

## **Construction noise and vibration Monthly Report – November 2021**

**London Borough of Camden**

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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 Camden during the month of November 2021.

Within this period monitoring was undertaken at the following worksites:

- Noise monitoring was undertaken in the vicinity of The Adelaide Road Ventilation Shaft (ref.: ARVS) where welfare setup, construction of piling and working platforms, removal of brick walls and foundations, installation of steel mats, ramp construction, surveys (including survey checks and installation of survey equipment), vegetation clearance and installation of ducts and troughing were underway.
- Noise monitoring was undertaken in the vicinity of the Vehicle Holding Area worksite (ref.: VHA), where compound operations were underway.
- Noise monitoring was undertaken in the vicinity of Euston Throat Retained Cut and Granby Terrace Bridge worksite (ref.: ETRC & GTB) where retaining wall works, demolition, site maintenance, piling, low key works under night-time possession, haul road works, earthworks and stockpiling were underway.
- Noise monitoring was undertaken in the vicinity of Euston Scissor Cut worksite (ref.: ESC) where pile mat construction, guide wall construction, capping beam construction, demolition, drainage works, installation of waste bin, concrete slab construction, crane platform construction, fencing foundation works, wall works, haul road works and excavations were underway.
- Noise and vibration monitoring were undertaken in the vicinity of the Hampstead Road Bridge worksite (ref.: HRB) where access ramp works and haul road works were underway.
- Noise and vibration monitoring were undertaken in the vicinity of the Euston Cavern worksite (ref.: ECAV), where wall support works, earthworks and pile mat construction were underway.
- Noise monitoring was undertaken in the vicinity of On-Network worksites (ref.: B, C, D, E, F, G and H), where:
  - material deliveries to and waste export from Clarkson Row Access Point (worksite E); and
  - surveys on station platforms were underway.
  - no HS2 works were undertaken at worksites B, C, D, F and G.

- Noise monitoring was undertaken in the vicinity of the Former National Temperance Hospital - Euston North worksite (ref.: NTH-EN) retaining wall construction, backfilling, drain surveys, pile mat installation, test piling, digging of trial holes and site clearance were underway.
- Noise monitoring was undertaken in the vicinity of the Euston Towers Demolition worksite (ref.: ETD), where demolition, saw cutting and removal of granite cladding were underway.
- Noise monitoring was undertaken in the vicinity of the Traction Substation worksite (ref.: TSS) where tunnelling, piling and mobilisation of plant for capping beam works were underway.
- Noise monitoring was undertaken in the vicinity of the Interim Taxi Rank worksite (ref.: ITR), where ground works and lowering of services was underway.

Further works, where monitoring did not take place, were:

- Varndell Street, Starcross Street, and North Gower Street where utilities works were underway; and
- Gloucester Avenue where sewer utility works were underway.

The HS2 threshold levels for significant noise impacts, which are defined in Information Paper E23 (<https://www.gov.uk/government/publications/hs2-information-papers-environment>) were exceeded on eight (8) occasions due to HS2 works in the Local Authority Area during November 2021.

There were no exceedances of trigger levels as defined in section 61 consents during the reporting period.

Six (6) complaints were received during the monitoring period. A description of complaints, the results of investigations and any actions taken are detailed in Table 8 of this report.



# 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 $L_{Aeq,T}$	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.
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.
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.
LOAEL	Lowest Observed Adverse Effect Level - the level above which adverse effects on health and quality of life can be detected.
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.
SOAEL	Significant Observed Adverse Effect Level - the level above which significant adverse effects on health and quality of life occur.
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 HS2 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 Camden (LBC) for the period 1<sup>st</sup> to 30<sup>th</sup> November 2021.

1.1.2 Active construction sites in the local authority area where monitoring was undertaken during this period include:

- The Adelaide Road ventilation shaft ref.: ARVS, (see plan 2 in Appendix A), where work activities included:
  - setting up of welfare facilities;
  - installation of structural fill blocks to form the base for a piling platform for future sheet piling;
  - casting of concrete sections of working platform;
  - removal of a section of brick wall to allow for structural fill installation/mats;
  - installation of steel mats over structural fill blocks;
  - construction of ramp to the piling platform;
  - surveys of levels;
  - vegetation clearance;
  - removal of brick wall and foundations;

- ongoing installation of ducts for utilities runs;
- installation of troughing for cables diversions;
- unexploded ordnance checks; and
- installation of survey prisms on retaining wall.
- Vehicle Holding Area worksite ref.: VHA (see plan 1 in Appendix A), where work activities included:
  - general compound operation (vehicle movements).
- Euston Throat Retained Cut and Granby Terrace Bridge worksite ref.: ETRC & GTB (see plan 2 in Appendix A), where work activities included:
  - western retaining wall works (including propping, excavation, installation of staircase, pile cleaning and cutting bars, concrete pour of lower section of capping beam, hydroscabbling,, relocating and upgrading acoustic tent);
  - retaining wall demolition;
  - general site maintenance (including water treatment plant maintenance, footpath sweeping, cleaning and clearing site) and muckaway;
  - sheet piling including excavation between sheet piles and steelwork installation;
  - contiguous bored piling (excavations, cage installation, polymer fill, concrete pour, vacuum excavation of excess concrete)
  - low key works under night-time railway possession (attaching bonding cable to sheet piles)
  - line E works under possession (installation of sheet piles)
  - haul road digging and maintenance;
  - earthworks; and
  - stockpiling.
- Euston Scissor Cut worksite ref.: ESC (see plan 2 in Appendix A), where work activities included:
  - portal pile mat construction (excavation, backfill and compaction, muckaway, piling, concreting);
  - guide wall construction (excavation, steel fixing and framework, concrete pour);
  - western and eastern capping beam construction (steel fixing, formworks, sheet piling, concrete pouring, breaking out of guide walls);
  - retaining wall demolition;
  - sitewide temporary drainage;

- line works (bridge strengthening and ground anchor installation);
  - installation of muck bin;
  - polymer silo base construction (including excavations, compaction, concrete breaking, blinding pour, steel fixing, formworks and concreting);
  - tower crane platform construction (including excavation, backfilling and compaction, steel fixing, formworks and concreting)
  - fencing foundation works for electricity substation;
  - Park Village East wall works (coring, installation of ground anchors, UXO probing);
  - haul road modification; and
  - bulk excavations.
- Hampstead Road Bridge worksite ref.: HRB (see plan 3 in Appendix A), where work activities included:
    - Cartmel access ramp works (including saw cutting and breaking out of concrete, concrete pour, laying of Tarmac);
    - haul road modifications (including trial holes, road breaking, excavations, backfilling and compaction, concrete pour and finish, installation of gate, fencing, walkways and access, installation of aggregate, hoarding realignment and installation of lighting); and
  - Euston Cavern worksite ref.: ECAV (see plan 3 in Appendix A), where work activities included:
    - Park Village East wall works (coring, installation of ground anchors, unexploded ordinance survey probing);
    - backfilling of trial holes;
    - spoil removal; and
    - portal pile mat construction (excavation, backfill and compaction, muck away, piling).
  - On-Network worksites ref.: B, C, D, E, F, G and H (see plan 3 in Appendix A), where work activities included:
    - materials deliveries to and waste export from Clarkson Row Access Point (worksite E); and
    - surveys on station platforms (worksite H).
    - no works were undertaken at worksites B, C, D, F and G.
  - Former National Temperance Hospital - Euston North worksite ref.: NTH-EN (see plan 3 in Appendix A), where work activities included:

- retaining wall construction;
  - preparation of concrete moulds (shuttering) for removal;
  - backfilling;
  - drain surveys;
  - pile mat installation;
  - testing piling;
  - digging of trial holes; and
  - site clearance.
- Euston Towers Demolition worksite ref.: ETD (see plan 3 in Appendix A), where work activities included:
    - basement and ground floor slab and vertical element demolition;
    - saw cutting around substation; and
    - removal of granite cladding from Euston Station columns.
  - Traction Substation worksite ref.: TSS (see plan 3 in Appendix A), where work activities included:
    - tunnelling;
    - installation rotary bored piles; and
    - mobilisation of plant for capping beam works.
  - Interim Taxi Rank worksite ref.: ITR (see plan 3 in Appendix A), where work activities included:
    - groundworks; and
    - lowering of services.

1.1.3 Further works, where monitoring did not take place, were also undertaken at the following locations:

- Starcross Street and North Gower Street where utilities works were underway;
- Doric Way, where digging of trial holes were undertaken;
- Barnby Street, where civil works, installation of street furniture and road marking works were underway; and
- Gloucester Avenue where sewer utility works were underway.

1.1.4 The applicable standards, guidance, and monitoring methodology are 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 Thirty-three (33) noise and ten (10) vibration monitoring installations were active across fourteen worksites in November in the LBC area. Table 2 summarises the position of noise and vibration monitoring installations within the LBC area in November 2021.

1.2.2 Maps showing the position of noise and vibration monitoring installations are presented in Appendix B.

Table 2: Monitoring Locations

Worksite Reference	Measurement Reference	Address
ARVS	N051	Outside 70 Adelaide Road
	N052	Adelaide Road-Beaumont Walk
	V059	Outside 68 Adelaide Road
B	JC	Juniper Crescent
ESC	N024	External to Park Village Studios, Park Village East
	N047	Park Village East/Mornington Street bridge, lamppost #13
	PVS-V1	Park Village Studios
ESC, C	N022	External to 34 Mornington Terrace
	N046	Mornington Terrace near The Edinboro Castle pub, lamppost #18
ETRC & GTB	N001	Park Village East, lamppost #1 (external to Cubitt Court, 100 Park Village East)
	N002	Park Village East, lamppost #2 (external to Richmond Court)
	N003	Park Village East, lamppost #9 (external to Silsoe House)
	SH-V1	Silsoe House
ETRC & GTB, D	N004	Mornington Terrace, lamppost #7 (junction of Mornington Terrace, Mornington Place and Clarkson Row)
ETRC & GTB, E	N005	5A Granby Terrace
E	CR	Lamppost #2 on Clarkson Row
ETRC & GTB, F	N023	Lamppost #21 on Hampstead Road

Worksite Reference	Measurement Reference	Address
HRB	N020	Mackworth Street, lamppost #1
	N021	Stanhope Street, lamppost #2
	N044	Regents Park Estate west, near Langdale
	N045	Regents Park Estate south, external to Coniston
	V039	Coniston, Regents Park Estate
	V043	Cubitt Court, Park Village East
G, H	HH	Euston Station Parcel Deck, Barnby Street
G	BS	Roof of Stockbeck House, Barnby Street
ETD, TSS	N006	Royal College of General Practitioners roof level
TSS	N008	Stephenson's Way lamppost (external to RCGP)
	N010	Wesley Hotel
	N011	Euston Street, lamppost #4 (external to 82 Euston Street)
	V002	Royal College of General Practitioners basement boiler room by Stephenson Way
	V037	Magic Circle, basement
	V038	Wesley Hotel, basement lightwell, Euston Street
ETD	N007	Royal College of General Practitioners, Melton Street
	V003	Royal College of General Practitioners basement vaults under Melton St
VHA	N025	External to 3 Prince Albert Road
	N026	Thames Water Compound
NTH-EN, TSS	N012	Drummond Street, lamppost #14 (opposite to 92-94 Drummond Street)
NTH-EN	N014	Starcross Street lamppost (external to Exmouth Arms)
	N016	Margaret Centre roof
	N017	Hampstead Road, lamppost #48
	N018	Outside replacement housing, Hampstead Road
	N019	Outside Cartmel, Hampstead Road
	V021	42-44 Cobourg Street

## 2 Summary of Results

### 2.1 Summary of Measured Noise and Vibration Levels

2.1.1 Table 3 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.



Table 3: Summary of Measured dB LAeq Data over the Monitoring Period

Worksite Reference	Measurement Reference	Site Address	Free-field or Façade Measurement	Weekday Average LAeq,T (Highest Day LAeq,T)					Saturday Average LAeq,T (highest day LAeq,T)					Sunday / Public Holiday Average LAeq,T (highest day LAeq,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
ARVS	N051	Outside 70 Adelaide Road	Free-field	68.7 (71.5)	70.4 (72.5)	68.8 (72.3)	68.4 (73.0)	65.8 (75.6)	66.4 (67.4)	68.7 (69.4)	69.1 (70.0)	69.9 (75.8)	66.4 (73.0)	68.4 (73.0)	65.5 (75.8)
	N052	Adelaide Road-Beaumont Walk	Free-field	66.7 (69.1)	68.8 (70.3)	67.2 (73.7)	66.0 (72.5)	63.6 (69.4)	65.2 (66.2)	67.7 (70.0)	68.0 (71.5)	67.2 (72.6)	64.4 (69.9)	65.9 (70.2)	62.6 (65.7)
B	JC	Juniper Crescent	Free-field	57.7 (59.8)	58.7 (60.7)	58.3 (64.5)	59.0 (67.7)	55.8 (65.2)	57.8 (59.9)	58.8 (60.0)	57.7 (58.9)	58.0 (64.3)	53.5 (59.5)	55.8 (59.4)	54.5 (59.3)
ESC	N024	External to Park Village Studios, Park Village East	Free-field	59.4 (61.2)	60.9 (64.2)	60.2 (63.1)	58.8 (64.2)	55.7 (73.1)	55.6 (58.7)	58.7 (60.3)	59.9 (62.8)	59.3 (63.6)	55.0 (61.5)	57.8 (62.7)	54.3 (60.5)
	N047	Park Village East/Mornington Street bridge, lamppost #13	Free-field	59.1 (62.9)	62.0 (64.2)	61.4 (68.1)	59.1 (67.9)	54.0 (62.0)	56.2 (58.1)	59.4 (61.1)	60.3 (62.6)	59.7 (63.1)	54.0 (59.2)	57.9 (60.1)	53.2 (58.9)
ESC, C	N022	External to 34 Mornington Terrace	Free-field	59.4 (61.0)	62.5 (65.0)	59.7 (63.7)	59.0 (67.1)	55.0 (66.9)	57.6 (59.6)	60.6 (63.5)	59.8 (60.7)	59.5 (67.6)	54.4 (62.3)	57.2 (60.2)	53.5 (58.0)
	N046	Mornington Terrace near The Edinboro Castle pub, lamppost #18	Free-field	62.5 (63.5)	65.2 (68.4)	62.5 (65.3)	62.1 (66.9)	58.5 (69.4)	61.4 (63.2)	62.9 (63.6)	62.6 (63.3)	62.1 (65.8)	57.3 (62.4)	60.5 (63.0)	57.4 (62.8)
ETRC & GTB	N001	External to Cubitt Court, 100 Park Village East	Free-field	58.3 (62.1)	65.7 (69.7)	60.6 (64.6)	58.6 (72.2)	52.8 (60.8)	55.9 (57.1)	64.3 (67.3)	60.1 (63.2)	60.8 (70.7)	54.9 (60.9)	58.2 (63.5)	53.1 (57.1)

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
	N002	Richmond Court, Park Village East	Free-field	58.9 (66.4)	65.8 (88.9)	61.2 (64.7)	58.8 (67.8)	53.3 (61.1)	56.0 (57.3)	61.5 (62.6)	60.1 (62.4)	61.0 (67.6)	54.5 (58.7)	58.4 (61.0)	53.5 (58.1)
	N003	Silsoe House, Park Village East	Façade	58.9 (60.7)	63.1 (66.4)	61.7 (63.9)	59.4 (66.4)	53.9 (61.7)	55.7 (58.3)	59.8 (61.9)	60.8 (63.2)	60.3 (63.7)	54.5 (59.6)	58.4 (60.9)	53.6 (59.2)
ETRC & GTB, D	N004	Mornington Terrace, lamppost #7	Free-field	63.5 (64.7)	67.5 (73.4)	63.9 (66.1)	63.4 (69.5)	59.7 (67.2)	62.8 (64.4)	65.4 (66.5)	63.1 (63.6)	64.3 (72.4)	56.6 (65.0)	63.0 (73.0)	58.4 (63.1)
ETRC & GTB, E	N005	5A Granby Terrace	Free-field	64.6 (67.6)	68.8 (76.8)	65.2 (67.4)	64.6 (71.6)	61.8 (65.6)	63.6 (64.0)	68.9 (70.1)	65.8 (69.5)	66.1 (75.5)	62.8 (67.0)	63.7 (67.8)	61.7 (65.3)
E	CR	Lamppost #2 on Clarkson Row	Free-field	63.9 (66.0)	68.9 (73.5)	65.9 (70.2)	64.9 (71.1)	59.1 (65.8)	63.6 (65.6)	68.9 (71.2)	66.7 (69.5)	67.6 (77.5)	58.5 (63.4)	65.3 (75.1)	59.4 (67.5)
ETRC & GTB, F	N023	Lamppost #21 on Hampstead Road	Free-field	69.1 (73.3)	70.6 (72.1)	69.3 (74.6)	68.9 (75.7)	66.5 (72.4)	67.1 (68.3)	70.1 (71.3)	70.0 (71.7)	68.9 (72.4)	67.4 (70.4)	68.2 (73.0)	66.1 (72.2)
HRB	N020	Mackworth Street, lamppost #1	Free-field	53.4 (59.8)	66.3 (80.0)	54.4 (66.4)	52.5 (81.6)	47.8 (56.8)	51.4 (53.2)	63.3 (64.9)	53.2 (55.0)	54.5 (62.6)	48.4 (51.8)	52.0 (63.3)	47.7 (52.1)
	N021	Stanhope Street, lamppost #2	Free-field	57.0 (60.1)	61.9 (66.0)	59.8 (67.4)	57.5 (74.9)	51.6 (57.1)	55.0 (59.0)	61.9 (66.5)	58.5 (61.3)	60.1 (69.5)	53.2 (57.8)	56.5 (60.3)	51.5 (56.7)

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
HRB	N044	Regents Park Estate west, near Langdale	Free-field	60.4 (62.3)	69.9 (74.6)	60.9 (65.3)	60.0 (72.7)	59.3 (62.1)	59.8 (60.4)	68.3 (69.8)	60.9 (61.5)	60.3 (64.4)	59.3 (60.4)	59.6 (64.7)	59.2 (59.9)
	N045	Regents Park Estate south, external to Coniston	Free-field	57.7 (63.5)	69.2 (73.2)	58.2 (67.6)	57.0 (75.5)	54.7 (78.6)	60.0 (72.5)	69.9 (74.7)	63.1 (79.4)	62.4 (80.5)	57.9 (75.8)	61.9 (70.8)	55.3 (64.4)
G, H	HH	Euston Station Parcel Deck, Barnby Street	Free-field	62.0 (67.1)	63.5 (65.2)	63.0 (71.9)	63.6 (71.5)	59.1 (67.3)	59.6 (60.7)	61.5 (61.8)	64.0 (69.7)	63.5 (67.5)	59.8 (66.2)	60.9 (66.5)	59.3 (69.1)
G	BS	Roof of Stockbeck House, Barnby Street	Free-field	59.8 (62.0)	63.8 (68.4)	60.9 (67.6)	60.7 (76.5)	57.1 (67.7)	60.0 (63.2)	62.6 (63.5)	60.8 (61.8)	60.8 (64.9)	56.4 (60.1)	59.6 (69.7)	56.5 (63.0)
ETD, TSS	N006	Royal College of General Practitioners roof level	Free-field	61.1 (62.8)	71.3 (74.8)	60.4 (64.1)	60.2 (68.4)	59.1 (62.4)	53.8 (56.3)	60.5 (65.8)	55.5 (58.6)	55.4 (59.5)	53.6 (57.1)	55.2 (58.9)	52.9 (57.0)
TSS	N008	Stephenson's Way lamppost (external to RCGP)	Façade	61.3 (68.3)	73.0 (78.5)	59.7 (69.4)	58.4 (67.8)	57.7 (65.5)	56.4 (60.7)	58.9 (60.4)	56.5 (59.0)	58.1 (67.5)	54.6 (59.5)	55.8 (58.6)	55.1 (60.8)
TSS	N010	Wesley Hotel	Façade	69.8 (70.3)	71.8 (73.6)	69.8 (70.4)	68.8 (71.6)	62.0 (70.3)	64.8 (69.8)	68.6 (70.0)	69.7 (69.8)	69.2 (69.8)	60.5 (69.7)	65.7 (69.8)	61.0 (69.9)
	N011	Outside 82 Euston Street	Free-field	56.8 (62.5)	61.5 (63.8)	56.1 (60.7)	55.5 (62.9)	53.5 (61.0)	51.8 (53.3)	55.8 (59.1)	56.7 (58.1)	56.0 (63.5)	50.8 (54.9)	54.5 (59.0)	51.2 (55.2)

OFFICIAL

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
ETD	N007	Royal College of General Practitioners, Melton Street	Free-field	65.5 (70.6)	72.5 (74.7)	64.6 (67.5)	64.4 (68.9)	63.2 (69.5)	65.2 (66.9)	65.3 (66.4)	65.9 (68.2)	64.7 (67.3)	62.9 (66.9)	64.2 (67.1)	62.6 (66.6)
VHA	N025	External to 3 Prince Albert Road	Free-field	67.0 (69.1)	67.8 (69.1)	67.0 (70.8)	66.1 (70.7)	64.0 (79.8)	64.9 (65.9)	66.4 (67.5)	67.0 (68.9)	67.3 (72.1)	65.4 (75.9)	65.8 (70.2)	63.5 (72.2)
VHA	N026	Thames Water Compound	Free-field	58.8 (62.4)	61.3 (68.5)	56.8 (60.5)	55.8 (65.3)	53.2 (77.9)	54.4 (55.2)	56.6 (57.5)	57.1 (59.6)	57.3 (61.4)	53.3 (59.1)	55.5 (58.5)	52.2 (57.3)
NTH-EN, TSS	N012	Opposite 92-94 Drummond Street	Free-field	55.9 (58.1)	60.4 (61.7)	57.8 (61.7)	58.1 (64.3)	55.8 (73.9)	52.9 (55.9)	57.1 (59.7)	57.0 (58.3)	57.3 (59.5)	54.1 (57.5)	57.4 (65.3)	53.2 (57.7)
NTH-EN	N014	Starcross Street lamppost (external to Exmouth Arms)	Free-field	53.9 (60.4)	58.9 (62.1)	57.0 (69.3)	56.9 (69.1)	52.1 (63.2)	50.7 (52.0)	56.3 (58.3)	55.4 (56.8)	55.8 (60.0)	51.1 (57.4)	55.0 (63.8)	51.6 (57.2)
	N016	Margaret Centre roof	Free-field	53.9 (59.0)	59.4 (61.4)	54.0 (61.0)	53.6 (66.2)	51.4 (57.8)	51.9 (52.4)	58.3 (61.3)	55.2 (57.9)	54.2 (56.6)	52.0 (56.2)	52.9 (58.2)	50.6 (55.3)
	N017	Hampstead Road, lamppost #48	Free-field	69.2 (71.5)	70.8 (72.7)	69.8 (73.7)	69.0 (77.7)	67.6 (78.7)	66.6 (68.4)	68.5 (68.8)	69.7 (71.0)	69.6 (73.5)	67.7 (71.7)	68.4 (72.3)	65.8 (70.4)
	N018	Outside replacement housing, Hampstead Road	Free-field	68.5 (71.3)	70.7 (73.4)	69.0 (74.0)	68.7 (79.2)	66.8 (75.9)	66.5 (67.3)	68.2 (69.0)	70.6 (71.9)	68.9 (72.1)	67.7 (73.2)	68.0 (71.5)	65.4 (68.9)

OFFICIAL

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
	N019	Outside Cartmel, Hampstead Road	Free-field	55.7 (61.7)	63.2 (68.3)	56.4 (63.9)	56.3 (76.7)	53.6 (61.0)	54.8 (59.7)	62.1 (65.5)	57.4 (62.2)	58.0 (63.1)	55.4 (60.2)	57.2 (63.3)	54.6 (59.9)

2.1.2 Table 4 presents a summary of the measured vibration levels at each monitoring location over the reporting period. The highest PPV measured during the monitoring along any axis is presented in the table.

Table 4: Summary of Measured PPV Data over the Monitoring Period

Worksite Reference	Measurement Reference	Monitor Address	Highest PPV measured in any axis, mm/s
ARVS	V059	Outside 68 Adelaide Road	2.77 (X-axis)
HRB	V039	Coniston, Regents Park Estate	3.60 (Z-axis)
	V043	Cubitt Court, Park Village East	1.30 (Y-axis)
ETD, TSS	V003	RCGP basement vaults, 305 Euston Road	0.97 (Z-axis)
TSS	V002	RCGP basement boiler room, 305 Euston Road	2.39 (Y-axis)
	V037	Magic Circle, basement	2.29 (Z-axis)
	V038	Wesley Hotel, basement lightwell, Euston Street	0.56 (Z-axis)
NTH-EN	V021	42-44 Cobourg Street (floor)	0.83 (Z-axis)
ESC	PVS-V1	Park Village Studios	1.24 (Y-axis)
ETRC & GTB	SH-V1	Silsoe House	0.68 (Z-axis)

2.1.3 Appendix C presents graphs of the noise and vibration monitoring data over the month for each of the measurement locations. Noise data presented consists of 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). Vibration data presented consist of hourly PPV values. 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 Exceedances of the SOAEL

2.2.1 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."

2.2.2 HS2 Phase One Information Paper E23: Control of Construction Noise and Vibration sets out the SOAELs for construction noise.

2.2.3 Where reported construction noise levels exceed the SOAEL at nearby receptors, relevant periods will be identified. Summary statistics to evaluate ongoing qualification for noise insulation and temporary rehousing are also presented where relevant.

2.2.4 Table 5 presents a summary of recorded exceedances of the SOAEL at each measurement location over the reporting period, including the number of exceedances during each time period.

Table 5: Summary of Exceedances of SOAEL

Worksite Reference	Measurement Reference	Site Address	Day (Weekday, Saturday, Sunday, Night)	Time period	Number of exceedances of SOAEL
ARVS	N051	Outside 70 Adelaide Road	All days	All periods	No exceedance
	N052	Adelaide Road-Beaumont Walk	All days	All periods	No exceedance
B	JC	Juniper Crescent	All days	All periods	No exceedance
ESC	N024	External to Park Village Studios, Park Village East	All days	All periods	No exceedance
	N047	Park Village East/Mornington Street bridge, lamppost #13	All days	All periods	No exceedance
ESC, C	N022	External to 34 Mornington Terrace	All days	All periods	No exceedance
	N046	Mornington Terrace near The Edinboro Castle pub, lamppost #18	All days	All periods	No exceedance
ETRC & GTB	N001	External to Cubitt Court, 100 Park Village East	Night	22:00 – 07:00	6
	N002	Richmond Court, Park Village East	All days	All periods	No exceedance
	N003	Silsoe House, Park Village East	All days	All periods	No exceedance
ETRC & GTB, D	N004	Mornington Terrace, lamppost #7	Weekday	08:00 – 18:00	1
ETRC & GTB, E	N005	5A Granby Terrace	Saturday	14:00 – 22:00	2
			Sunday	07:00 – 22:00	1

Worksite Reference	Measurement Reference	Site Address	Day (Weekday, Saturday, Sunday, Night)	Time period	Number of exceedances of SOAEL
E	CR	Lamppost #2 on Clarkson Row	All days	All periods	No exceedance
ETRC & GTB, F	N023	Lamppost #21 on Hampstead Road	Night	22:00 – 07:00	3
HRB	N020	Mackworth Street, lamppost #1	Weekday	08:00 – 18:00	3
	N021	Stanhope Street, lamppost #2	All days	All periods	No exceedance
	N044**	Regents Park Estate west, near Langdale	All days	All periods	No exceedance
	N045	Regents Park Estate south, external to Coniston	Weekday	08:00-18:00	1
G, H	HH	Euston Station Parcel Deck, Barnby Street	All days	All periods	No exceedance
G	BS	Roof of Stockbeck House, Barnby Street	All days	All periods	No exceedance
ETD, TSS	N006	RCGP Roof level	All days	All periods	Not applicable*
TSS	N008	RCGP Stephenson Way	All days	All periods	Not applicable*
	N010	Wesley Hotel	All days	All periods	Not applicable*
	N011	Outside 82 Euston Street	All days	All periods	No exceedance
ETD	N007	RCGP, Melton Street	All days	All periods	No exceedance
VHA	N025	External to 3 Prince Albert Road	All days	All periods	No exceedance
	N026	Thames Water Compound	All days	All periods	No exceedance
NTH-EN	N012	Opposite 92-94 Drummond Street	All days	All periods	No exceedance
	N014	Starcross Street lamppost (external to Exmouth Arms)	All days	All periods	No exceedance



Worksite Reference	Measurement Reference	Site Address	Day (Weekday, Saturday, Sunday, Night)	Time period	Number of exceedances of SOAEL
	N016	Margarete Centre roof	All days	All periods	No exceedance
	N017	Hampstead Road, lamppost #48	All days	All periods	No exceedance
	N018	Outside replacement housing, Hampstead Road	All days	All periods	No exceedance
	N019	Outside Cartmel, Hampstead Road	All days	All periods	No exceedance

\* The defined SOAEL criteria are not applicable to non-residential properties.

\*\* SOAEL exceedances recorded at monitoring location N044 were due to a diesel generator, hydroscabbling or pile trimming in close proximity to the monitoring location. Construction noise levels from these sources were determined to be below the respective SOAEL at the nearest sensitive receptors, which are further away from the noise sources.

2.2.5 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 6 and may be lower than the total sum of individual exceedances reported in Table 5 for each location.

Table 6: Summary of Total Exceedances of SOAEL

Worksite Reference	Measurement Reference	Monitor Address	Total of SOAEL exceedances in the month
ETRC & GTB	N001	External to Cubitt Court, 100 Park Village East	1
ETRC & GTB	N004	Mornington Terrace, lamppost #7	1
ETRC & GTB, E	N005	5A Granby Terrace	1
HRB	N020	Mackworth Street, lamppost #1	3
ETRC & GTB, F	N023	Lamppost #21 on Hampstead Road	1
HRB	N045	Regents Park Estate south, external to Coniston	1

2.2.6 Eight exceedances of the SOAEL at three monitoring locations were recorded due to HS2 construction works during November 2021. The exceedances occurred at:

- Monitoring location N001 during one night-time period due to sheet piling undertaken during weekend possession works;

- Monitoring location N004 during one weekday period due to sheet piling;
- Monitoring location N005 during one weekend period due to sheet piling undertaken during weekend possession works;
- Monitoring location N020 during three weekend periods due to utility works;
- Monitoring location N023 during one night-time period due to sheet piling undertaken during weekend possession works; and
- Monitoring location N045 during one weekday period due utility works.

## 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
-	-	-	-	-	-

## 2.4 Complaints

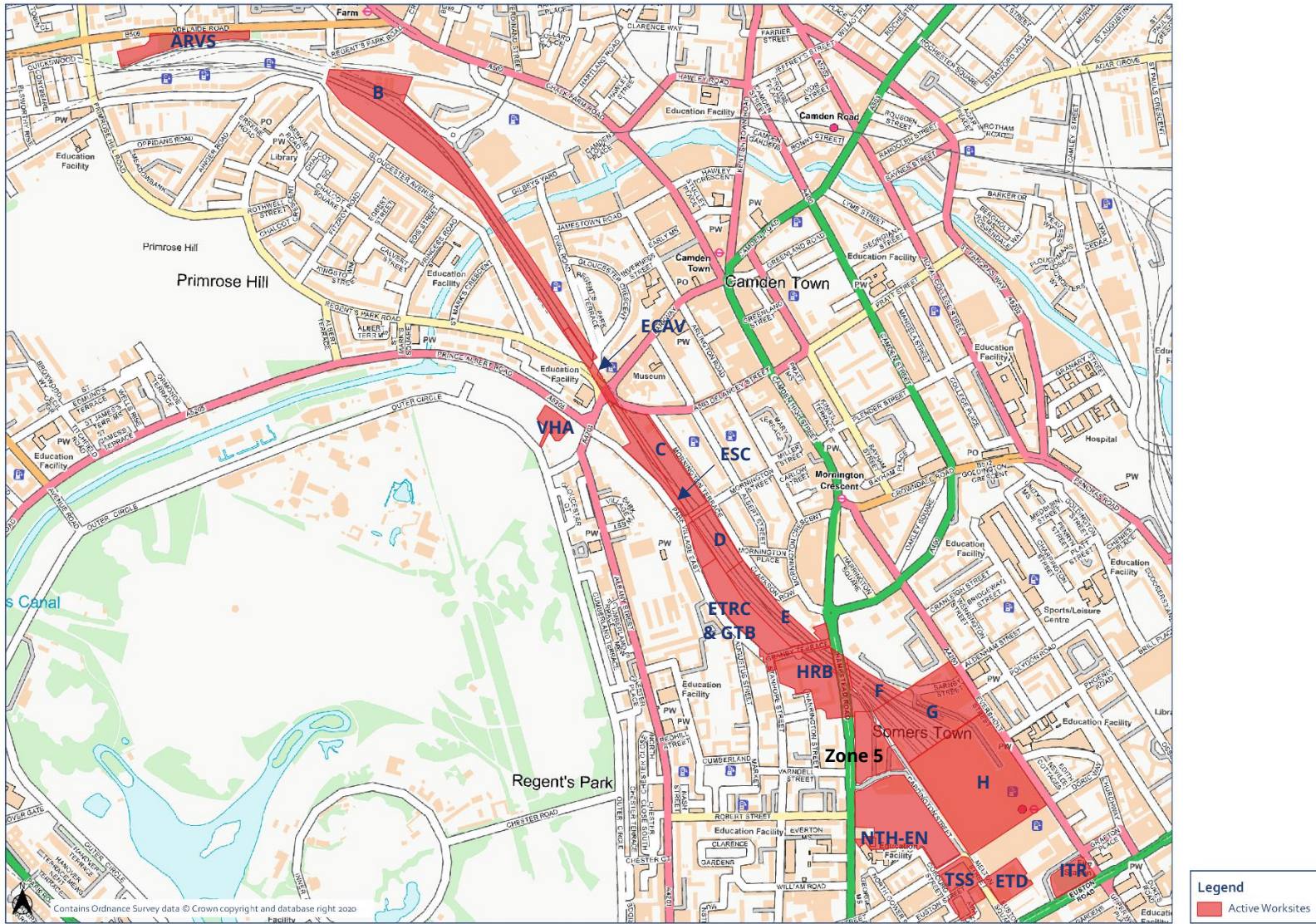
2.4.1 Table 8 provides a summary of complaint information related to noise and vibration received during the reporting period, along with the findings of any investigation.

Table 8: Summary of Complaints

Complaint Reference Number	Worksite Reference	Description of Complaint	Results of Investigation	Actions Taken
HS2-21-42950-C	NTH-EN	Complaint due to generator noise during the night-time.	Investigation confirmed that the noise was not associated with HS2 works. The noise was from mechanical plant installed at a nearby residential building.	Building owner contacted who will request inspection of relevant mechanical plant. Information was provided to the stakeholder.

Complaint Reference Number	Worksite Reference	Description of Complaint	Results of Investigation	Actions Taken
HS2-21-42994-C	HRB	Complaint about noise disturbance due to works near Cartmel during the daytime.	Noise levels measured by the monitor closest to the stakeholder's property were investigated and no significant noise levels were measured on the date concerned. Measured noise levels were within Section 61 requirements.	Information was provided to the stakeholder confirming the results of the investigation and details of mitigation which are currently in place to reduce HS2 construction noise levels.
HS2-21-42892-C	ETRC, HRB	Complaint from a resident of Langdale about noisy works and machinery near their property during the daytime.	Complaint was associated with hydroscabbling works being undertaken in proximity of the property. Measured noise levels were within Section 61 predictions.	Following the complaint working methodology was revised. The activity was limited to a few hours per day and a programme was developed to enhance the local screening used for this activity.
HS2-21-42893-C	ETRC, HRB	Complaint due to noise from works on Harrington Street.	Increased noise levels were measured at the monitor on the corner of Mackworth Street and Harrington Street. This was due to the position of a vacuum excavator operating very close to properties on Harrington Street.	Following receipt of the complaint best practicable means were reviewed and use of a vacuum excavator was put on hold for activities outside the site hoarding, with alternative methods being explored/used to conduct excavations in proximity of receptors. Information was provided to the stakeholder.
HS2-21-42902-C	N/A	Complaint due to construction noise during the night-time on Mornington Terrace.	Low risk activities were being undertaken at the time of the complaint and measured noise levels around the working area were within Section 61 predictions.	Following the complaint noise monitoring data were reviewed and available audio recordings were analysed but it was not possible to identify the source of the complaint. Information was provided to the stakeholder.
HS2-21-42993-C	ARVS	Complaints due to generator noise during the night-time.	A glitch was identified in the generator system which caused it not to operate as consistently as they should be overnight.	Following receipt of the complaint the glitch was corrected. Additional monitoring was also undertaken at night to check correct functioning of the generator.

