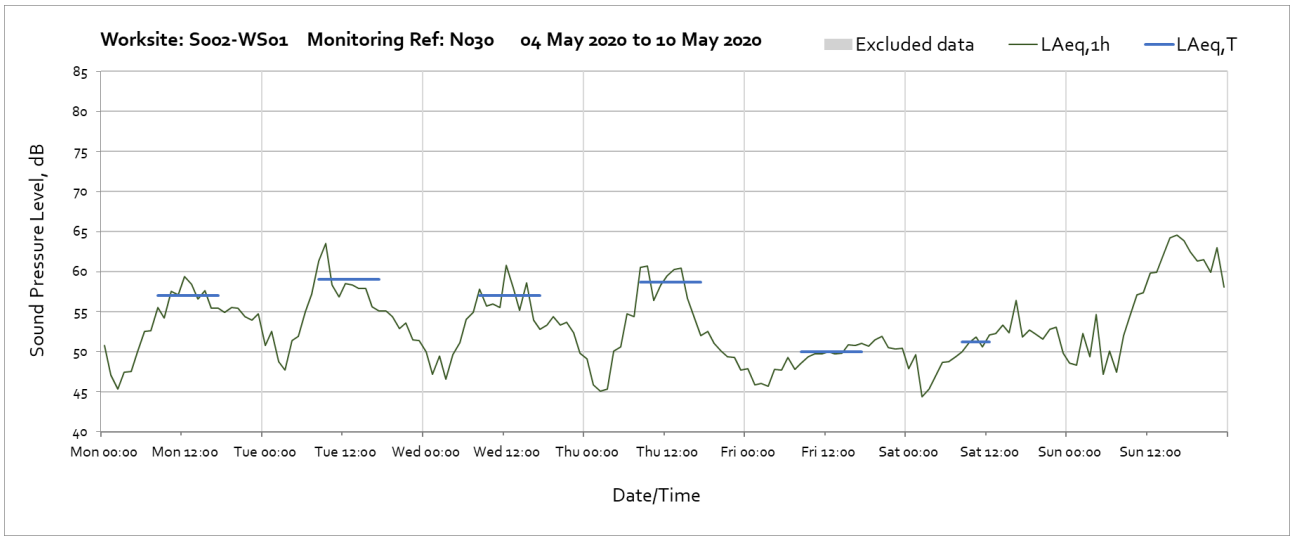
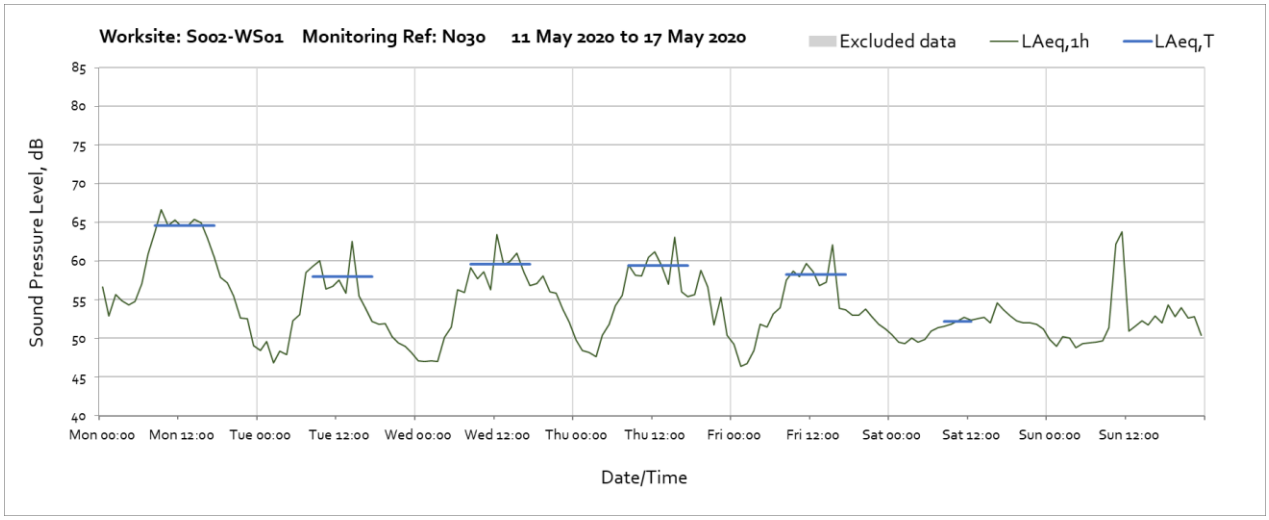
Date/Time



Worksite: S002-WS01 – Monitoring Ref: N030






Worksite: S002-WS01 Monitoring Ref: N030 11 May 2020 to 17 May 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
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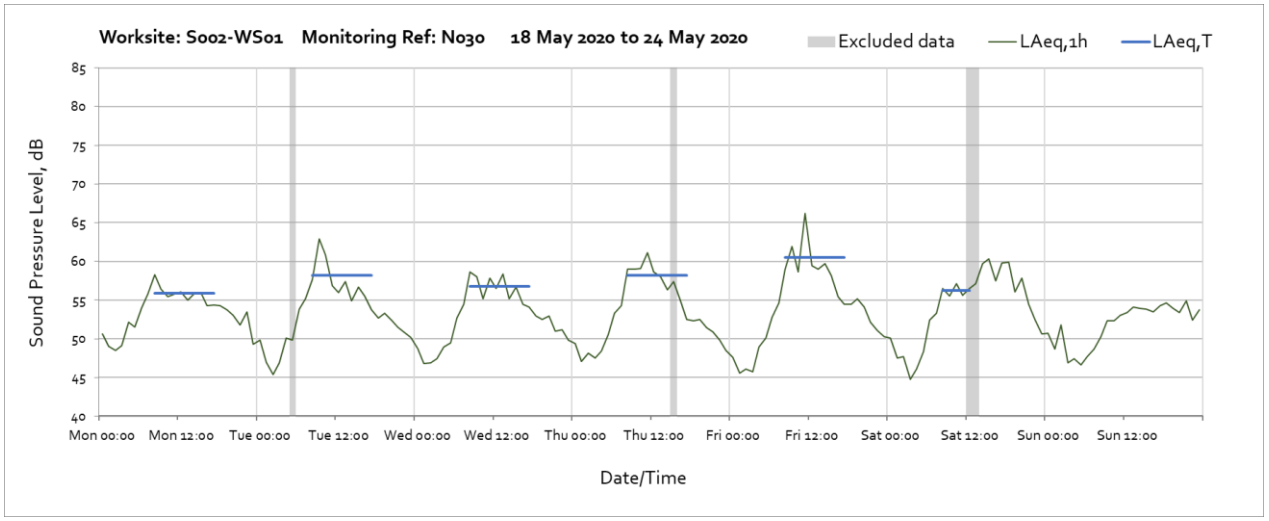
Sun 12:00
Date/Time


Worksite: S002-WS01 Monitoring Ref: N030 18 May 2020 to 24 May 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
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60
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50
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40
Mon 00:00
Mon 12:00
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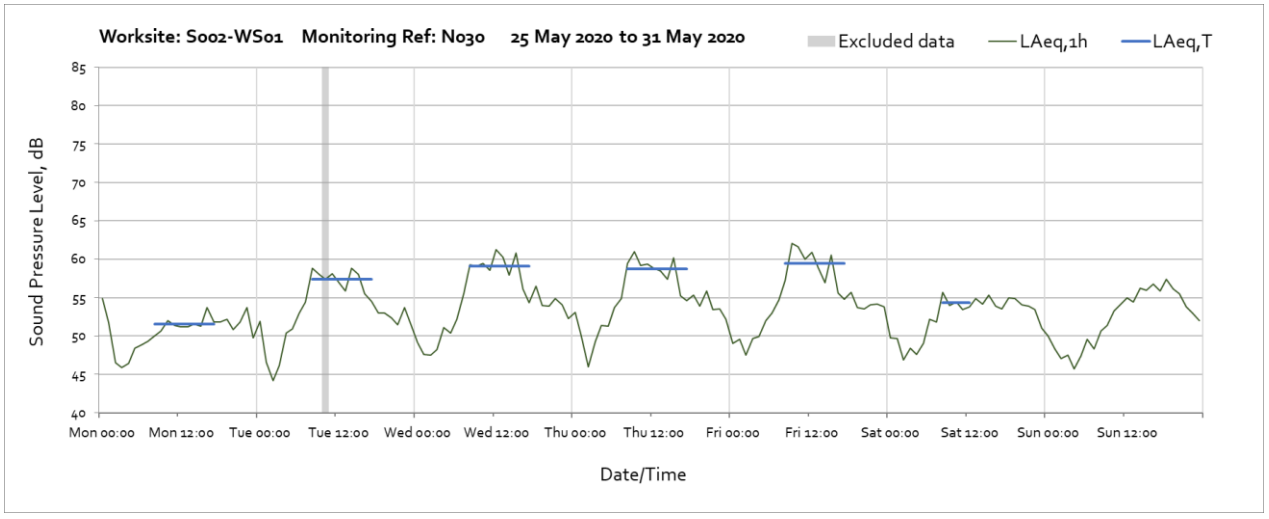
Date/Time