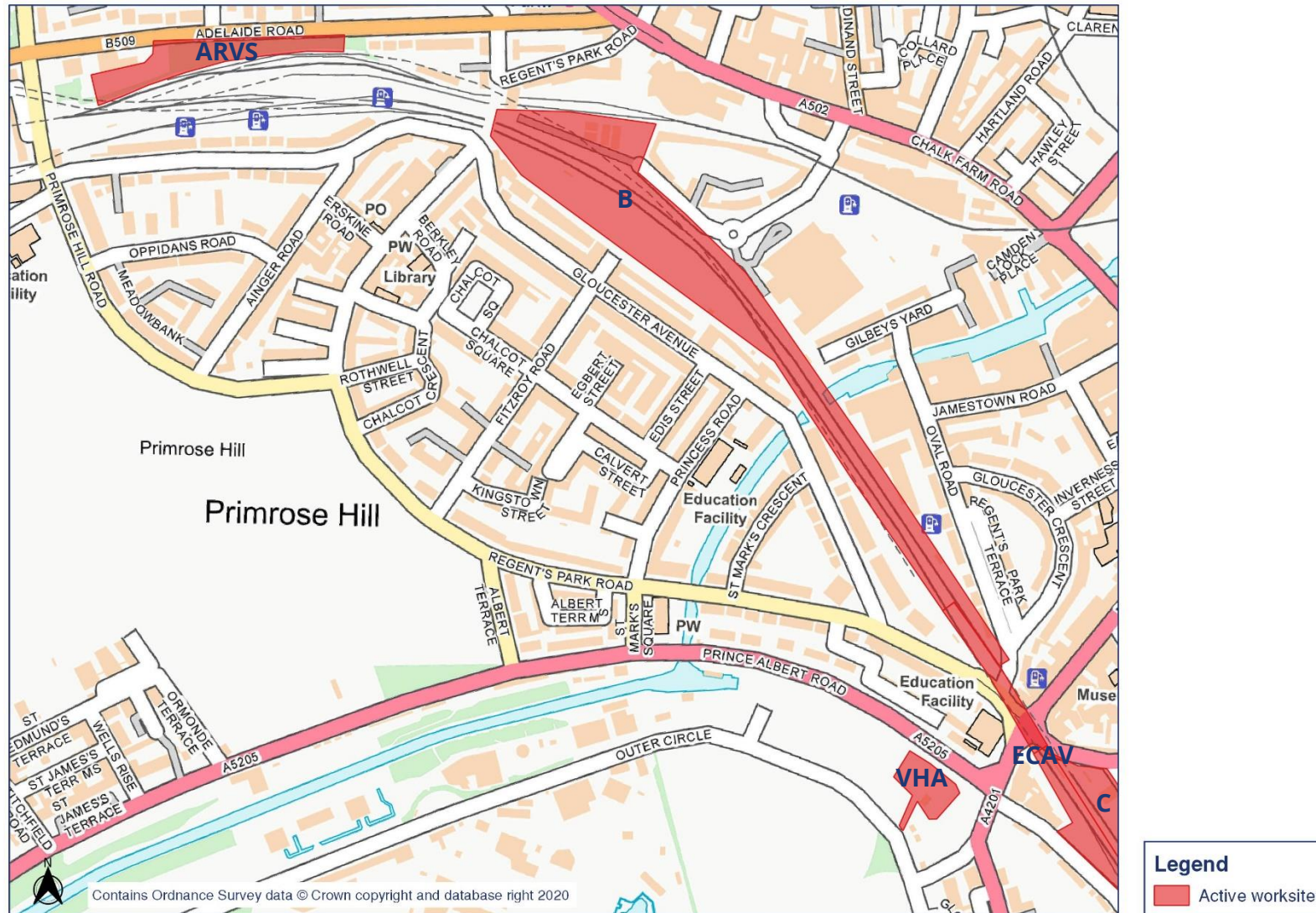
# Appendix A Site Locations





# HS2

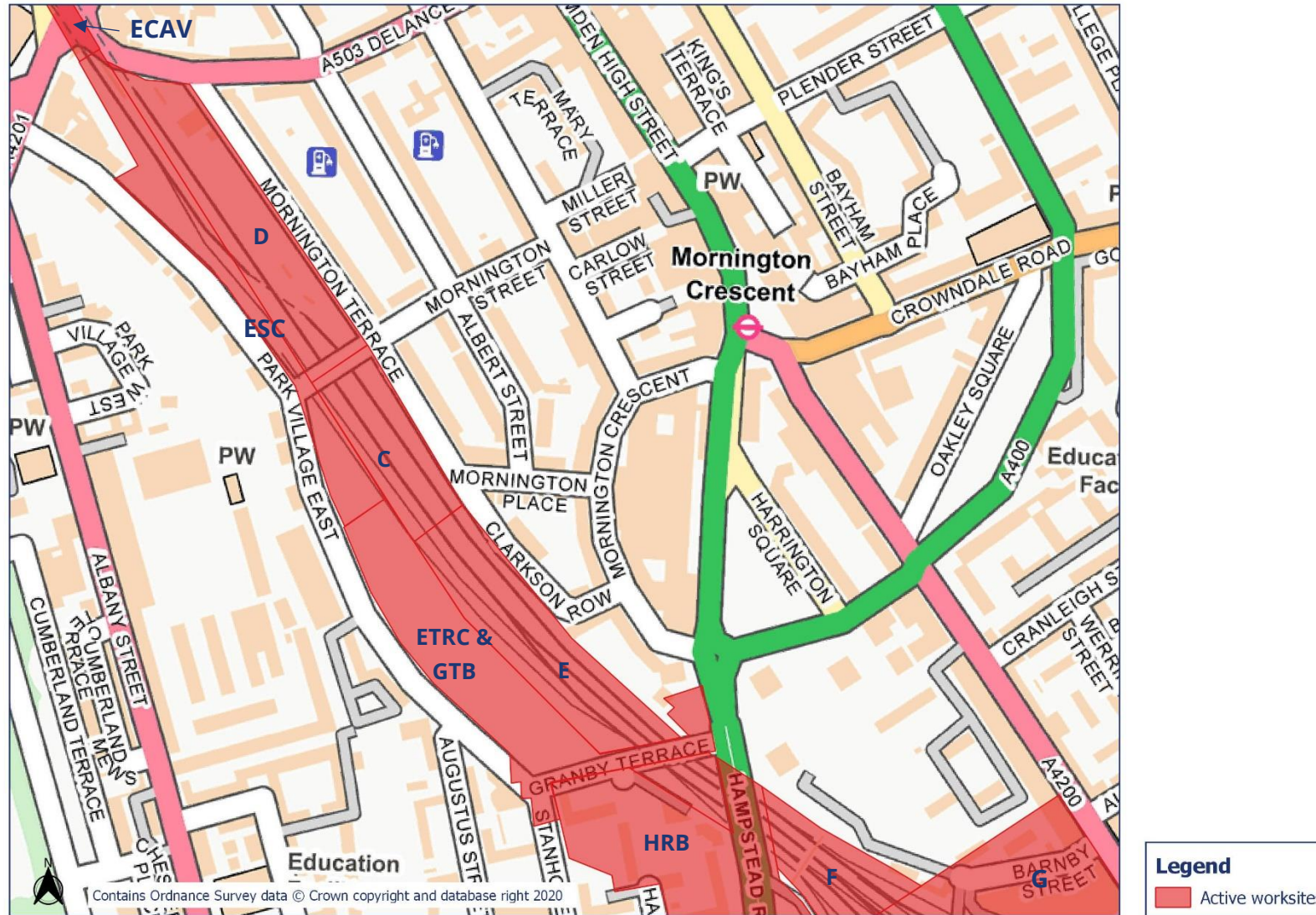
## Worksite identification plan - 1





# HS2

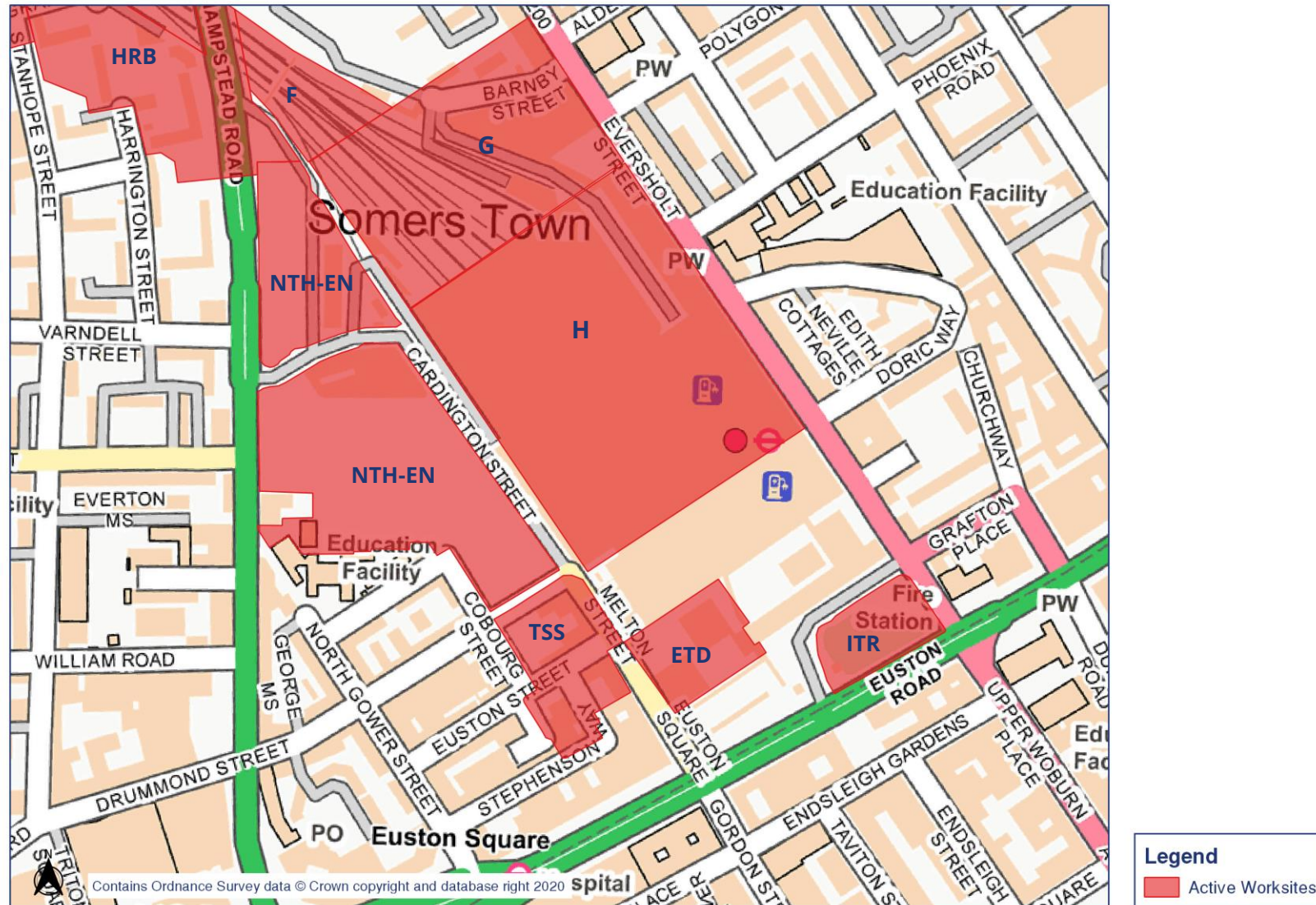
## Worksite identification plan - 2





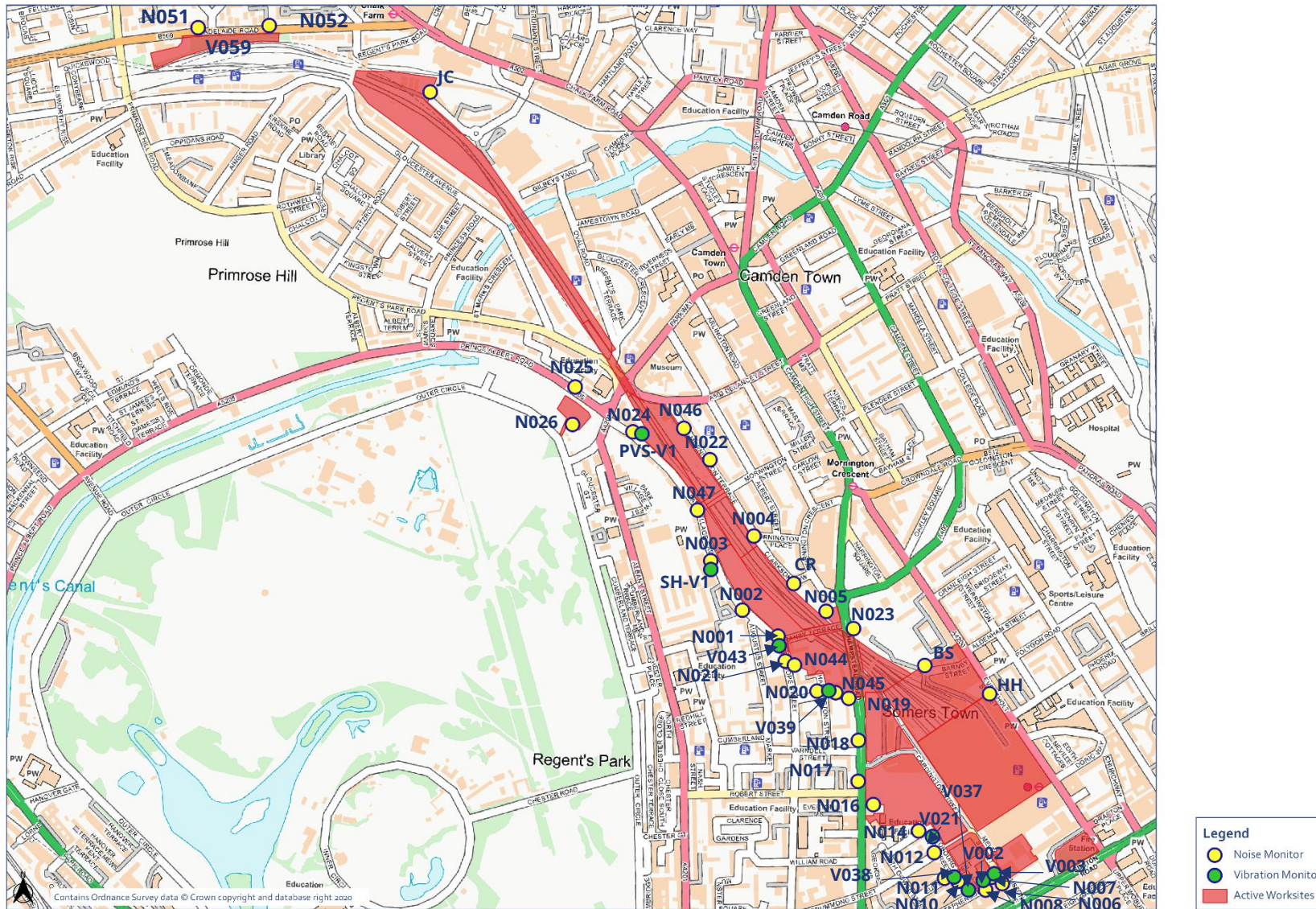
# HS2

## Worksite identification plan - 3



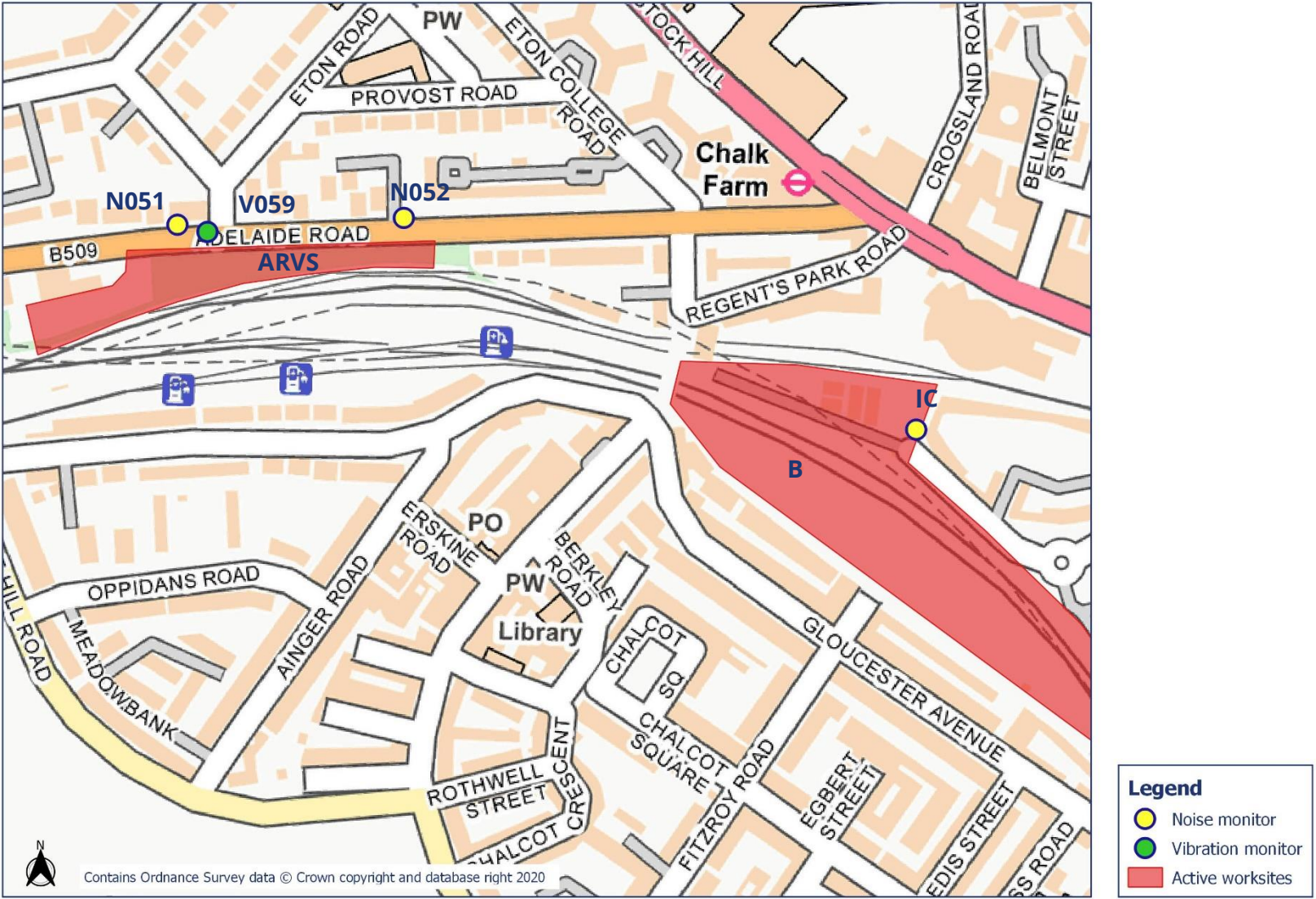


# Appendix B Monitoring Locations



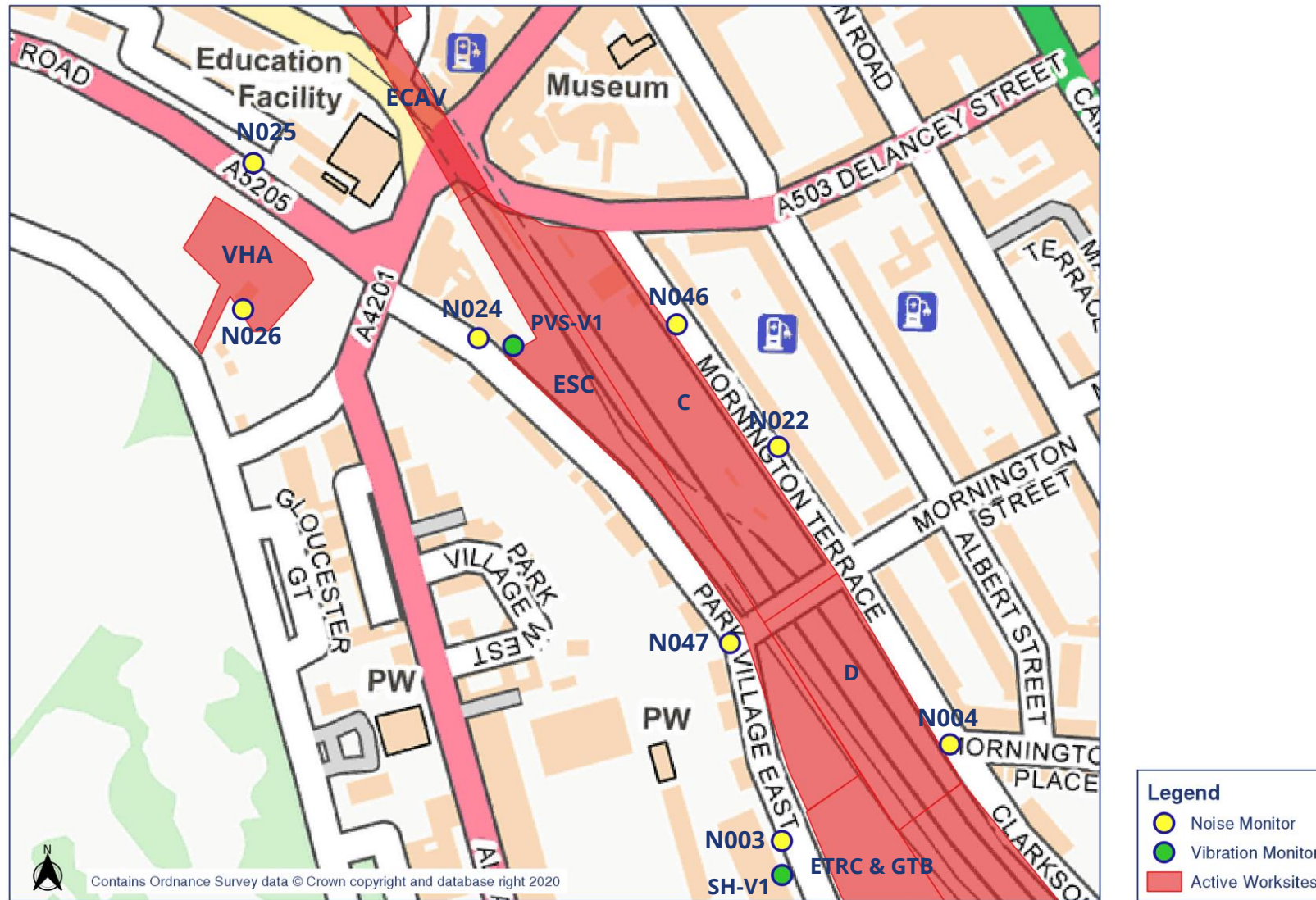


# HS2 Noise and vibration monitoring plan - 1



# HS2

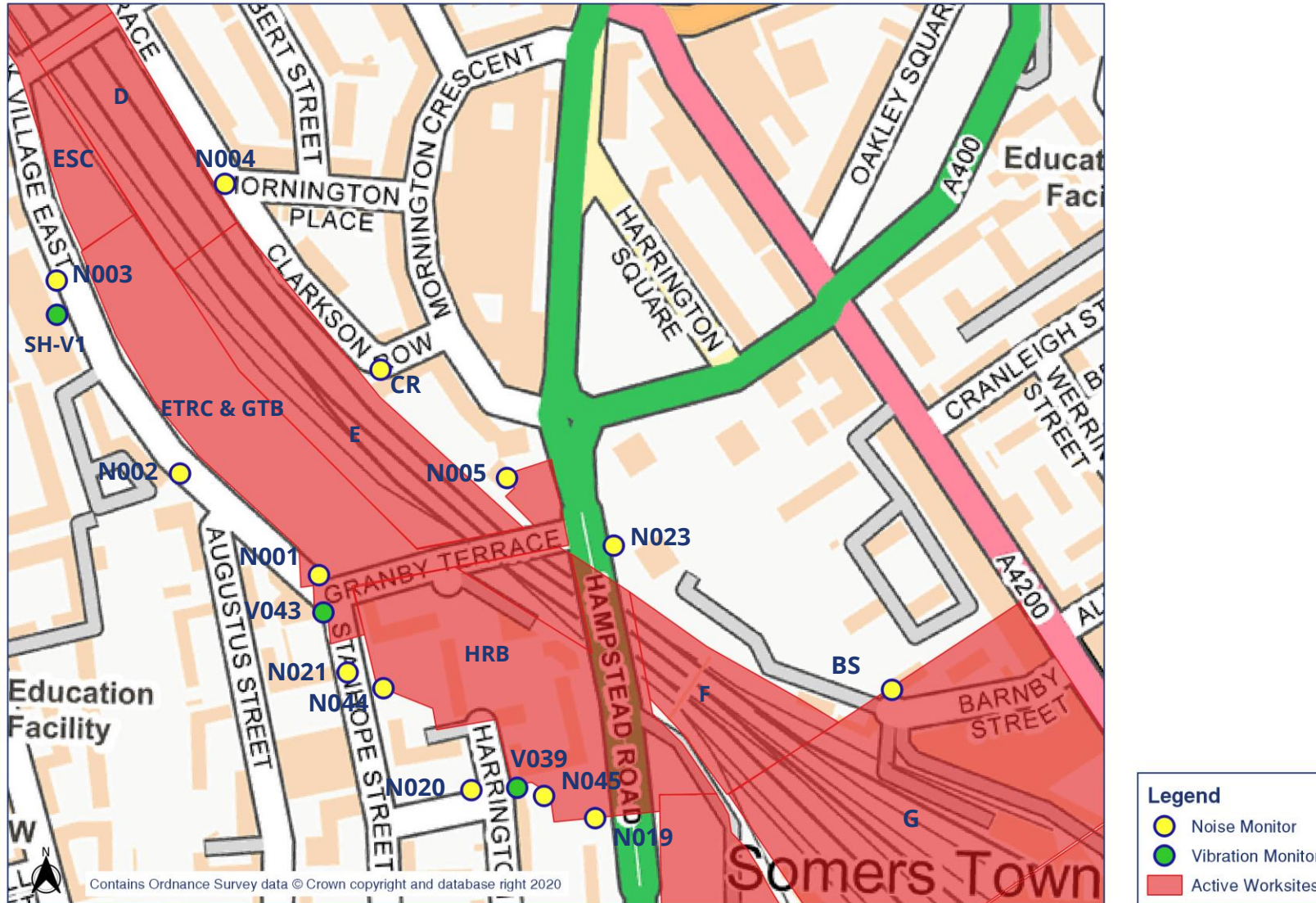
## Noise and vibration monitoring plan - 2





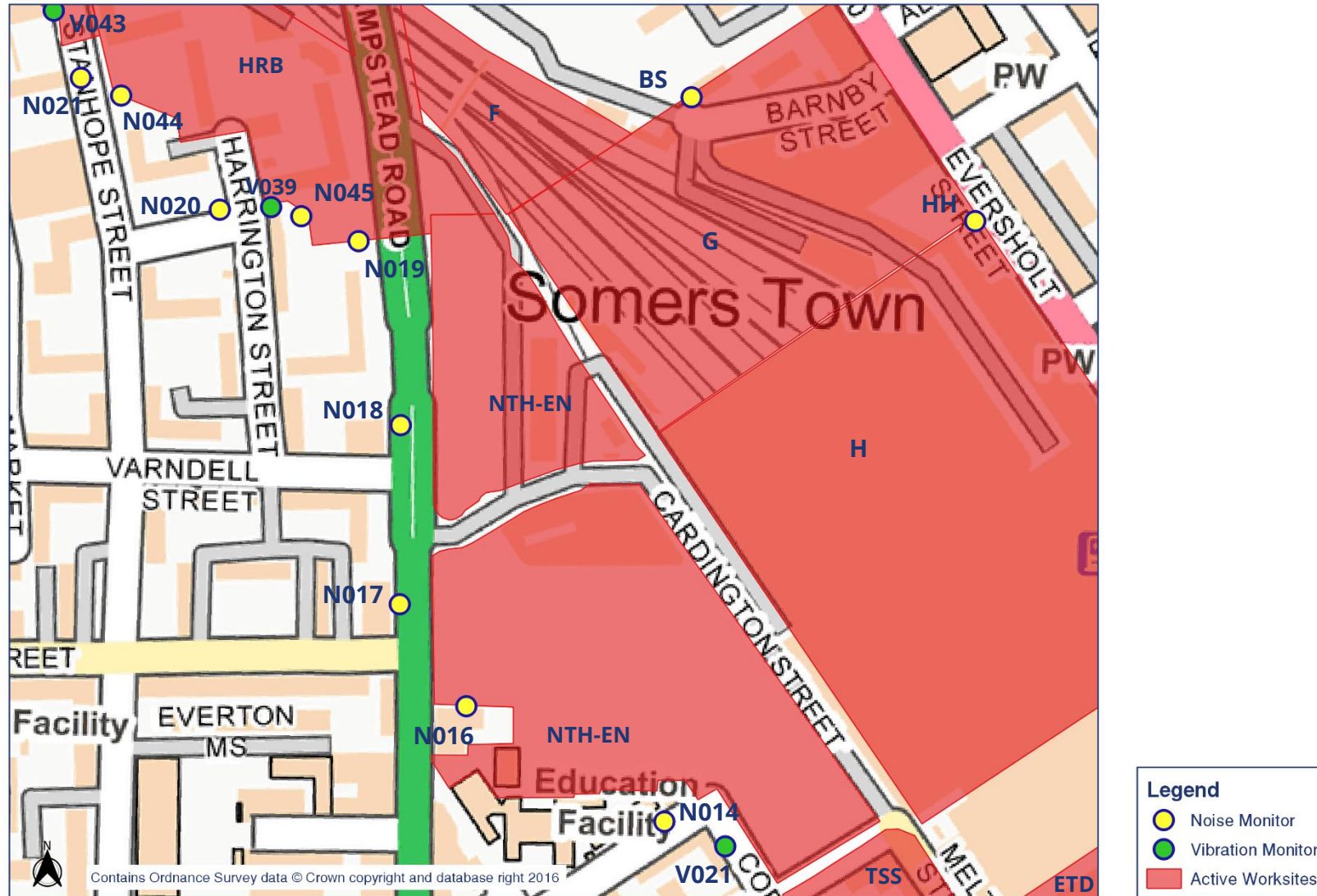
# HS2

## Noise and vibration monitoring plan - 3



# HS2

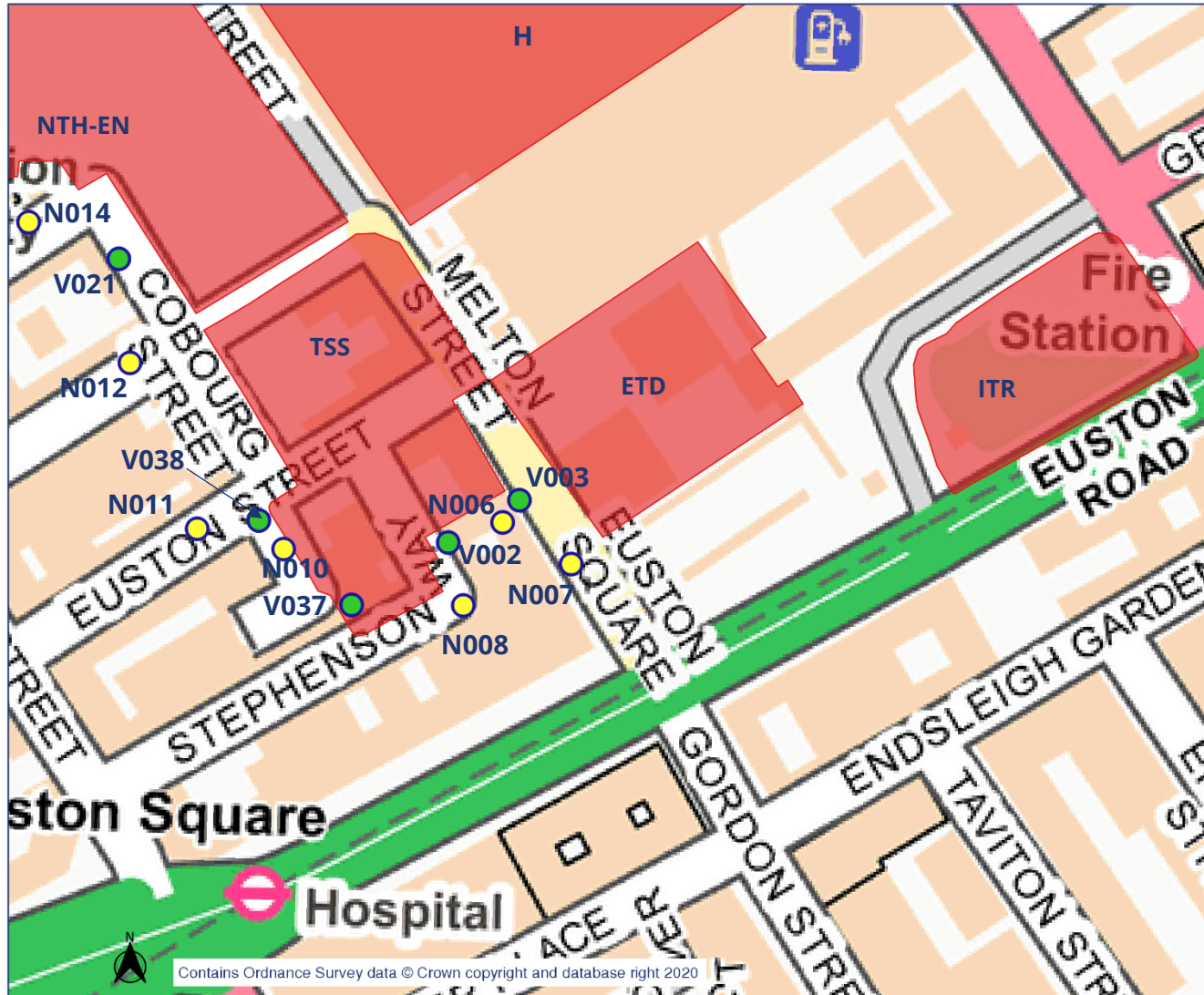
## Noise monitoring plan - 4





# HS2

## Noise and vibration monitoring plan - 5



**Legend**

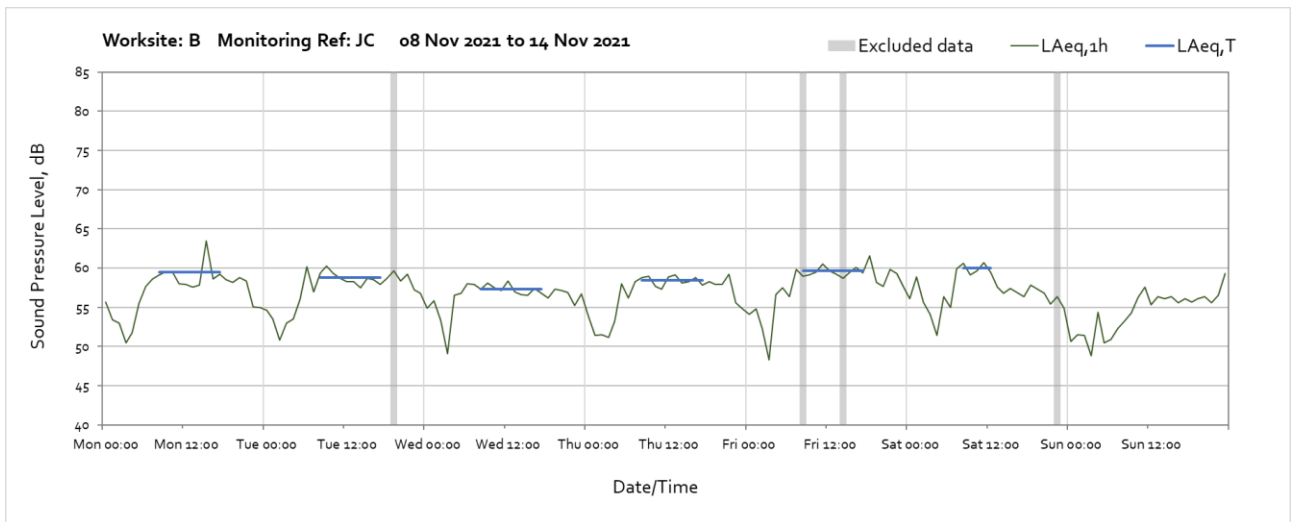
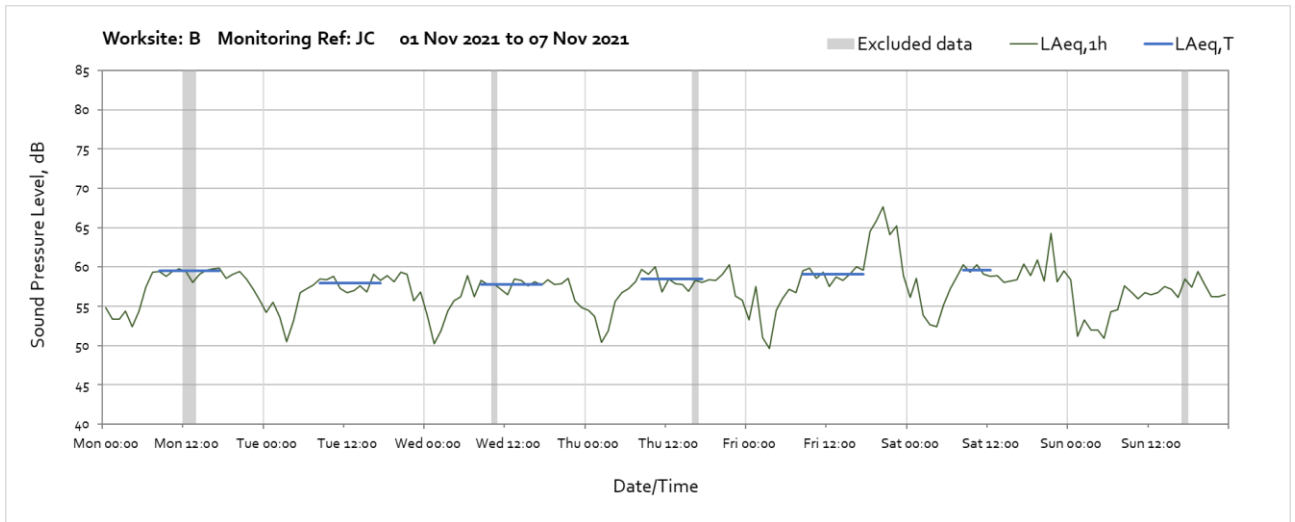
- Noise Monitor
- Vibration Monitor
- Active Worksites

# Appendix C Data

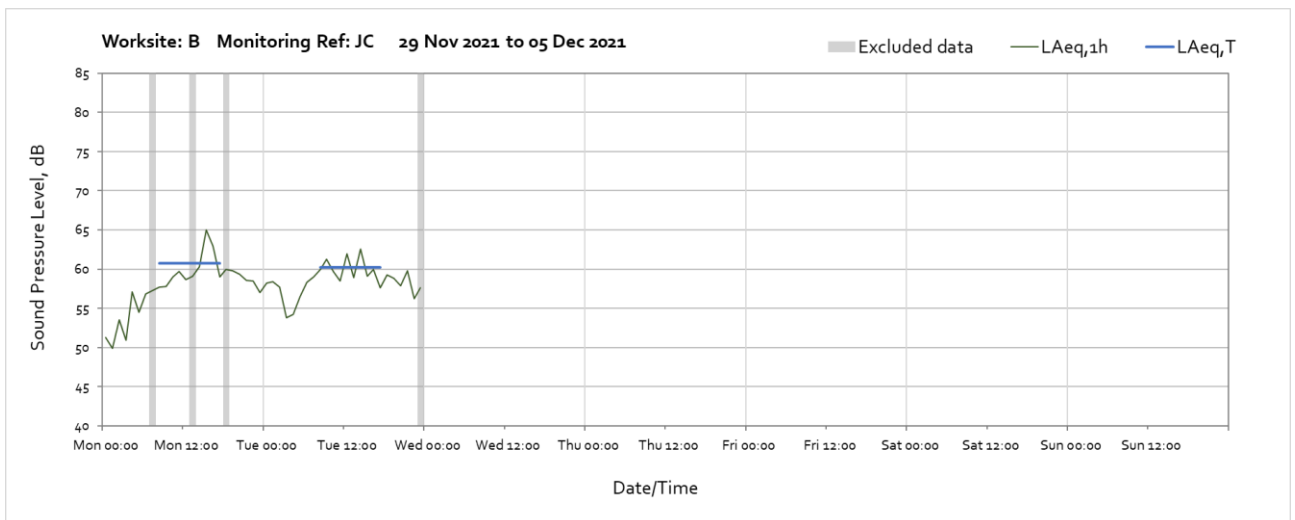
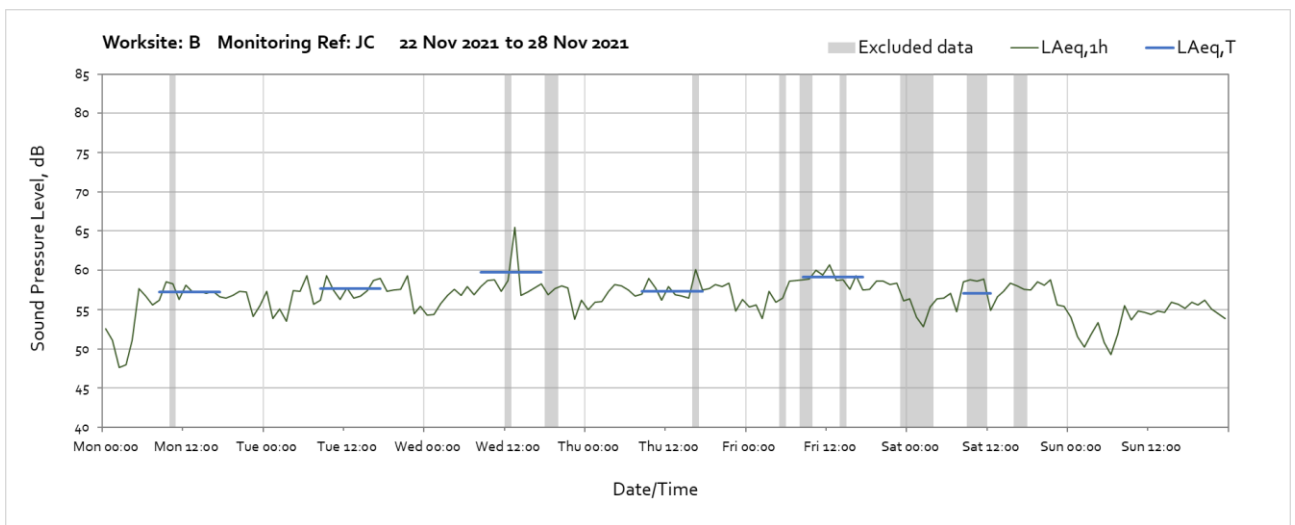
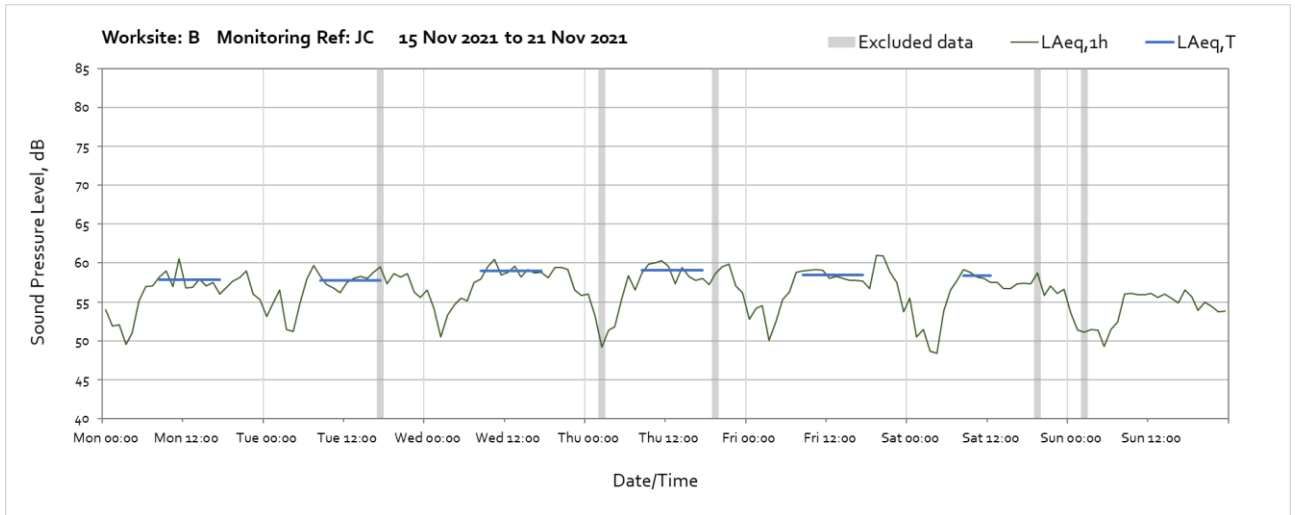
The following graphs show the hourly measured ambient noise level  $L_{Aeq,1h}$  and, where relevant, the averaged noise level  $L_{Aeq,T}$  values, where the time period T is as specified in Table 1 of HS2 Information Paper E23. Periods with adversely weather affected noise levels are greyed out and have been excluded from the calculation of the  $L_{Aeq,T}$  values in Table 3 of the main report.