Worksite: S002-WS01 Monitoring Ref: N030 25 May 2020 to 31 May 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
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65
60
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45
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Mon 00:00
Mon 12:00
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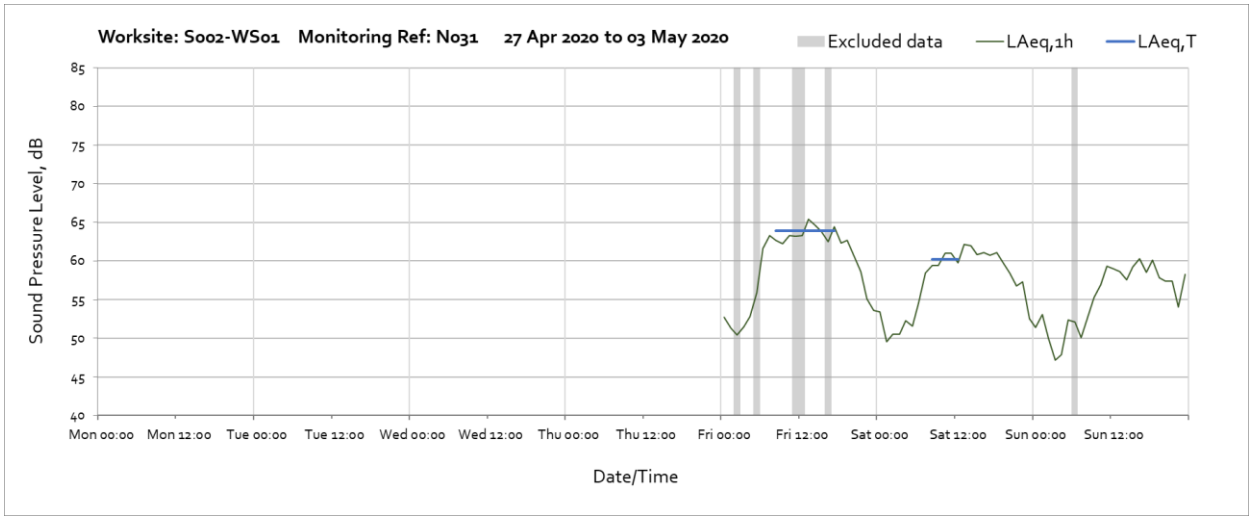
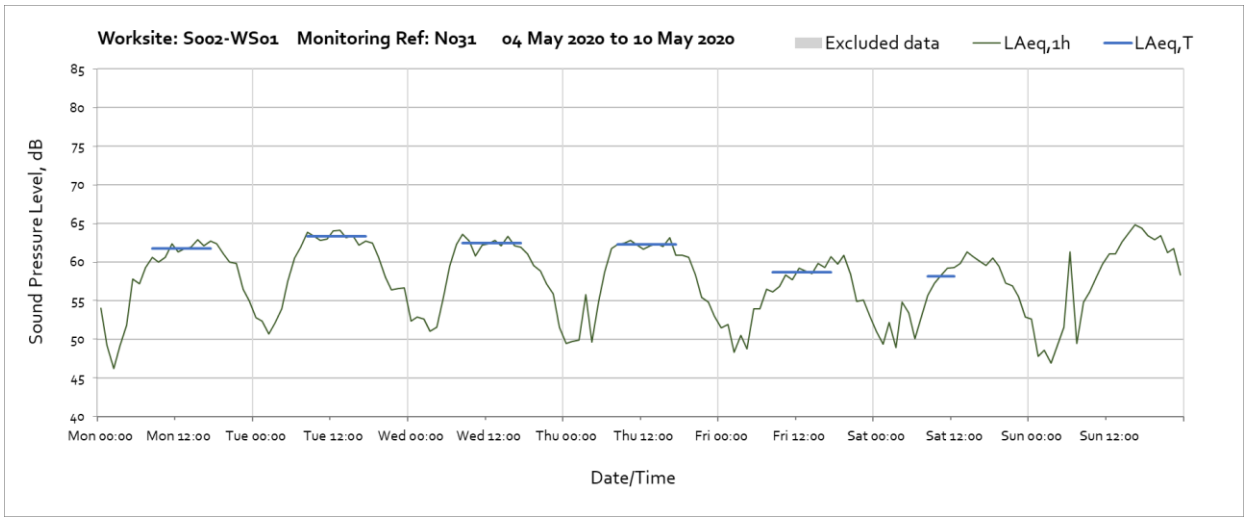
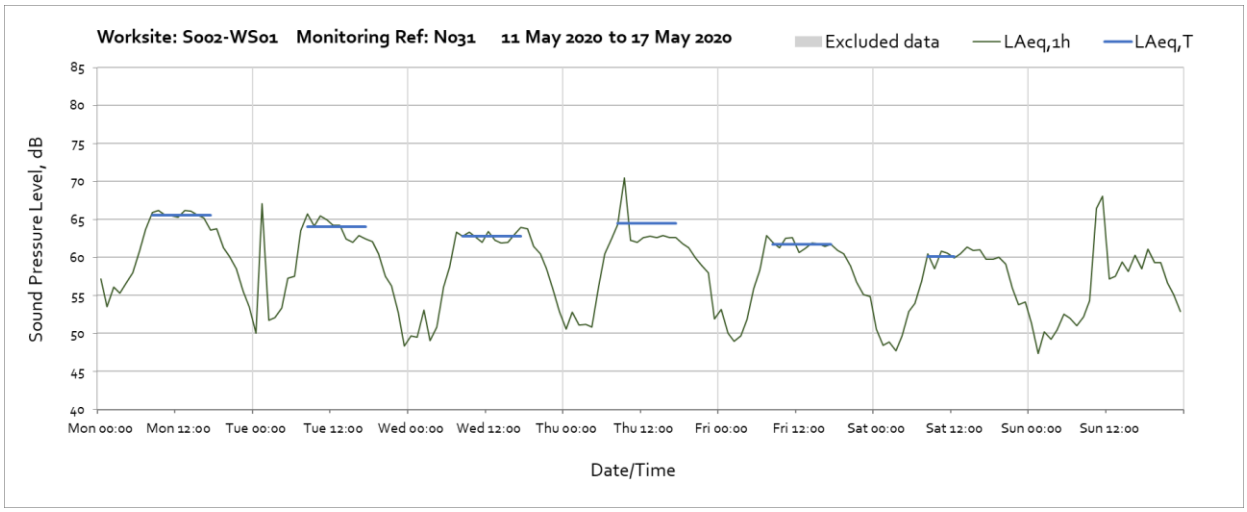
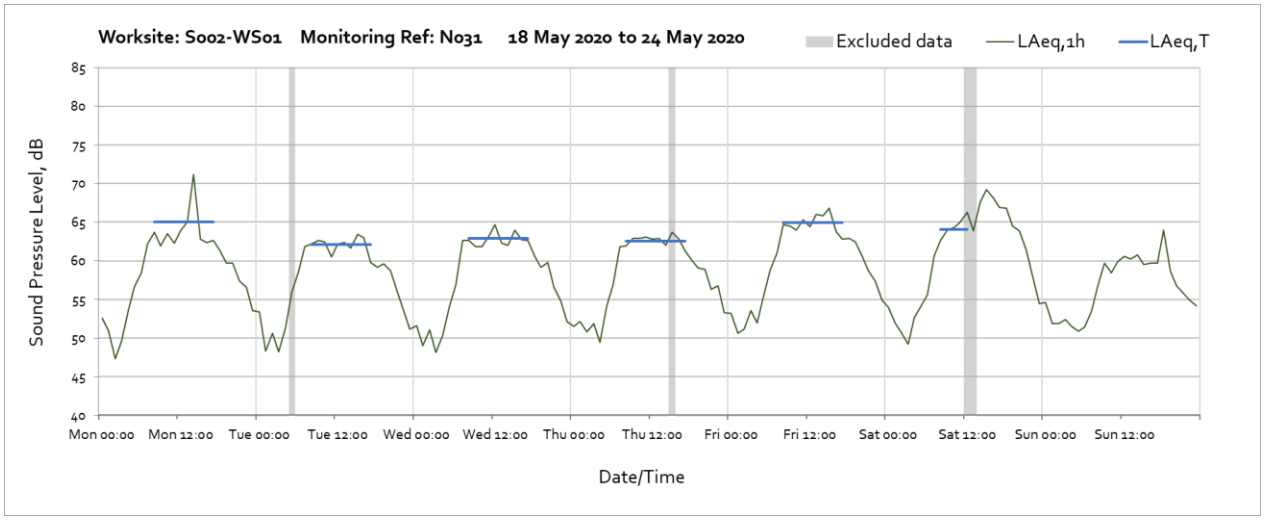
Date/Time

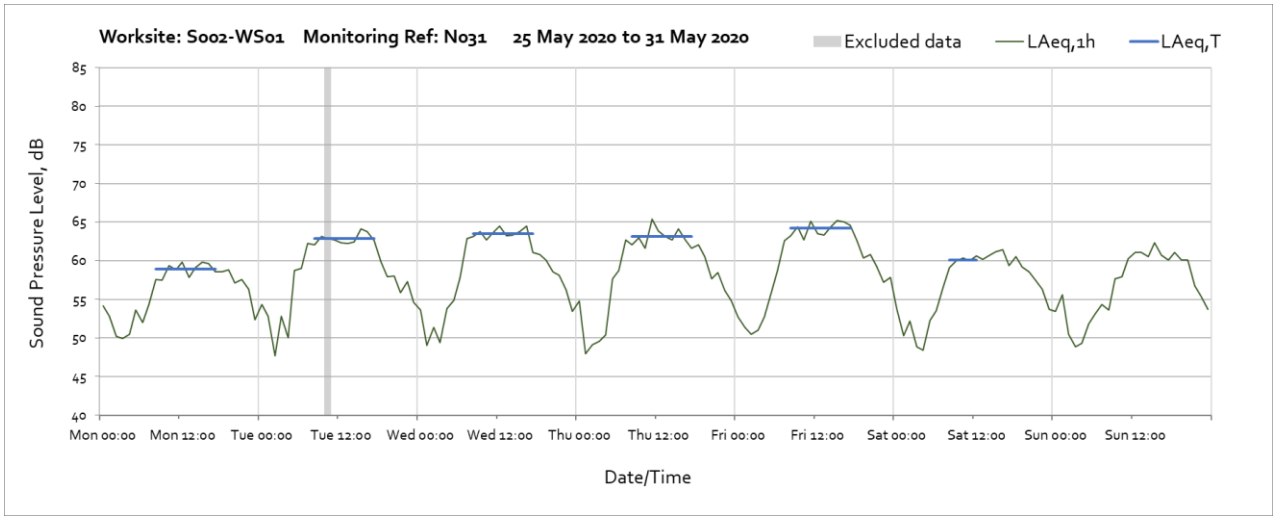
Worksite: S002-WS01 – Monitoring Ref: N031