## Noise

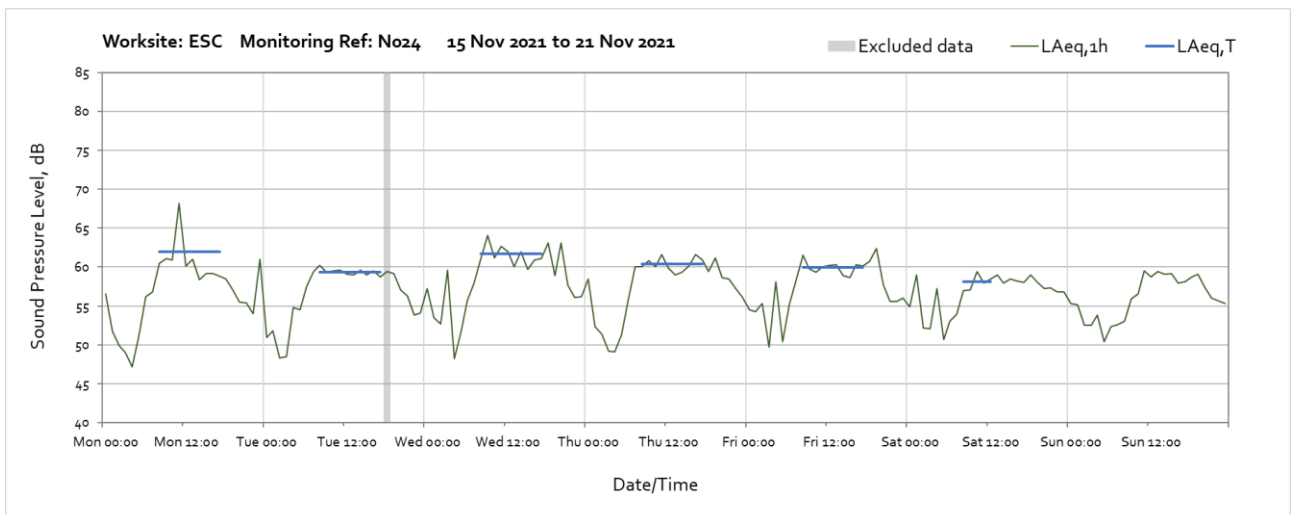
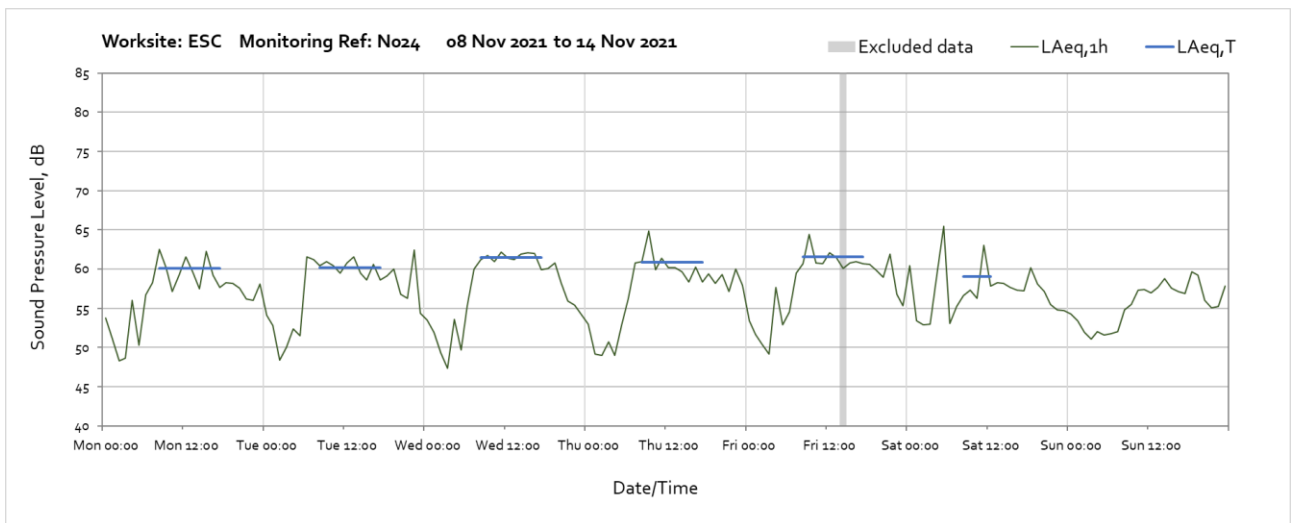
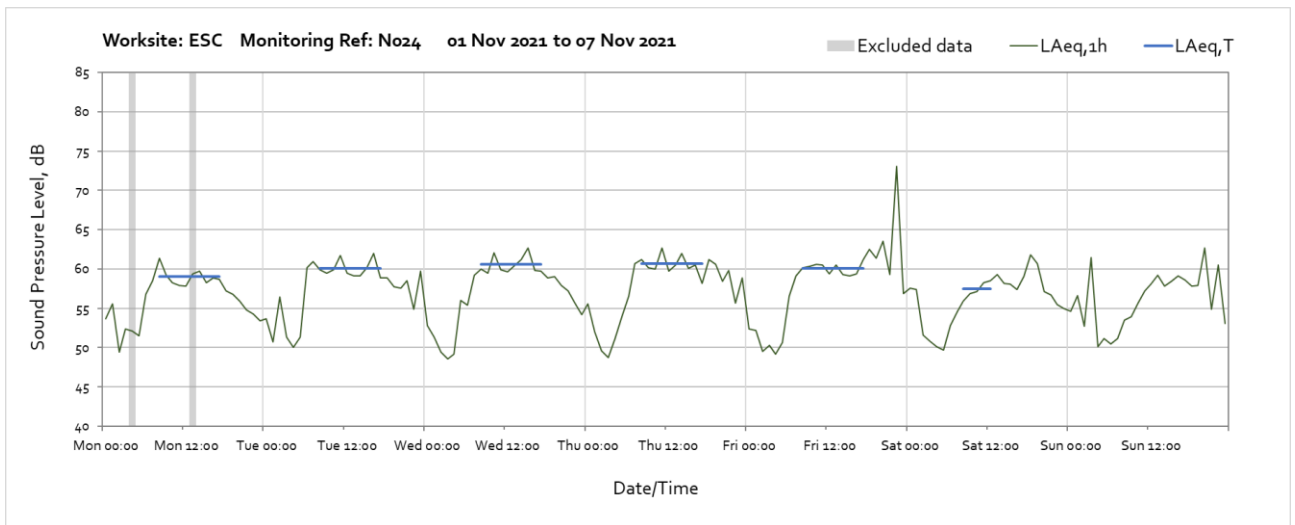
### Worksite: B – Monitoring Ref: JC

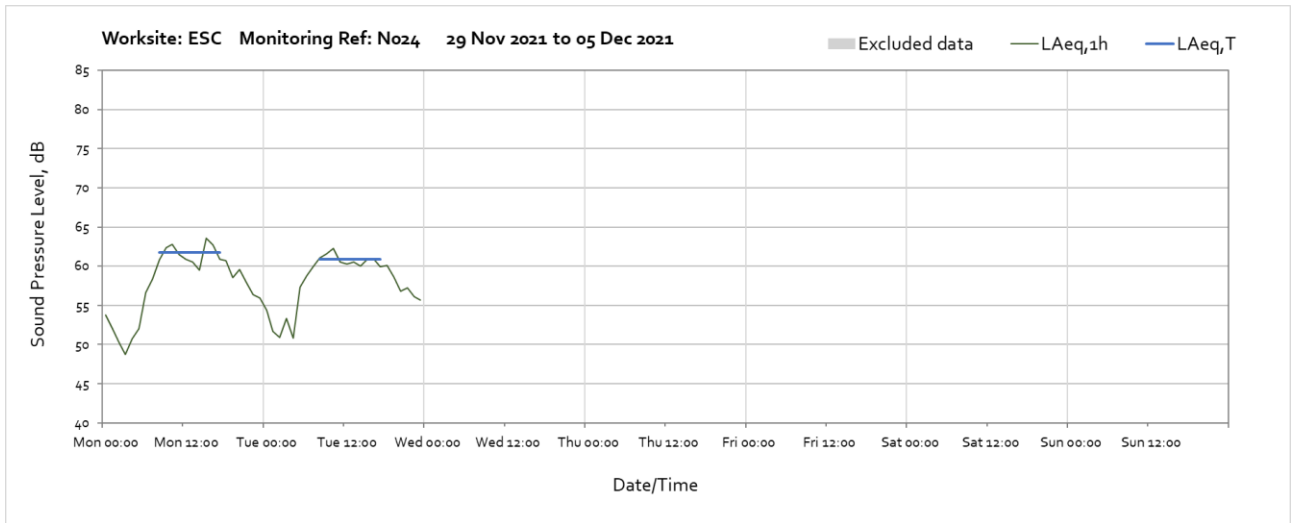
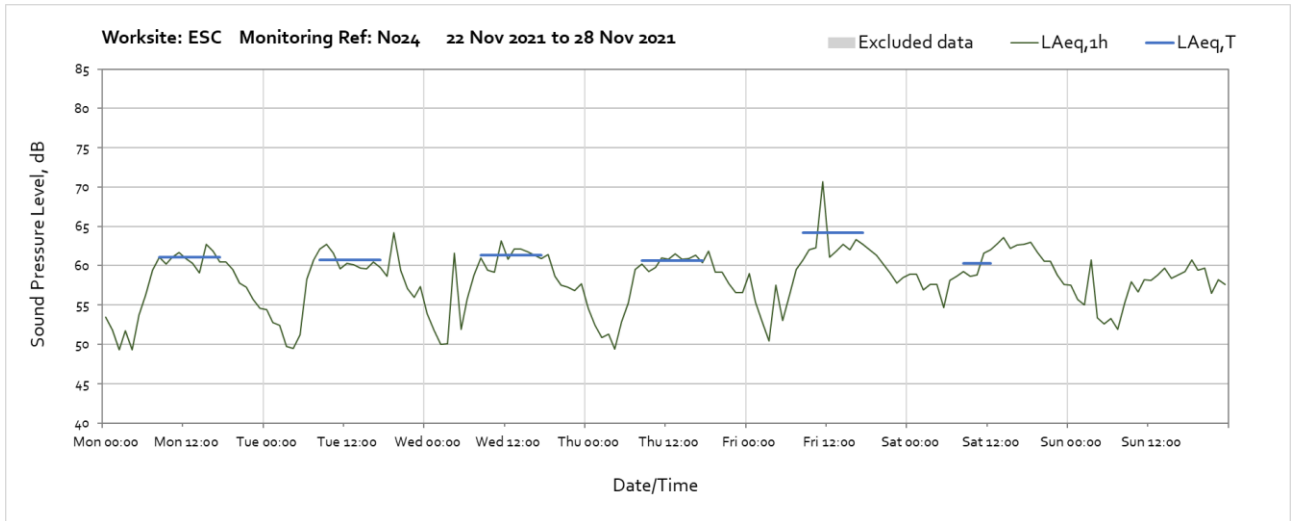




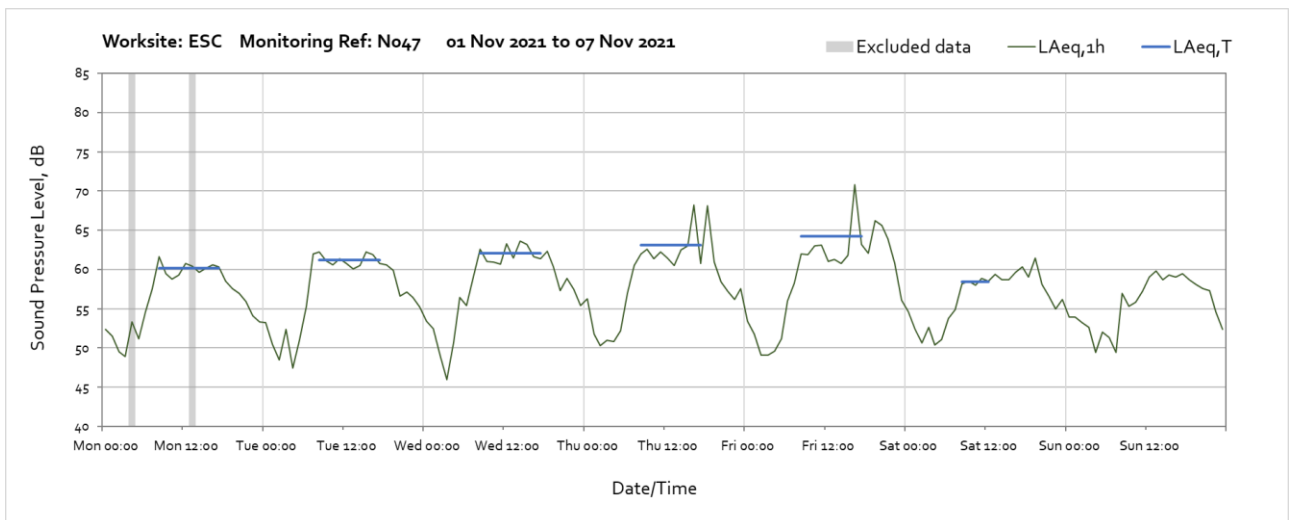


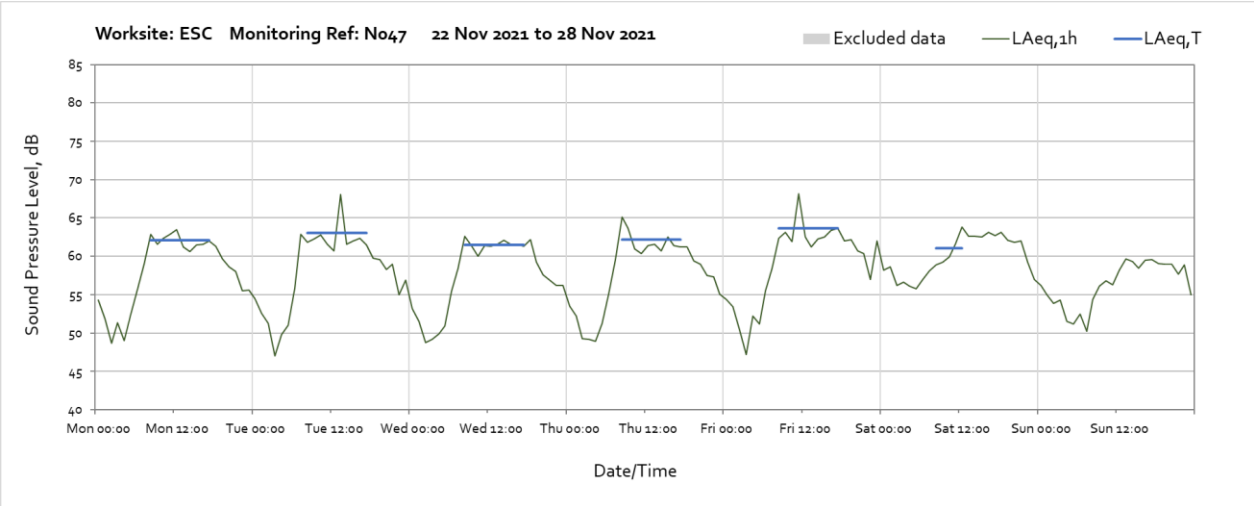
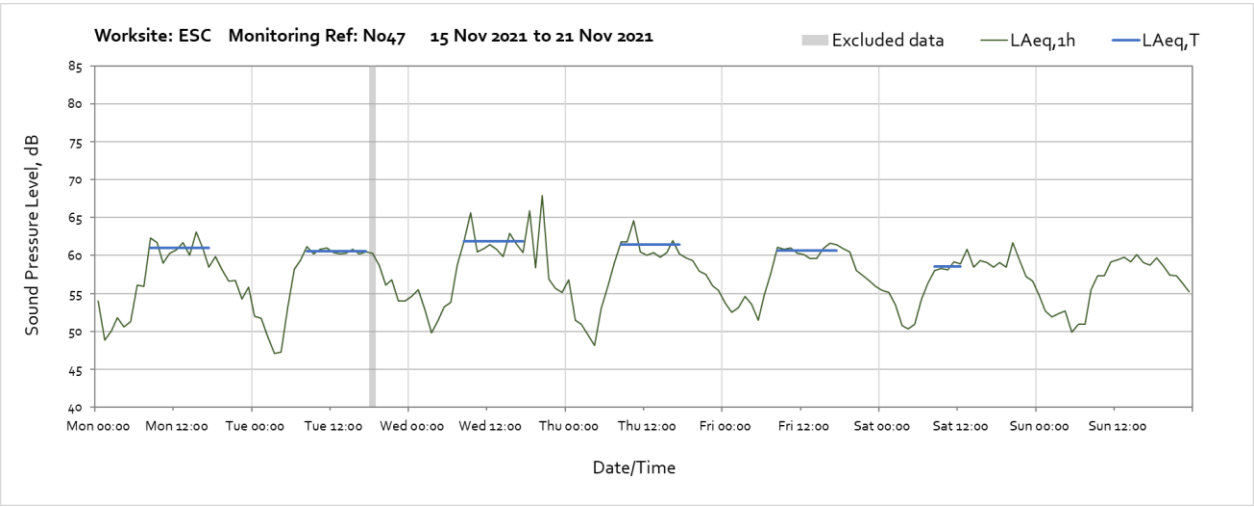
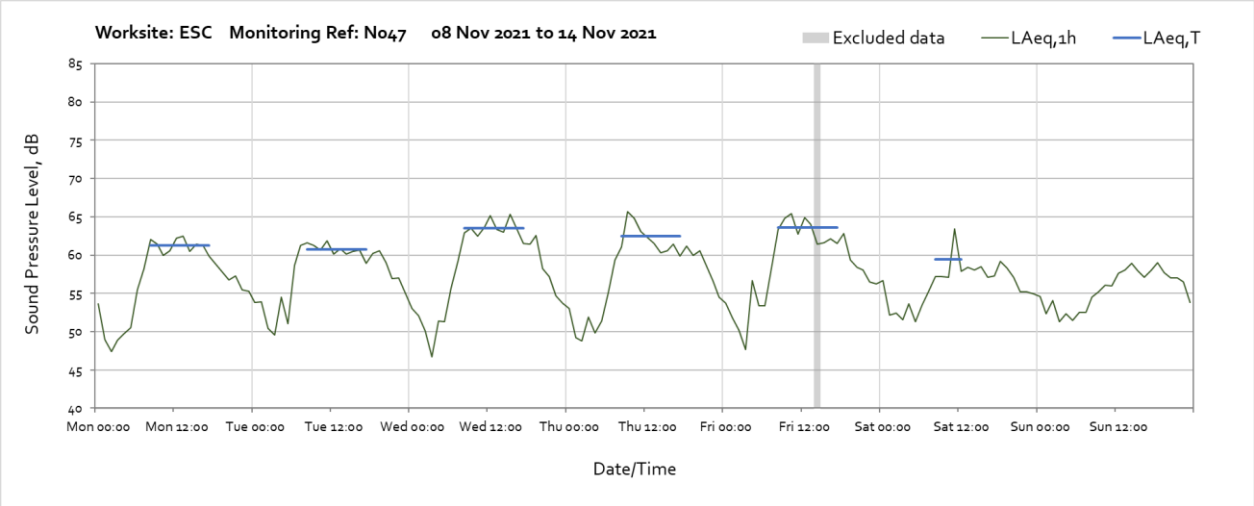
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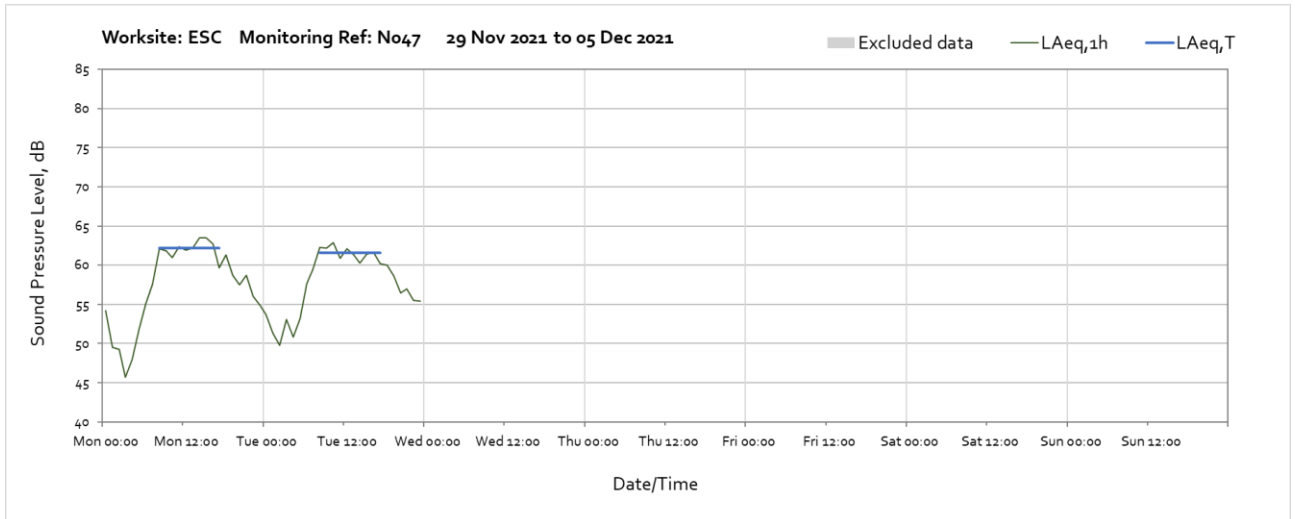




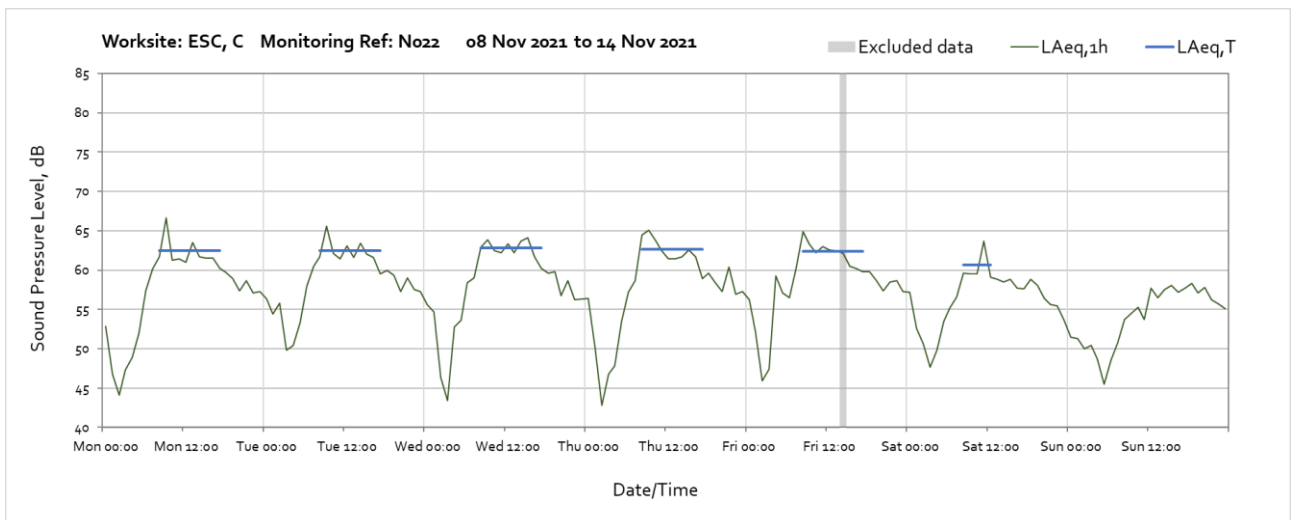
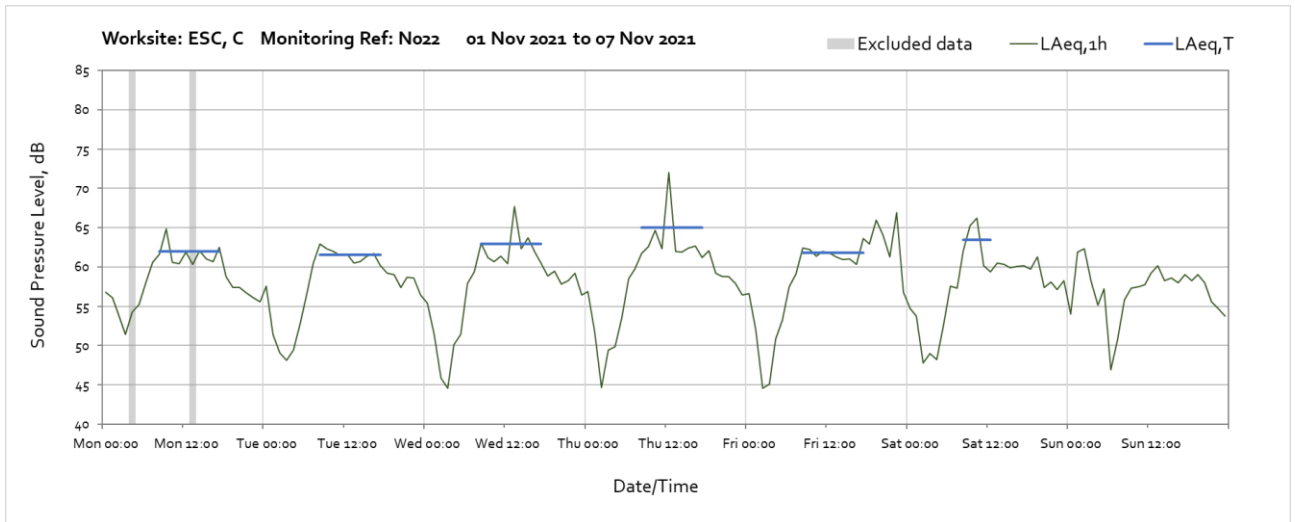
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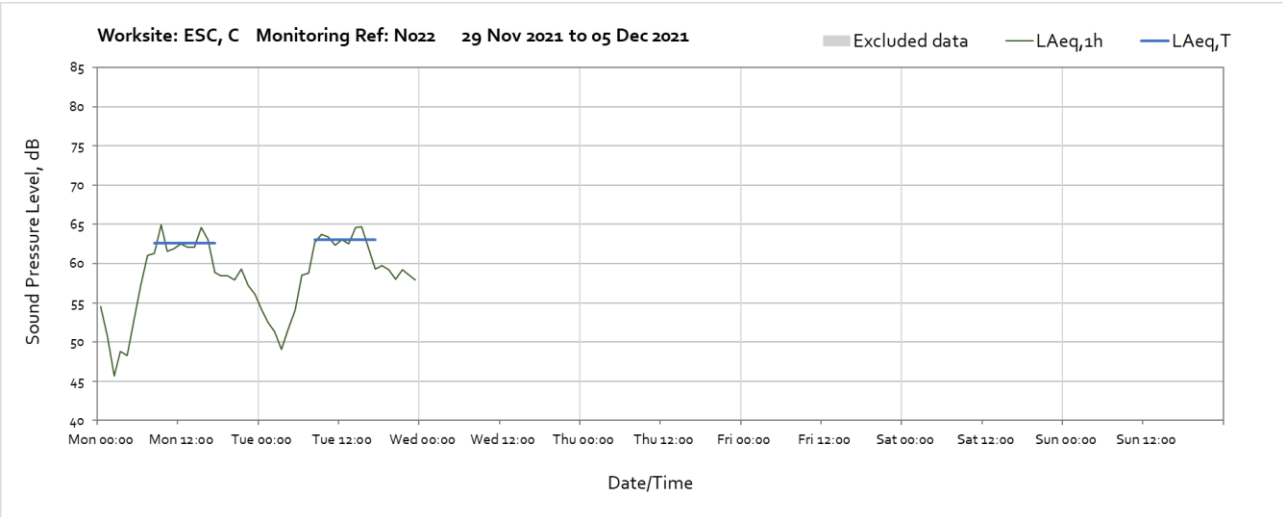
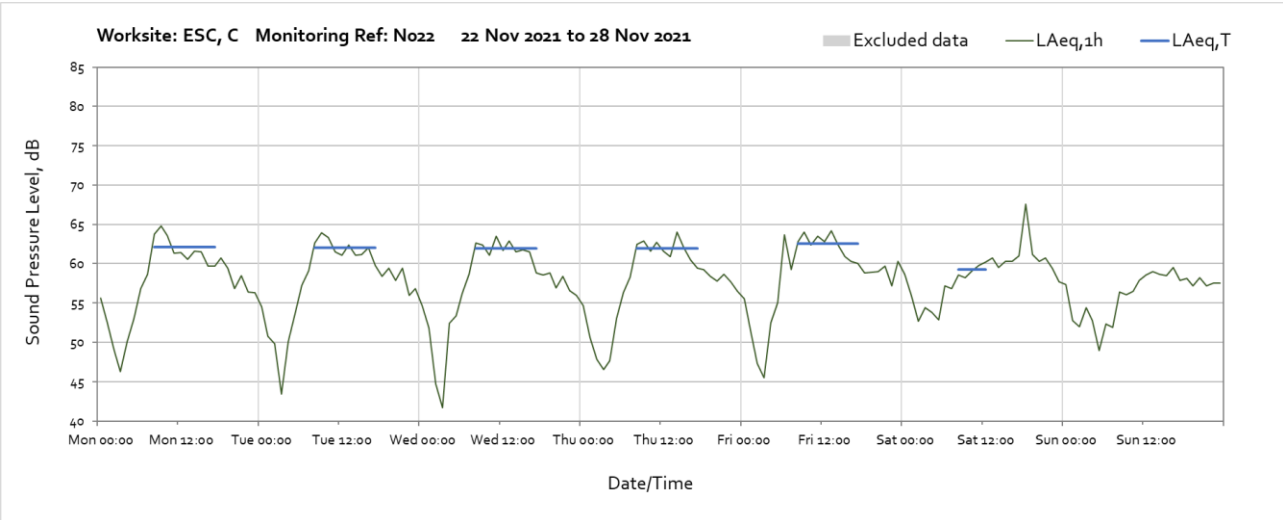
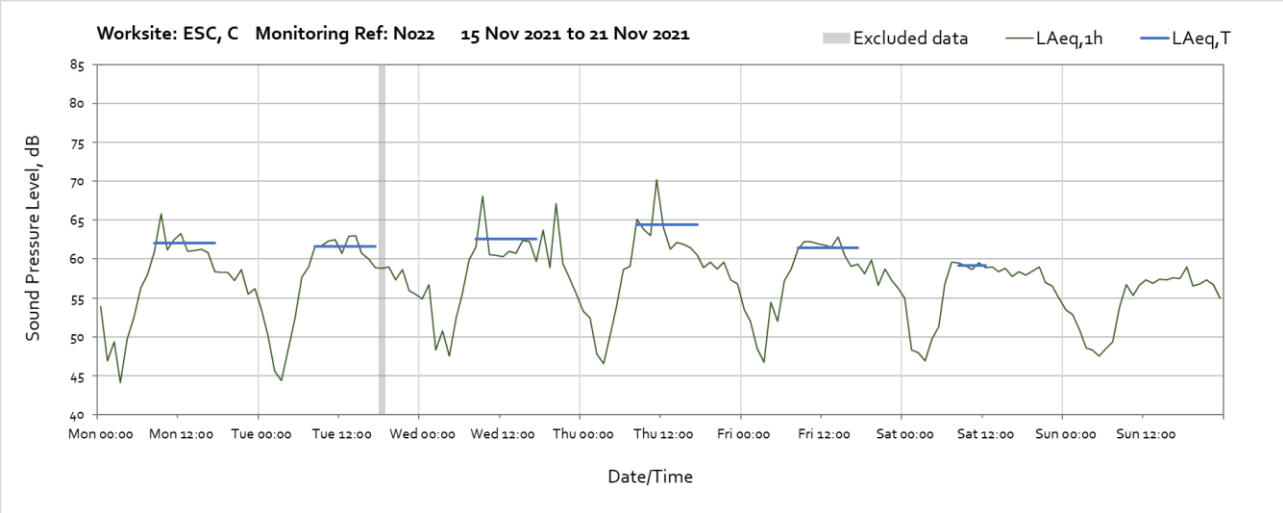






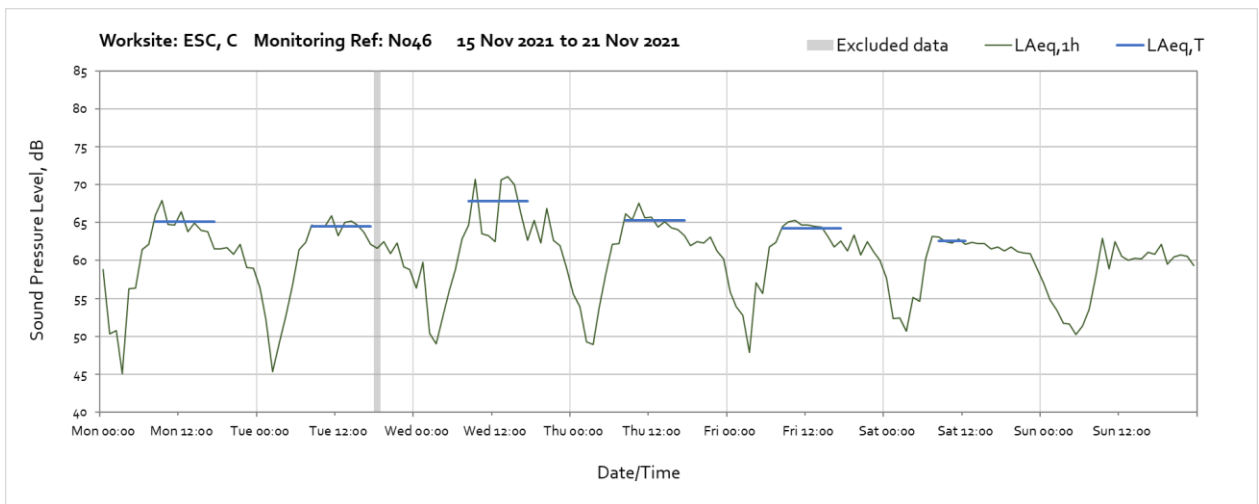
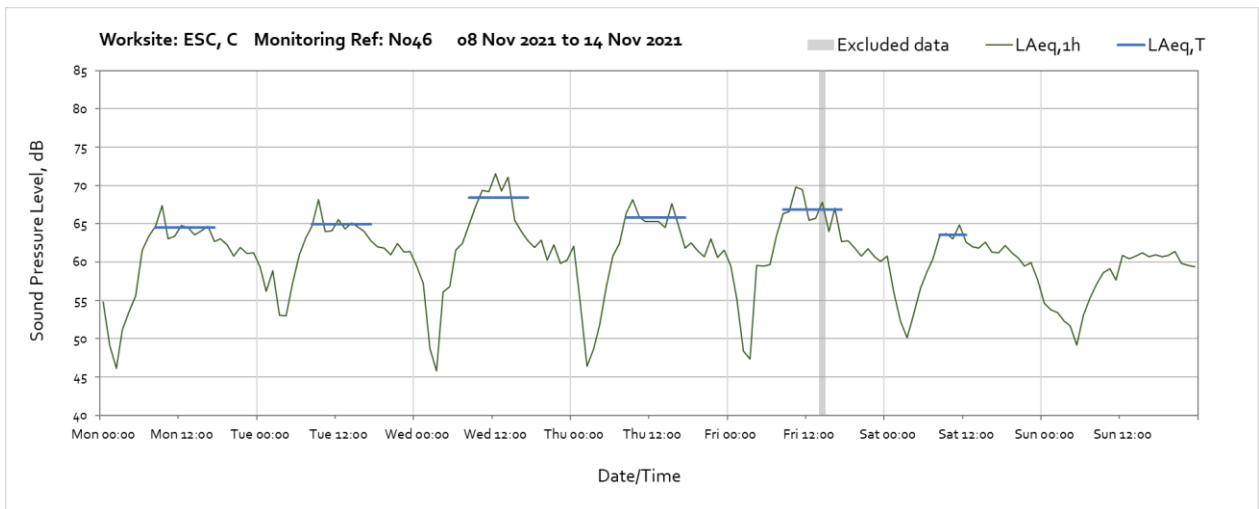
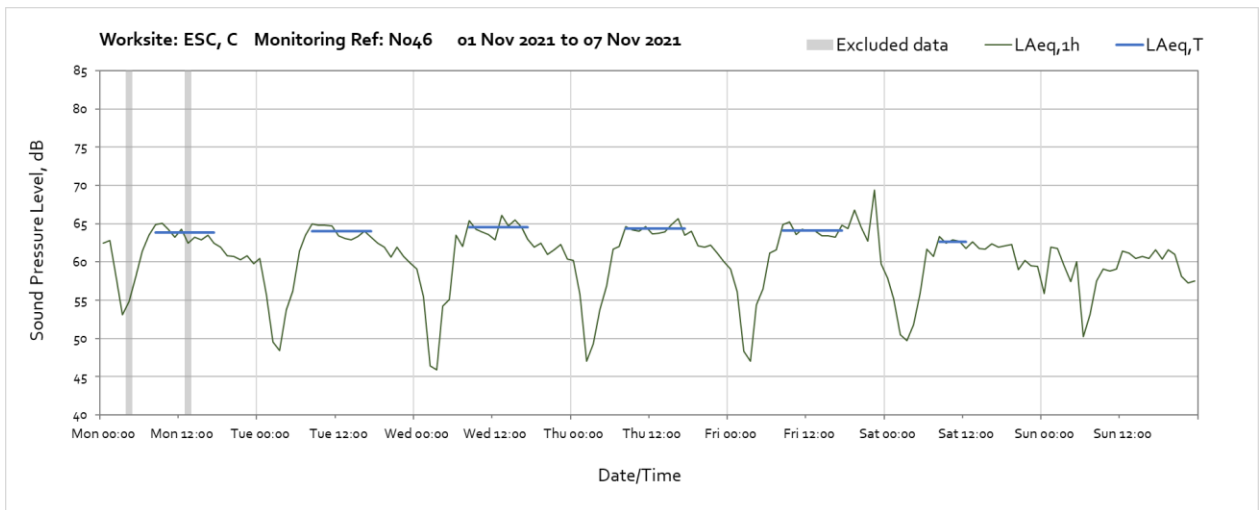
**Worksite: ESC, C – Monitoring Ref: N022**



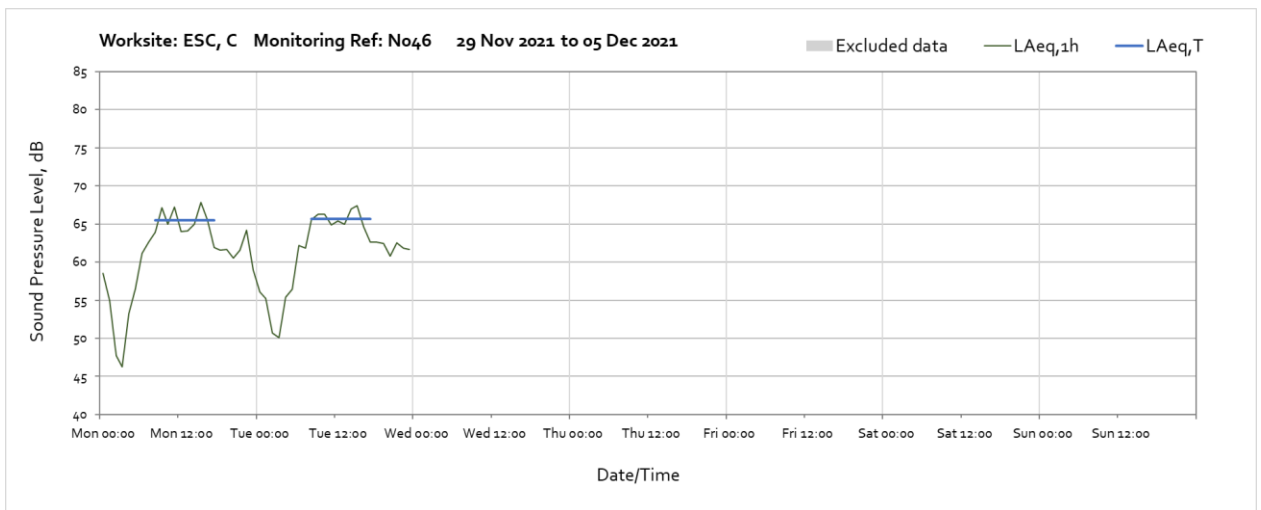
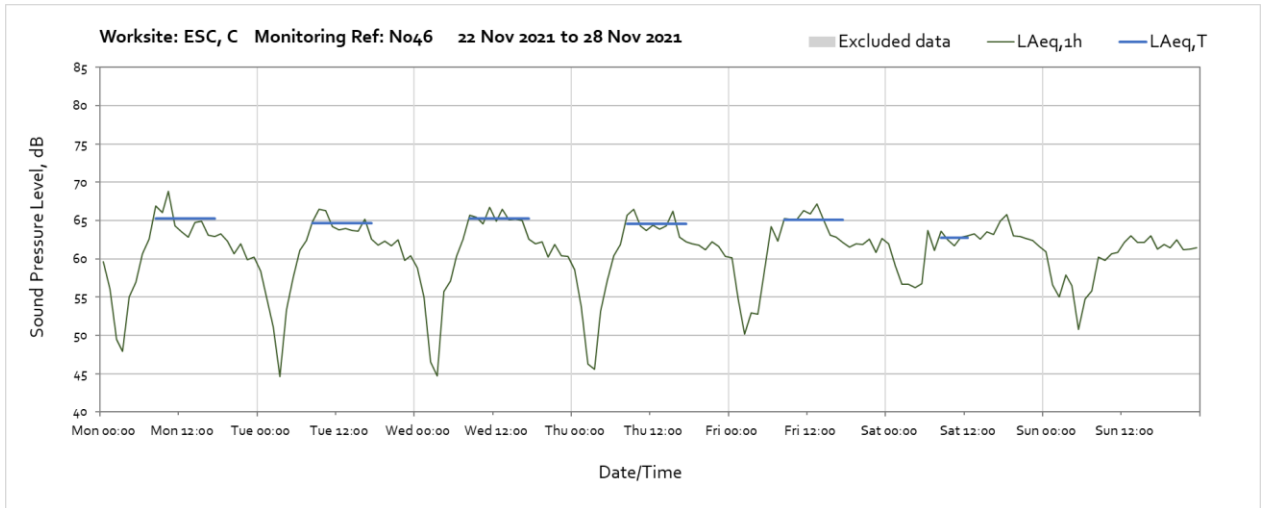




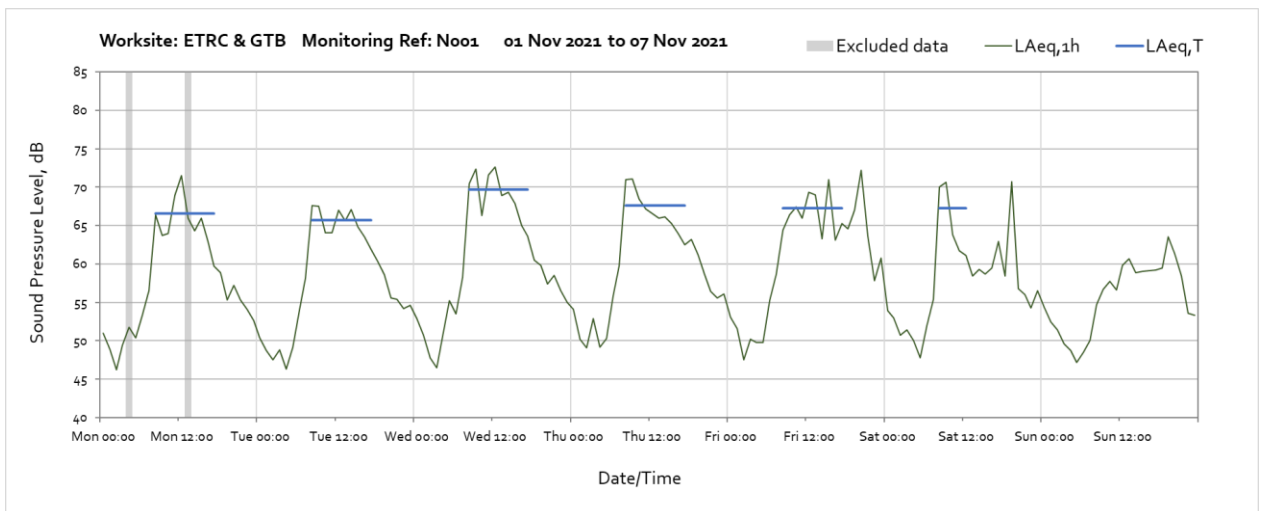
## Worksite: ESC, C – Monitoring Ref: N046

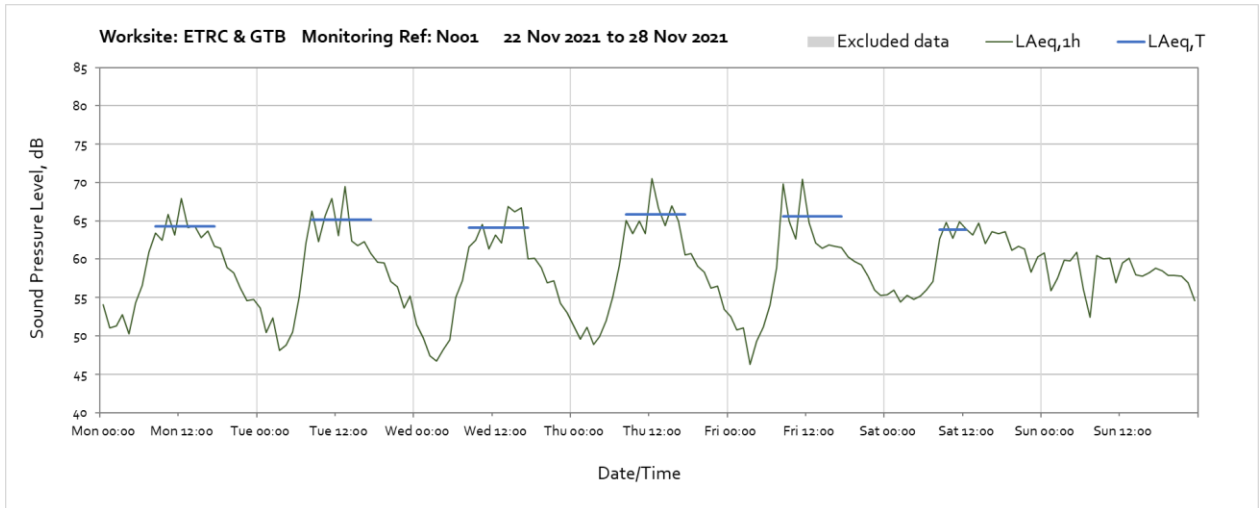
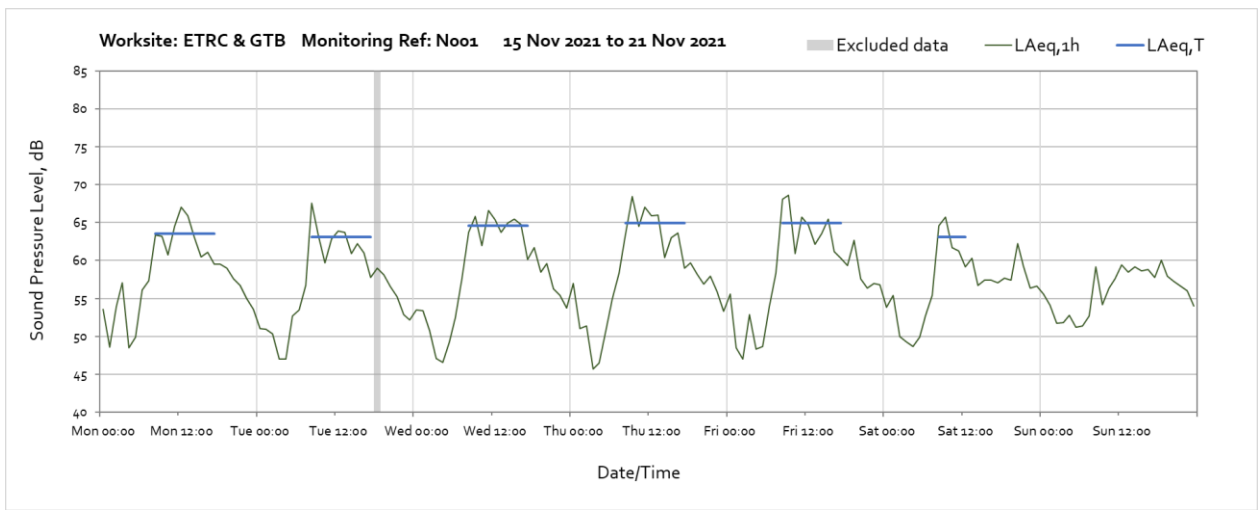
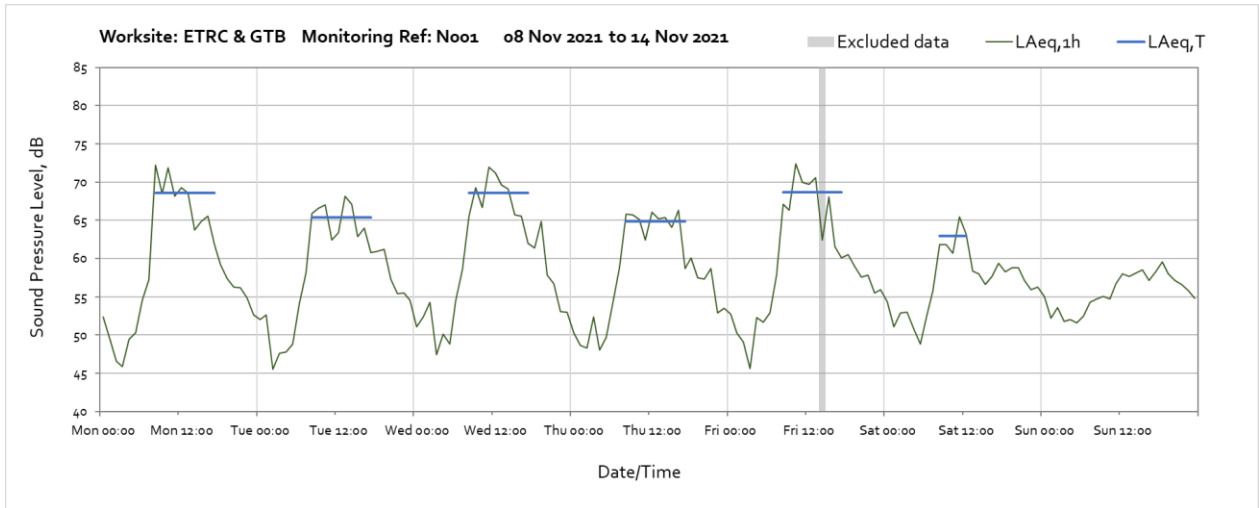