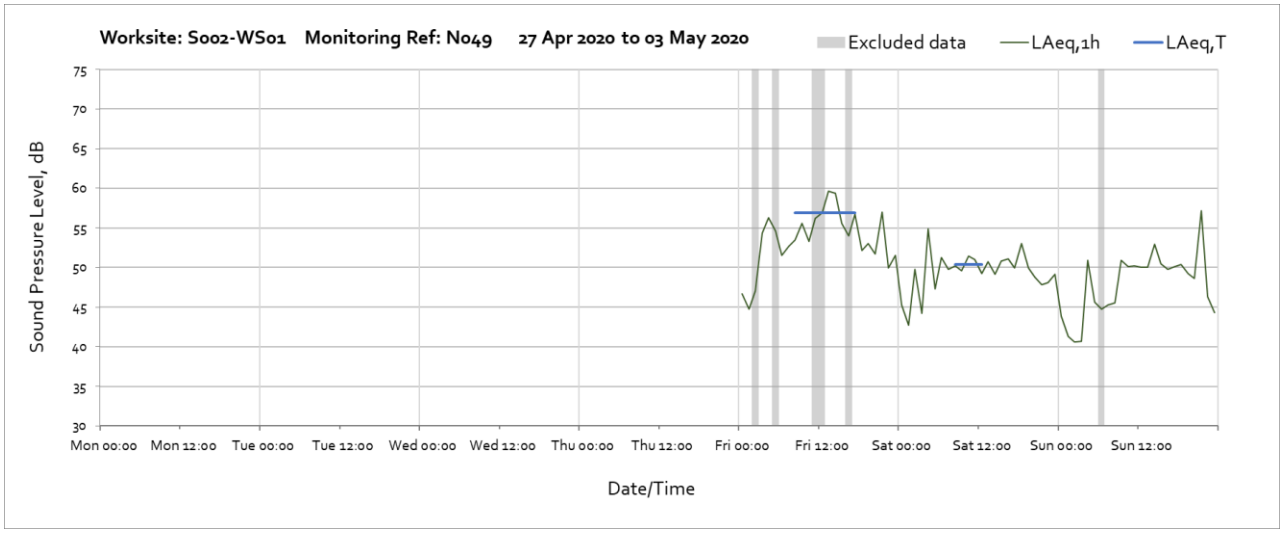


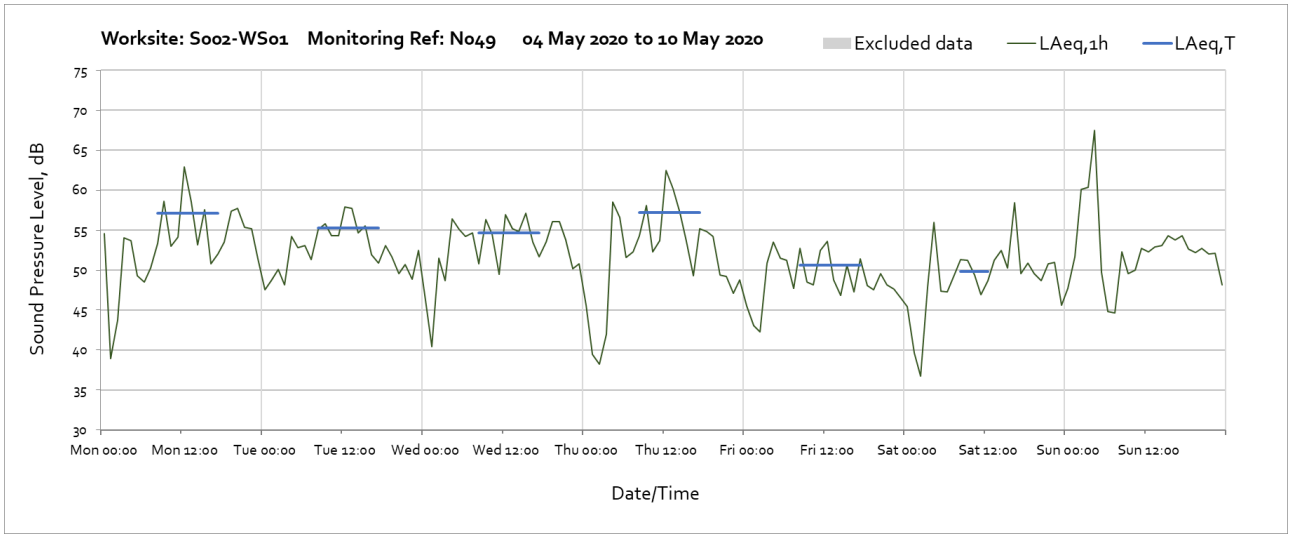






Worksite: S002-WS01 – Monitoring Ref: N049




Worksite: S002-WS01 Monitoring Ref: N049 04 May 2020 to 10 May 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
75
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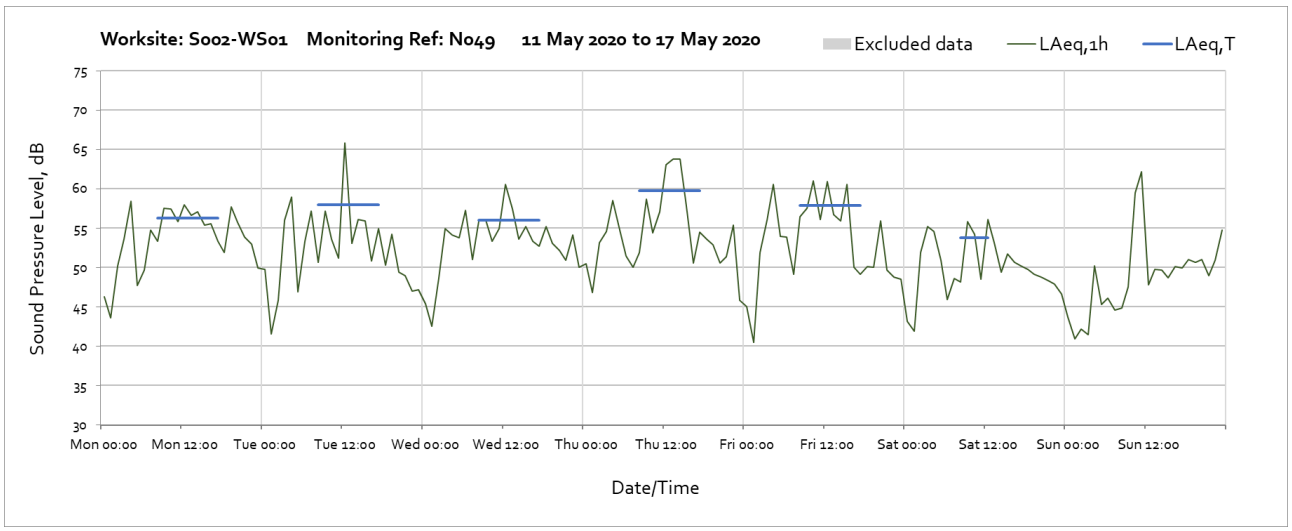
Date/Time


Worksite: S002-WS01 Monitoring Ref: N049 11 May 2020 to 17 May 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
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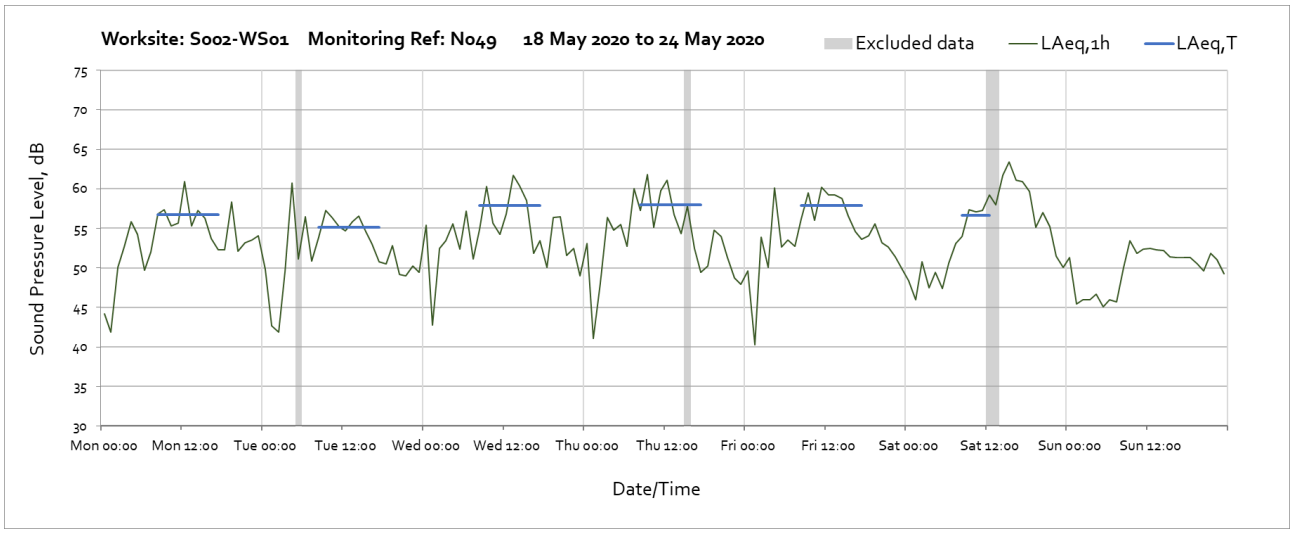
Date/Time