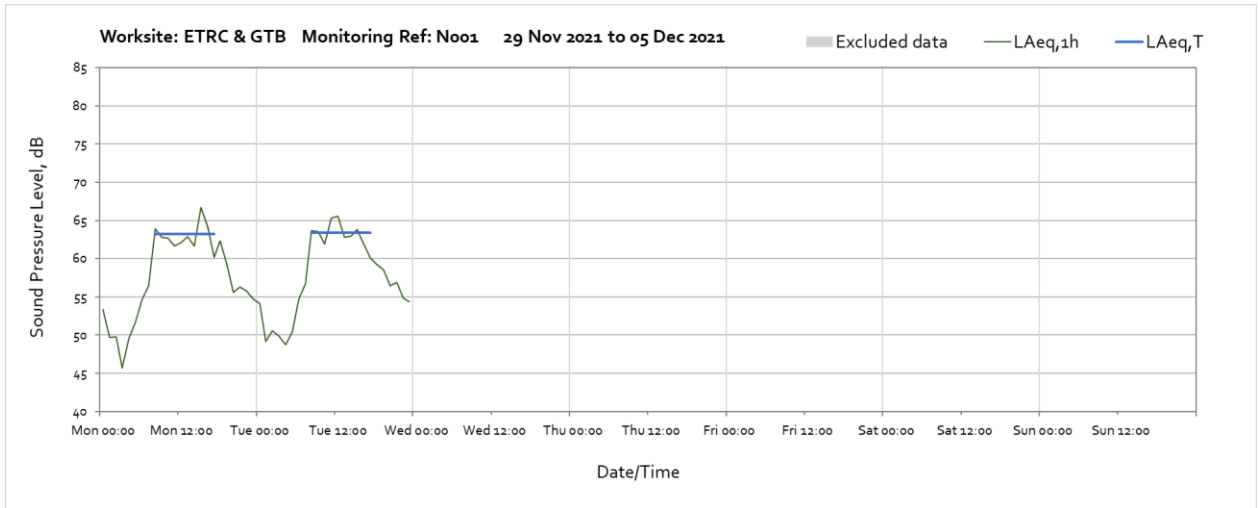
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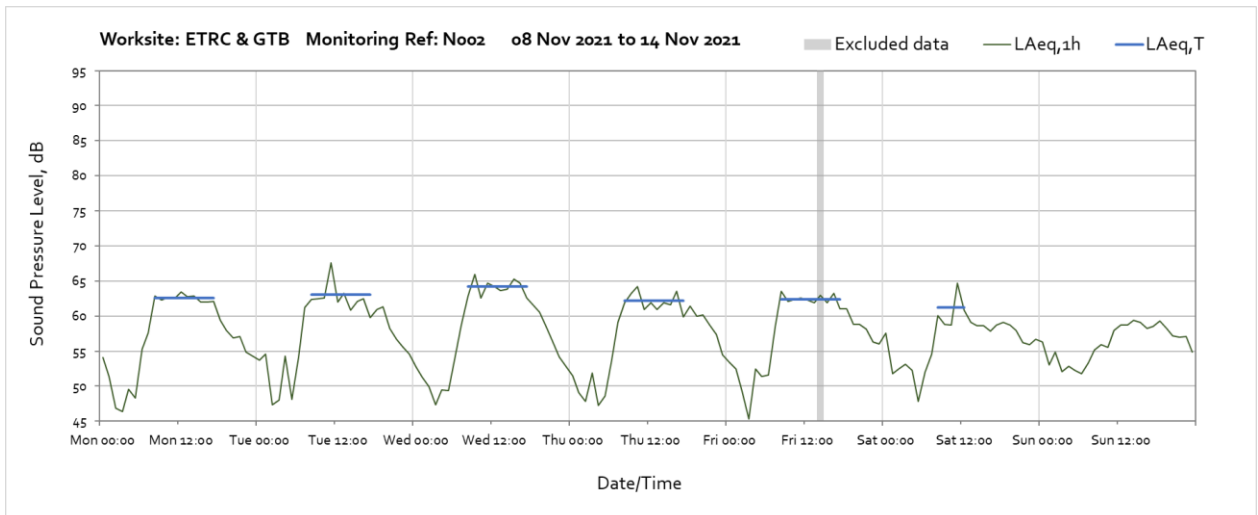
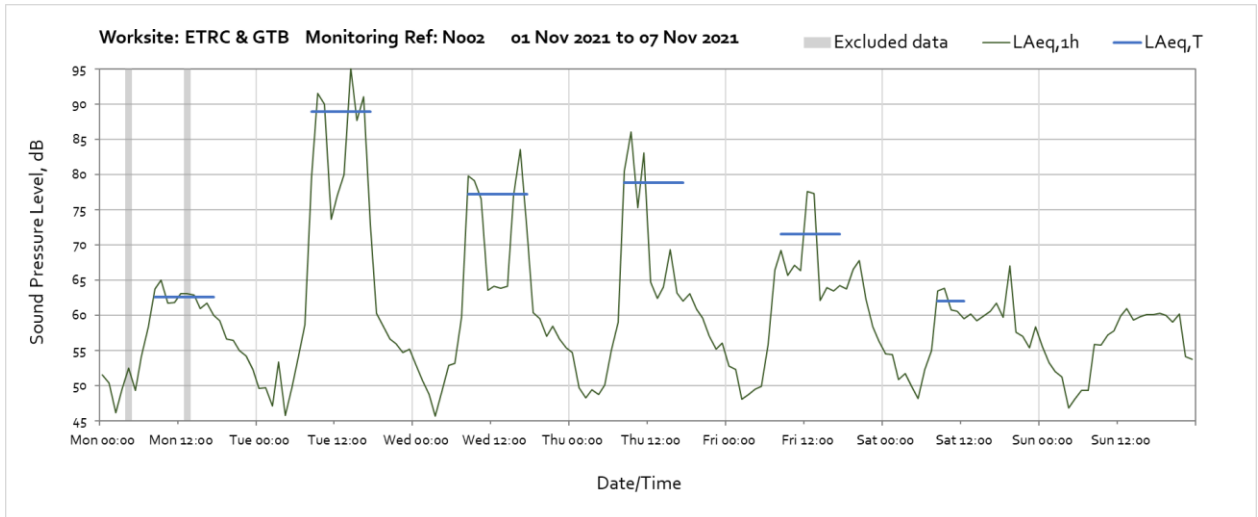
**Worksite: ETRC & GTB - Monitoring Ref: N001**

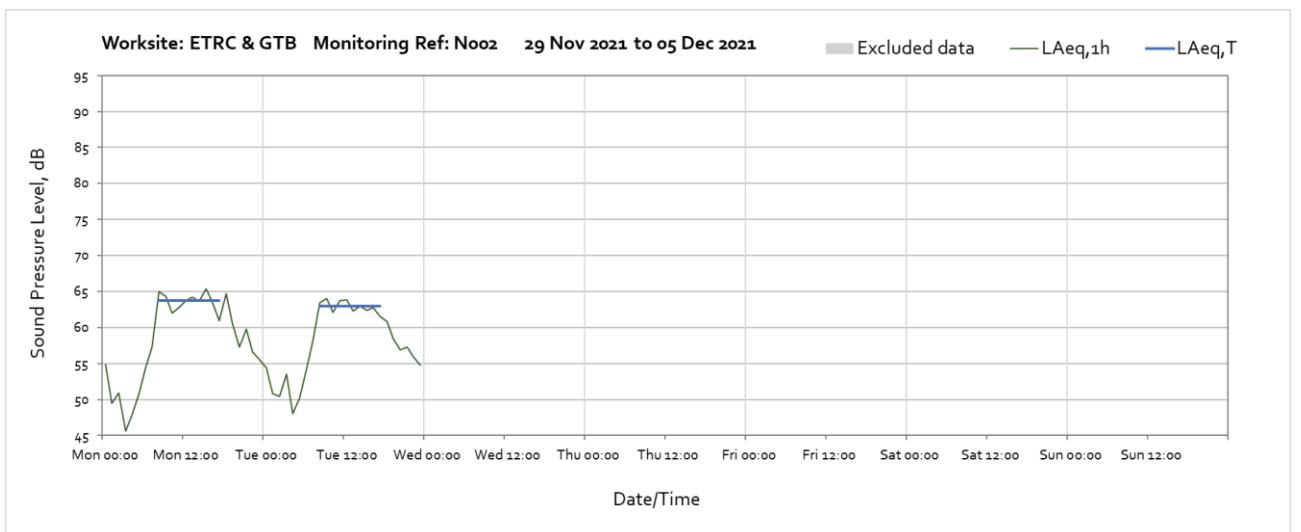
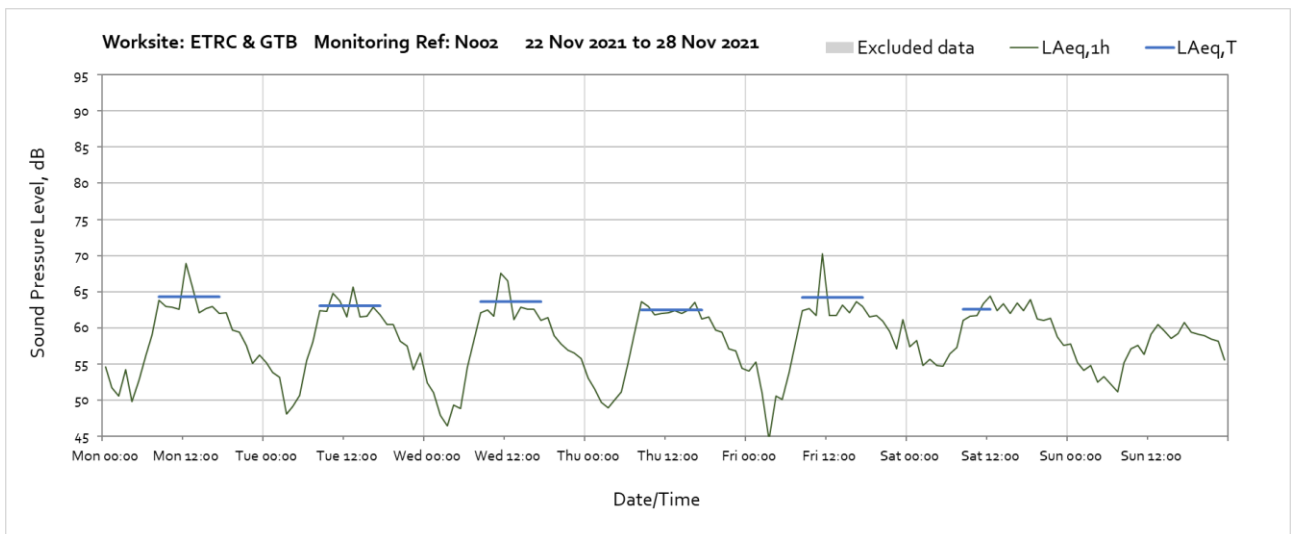
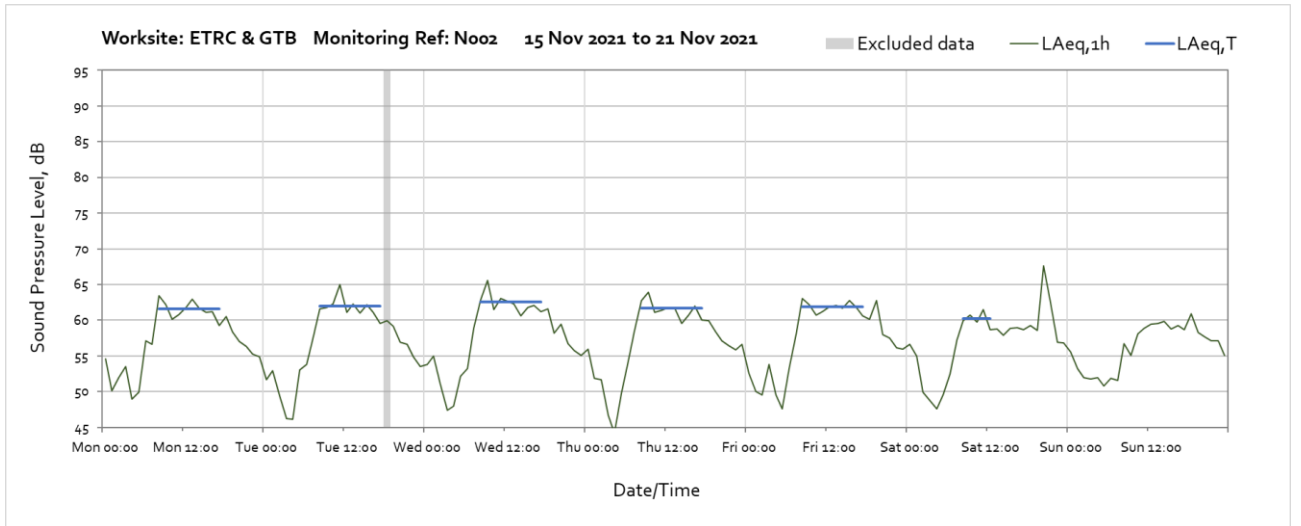




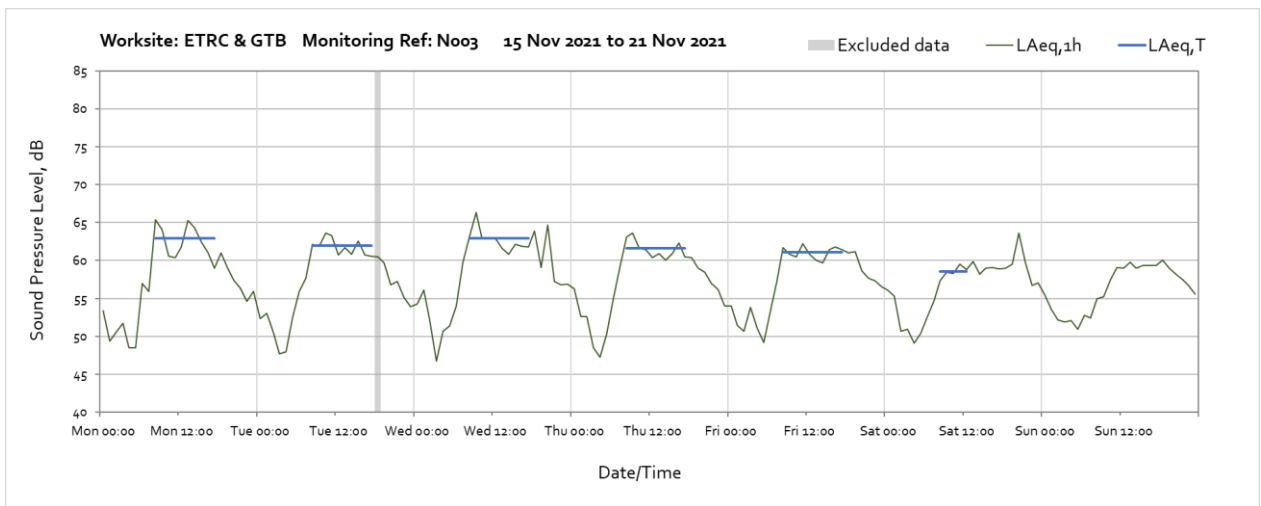
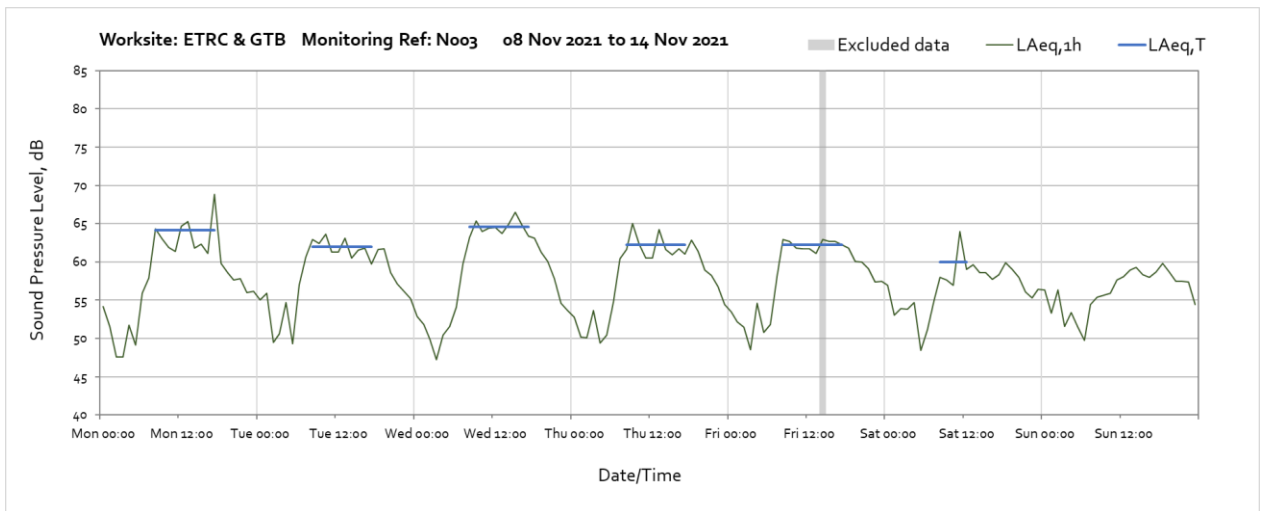
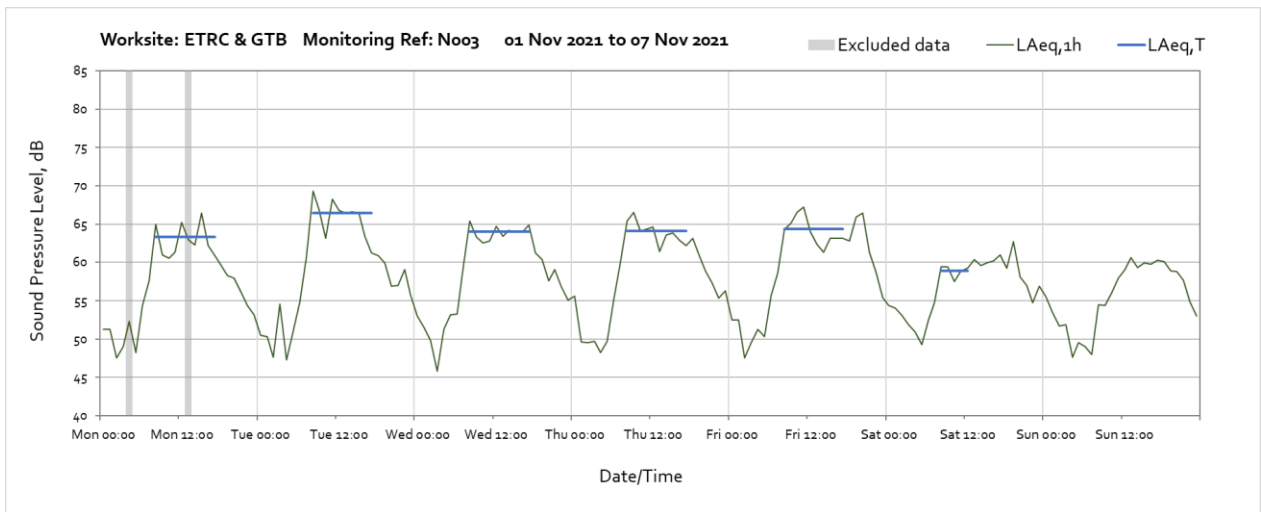


**Worksite: ETRC & GTB – Monitoring Ref: N002**

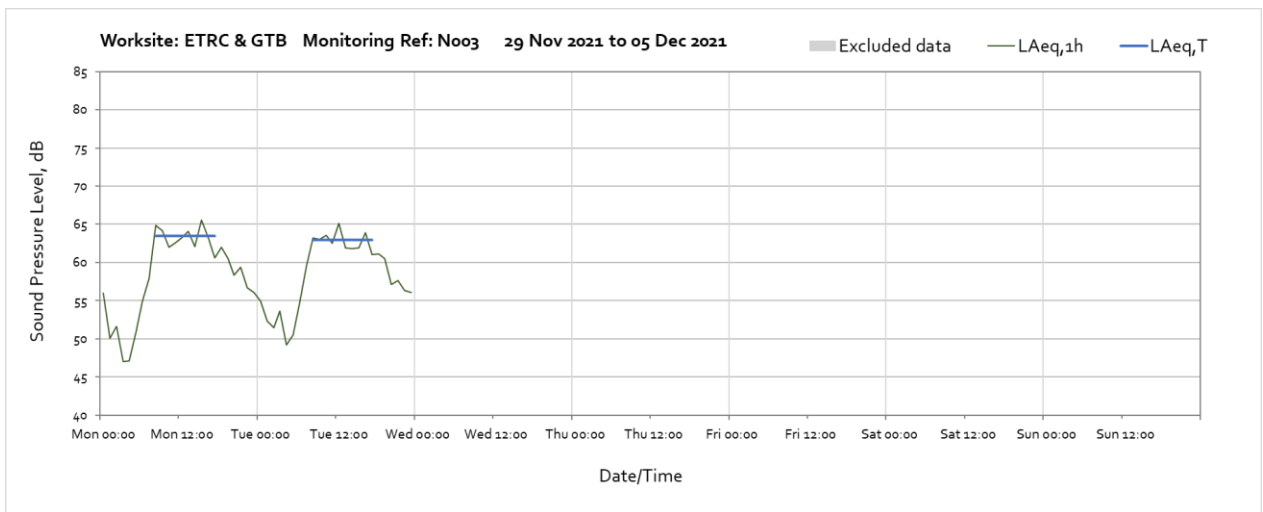
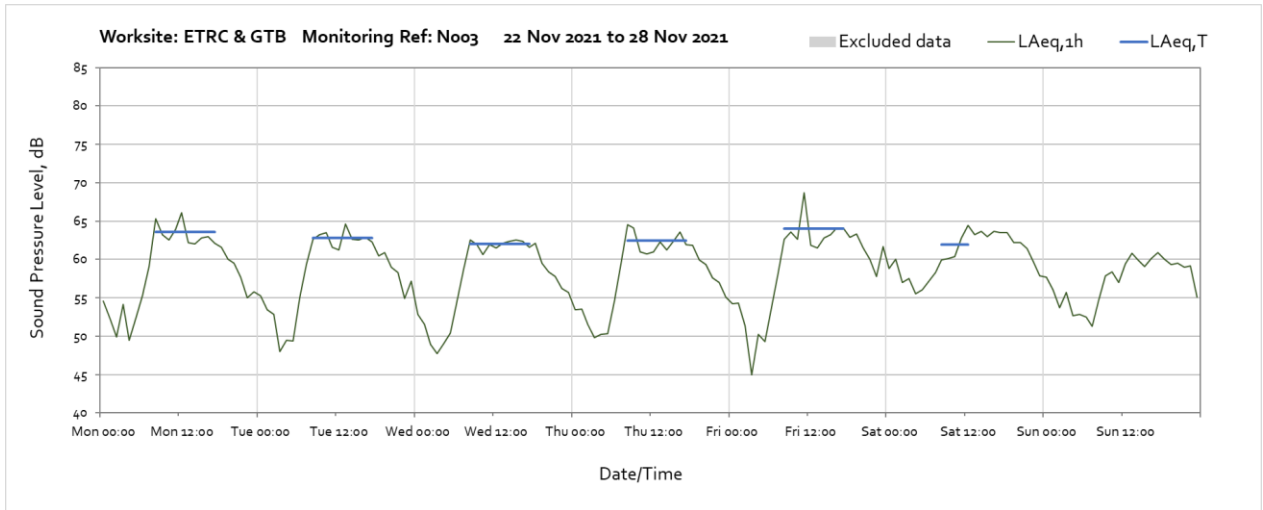




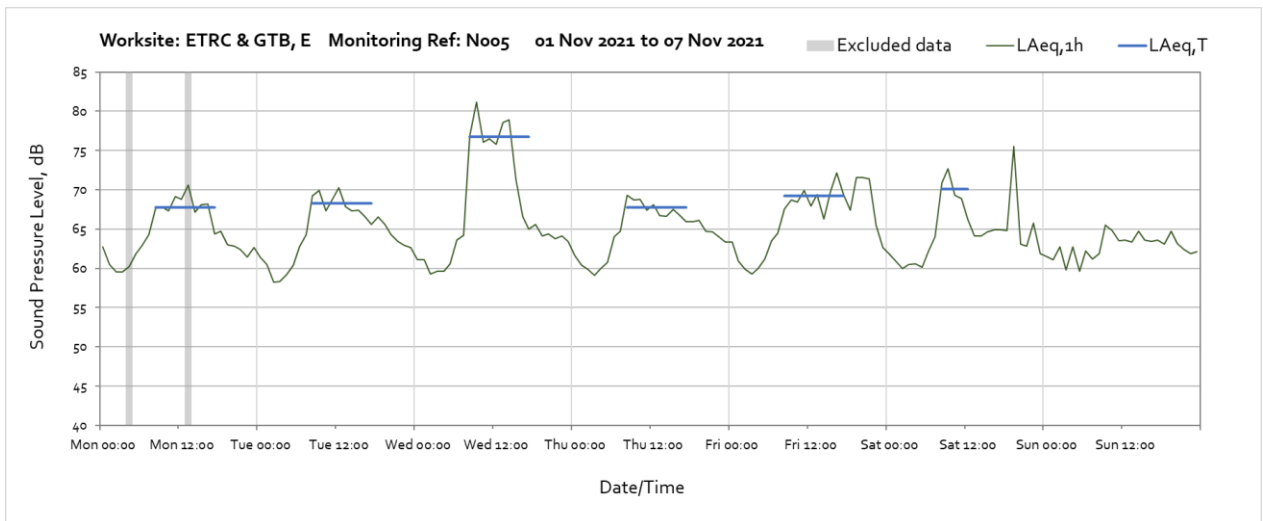
## Worksite: ETRC & GTB – Monitoring Ref: N003

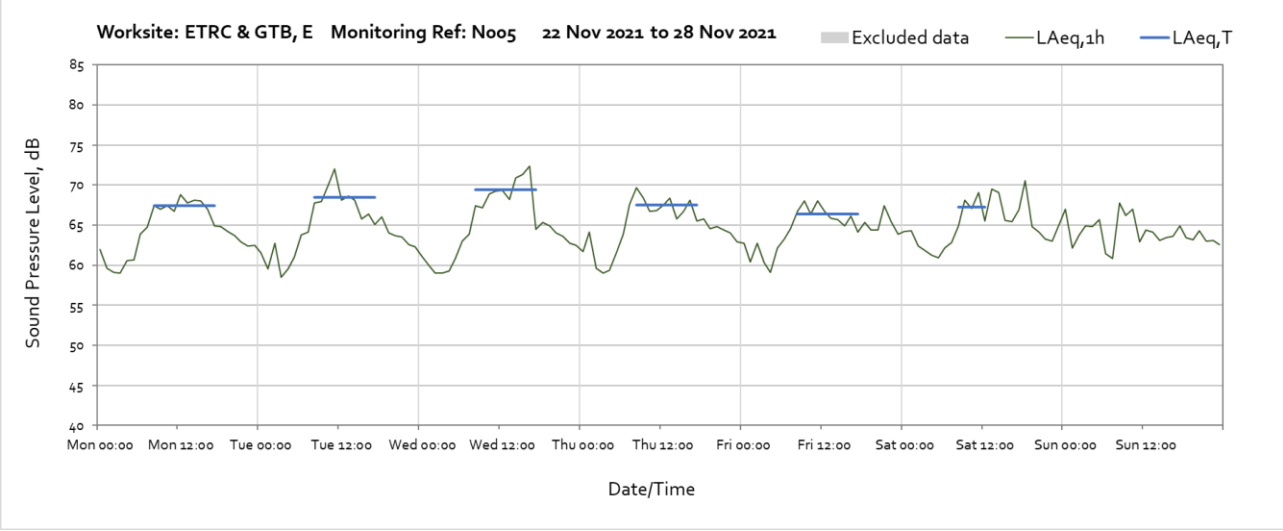
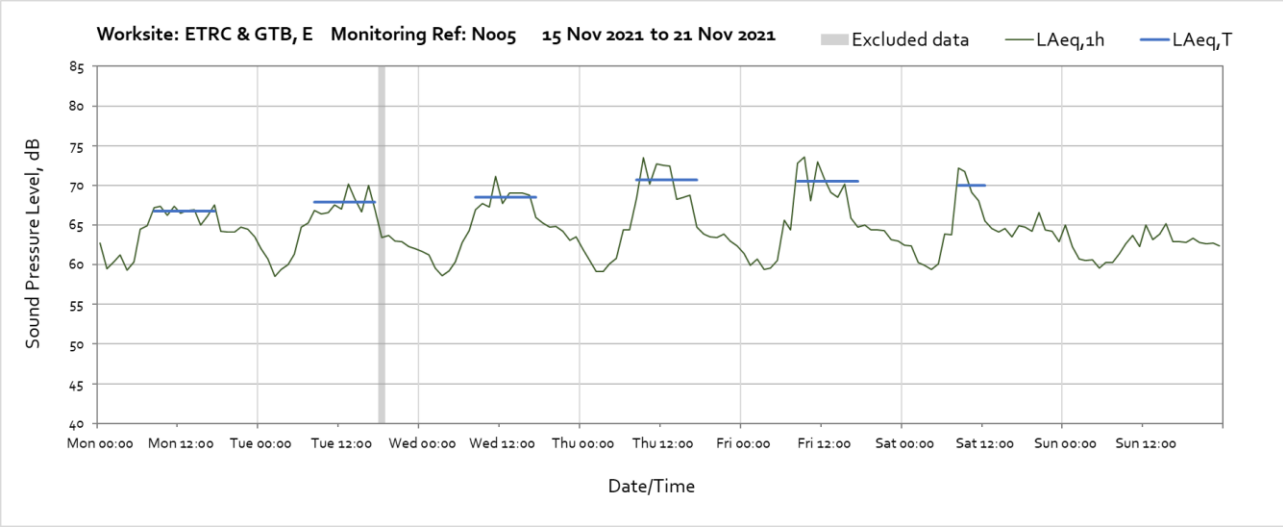
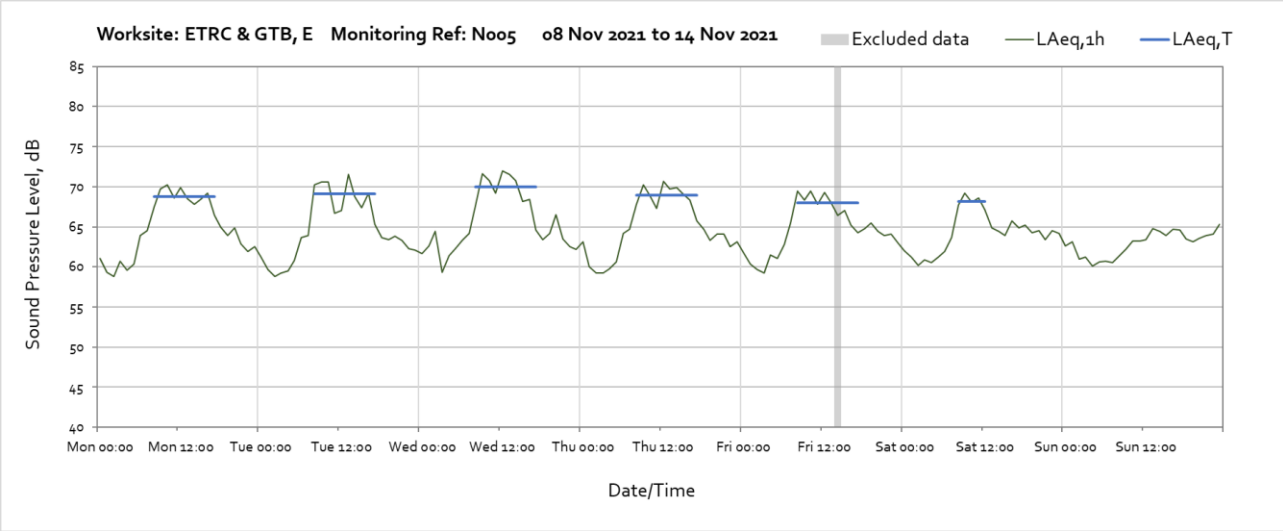


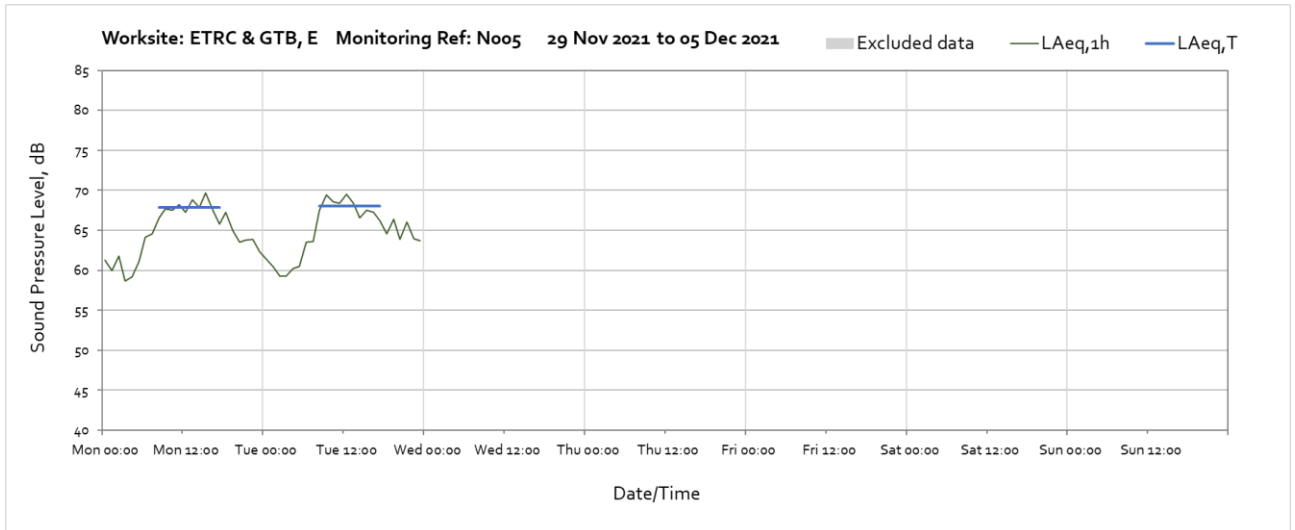




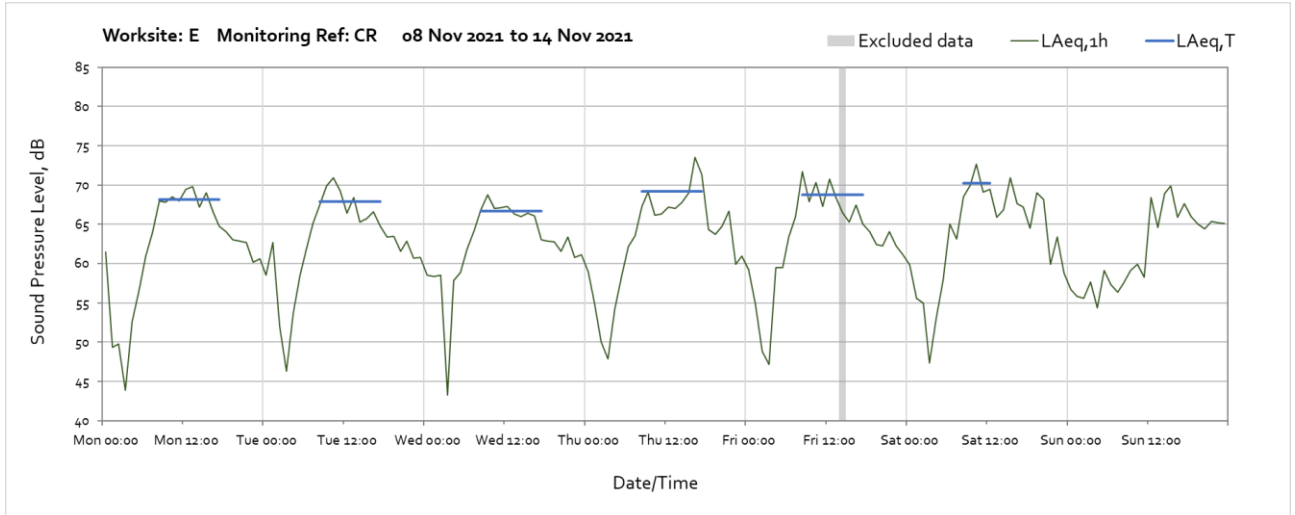
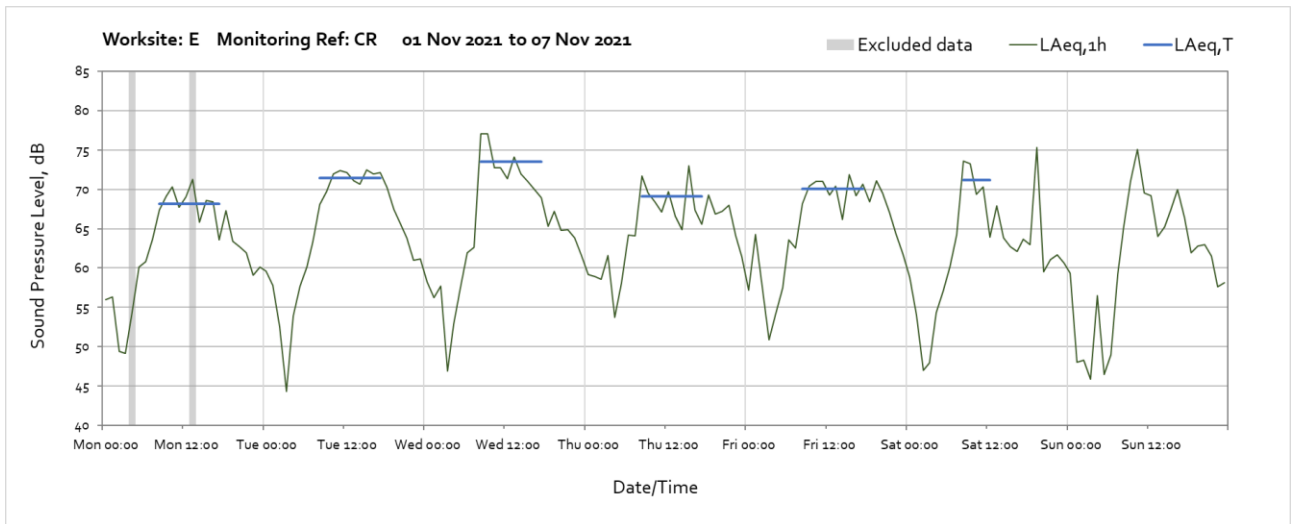
**Worksite: ETRC & GTB, E - Monitoring Ref: N005**