Worksite: S002-WS01 Monitoring Ref: N049 18 May 2020 to 24 May 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
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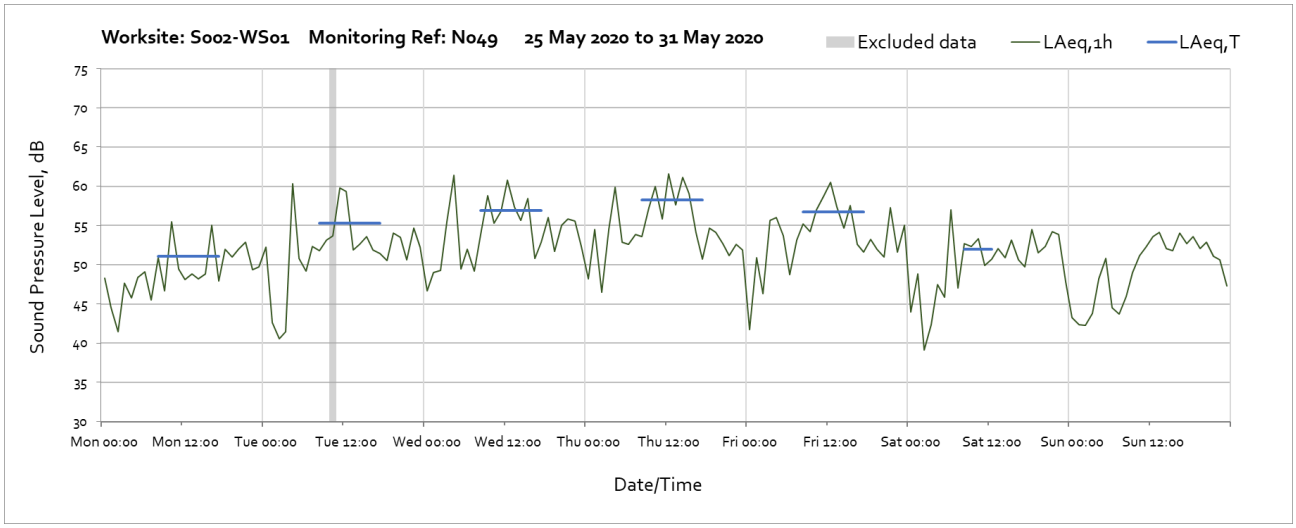
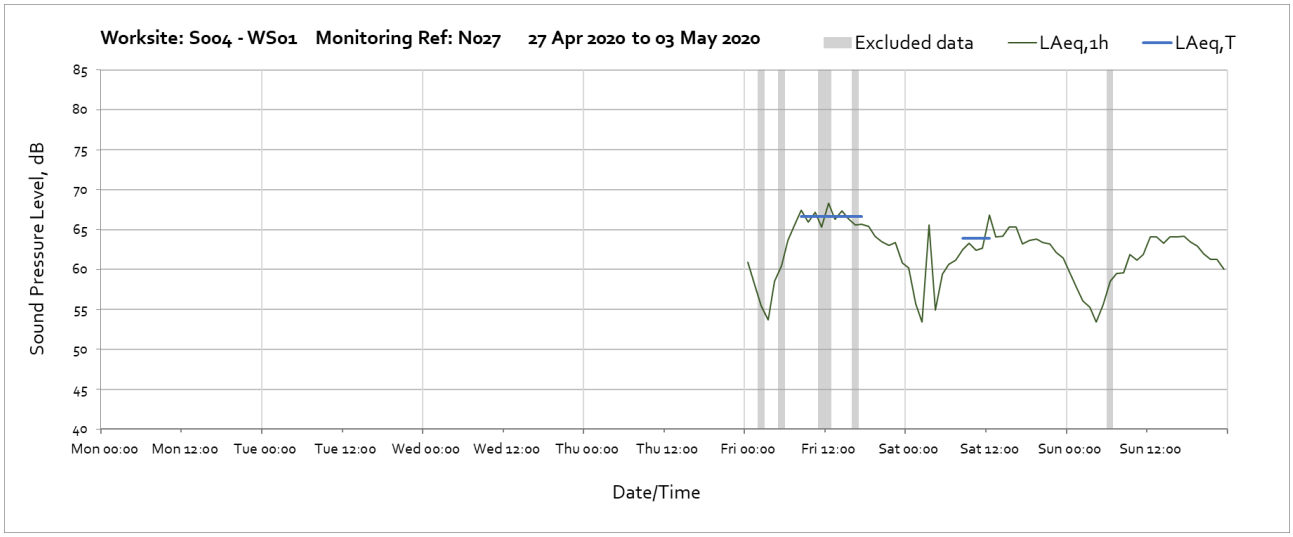
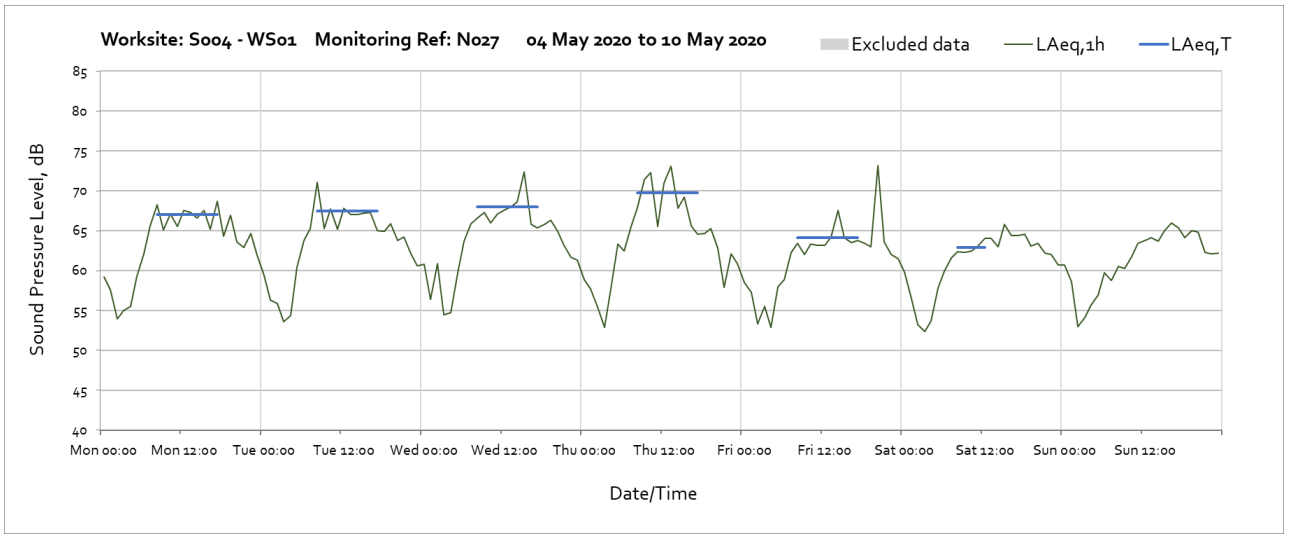
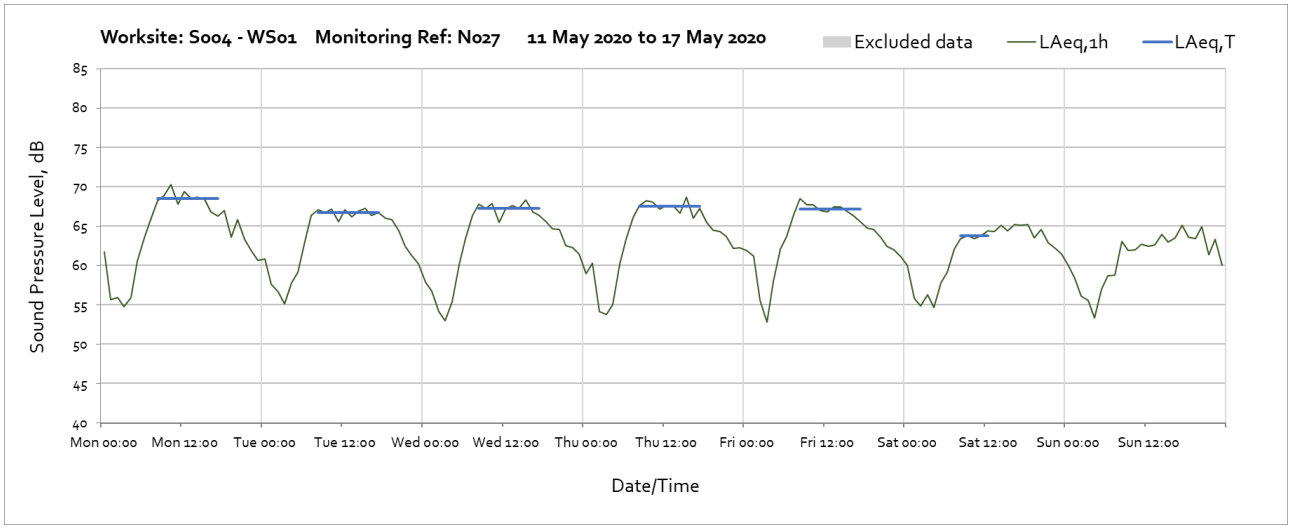
Date/Time

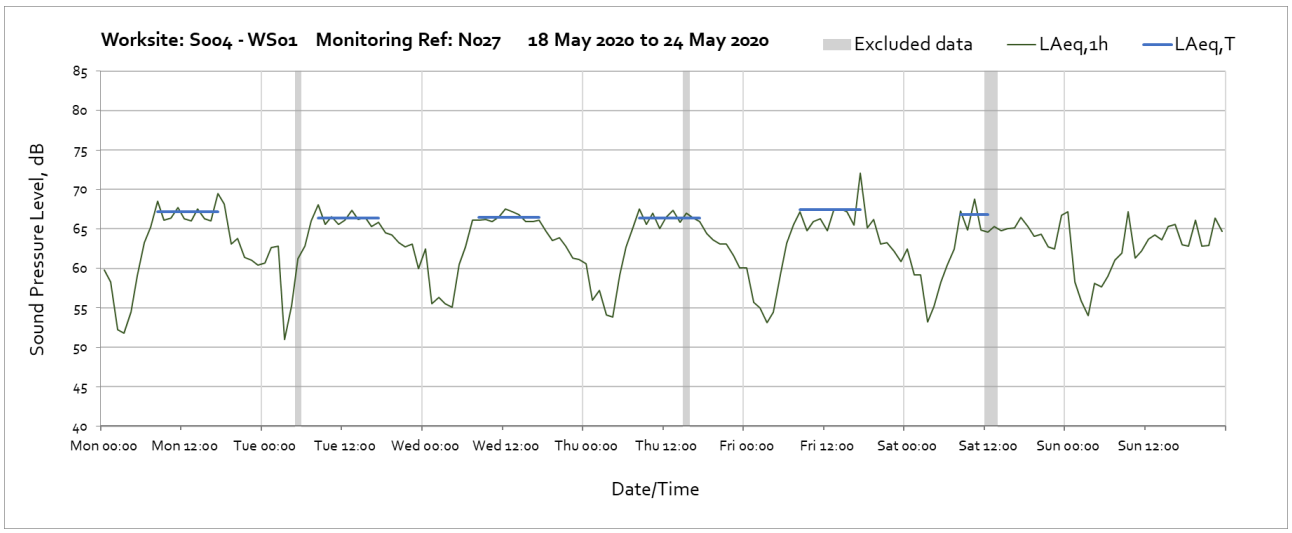


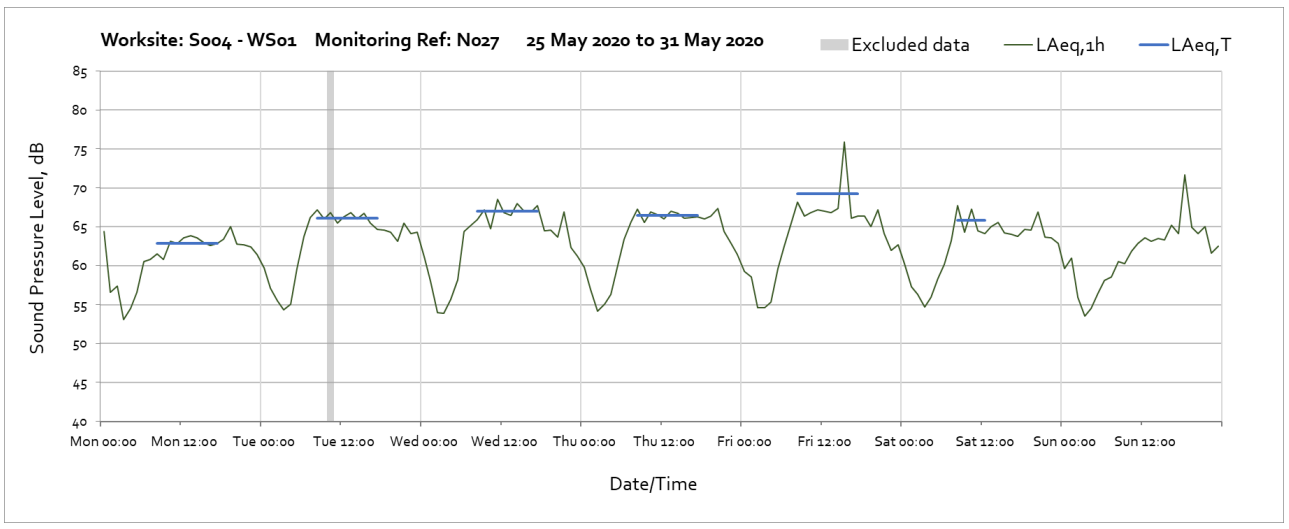
Worksite: S004-WS01 – Monitoring Ref: N027






Worksite: S004 - WS01 Monitoring Ref: N027 11 May 2020 to 17 May 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
70
65
60
55
50
45
40
Mon 00:00
Mon 12:00
Tue 00:00
Tue 12:00
Wed 00:00
Wed 12:00
Thu 00:00
Thu 12:00
Fri 00:00
Fri 12:00
Sat 00:00
Sat 12:00
Sun 00:00
Sun 12:00
Date/Time


Worksite: S004 - WS01 Monitoring Ref: N027 18 May 2020 to 24 May 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
70
65
60
55
50
45
40
Mon 00:00
Mon 12:00
Tue 00:00
Tue 12:00
Wed 00:00
Wed 12:00
Thu 00:00
Thu 12:00
Fri 00:00
Fri 12:00
Sat 00:00
Sat 12:00
Sun 00:00
Sun 12:00
Date/Time


Worksite: S004 - WS01 Monitoring Ref: N027 25 May 2020 to 31 May 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
70
65
60
55
50
45
40
Mon 00:00
Mon 12:00
Tue 00:00
Tue 12:00
Wed 00:00
Wed 12:00
Thu 00:00
Thu 12:00
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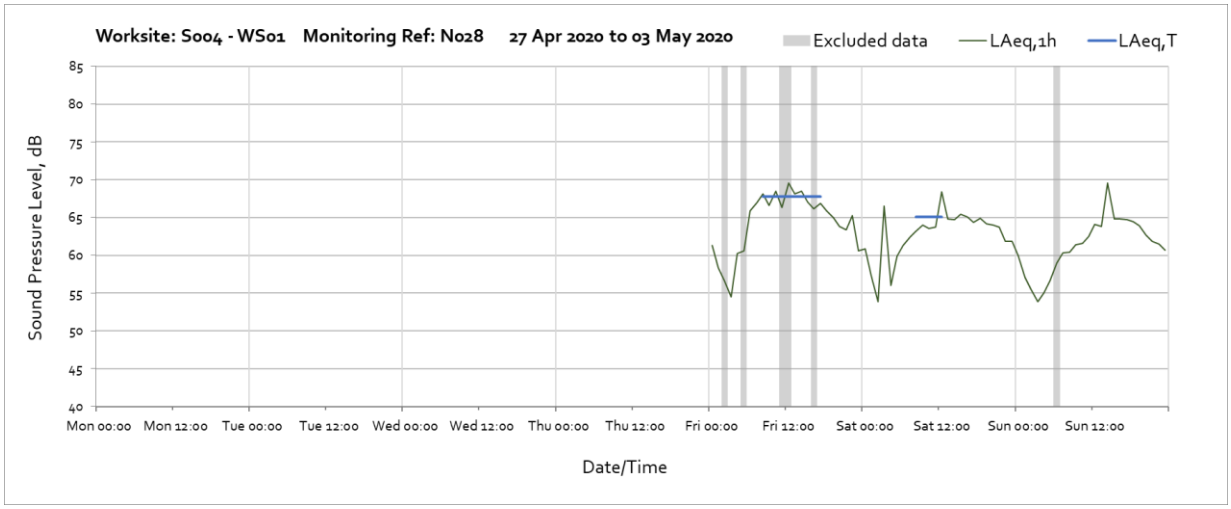
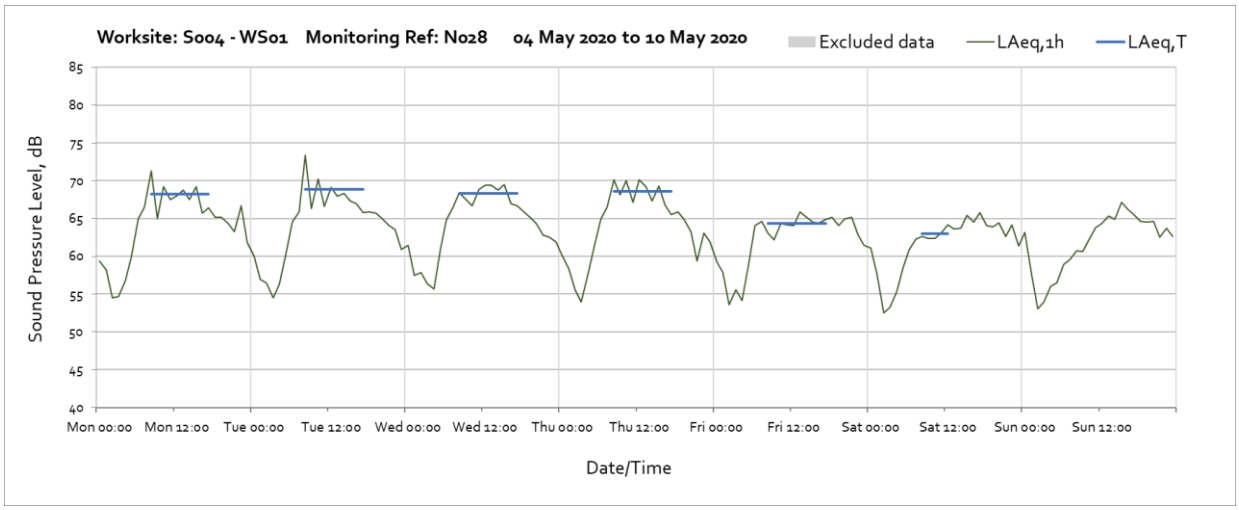
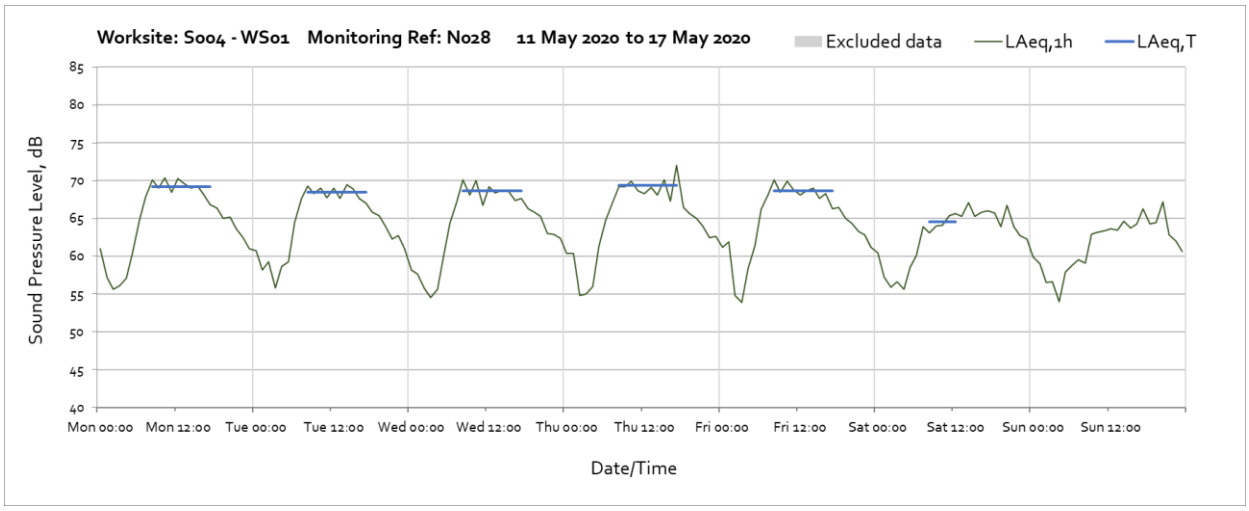
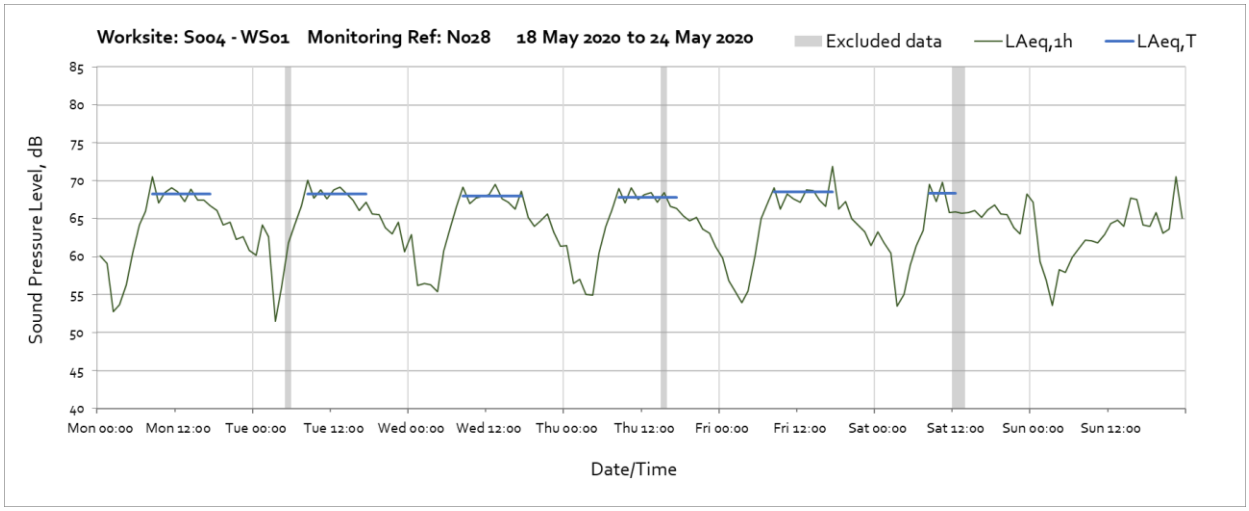
Fri 12:00
Sat 00:00
Sat 12:00
Sun 00:00
Sun 12:00
Date/Time