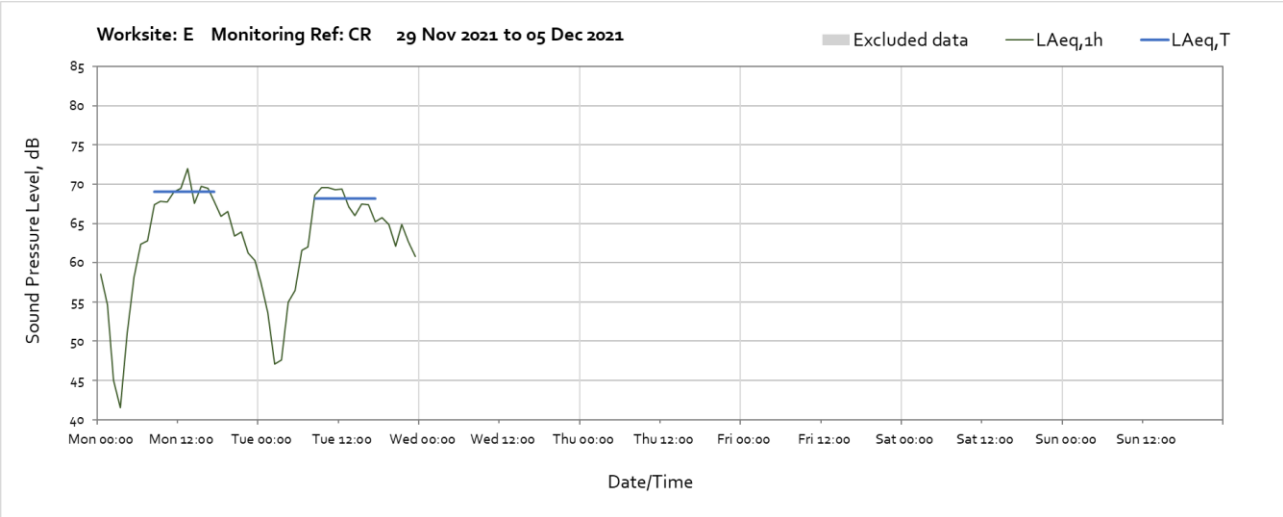
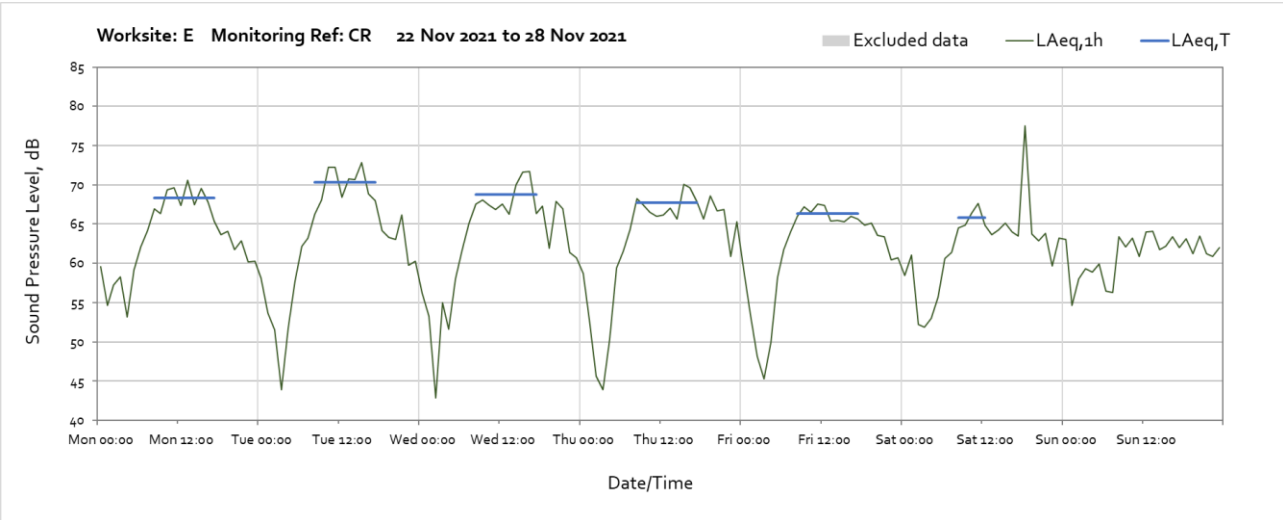
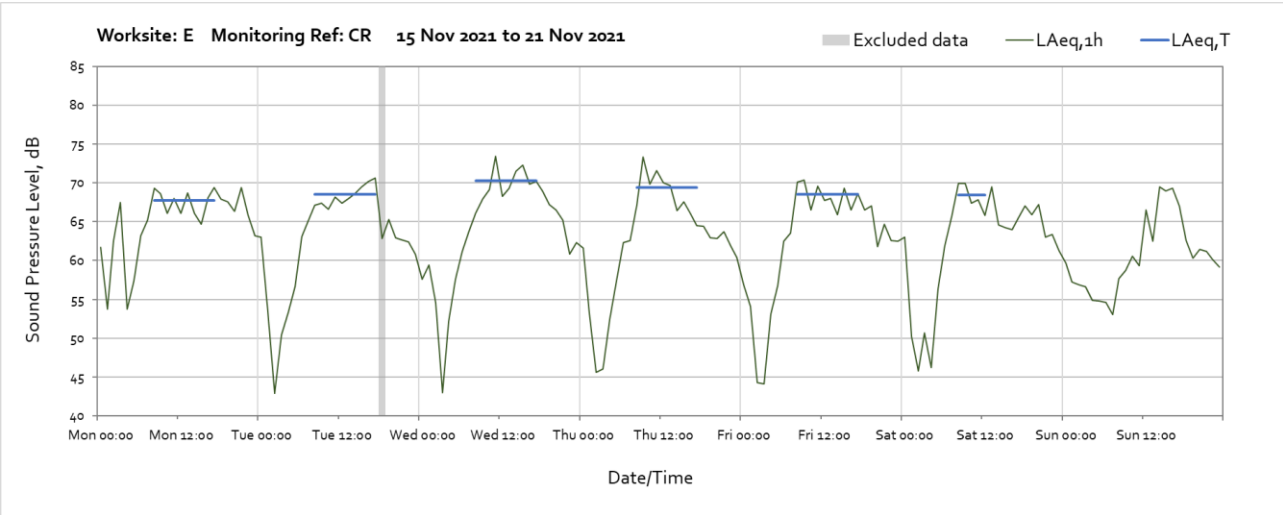




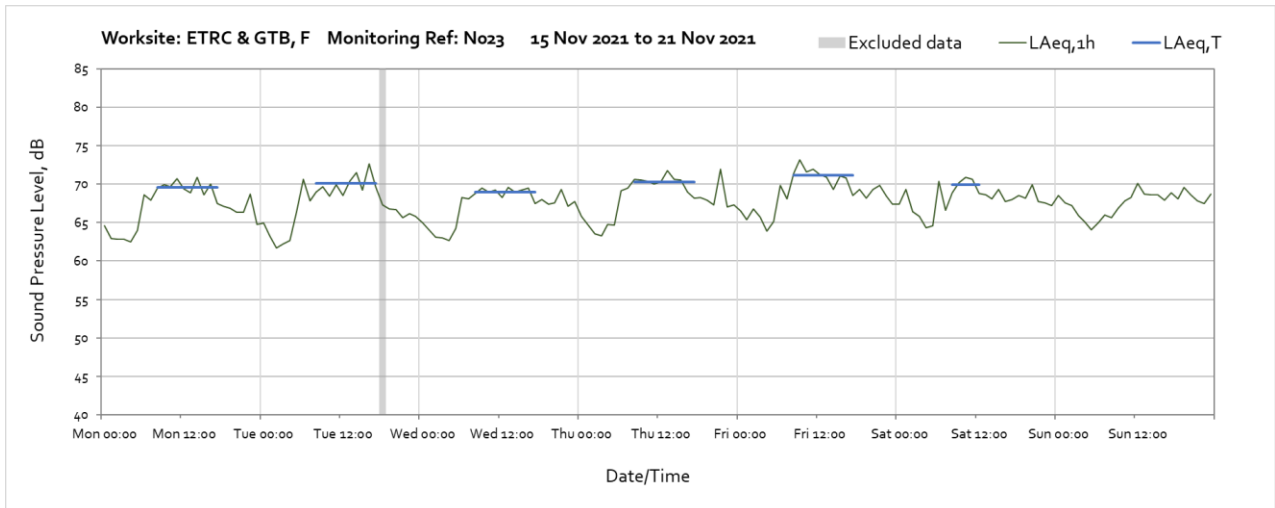
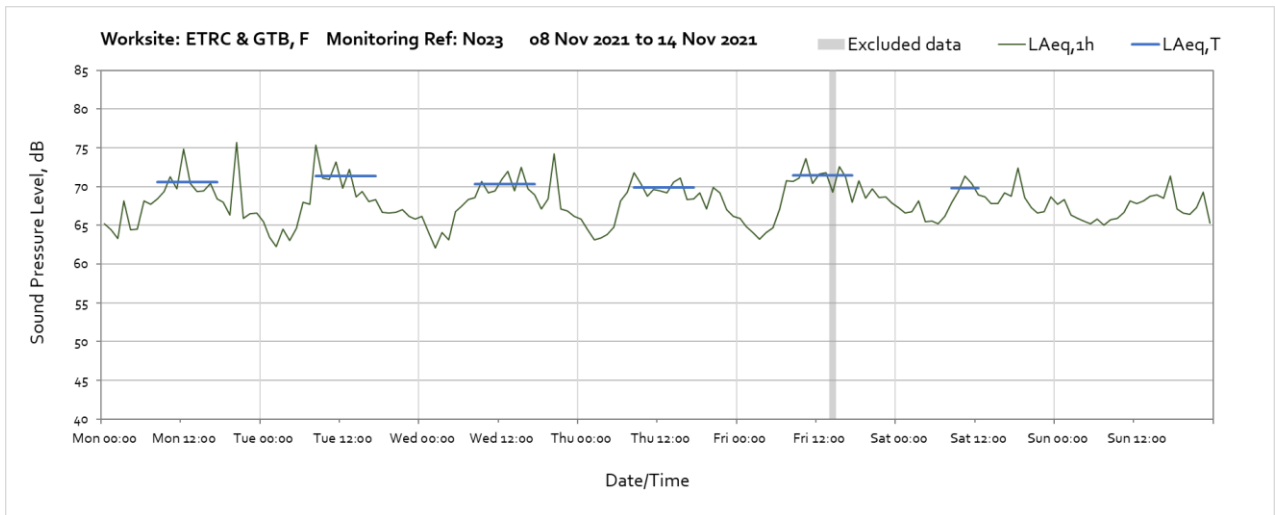
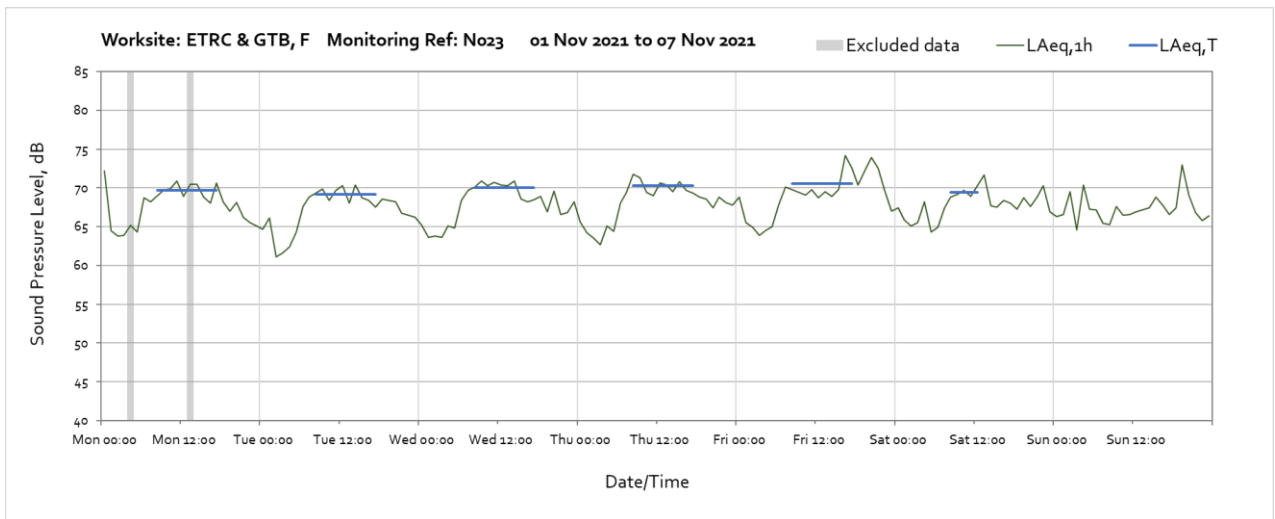


**Worksite: E - Monitoring Ref: CR**

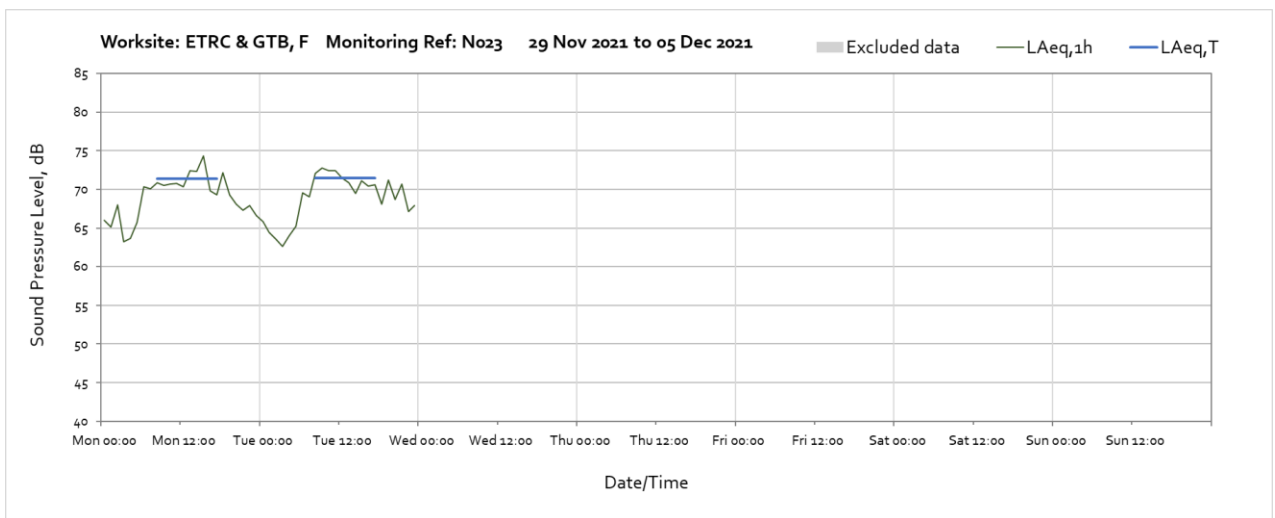
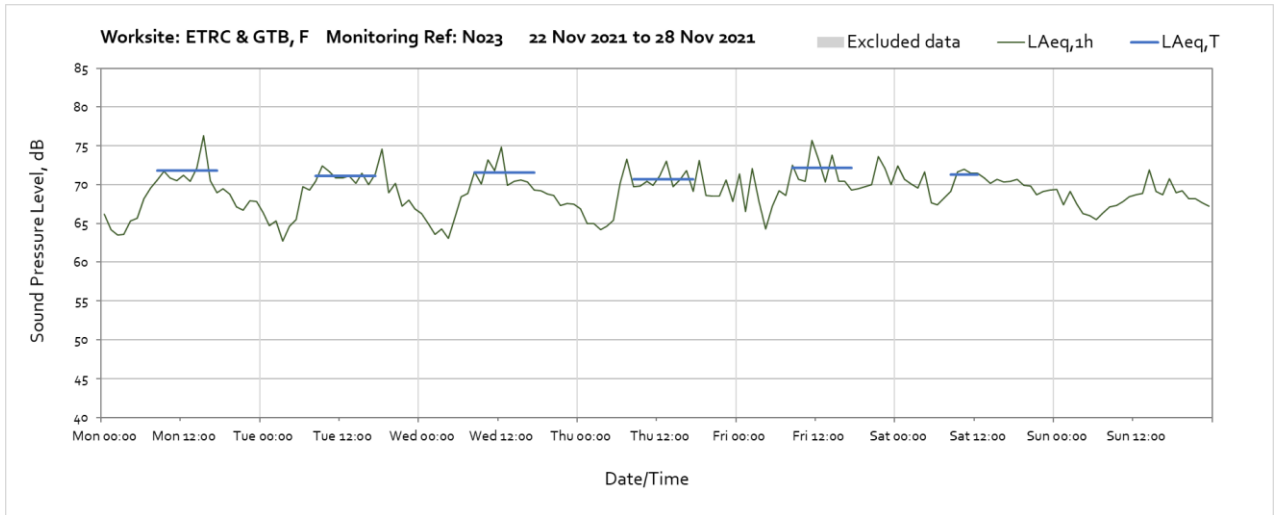




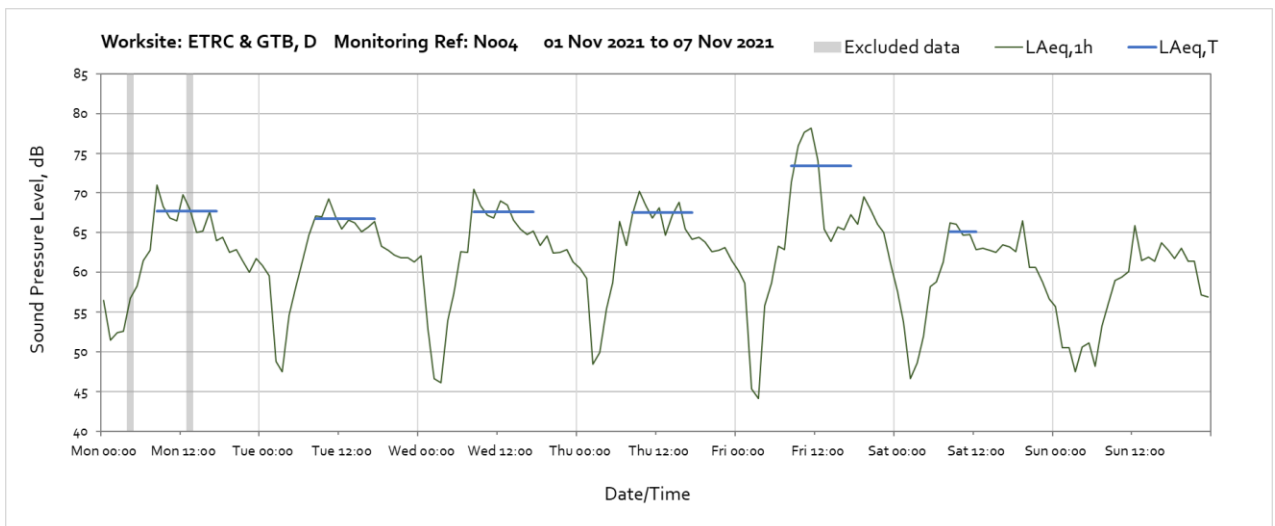
## Worksite: ETRC & GTB, F - Monitoring Ref: N023



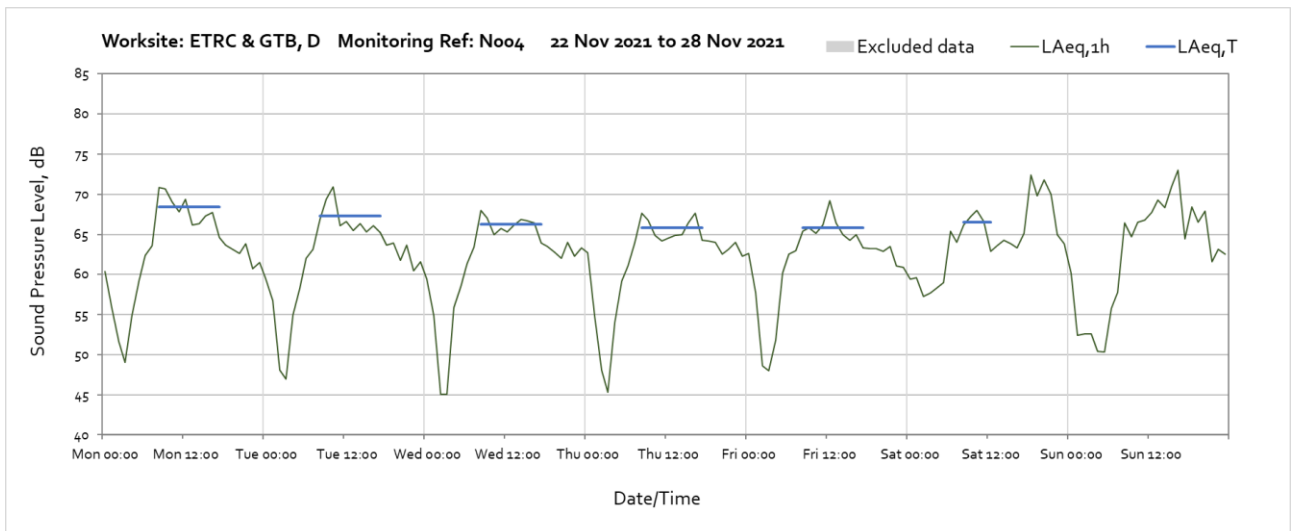
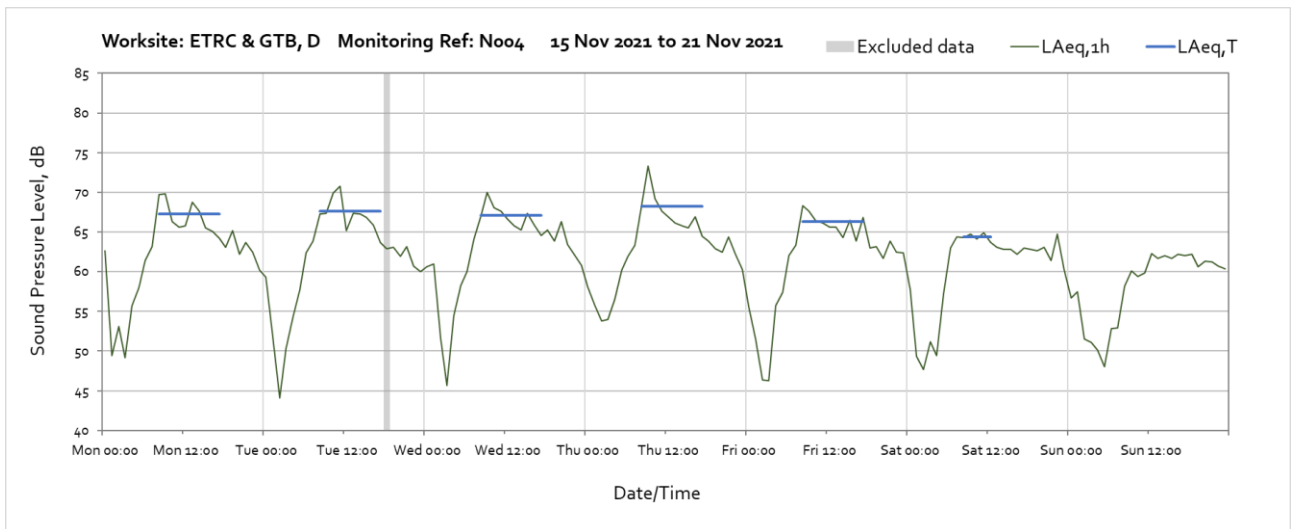
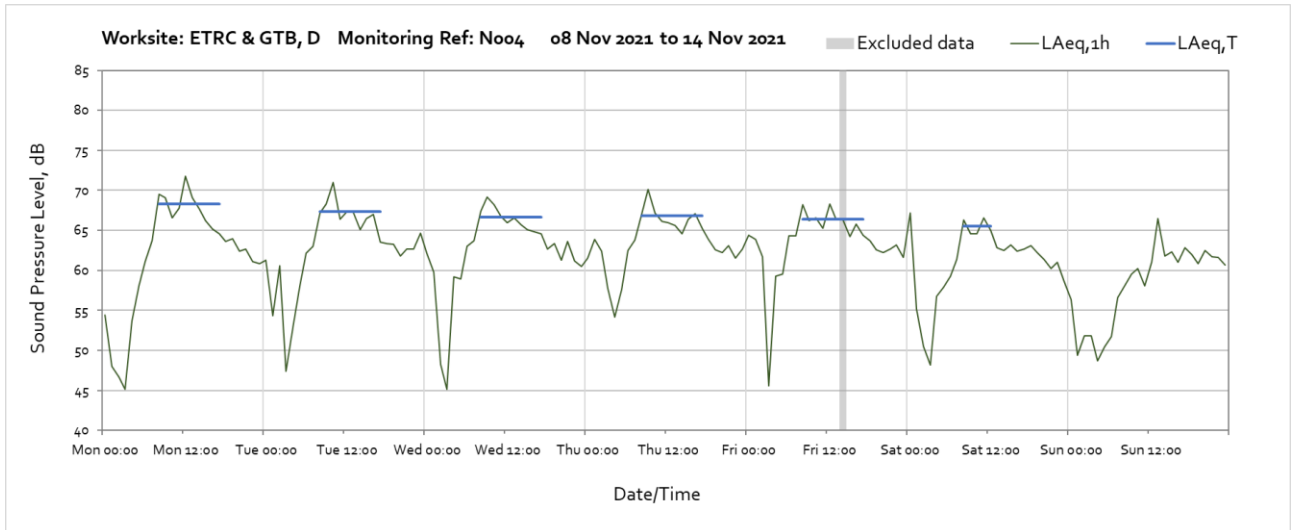
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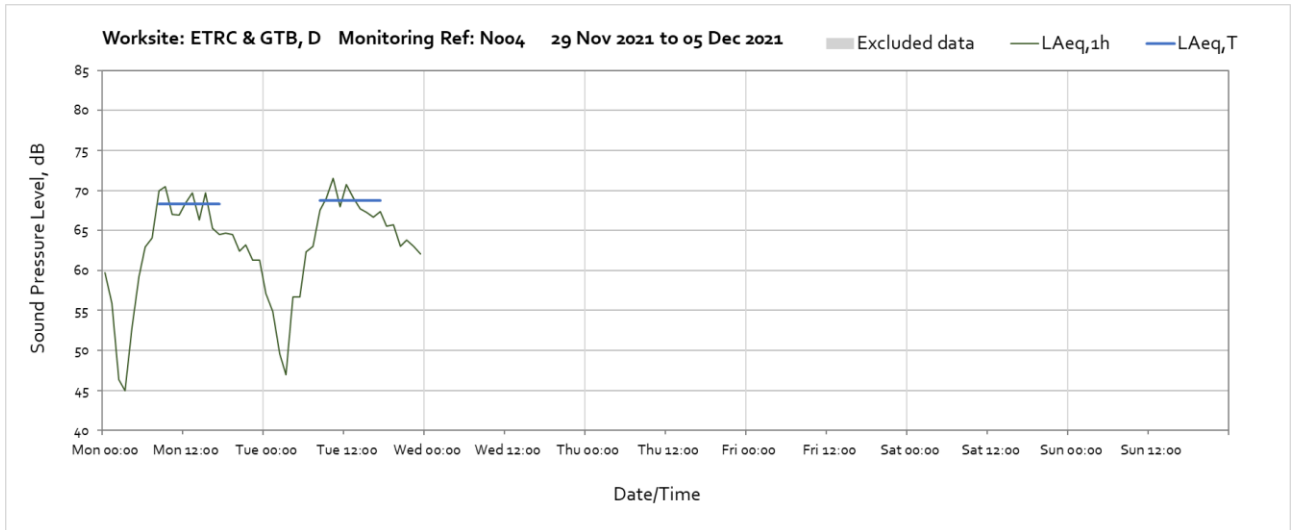


**Worksite: ETRC & GTB, D – Monitoring Ref: N004**

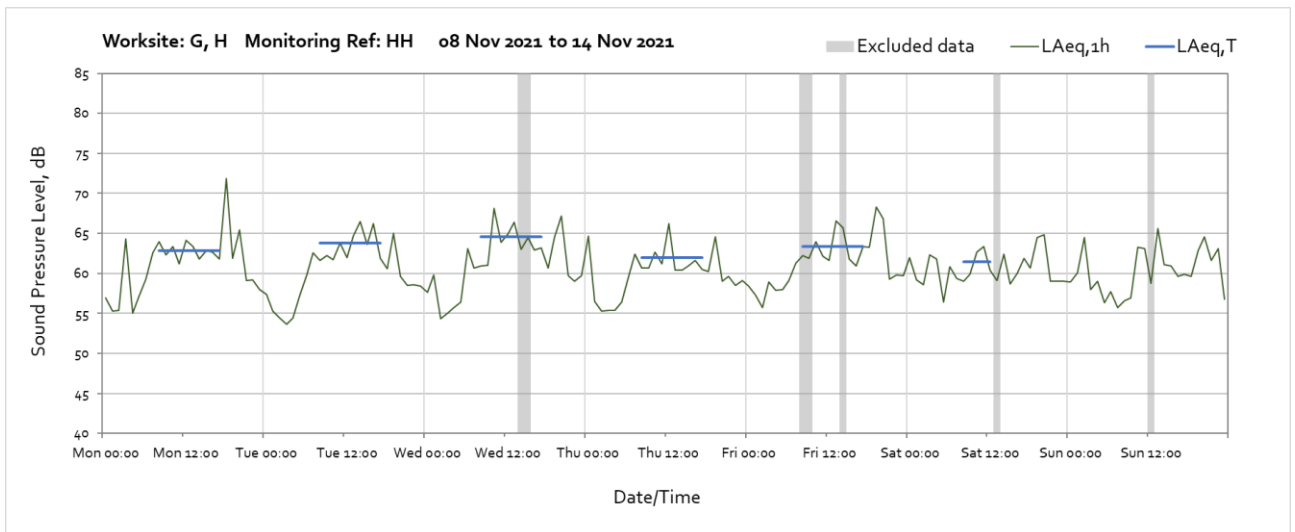
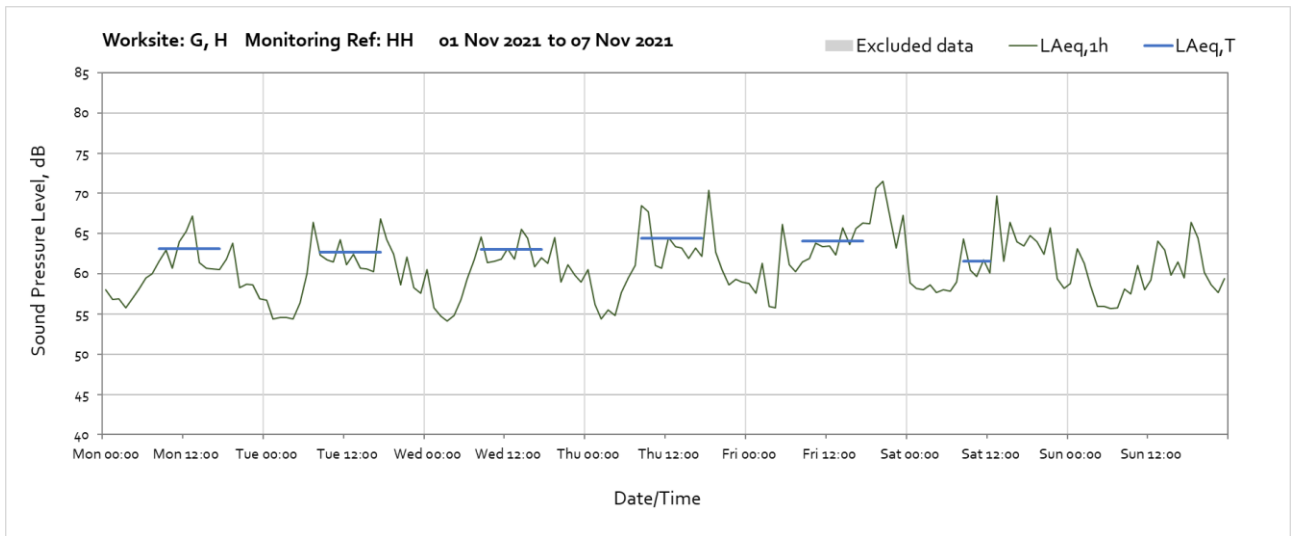


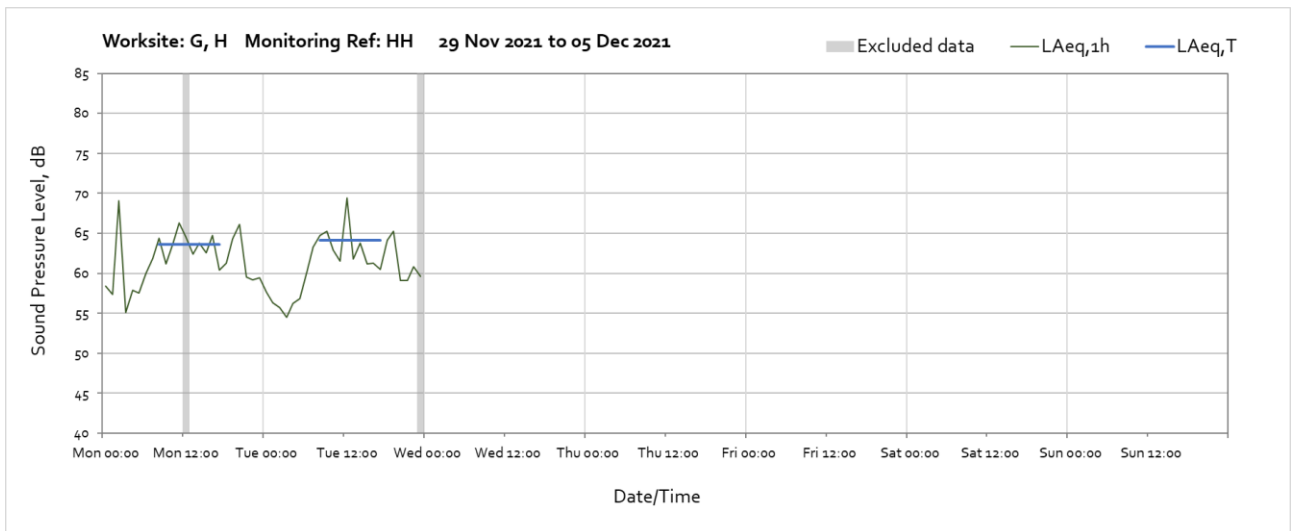
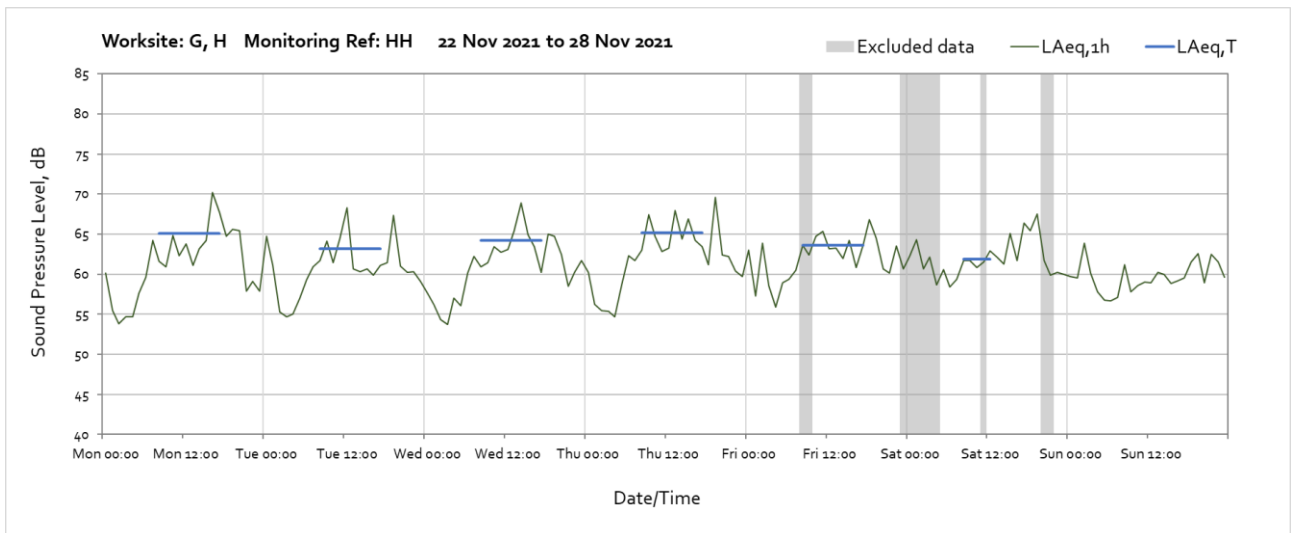
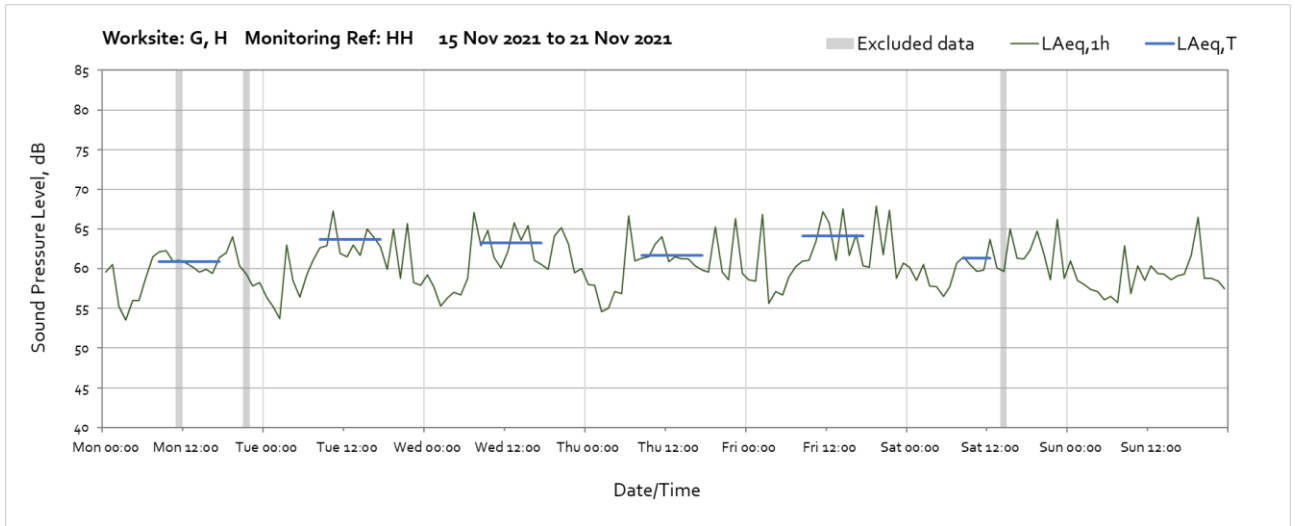




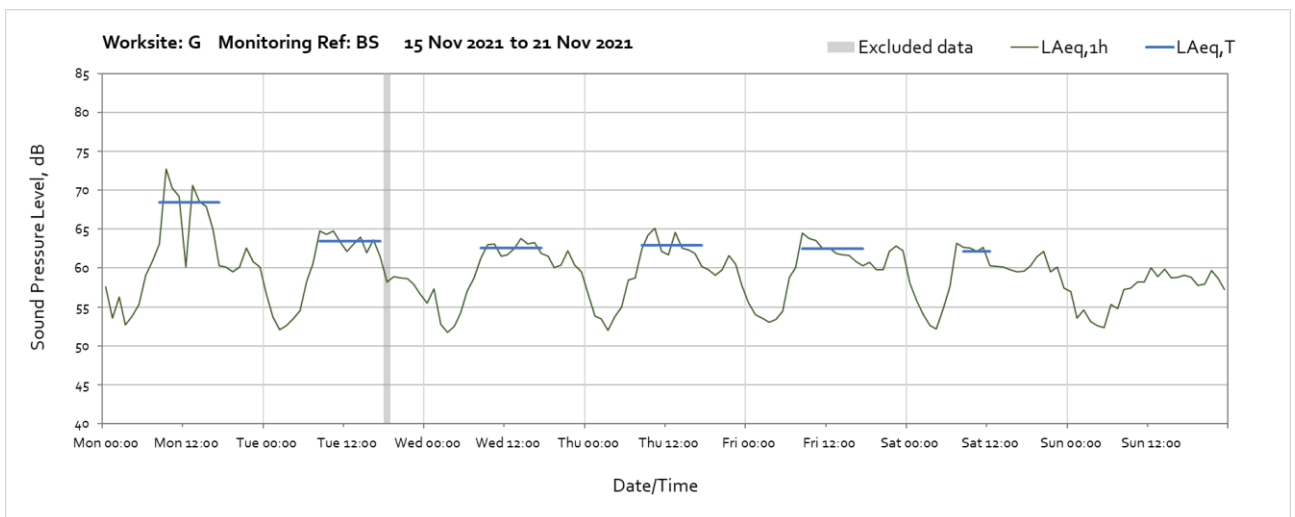
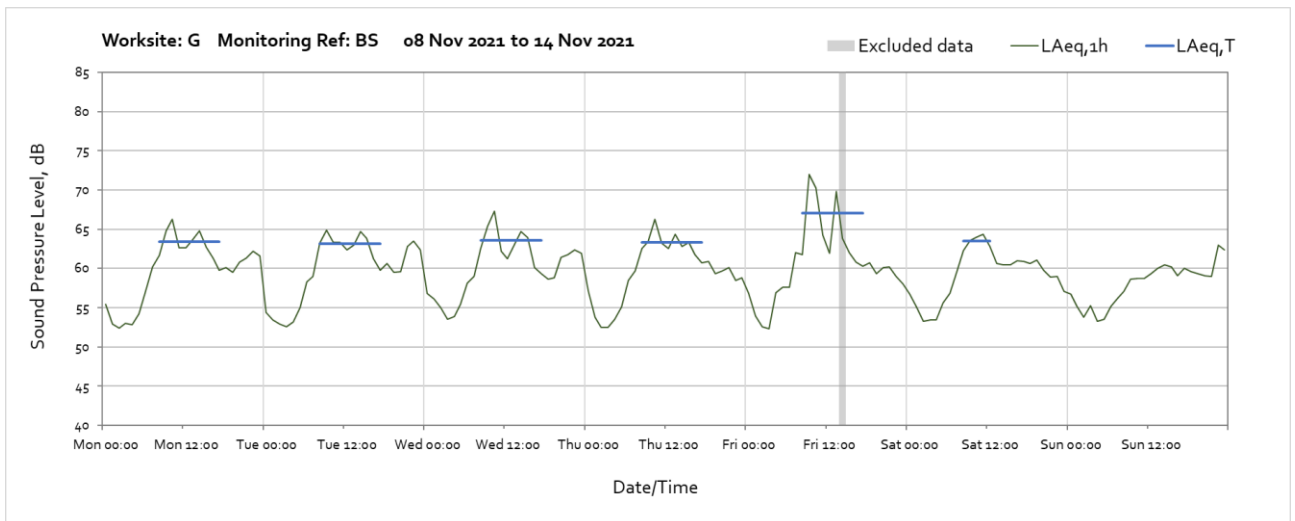
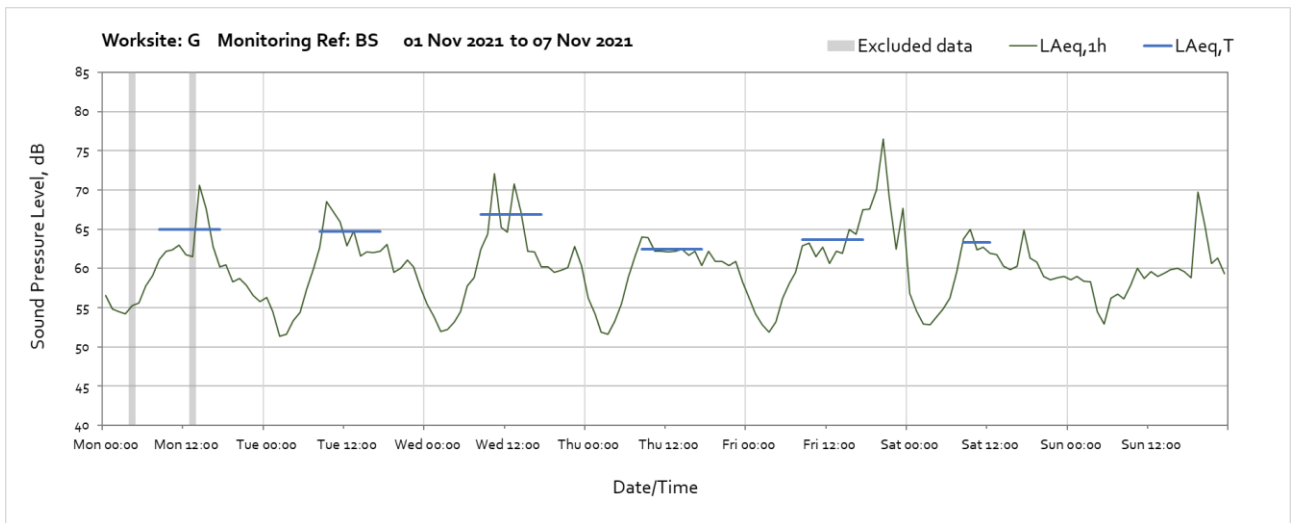