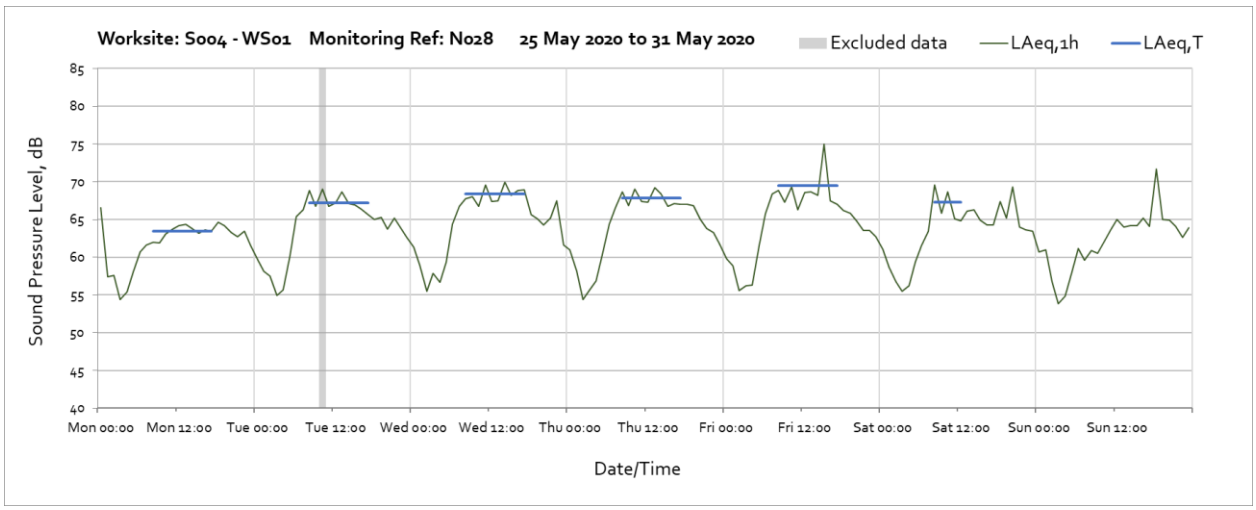
Worksite: S004-WS01 – Monitoring Ref: N028



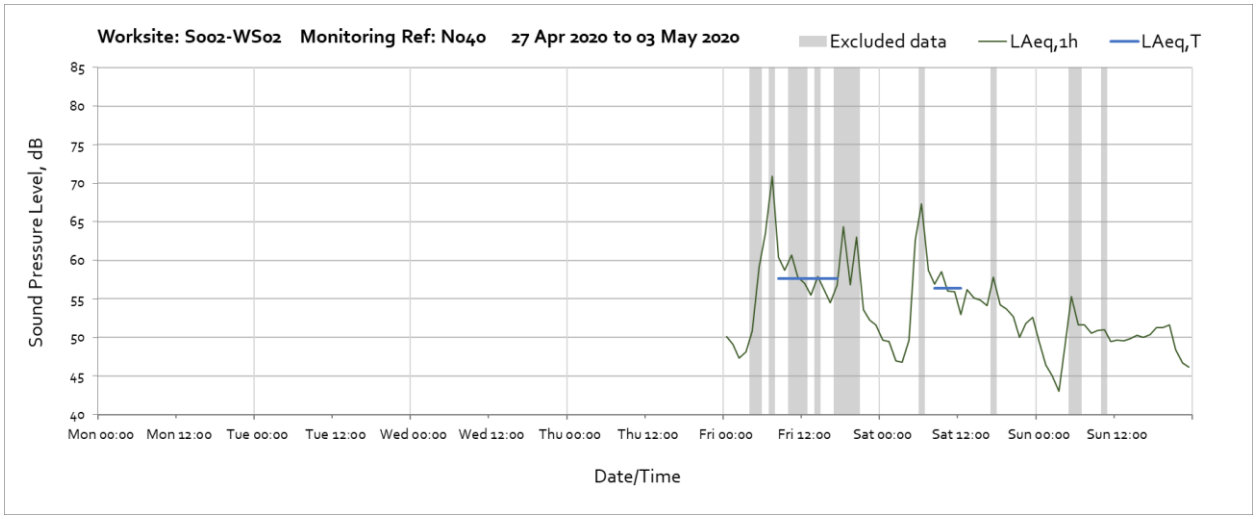


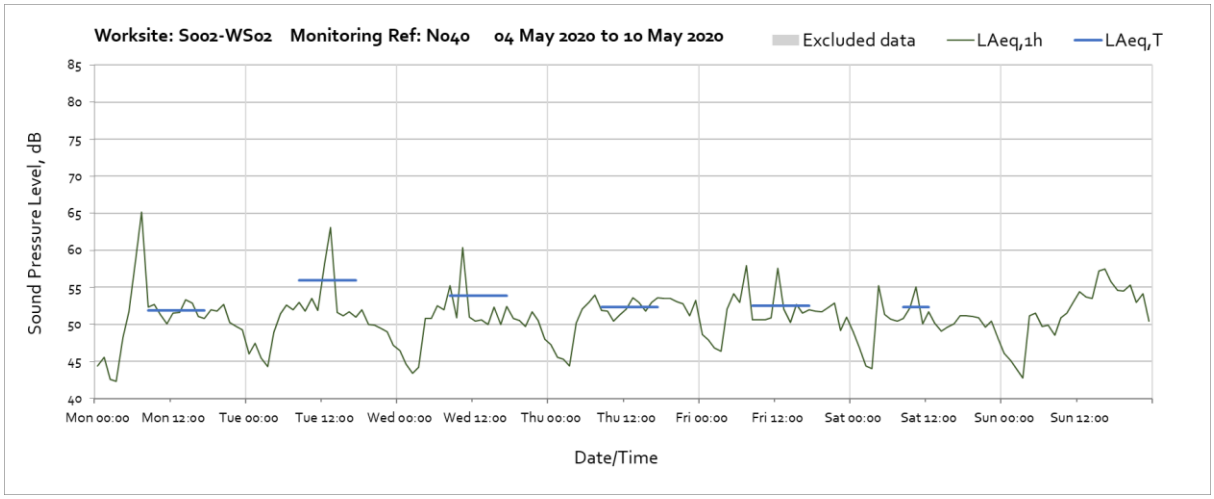


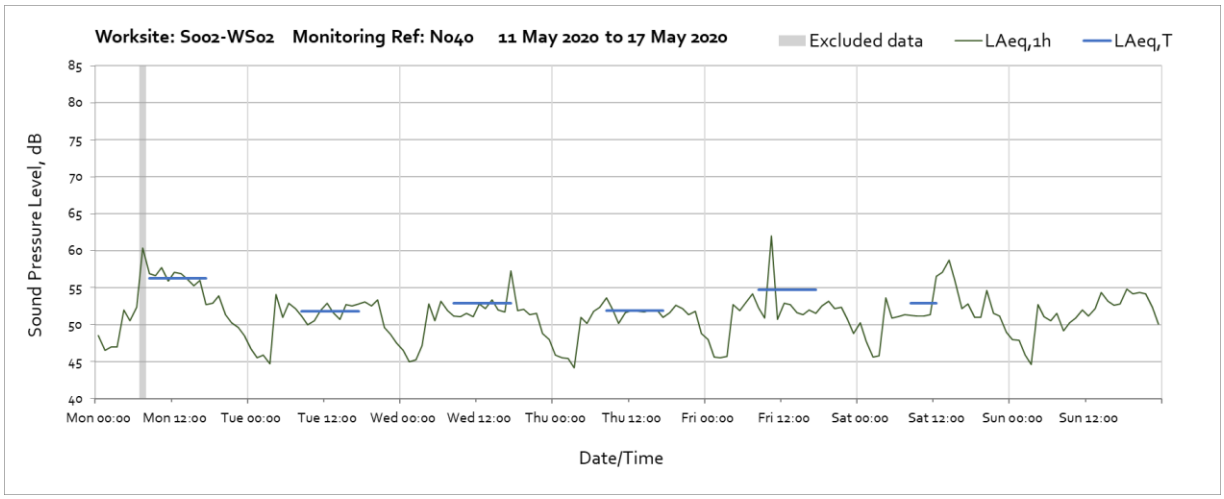


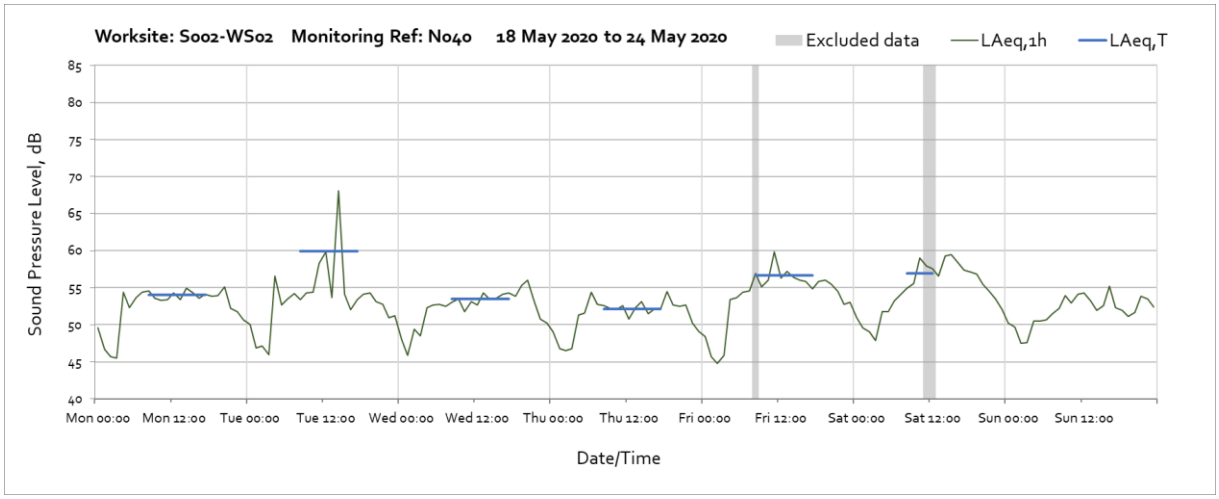


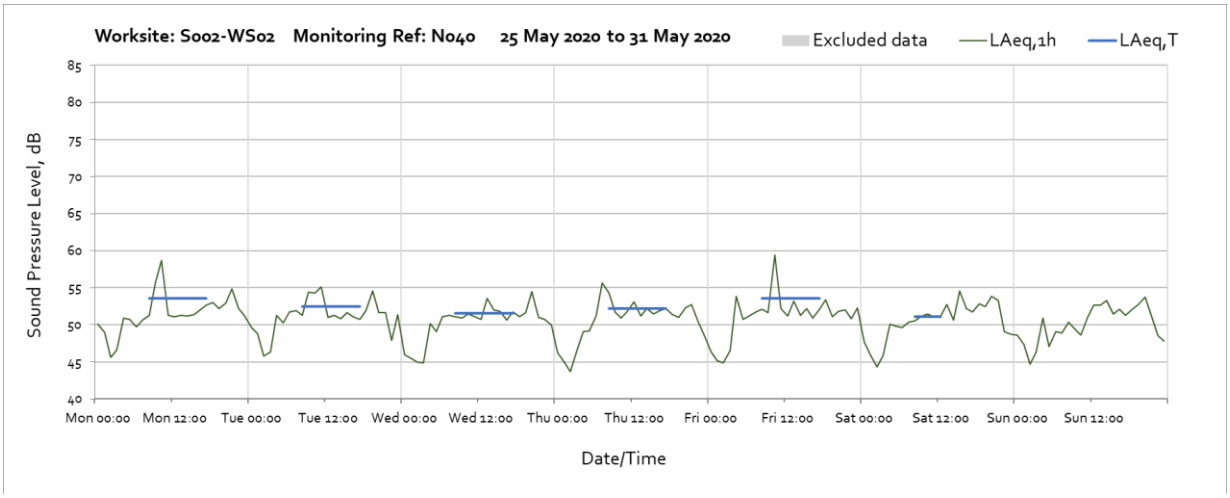
Worksite: BC Compound – Monitoring Ref: N040




Worksite: S002-WS02 Monitoring Ref: N040 04 May 2020 to 10 May 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
70
65
60
55
50
45
40
Mon 00:00
Mon 12:00
Tue 00:00
Tue 12:00
Wed 00:00
Wed 12:00
Thu 00:00
Thu 12:00
Fri 00:00
Fri 12:00
Sat 00:00
Sat 12:00
Sun 00:00
Sun 12:00
Date/Time


Worksite: S002-WS02 Monitoring Ref: N040 11 May 2020 to 17 May 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
70
65
60
55
50
45
40
Mon 00:00
Mon 12:00
Tue 00:00
Tue 12:00
Wed 00:00
Wed 12:00
Thu 00:00
Thu 12:00
Fri 00:00
Fri 12:00
Sat 00:00
Sat 12:00
Sun 00:00
Sun 12:00
Date/Time

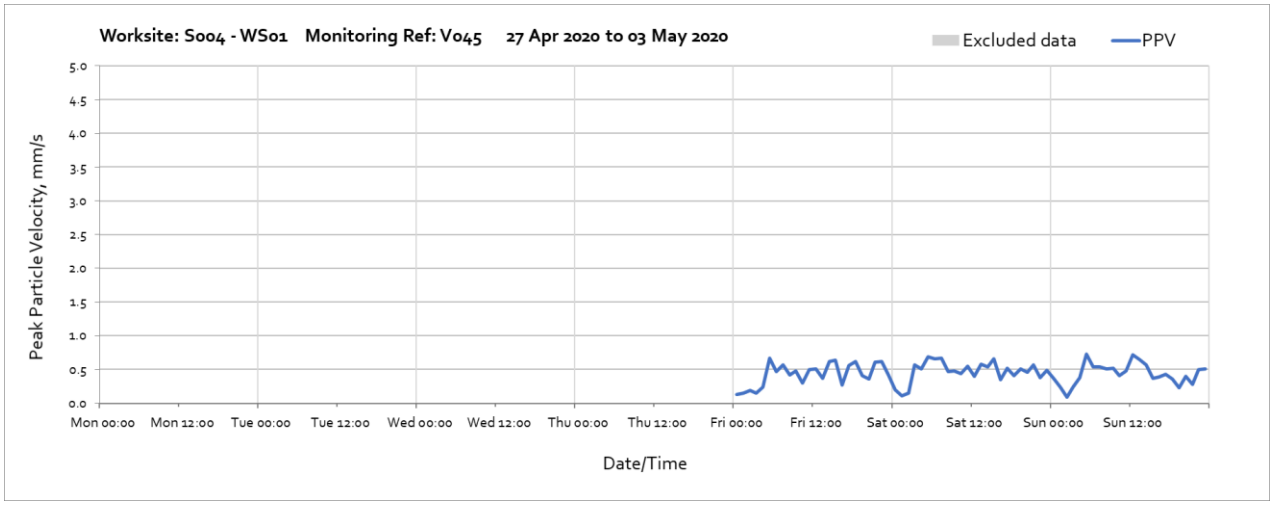

Worksite: S002-WS02 Monitoring Ref: N040 18 May 2020 to 24 May 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
70
65
60
55
50
45
40
Mon 00:00
Mon 12:00
Tue 00:00
Tue 12:00
Wed 00:00
Wed 12:00
Thu 00:00
Thu 12:00
Fri 00:00
Fri 12:00
Sat 00:00
Sat 12:00
Sun 00:00
Sun 12:00
Date/Time