**Worksite: G, H - Monitoring Ref: HH**

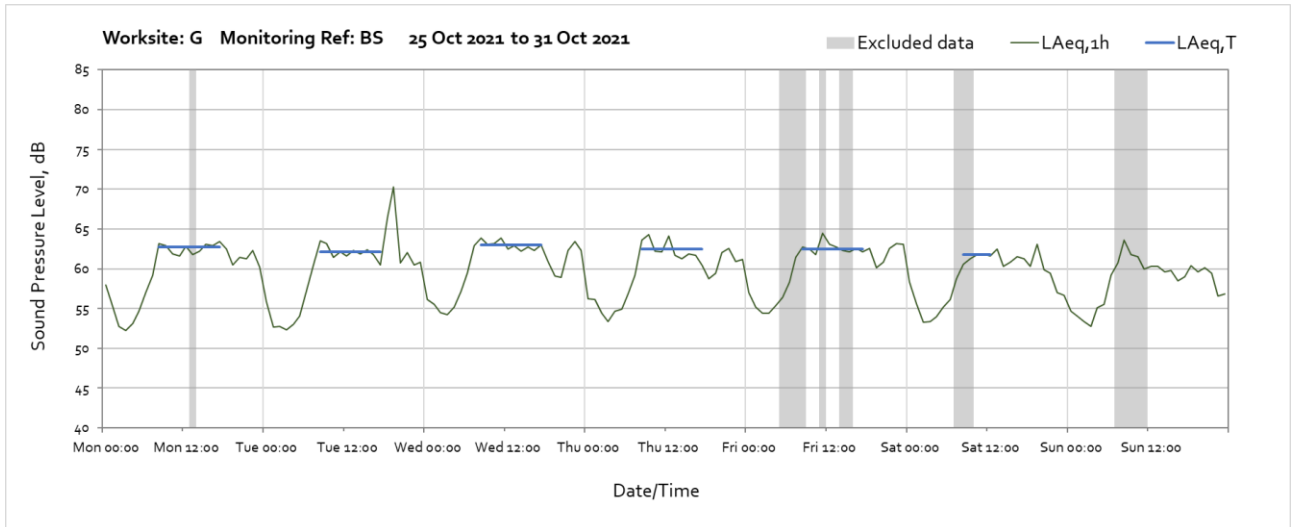
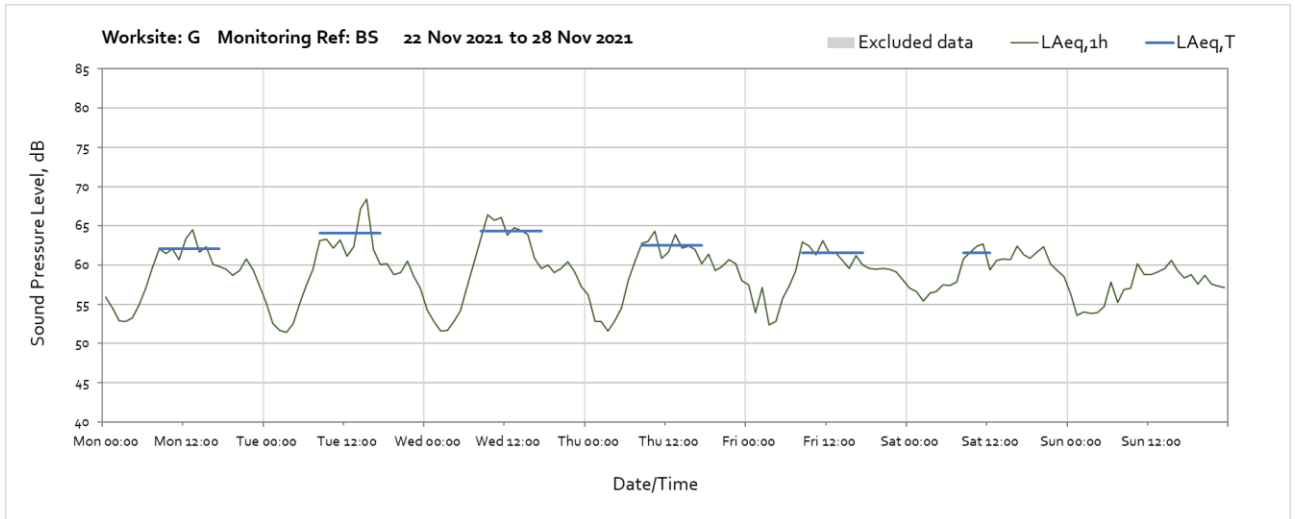




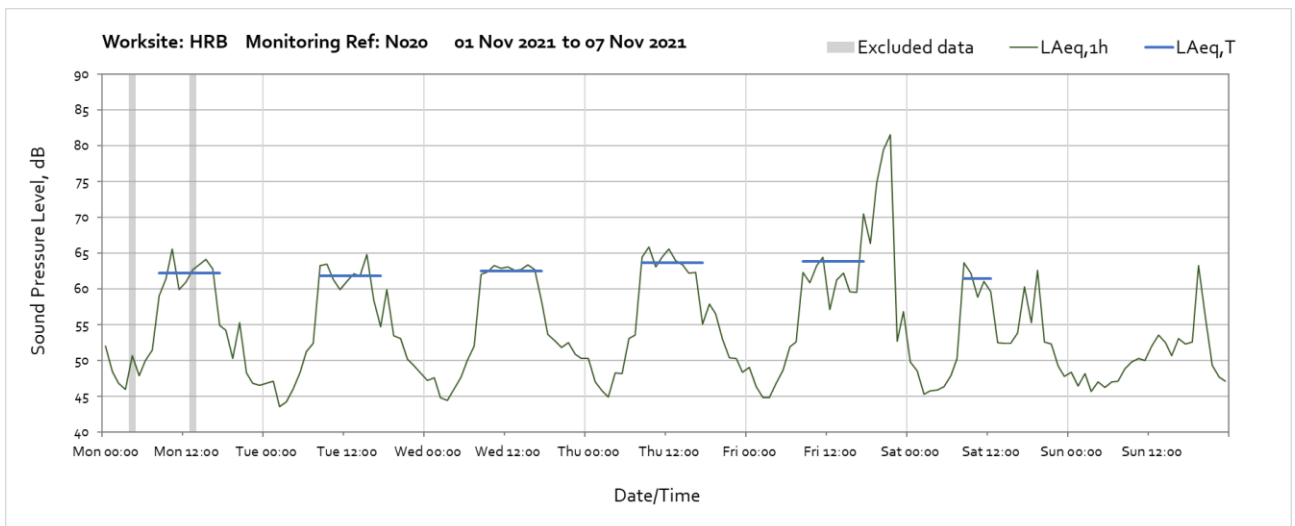
## Worksite: G - Monitoring Ref: BS

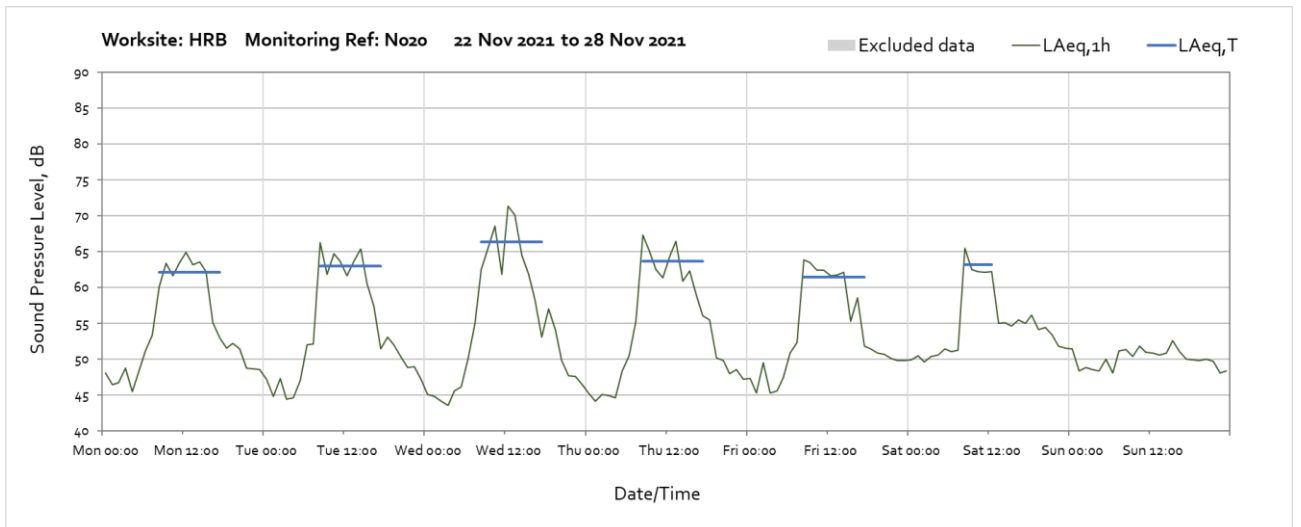
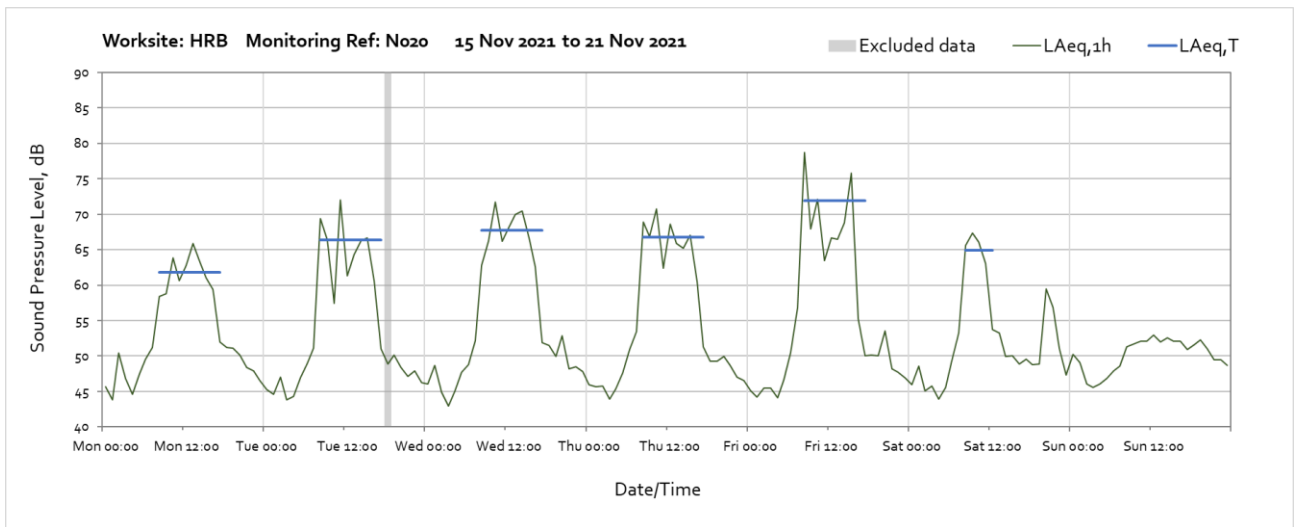
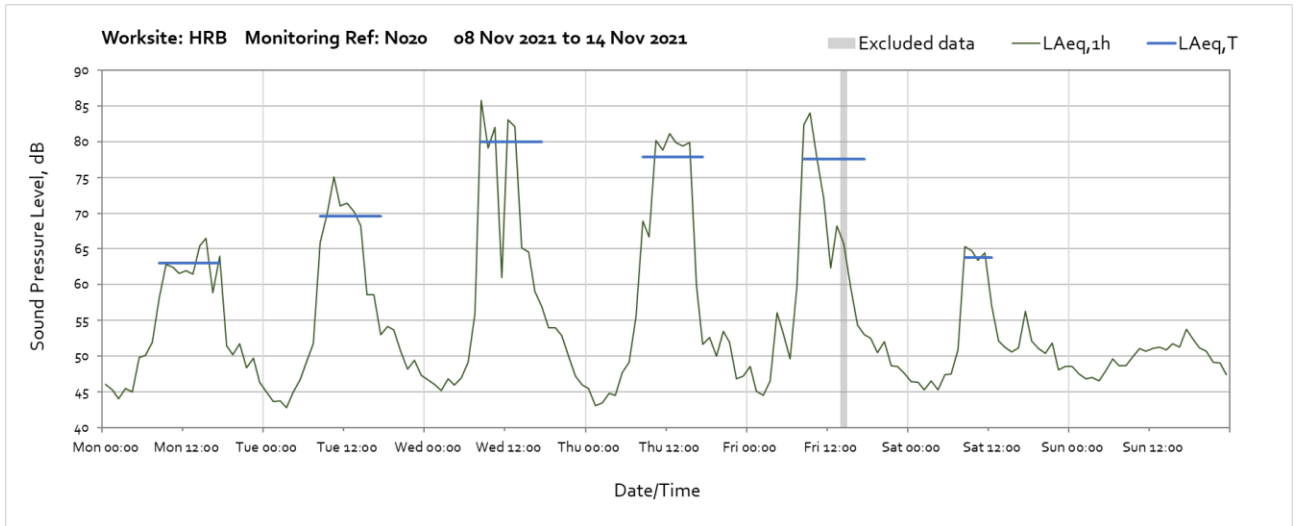


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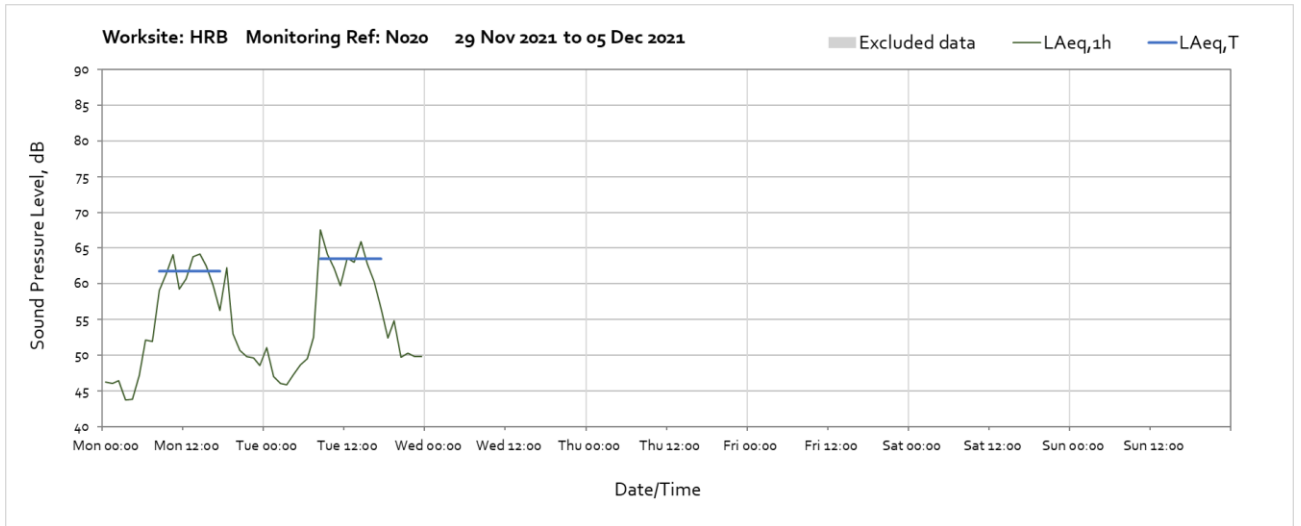


**Worksite: HRB – Monitoring Ref: N020**

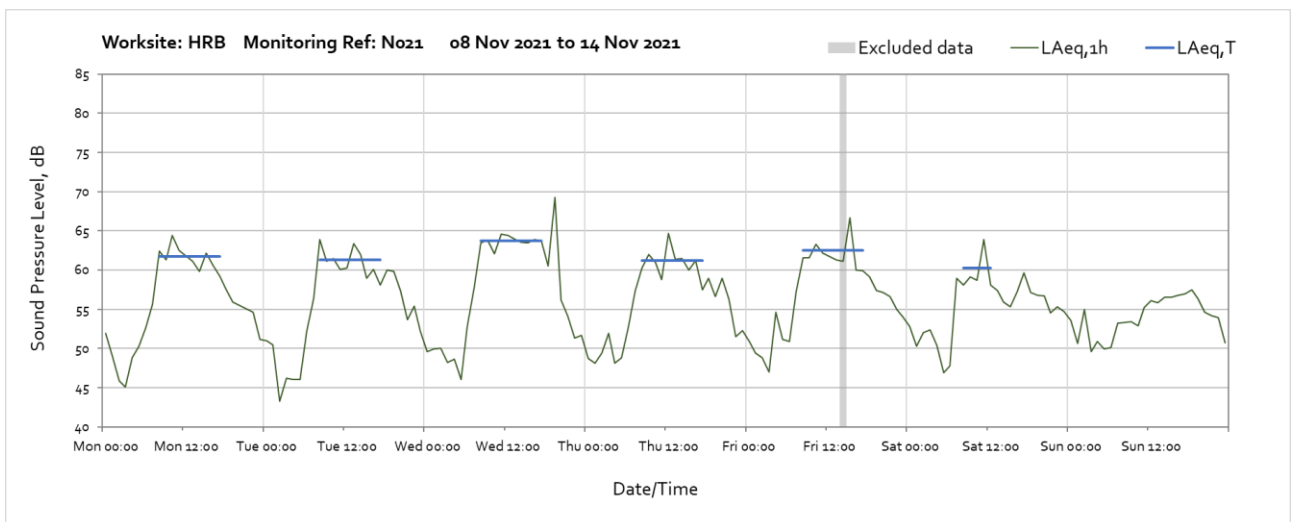
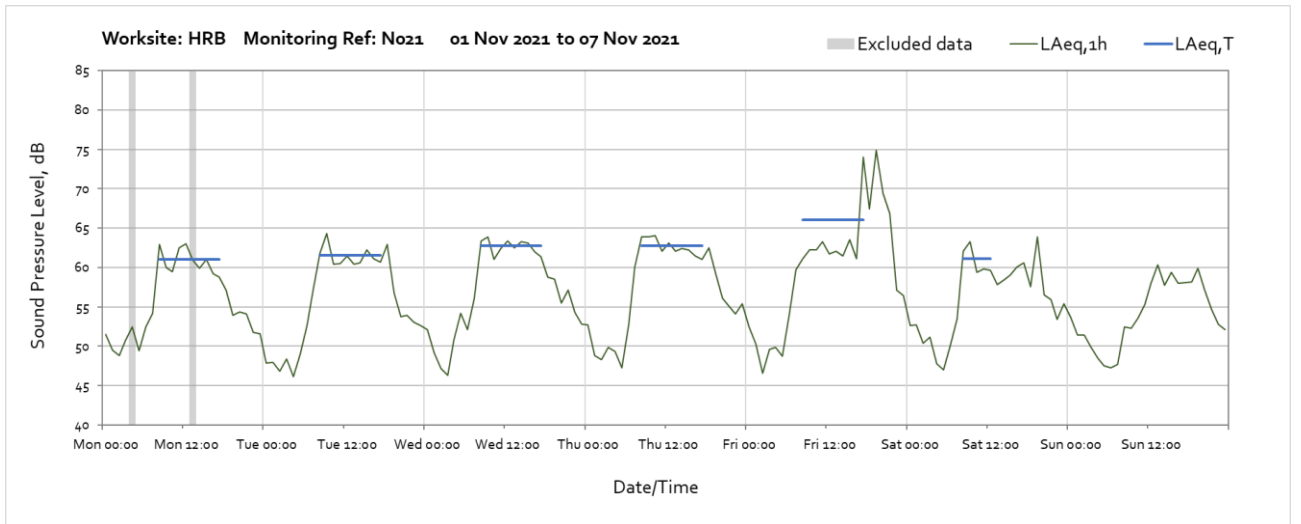


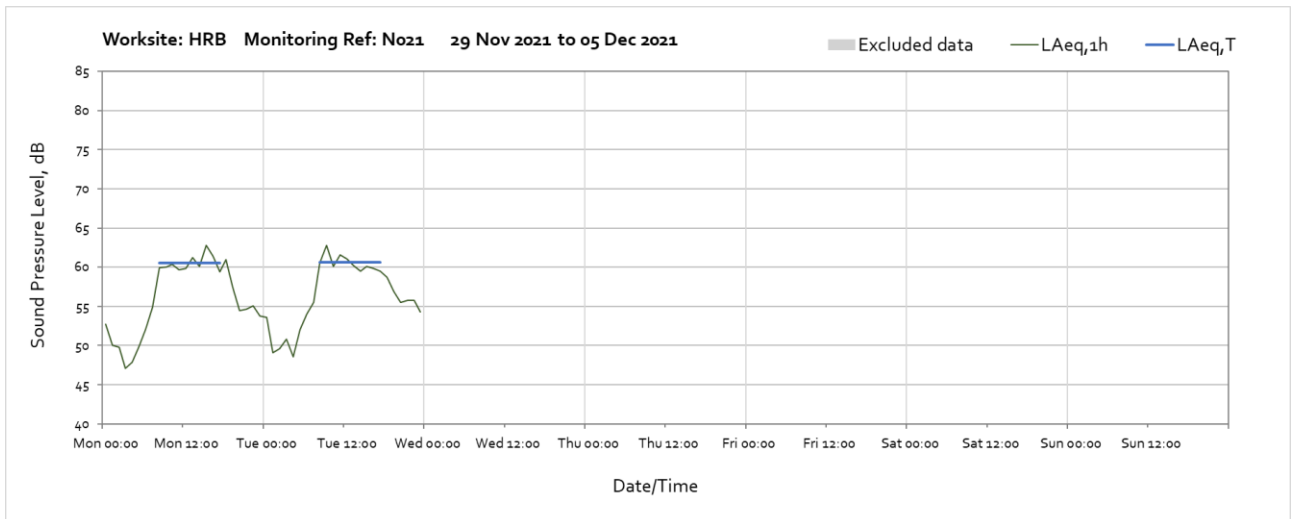
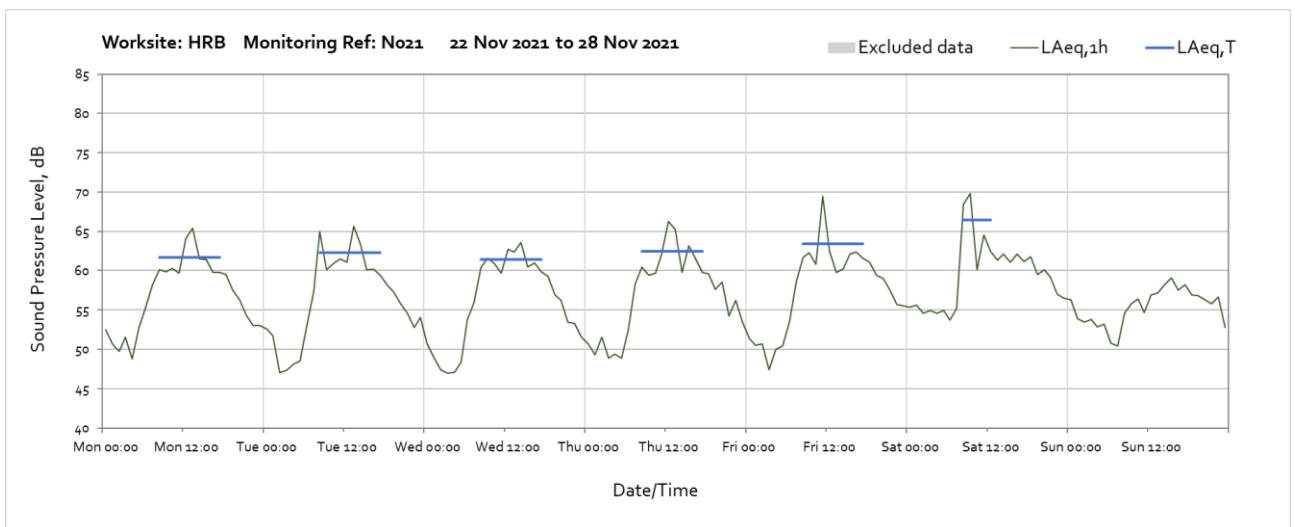
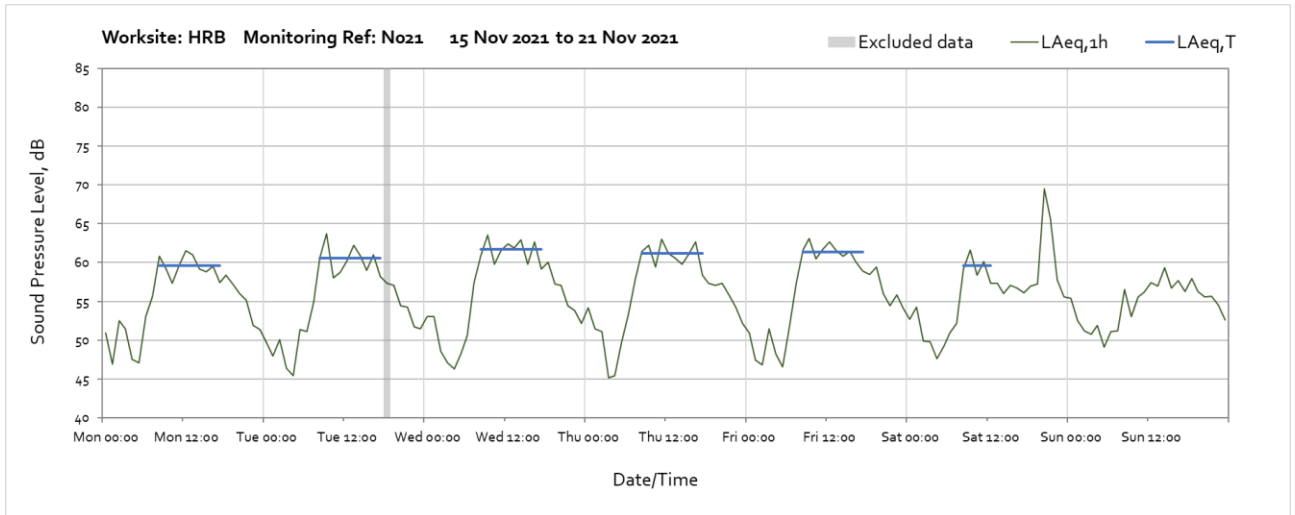




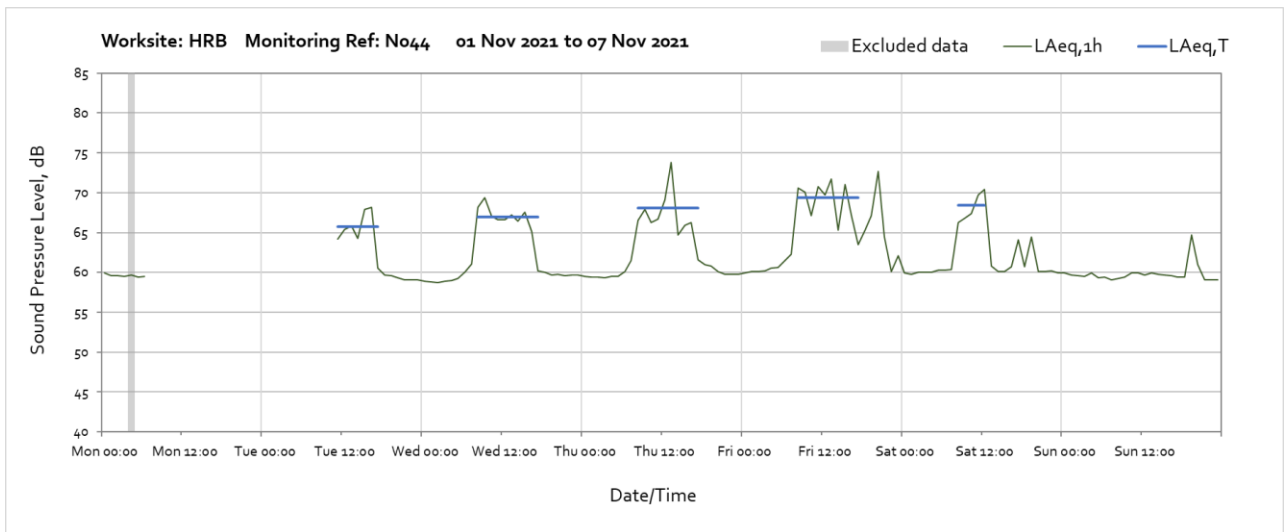


**Worksite: HRB – Monitoring Ref: N021**

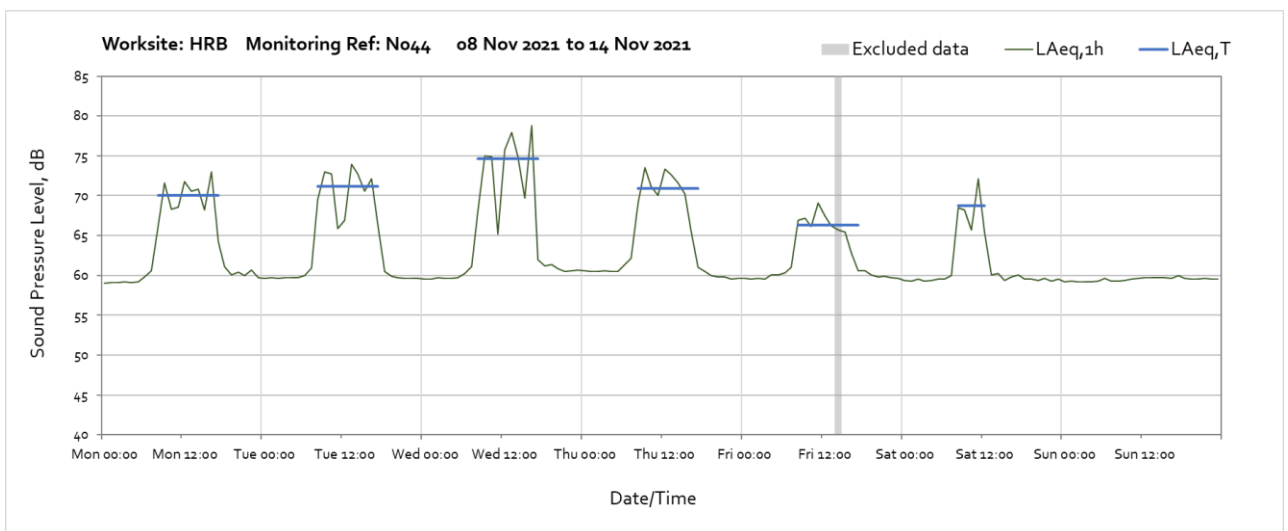




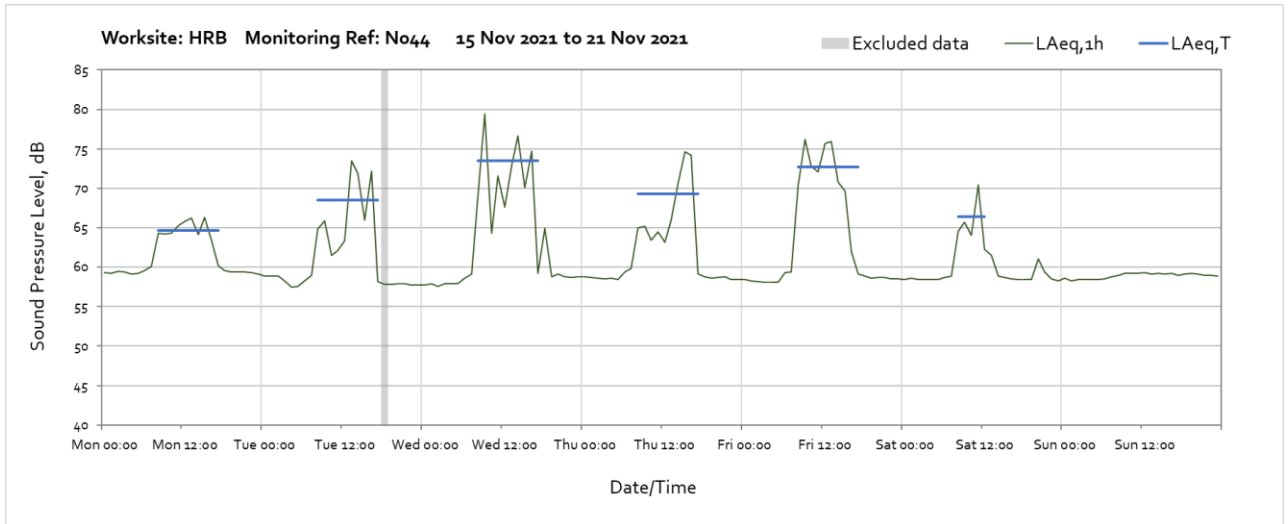
## Worksite: HRB – Monitoring Ref: N044



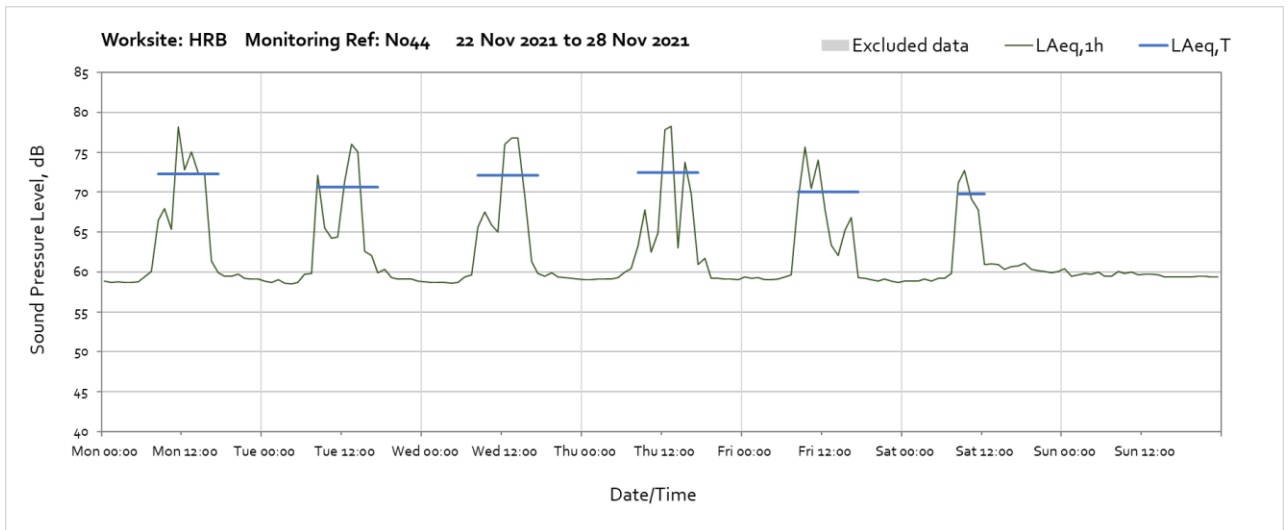
Note: Missing data from 07:00 on Monday 1<sup>st</sup> November until 11:00 on Tuesday 2<sup>nd</sup> November was due to a loss of power to the monitor. Continuous noise levels measured throughout the week were caused by an operational generator near to the monitor. The nearest receptor is located further from the generator and will therefore experience lower noise levels.



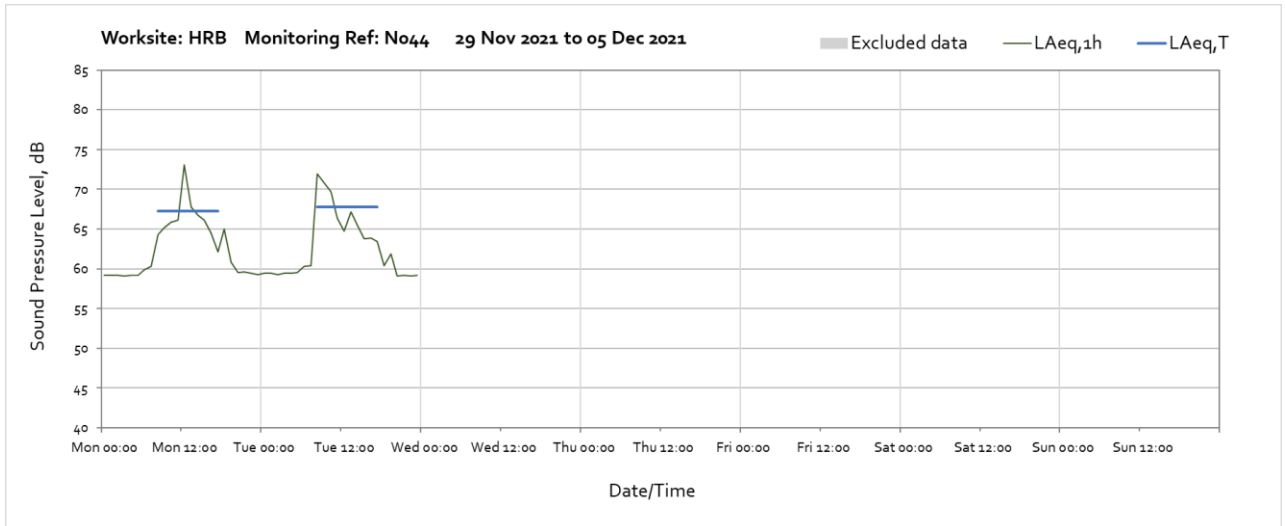
Note: Continuous noise levels measured throughout the week were caused by an operational generator near to the monitor. The nearest receptor is located further from the generator and will therefore experience lower noise levels.



Note: Continuous noise levels measured throughout the week were caused by an operational generator near to the monitor. The nearest receptor is located further from the generator and will therefore experience lower noise levels.

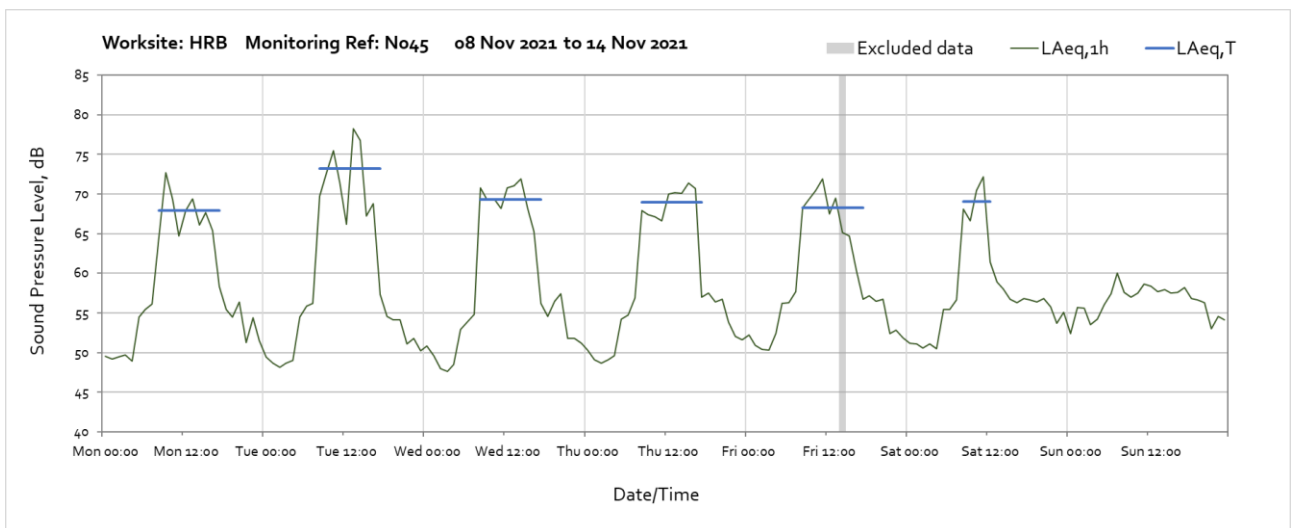
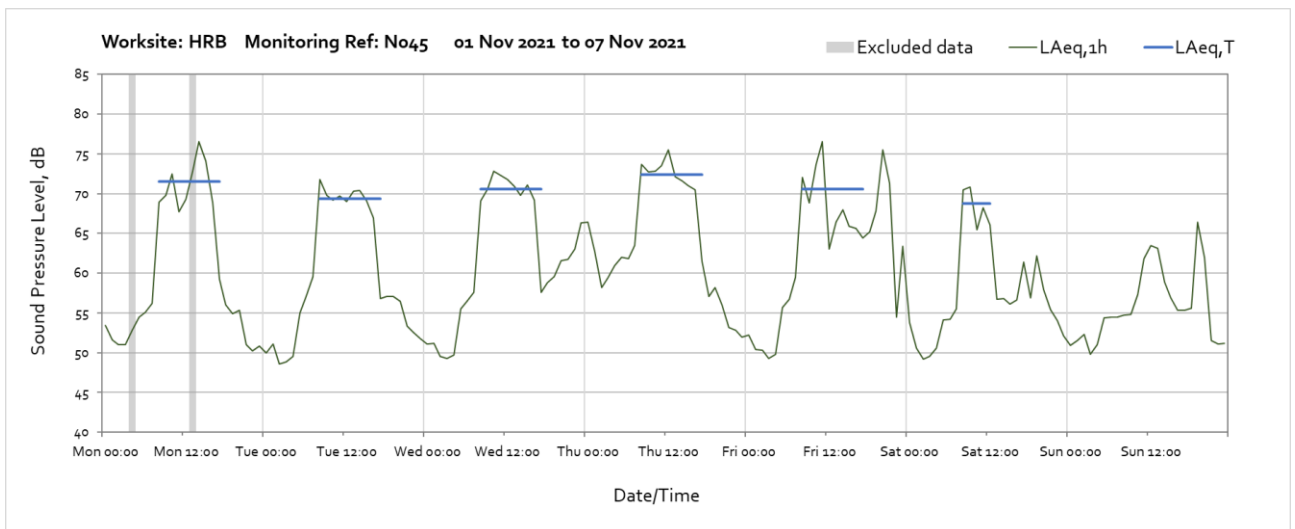


Note: Continuous noise levels measured throughout the week were caused by an operational generator near to the monitor. The nearest receptor is located further from the generator and will therefore experience lower noise levels.

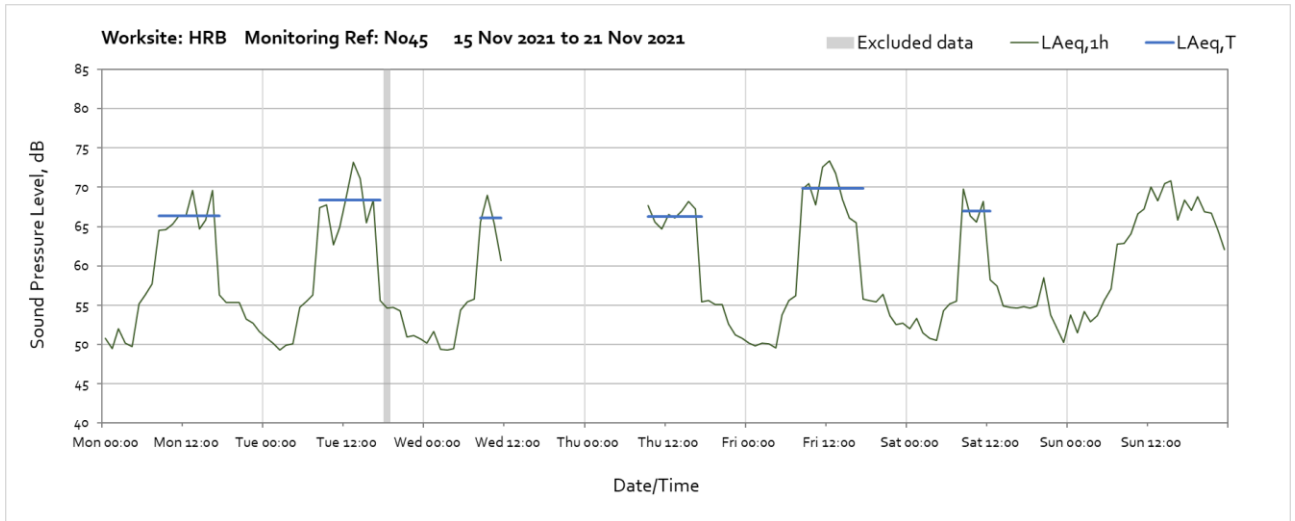


Note: Continuous noise levels measured throughout the week were caused by an operational generator near to the monitor. The nearest receptor is located further from the generator and will therefore experience lower noise levels.