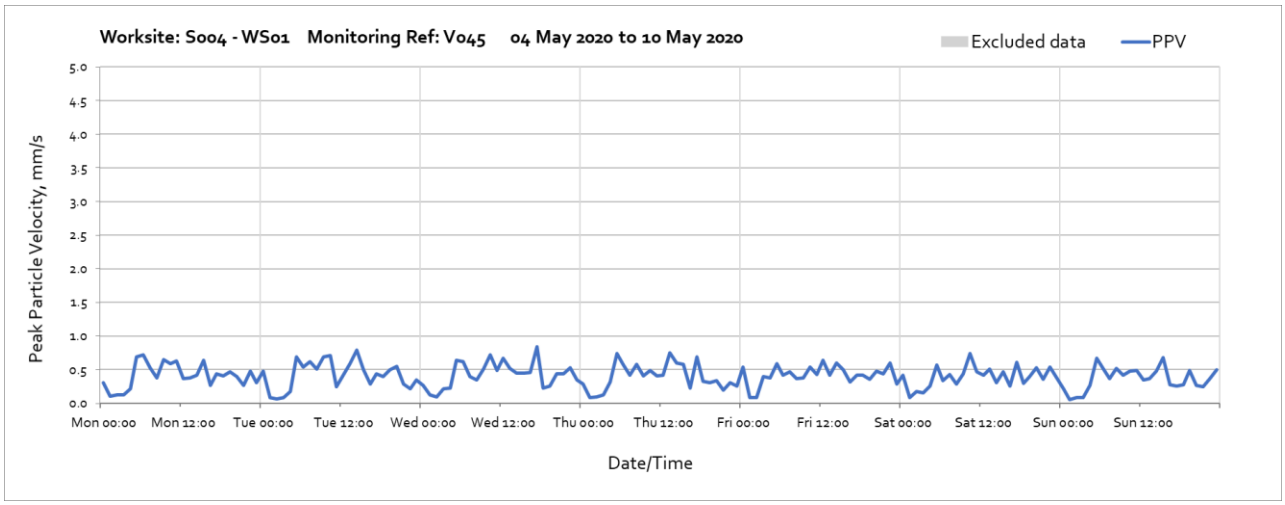

Worksite: S002-WS02 Monitoring Ref: N040 25 May 2020 to 31 May 2020
Excluded data
LAeq,1h
LAeq,T
Sound Pressure Level, dB
85
80
75
70
65
60
55
50
45
40
Mon 00:00
Mon 12:00
Tue 00:00
Tue 12:00
Wed 00:00
Wed 12:00
Thu 00:00
Thu 12:00
Fri 00:00
Fri 12:00
Sat 00:00
Sat 12:00
Sun 00:00
Sun 12:00
Date/Time

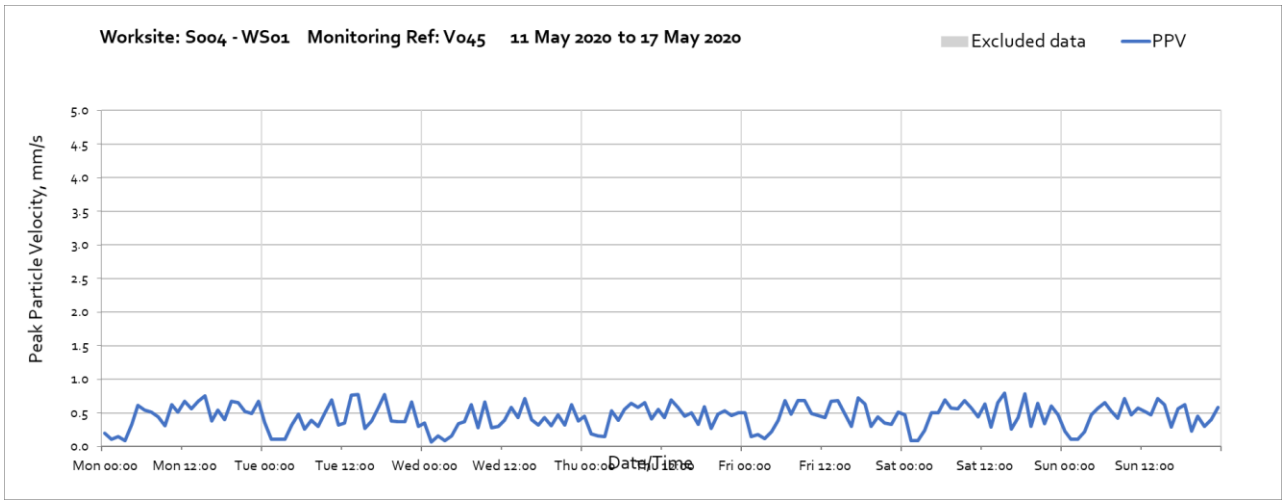
Vibration

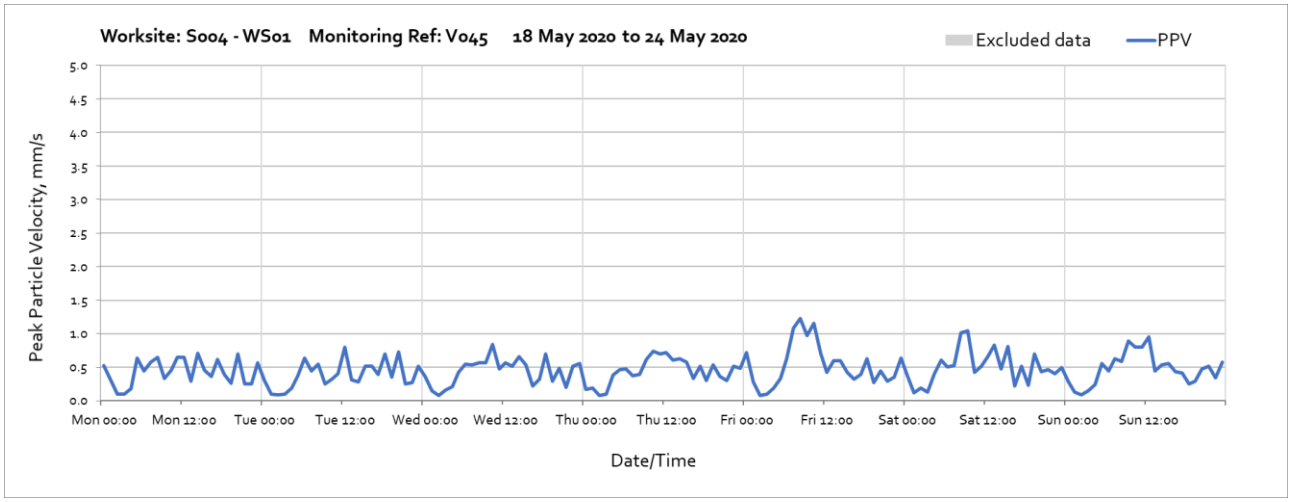
The following graphs show the hourly measured peak particle velocity PPV recorded during the monitoring period. The graphs show the resultant PPV due to vibration components on three orthogonal axis x, y and z.

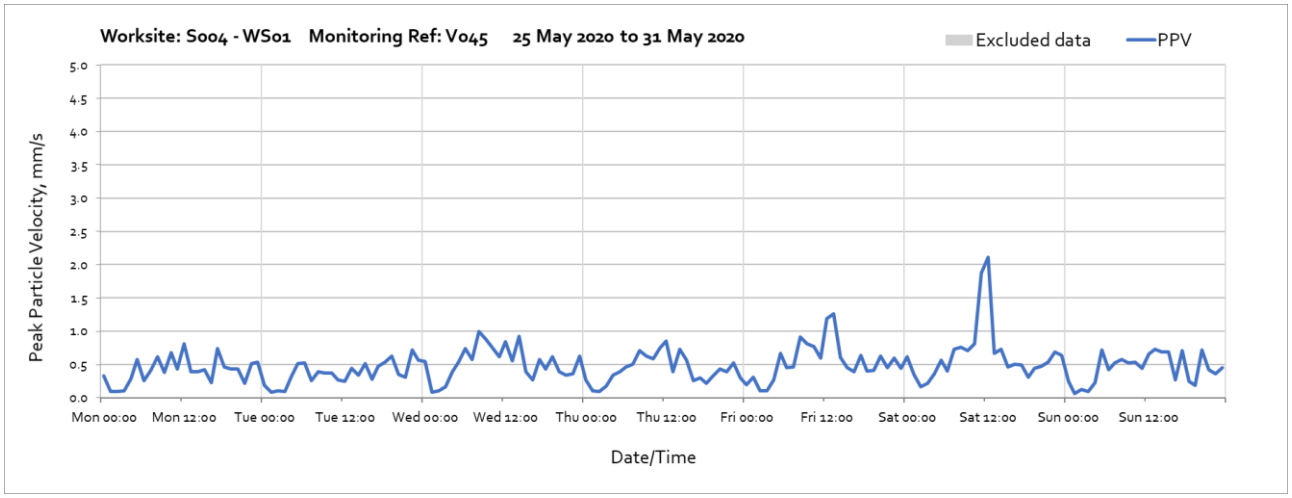
Worksite: S004-WS01 – Monitoring Ref: V045








Worksite: S004 - WS01 Monitoring Ref: V045 18 May 2020 to 24 May 2020
Excluded data
PPV
Peak Particle Velocity, mm/s
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Mon 00:00
Mon 12:00
Tue 00:00
Tue 12:00
Wed 00:00
Wed 12:00
Thu 00:00
Thu 12:00
Fri 00:00
Fri 12:00
Sat 00:00
Sat 12:00
Sun 00:00
Sun 12:00
Date/Time


Worksite: S004 - WS01 Monitoring Ref: V045 25 May 2020 to 31 May 2020
Excluded data
PPV
Peak Particle Velocity, mm/s
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Mon 00:00
Mon 12:00
Tue 00:00
Tue 12:00
Wed 00:00
Wed 12:00
Thu 00:00
Thu 12:00
Fri 00:00
Fri 12:00
Sat 00:00
Sat 12:00
Sun 00:00
Sun 12:00
Date/Time