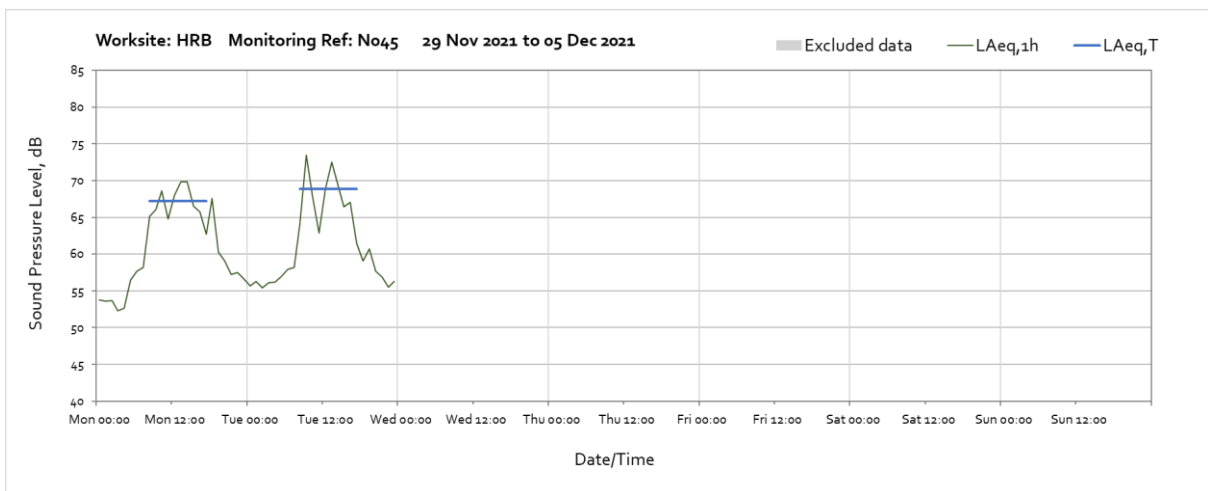
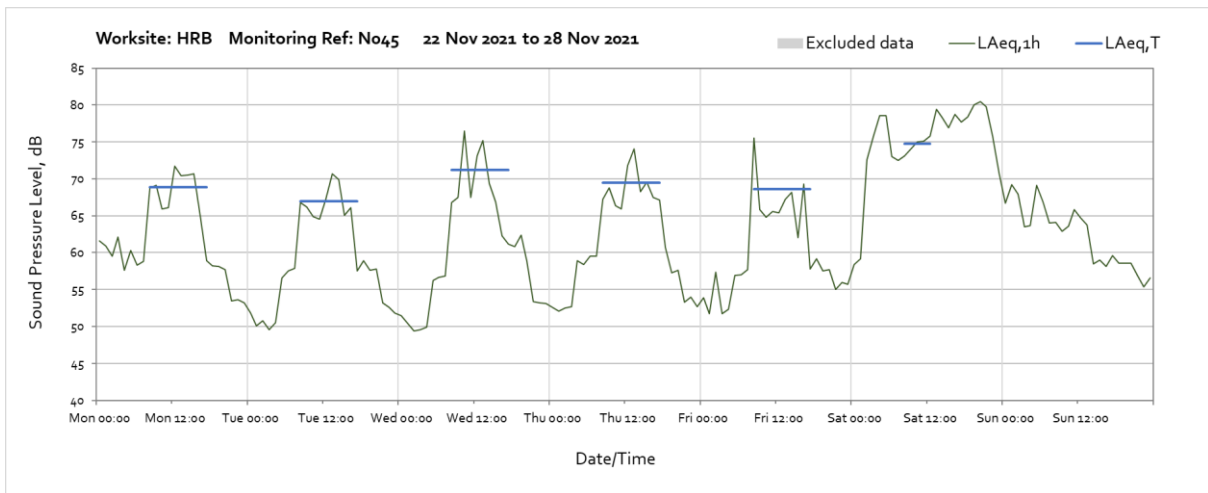
### Worksite: HRB – Monitoring Ref: N045



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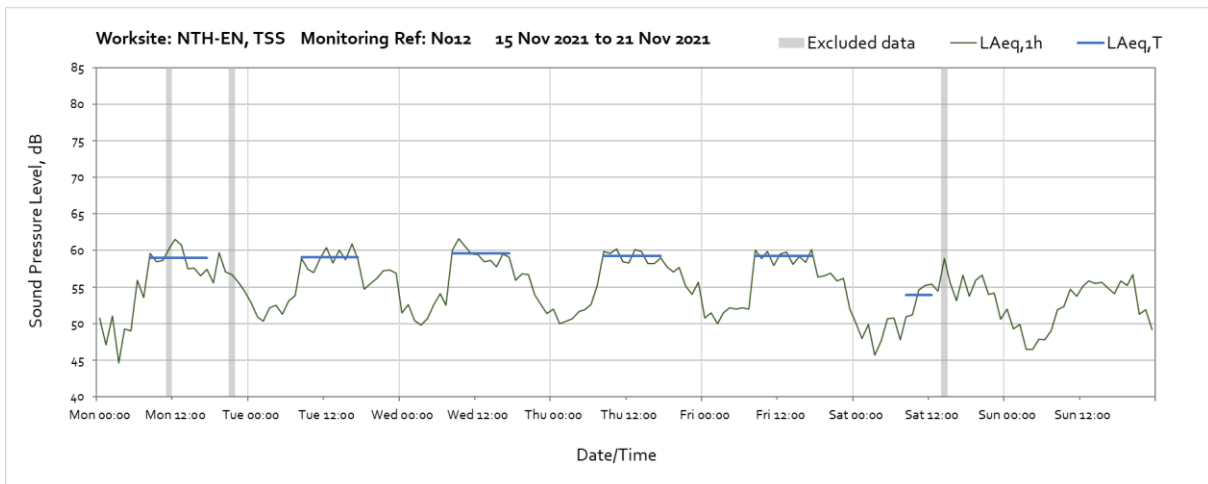
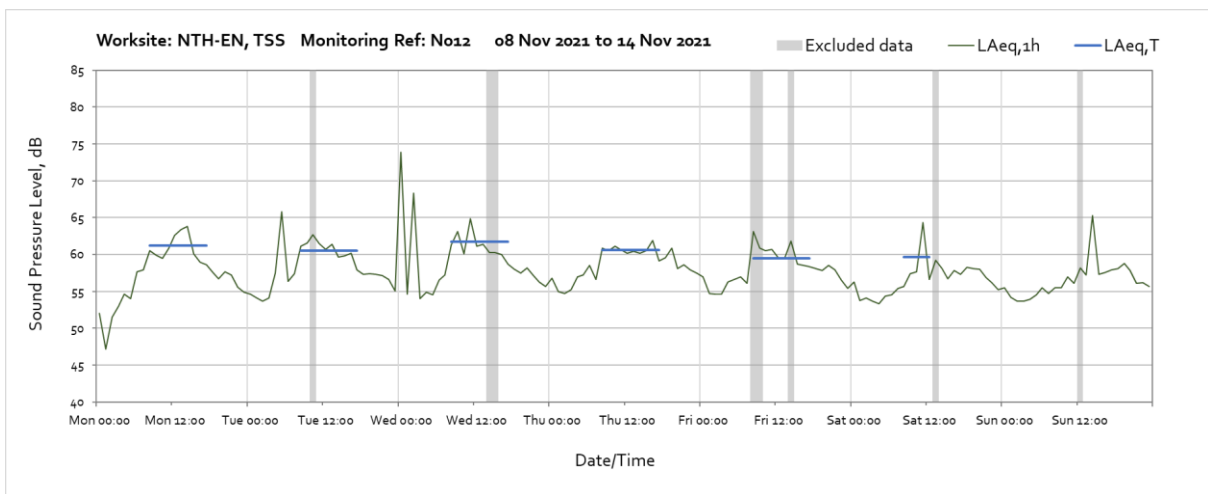
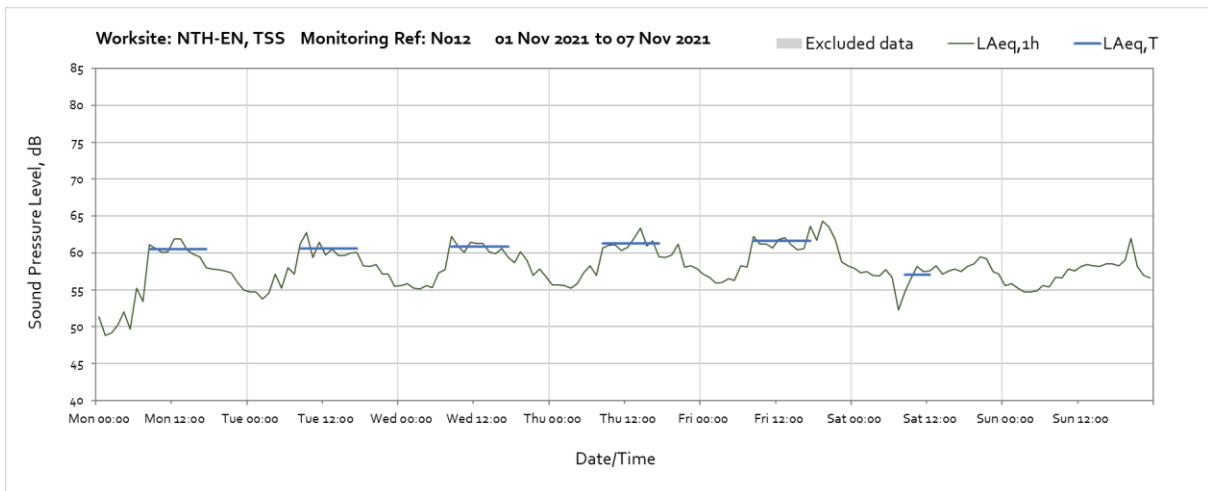


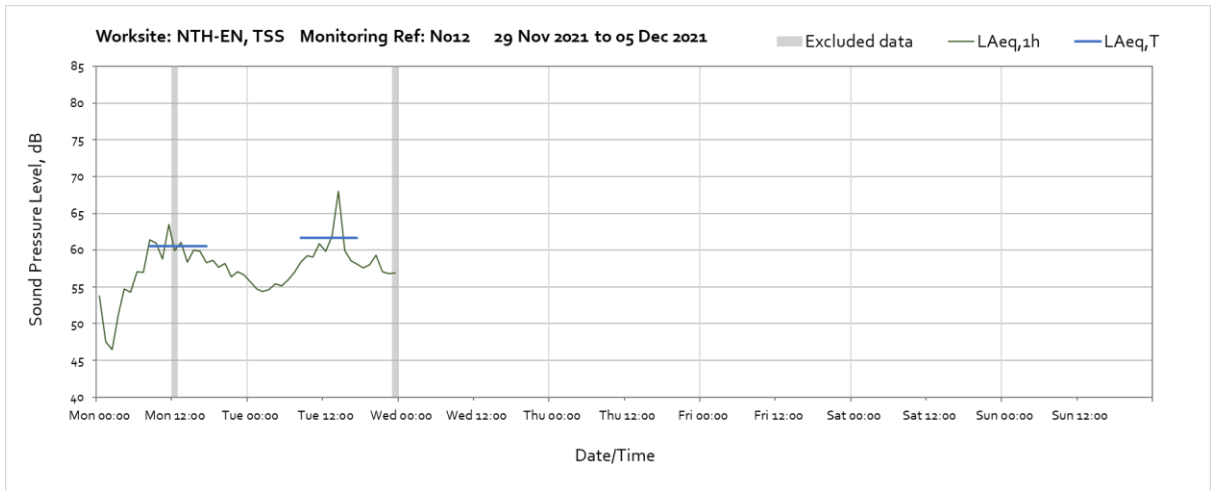
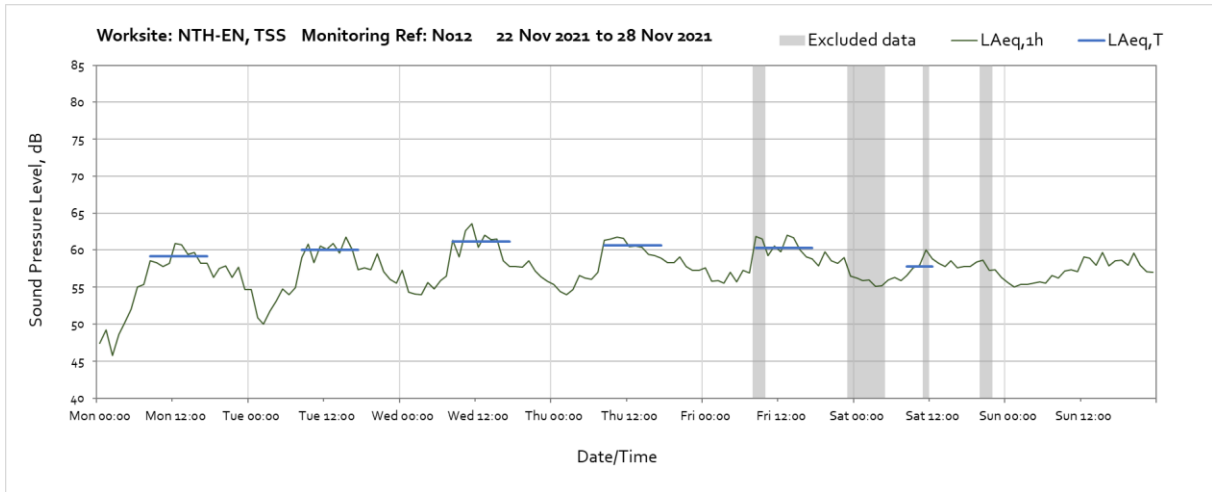
Note: Missing data from 12:00 on Wednesday 17<sup>th</sup> November until 09:00 on Thursday 3<sup>rd</sup> November was due to a monitor configuration error.



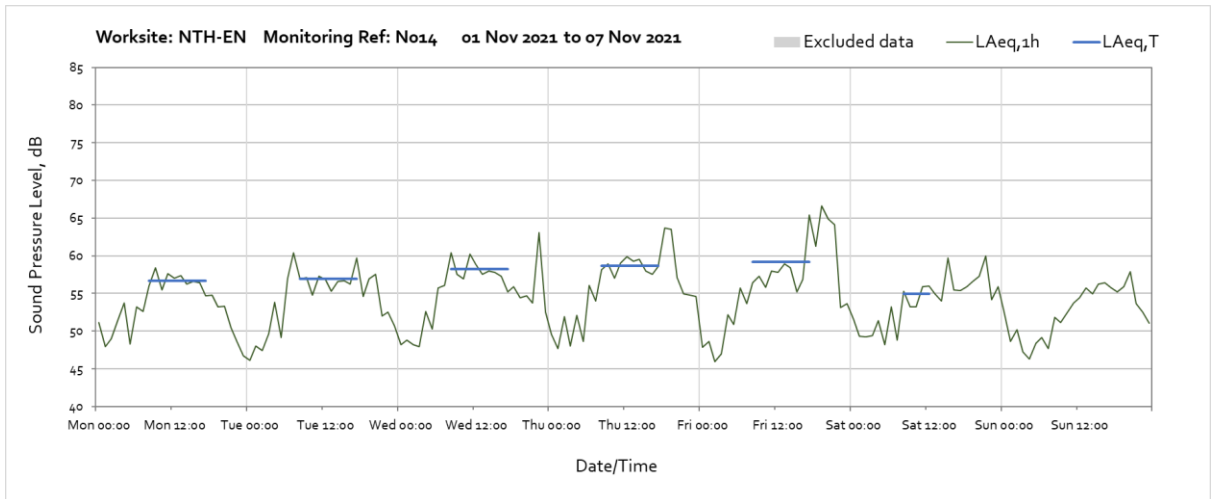


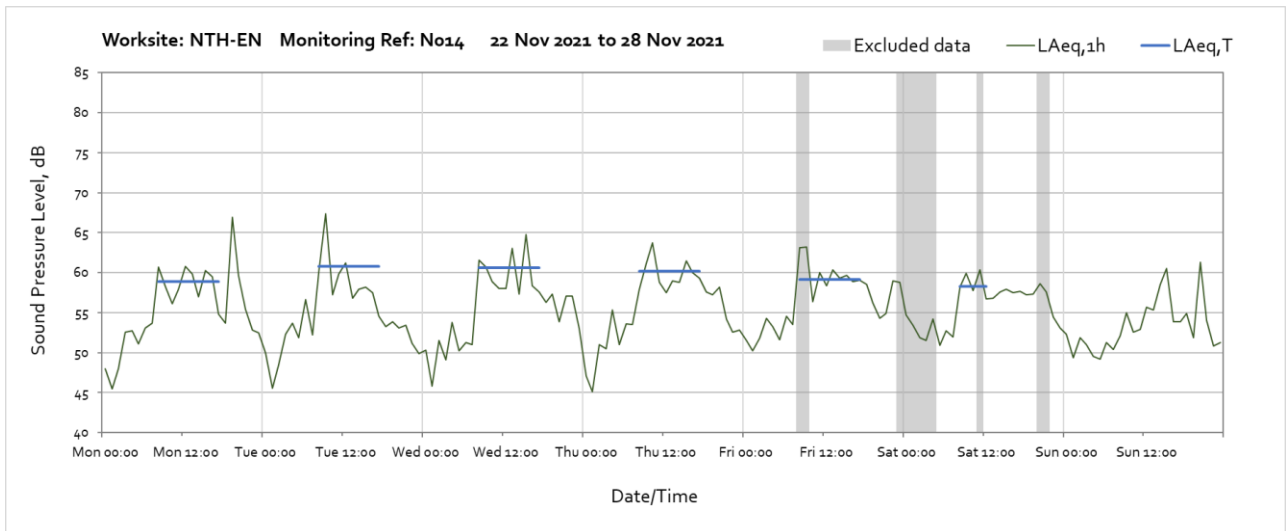
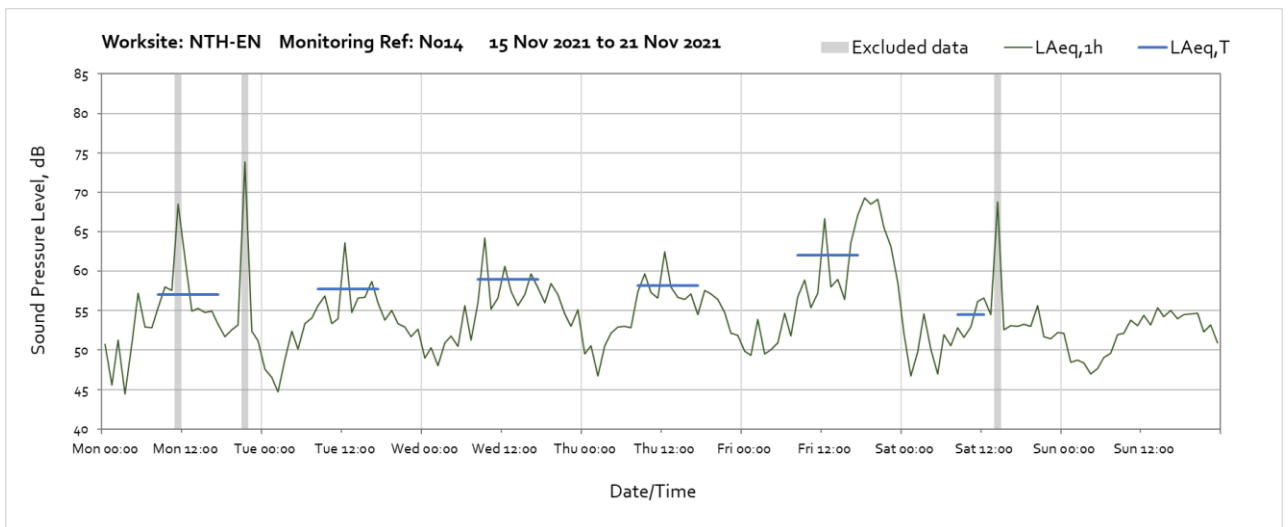
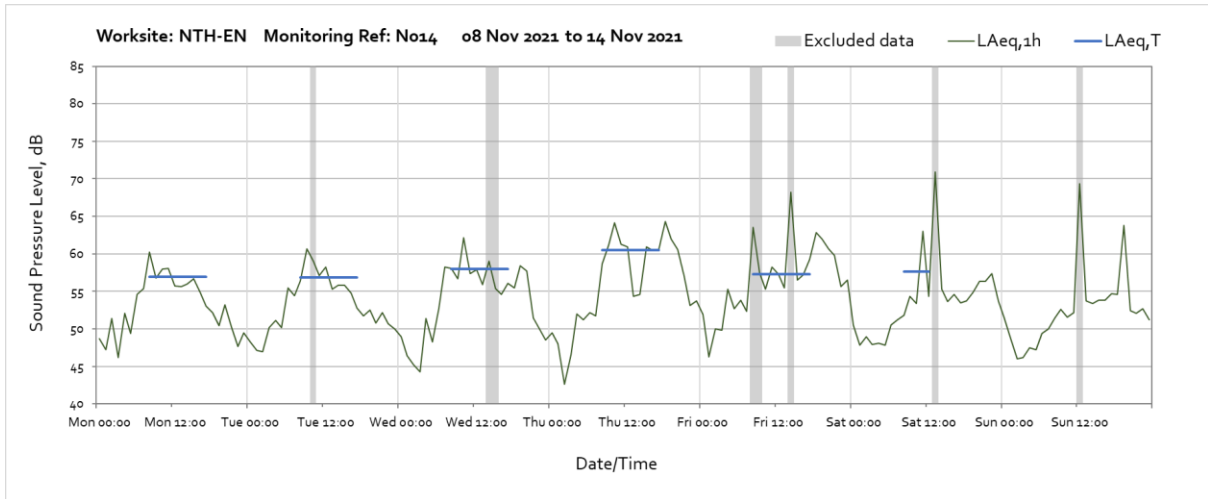
## Worksite: NTH-EN, TSS - Monitoring Ref: N012

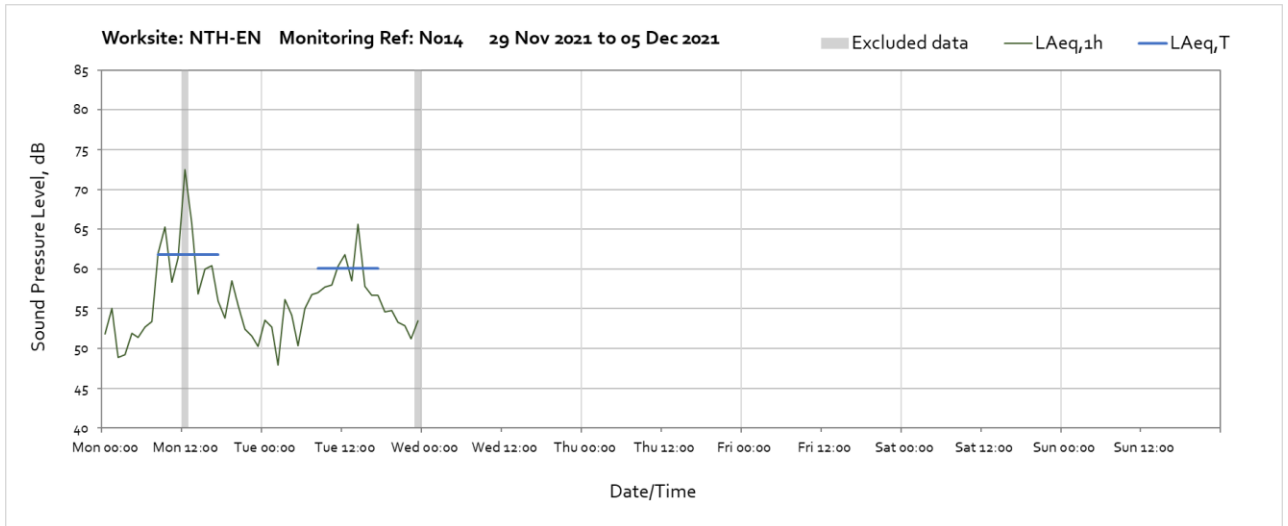




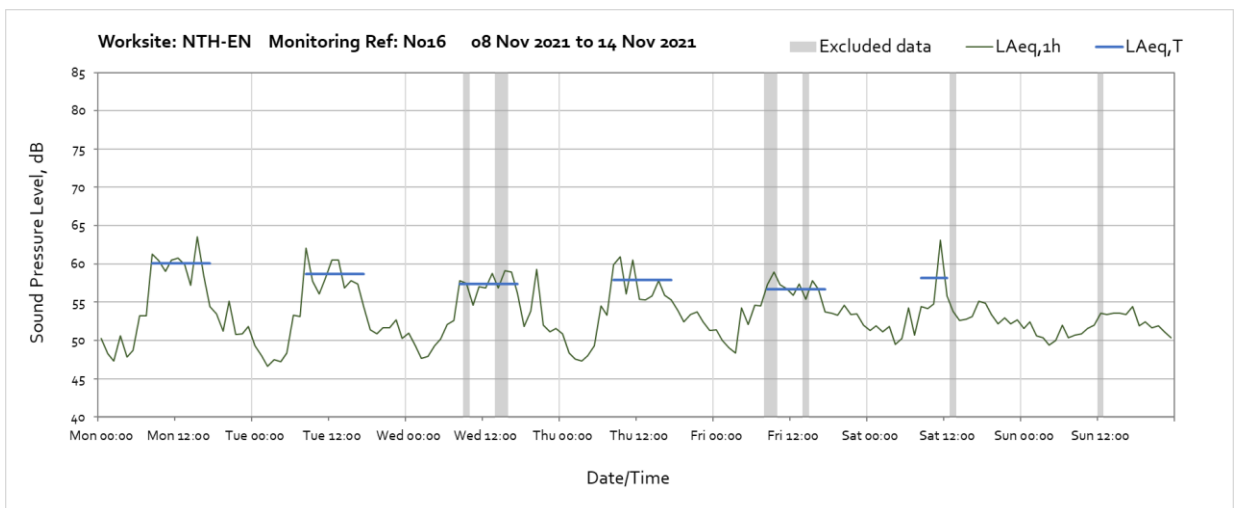
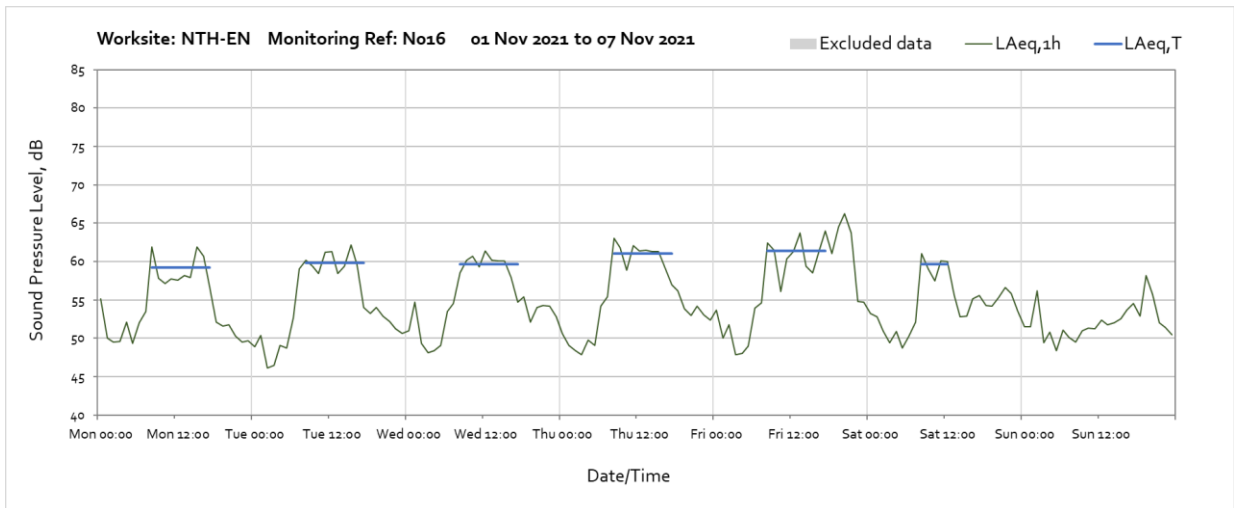
**Worksite: NTH-EN - Monitoring Ref: N014**

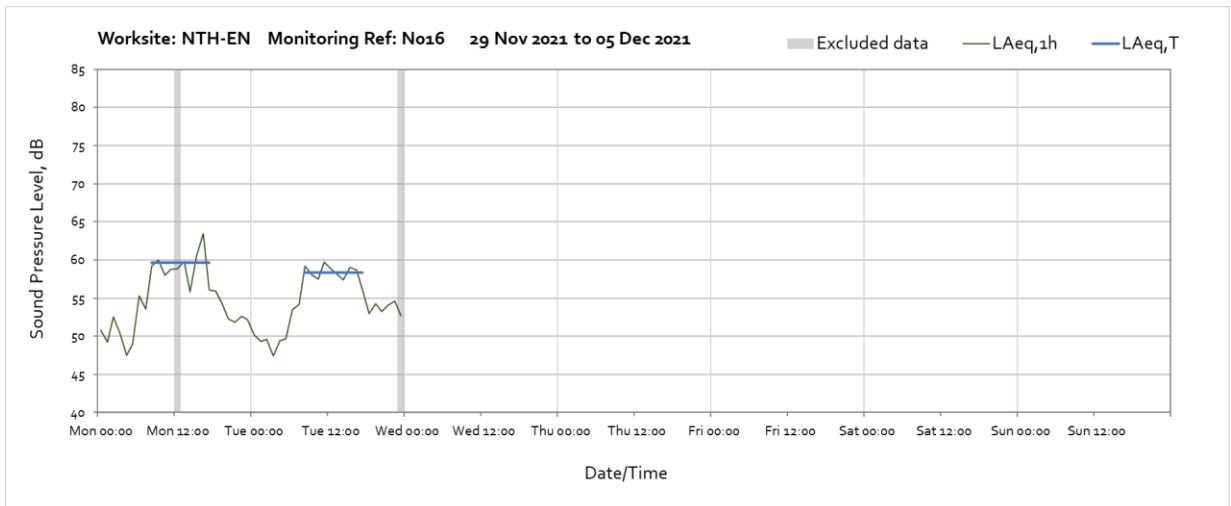
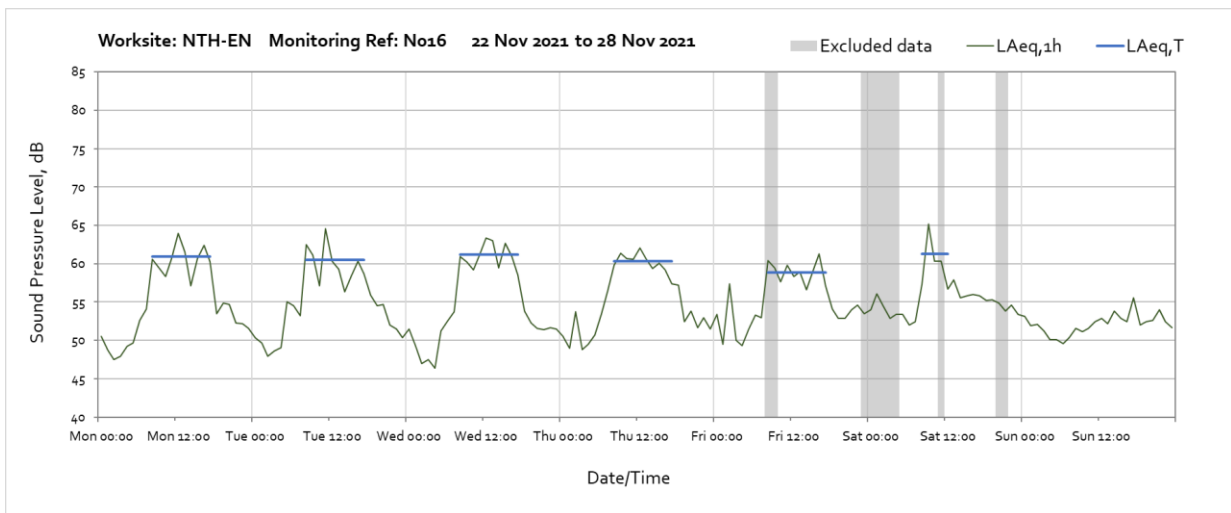
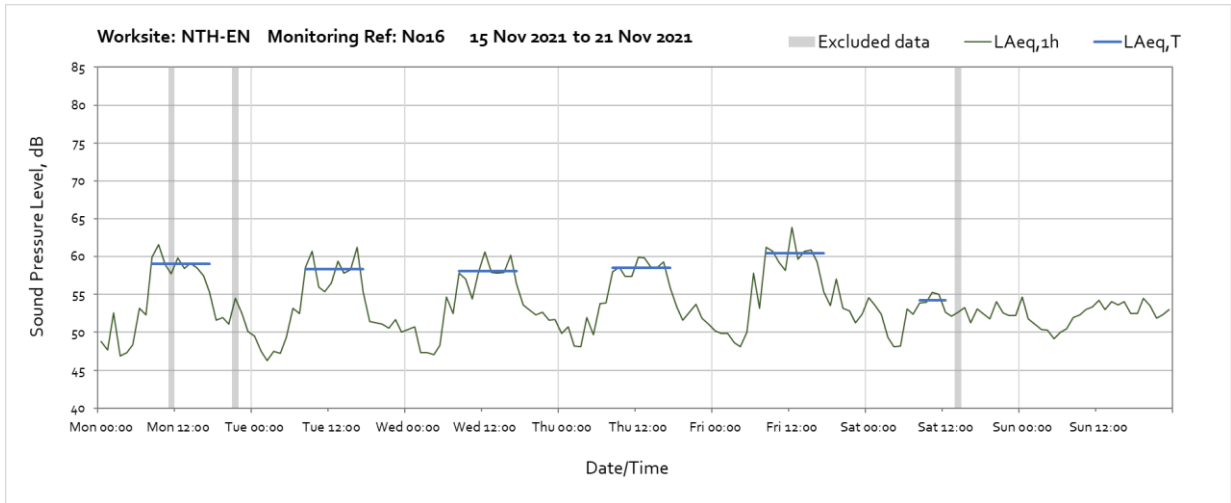




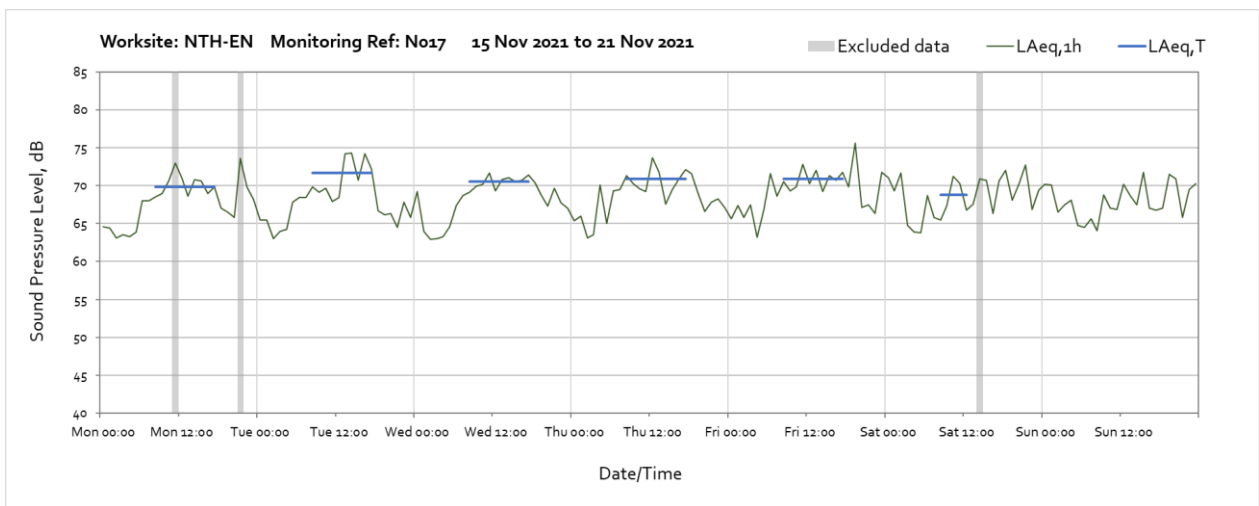
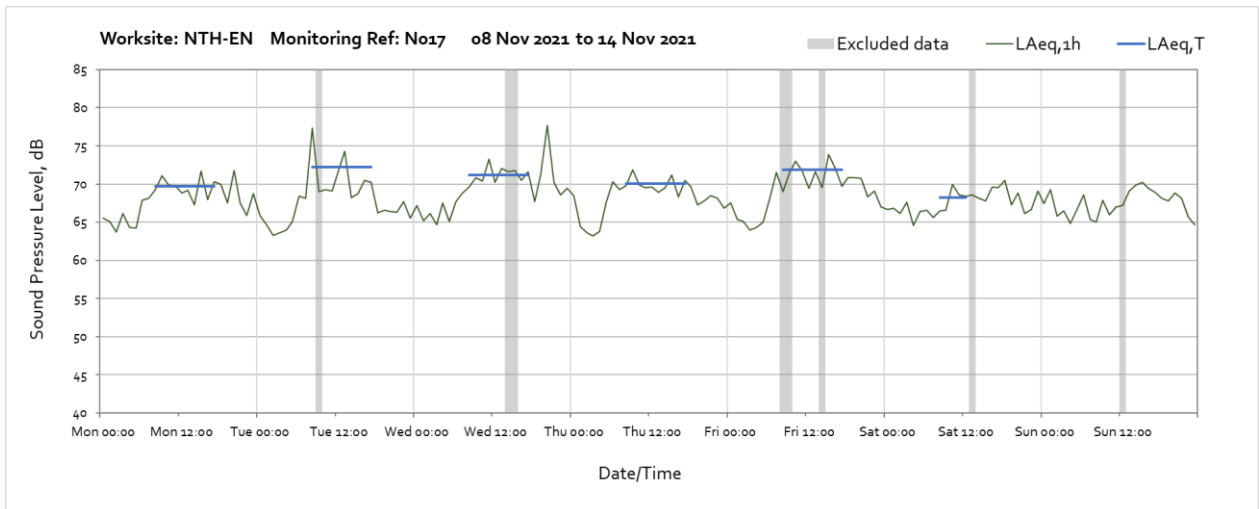
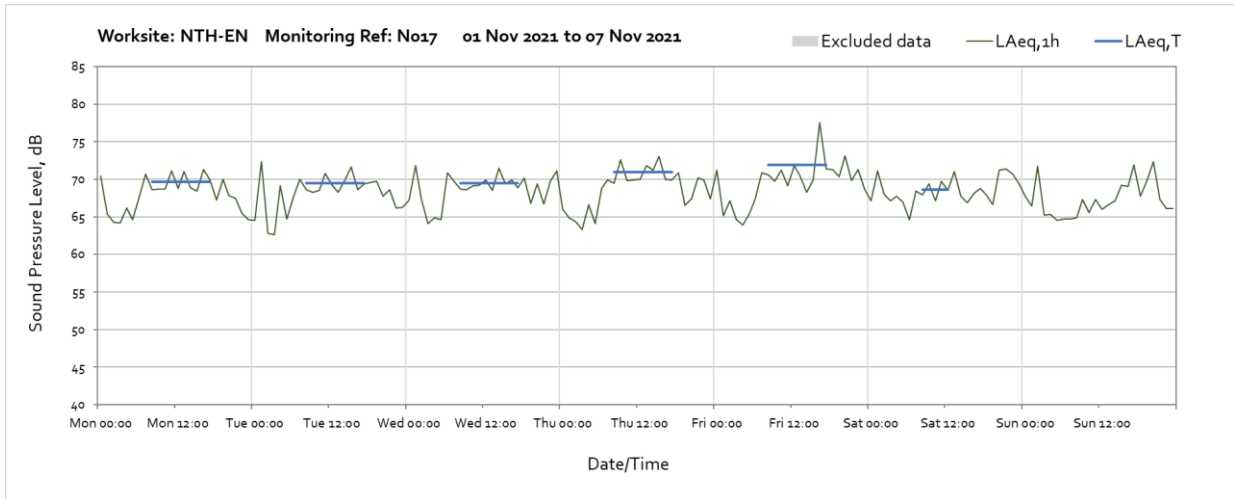


**Worksite: NTH-EN - Monitoring Ref: N016**

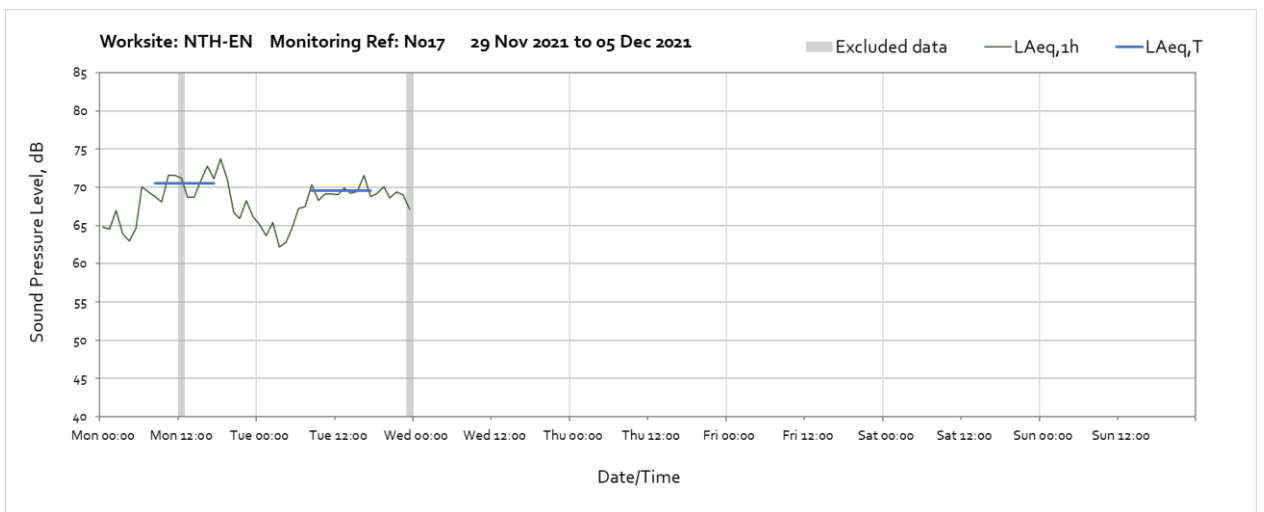
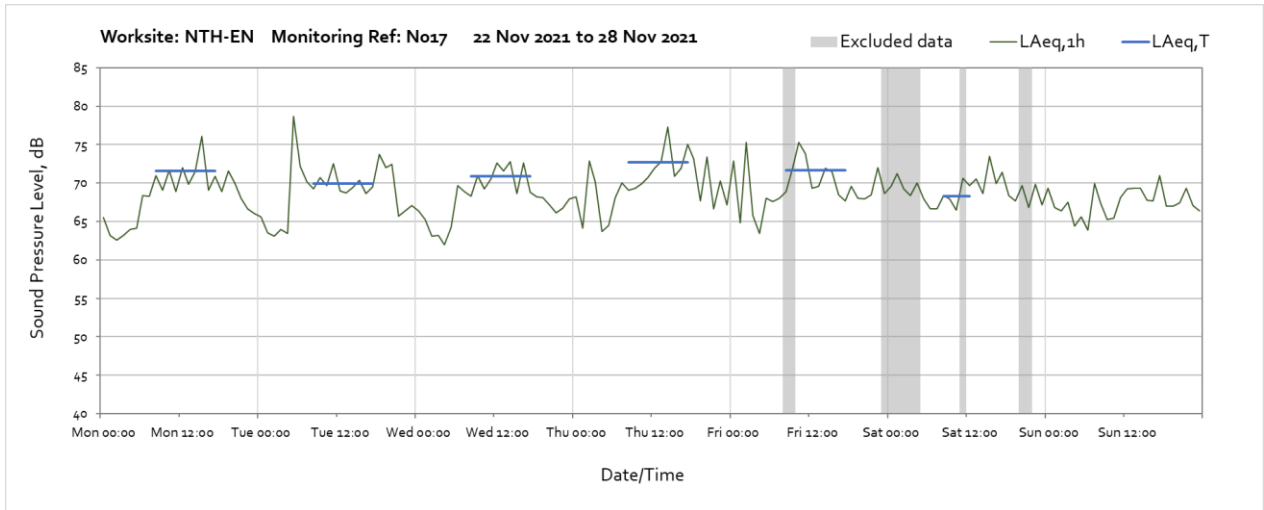




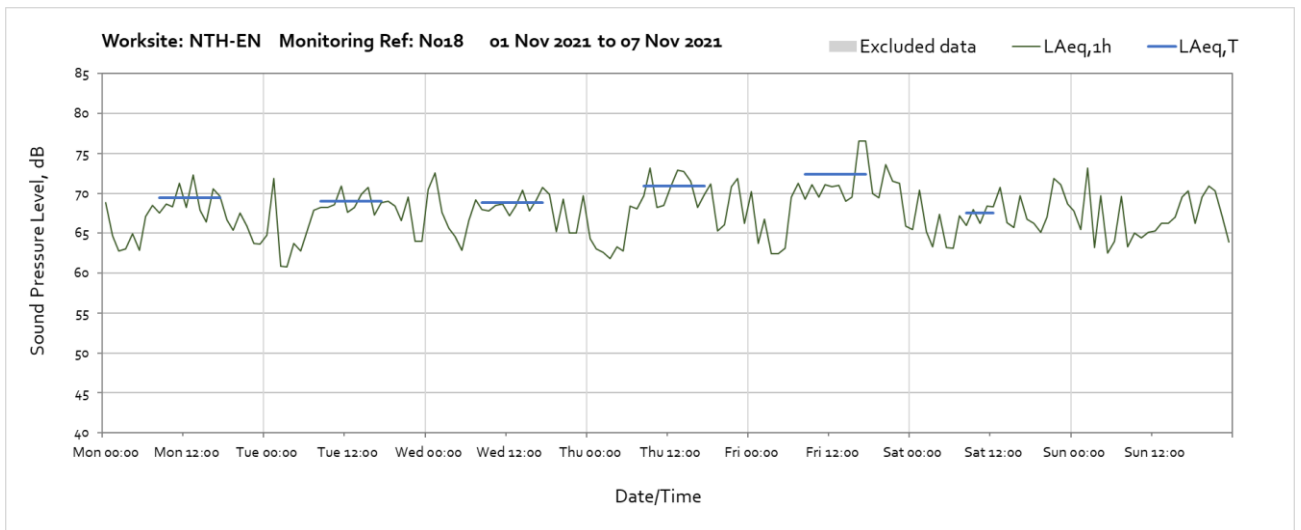
## Worksite: NTH-EN - Monitoring Ref: N017

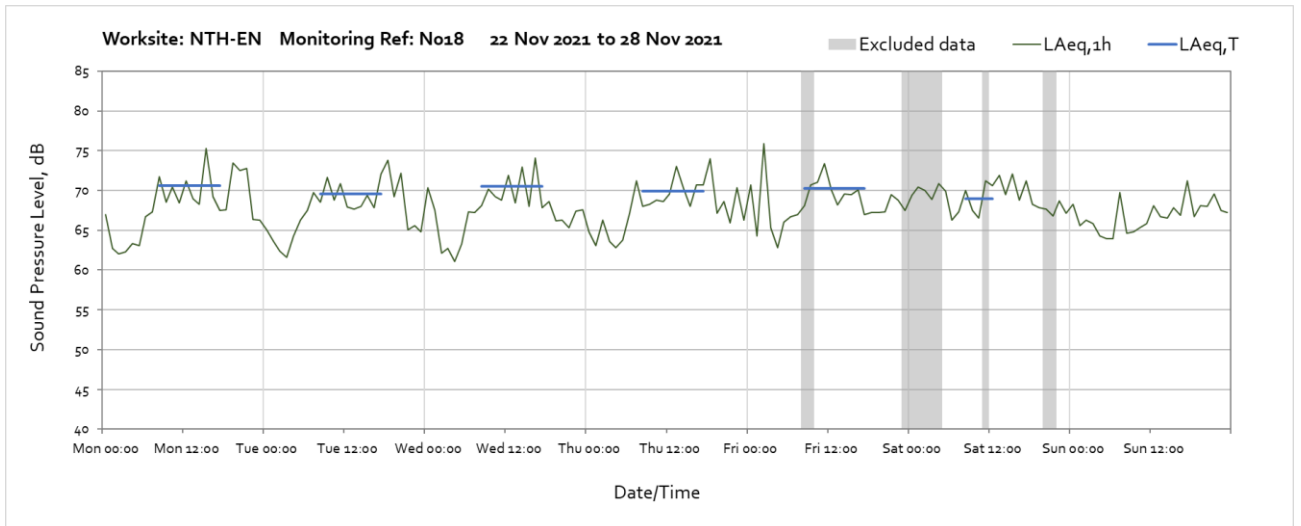
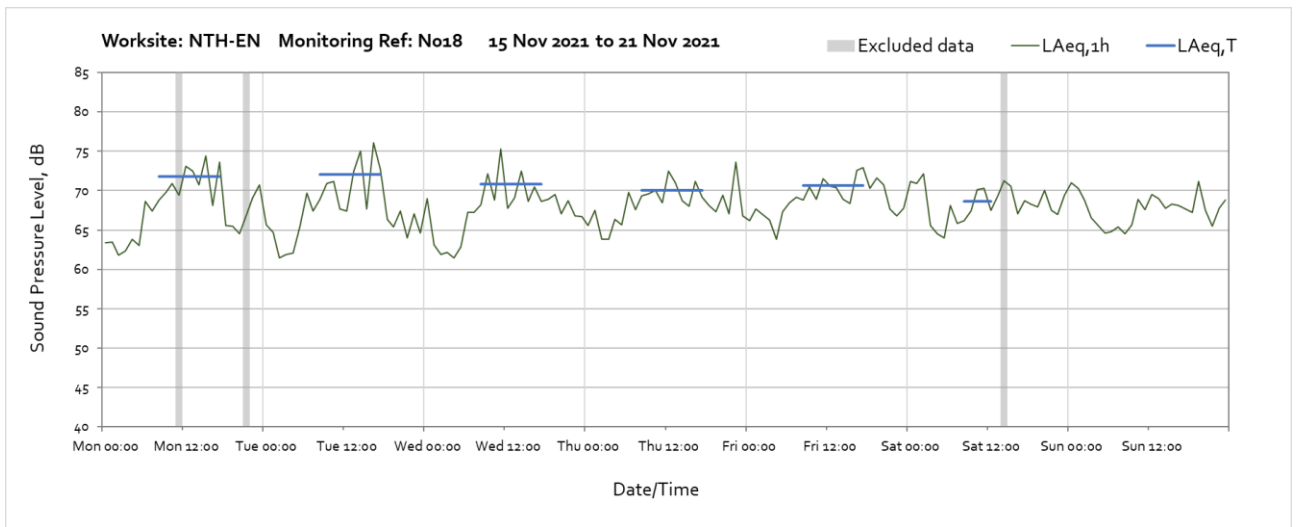
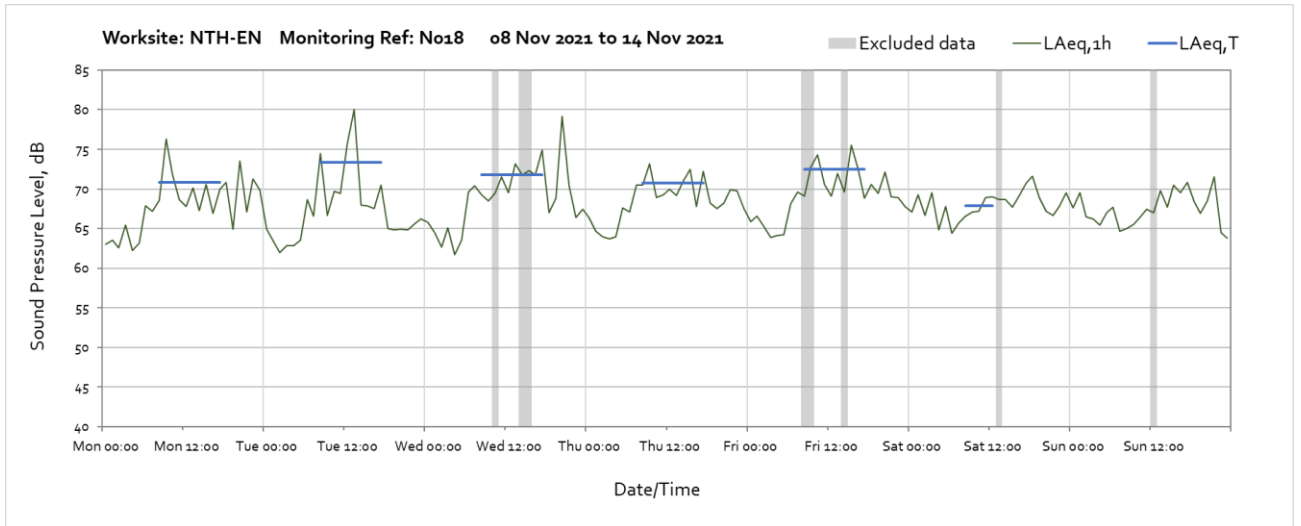


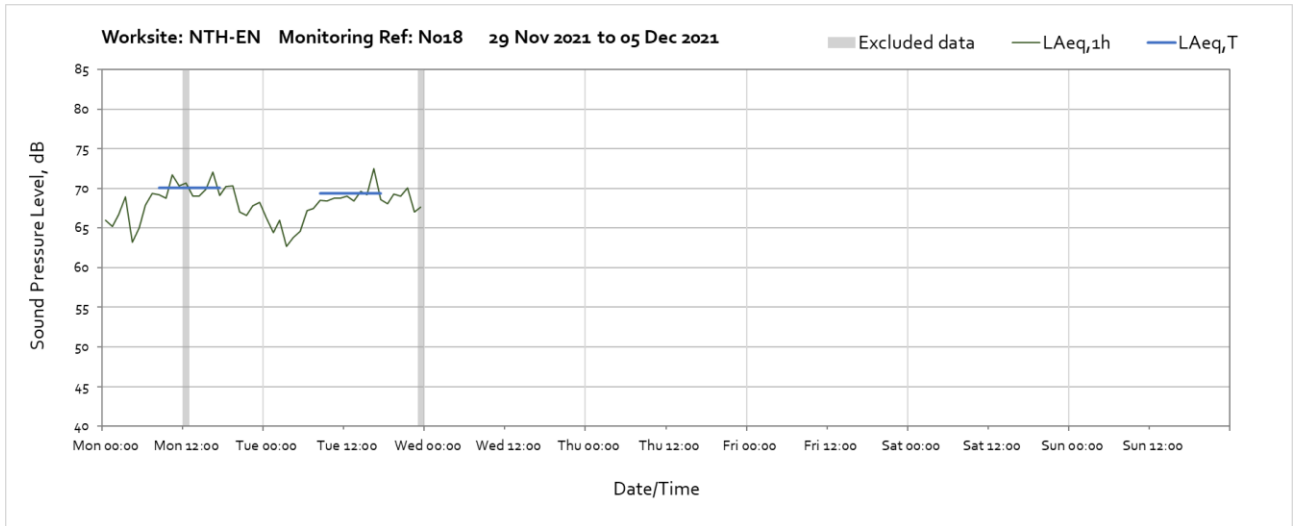




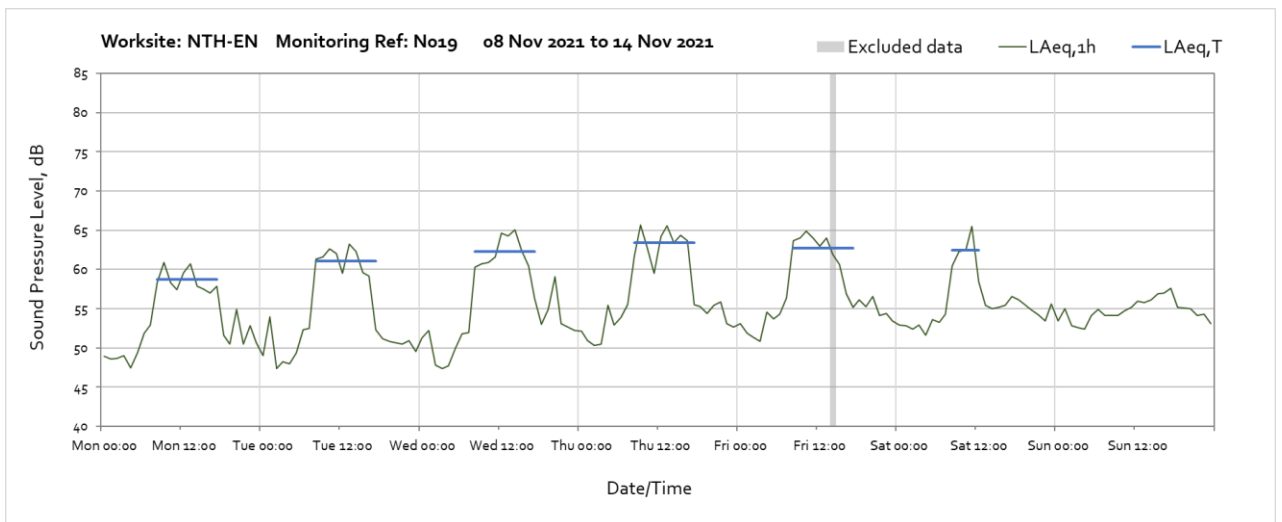
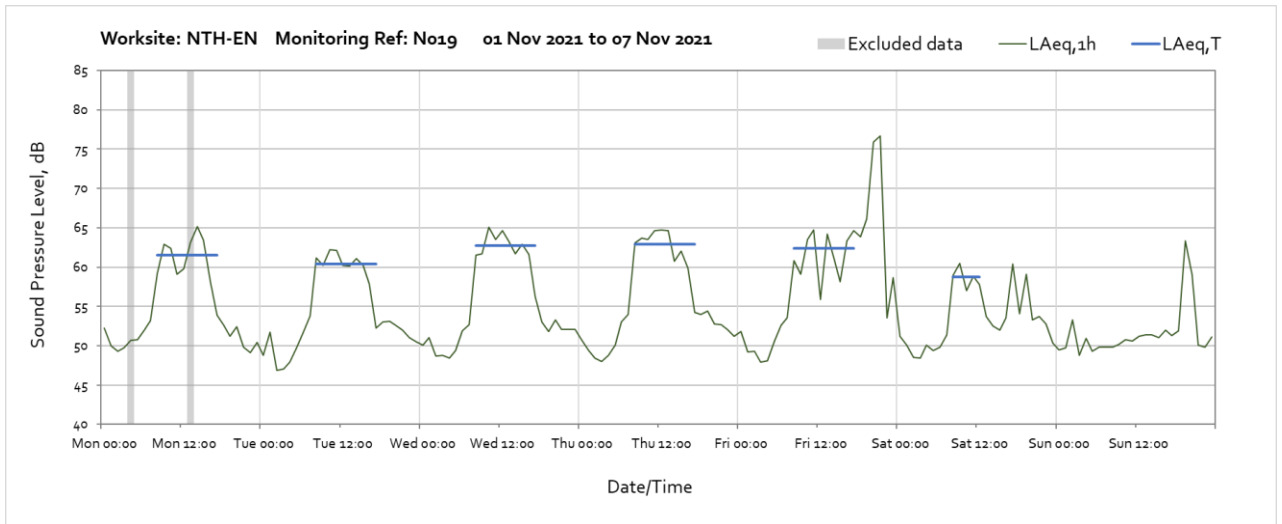
**Worksite: NTH-EN - Monitoring Ref: N018**

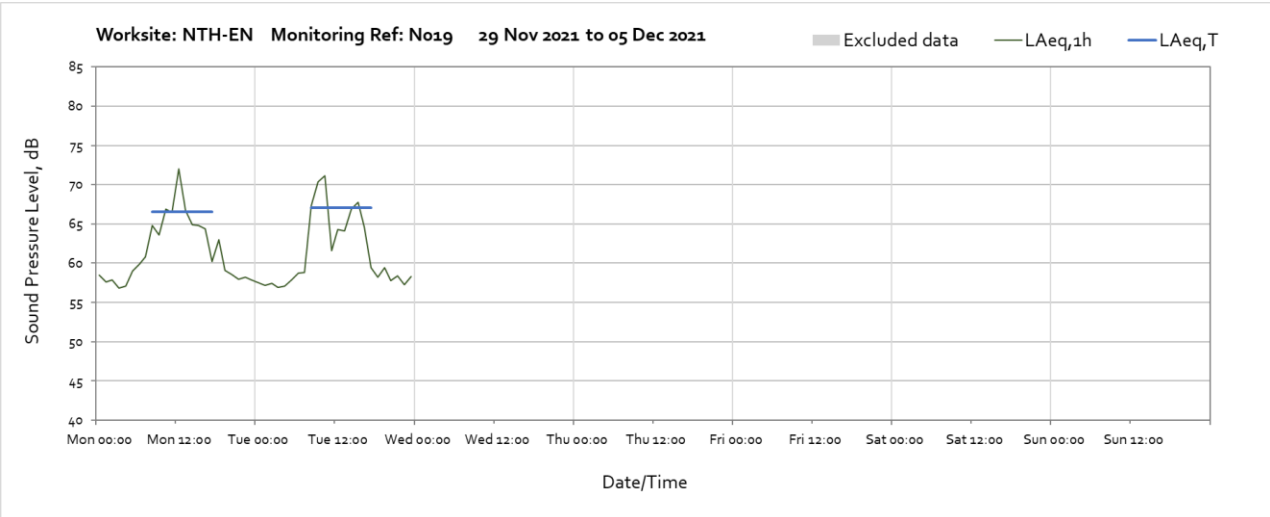
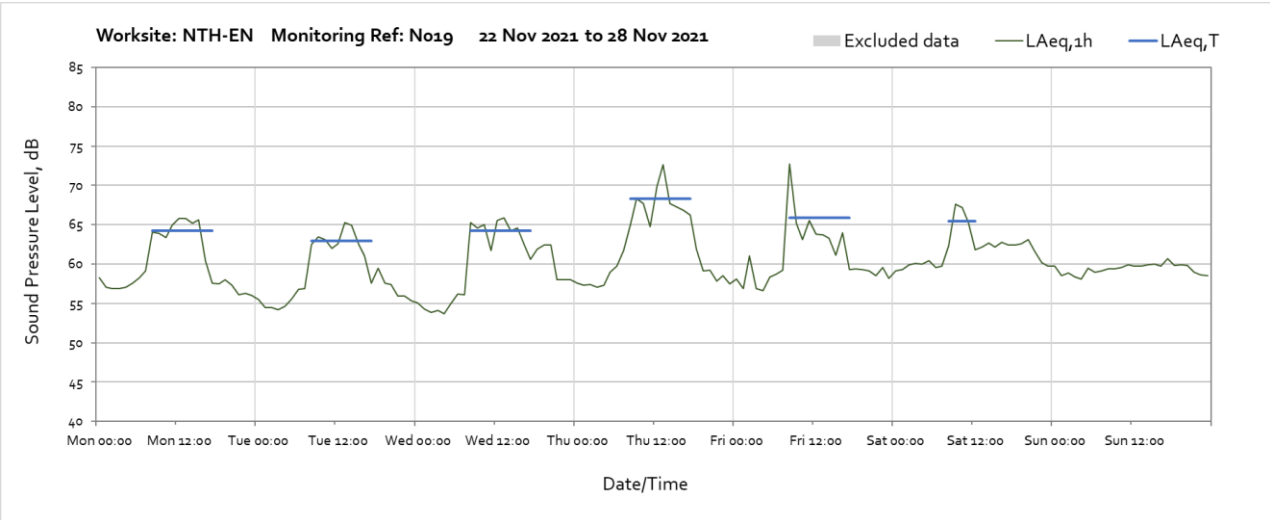
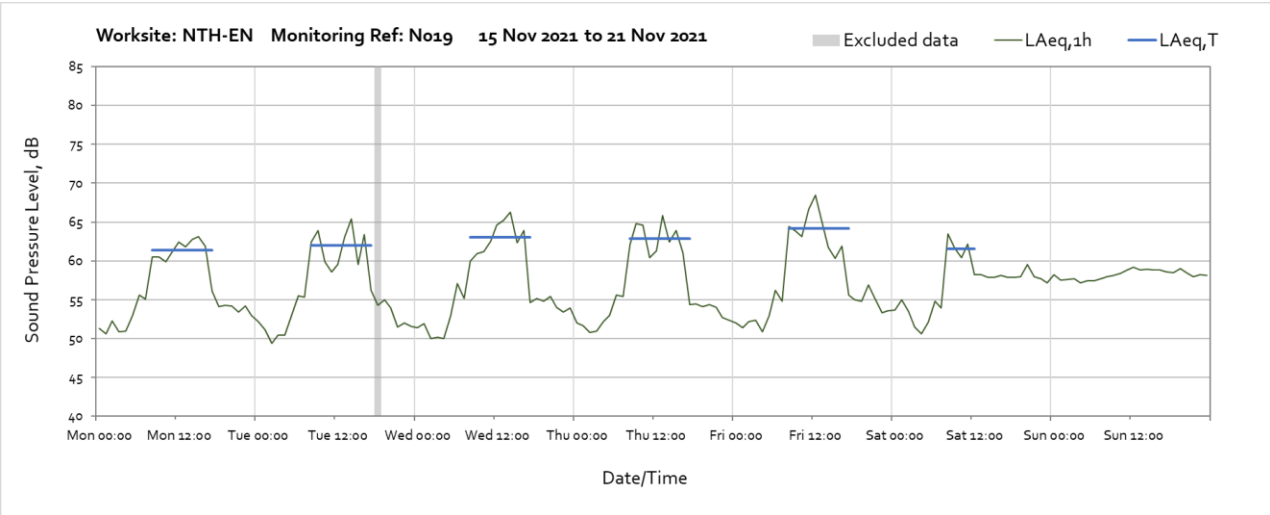




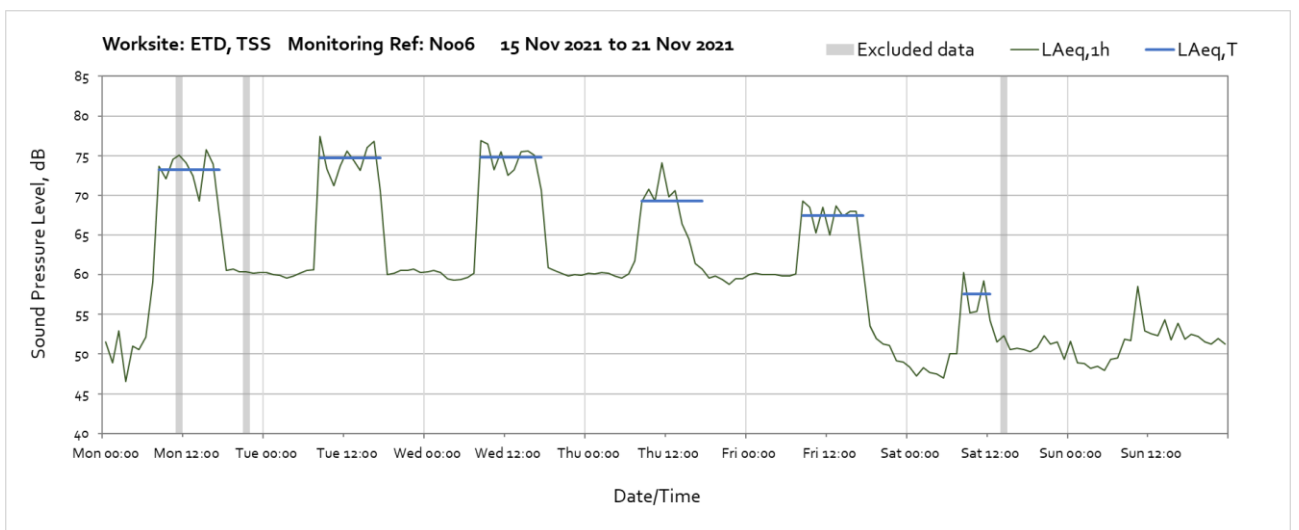
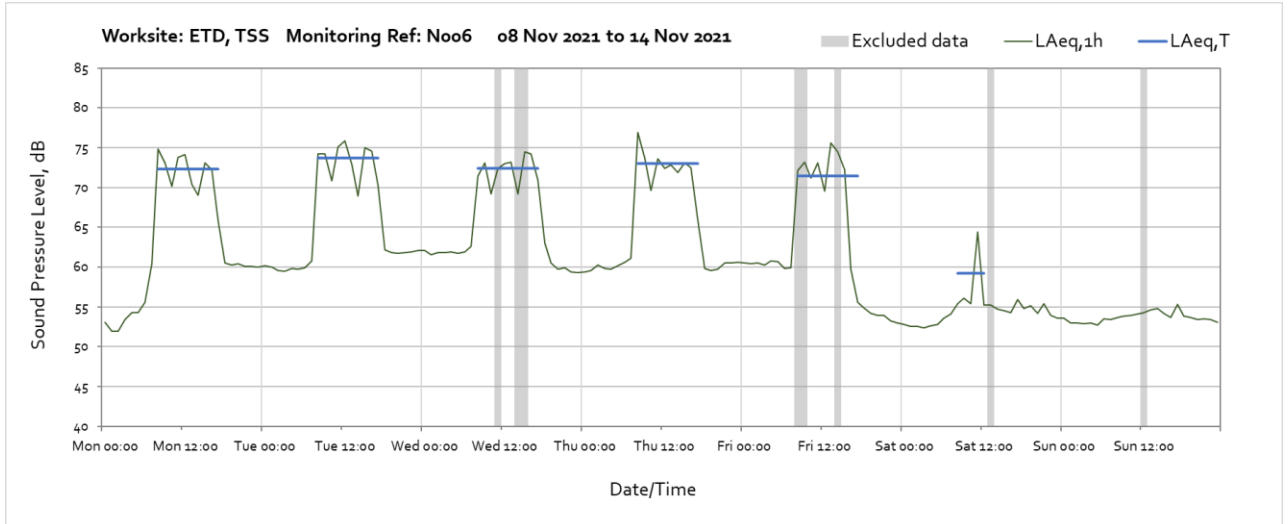
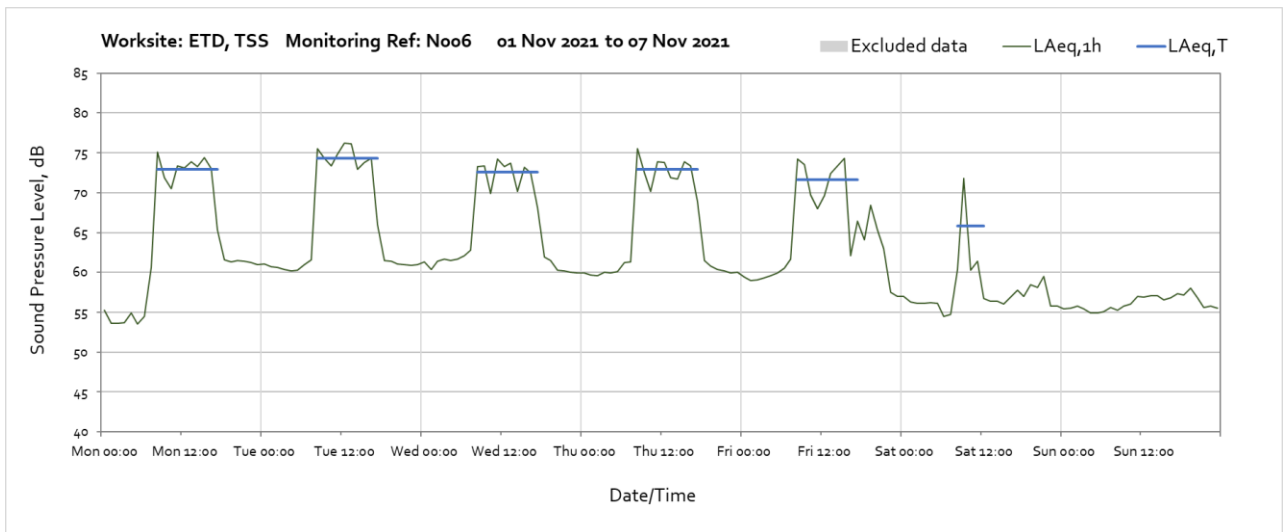


**Worksite: NTH-EN - Monitoring Ref: N019**

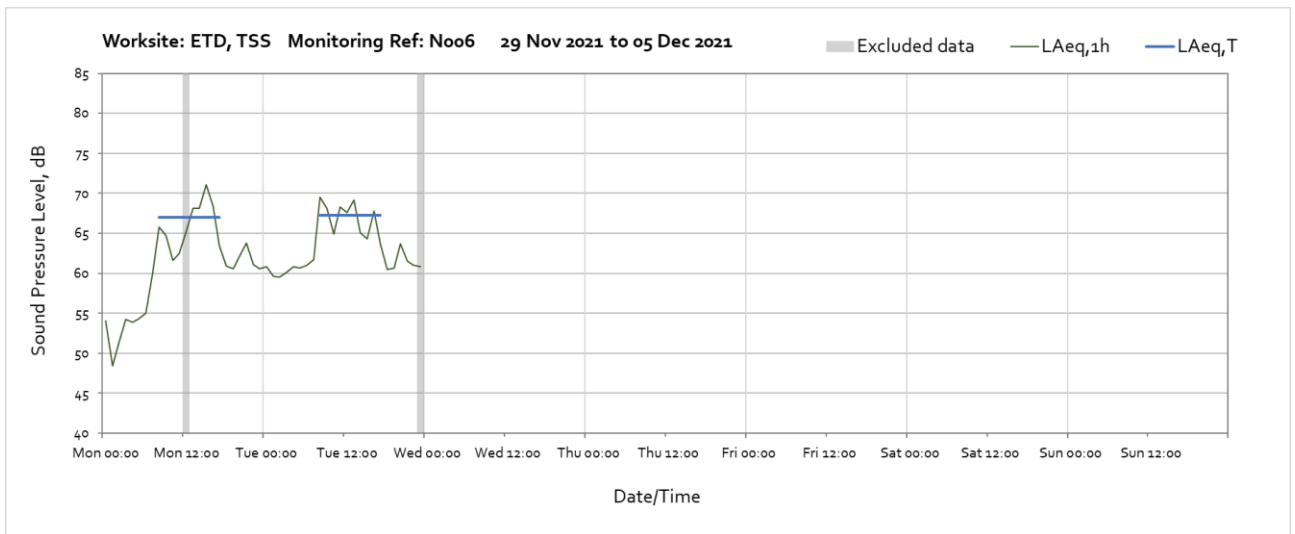
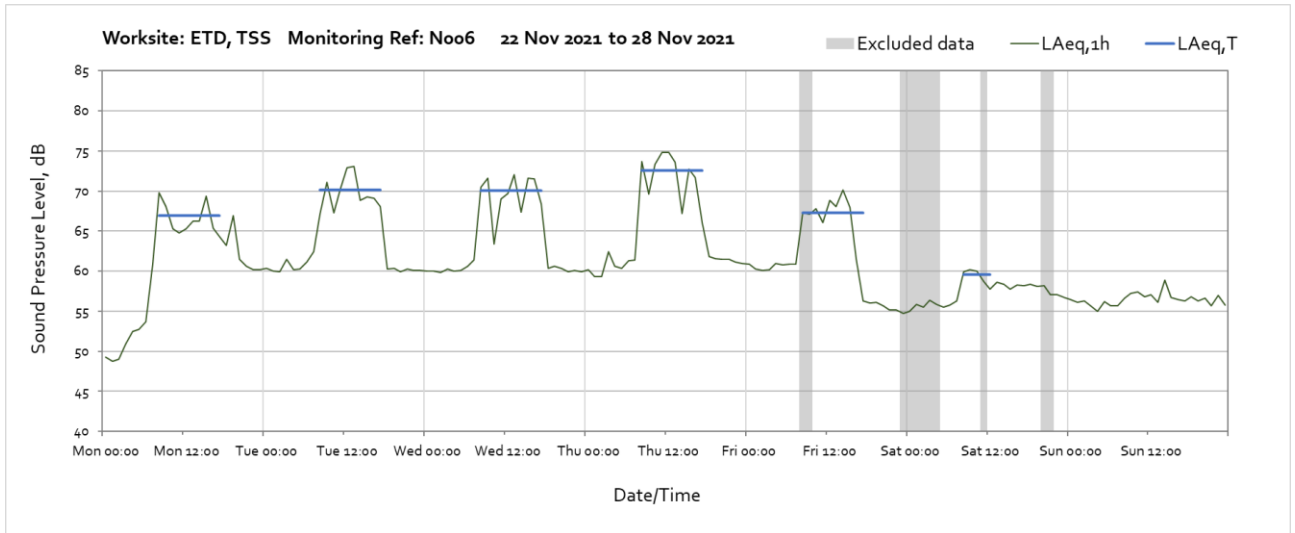




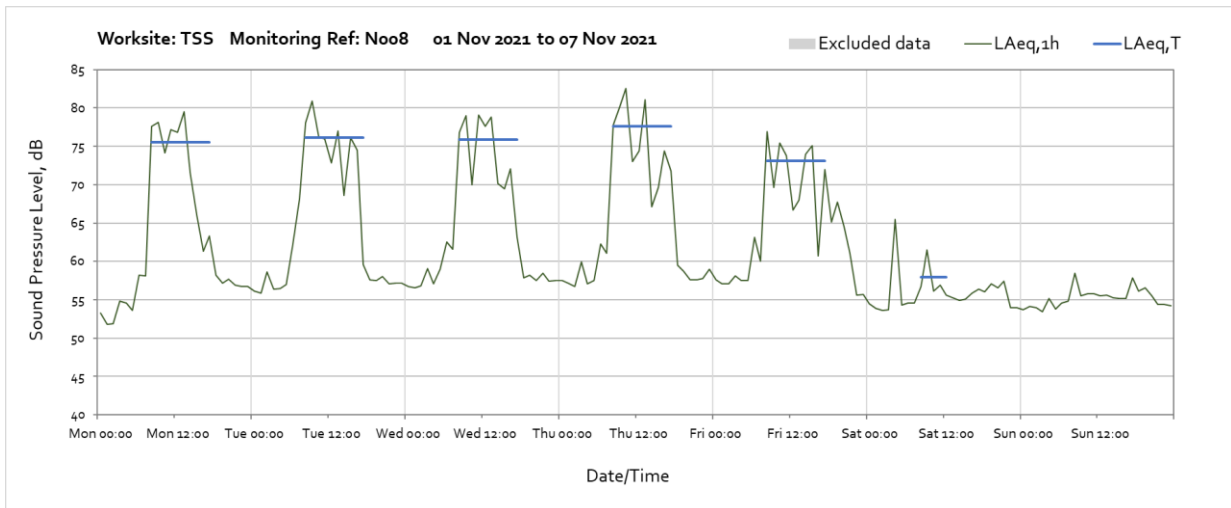
## Worksite: ETD, TSS – Monitoring Ref: N006

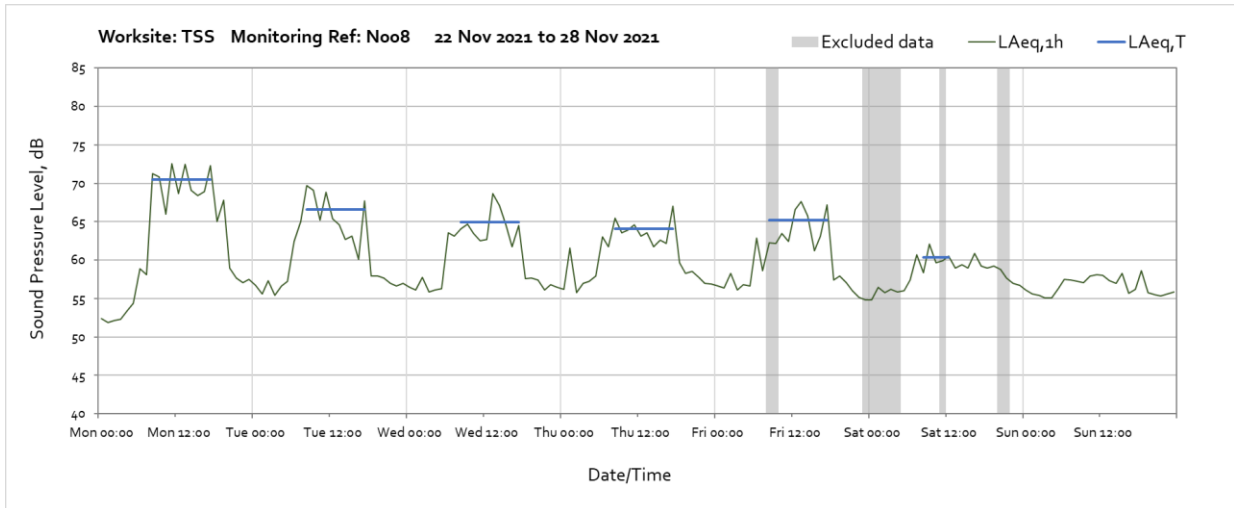
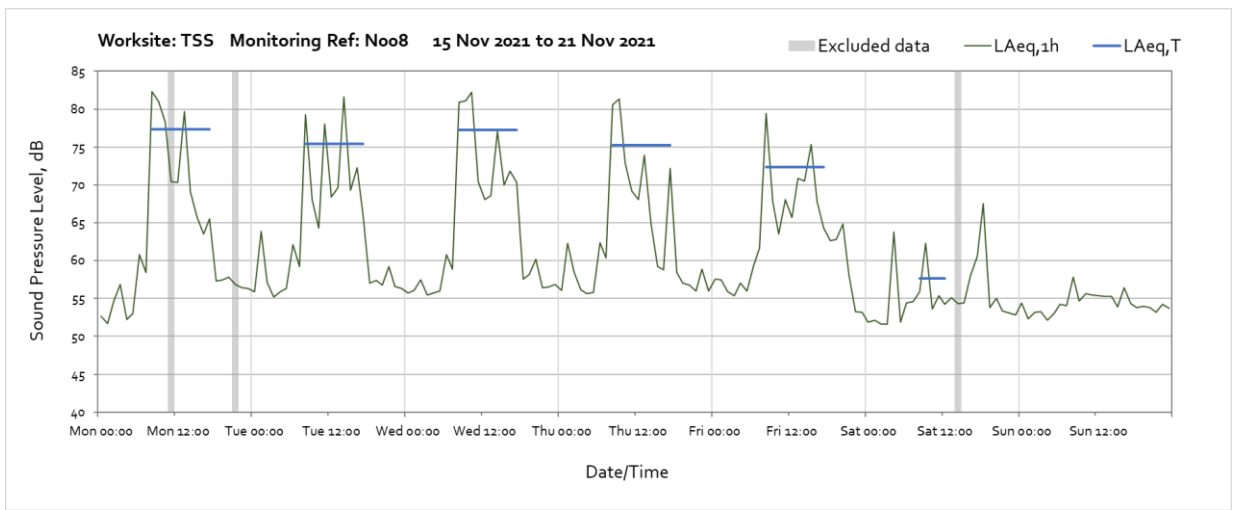
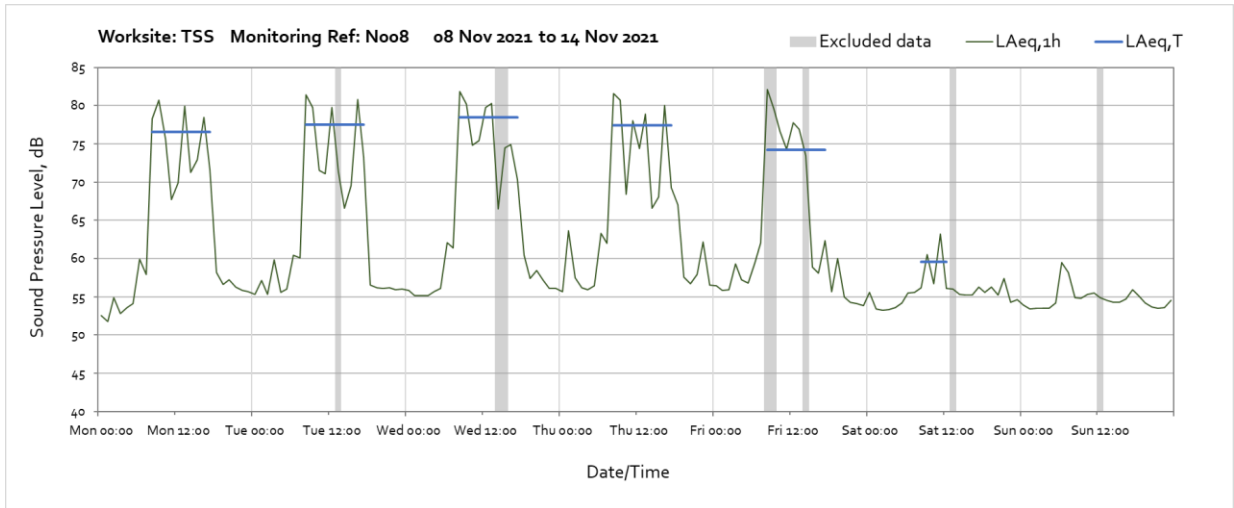


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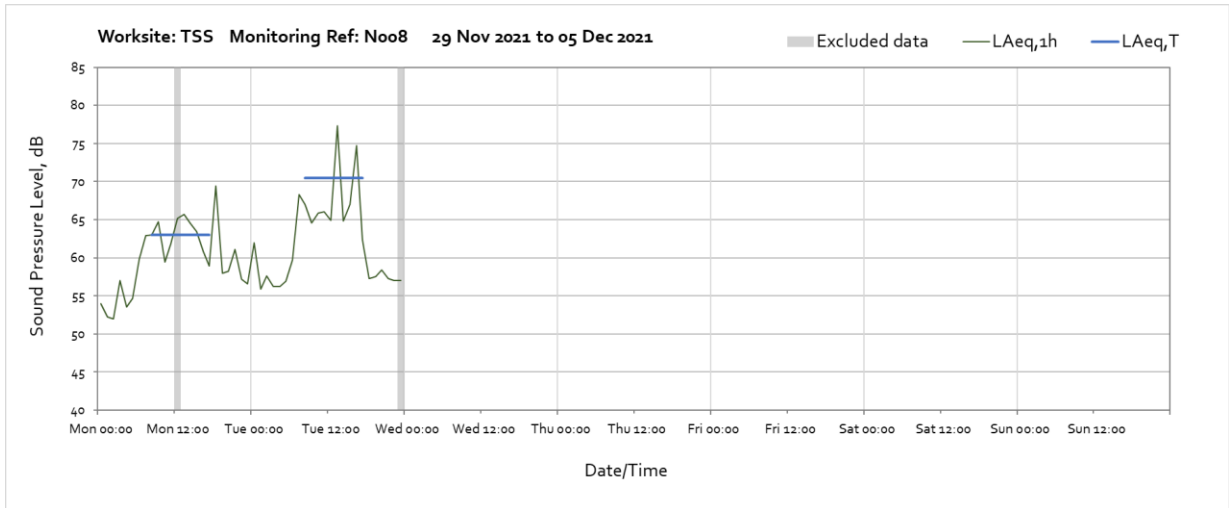


**Worksite: TSS - Monitoring Ref: N008**

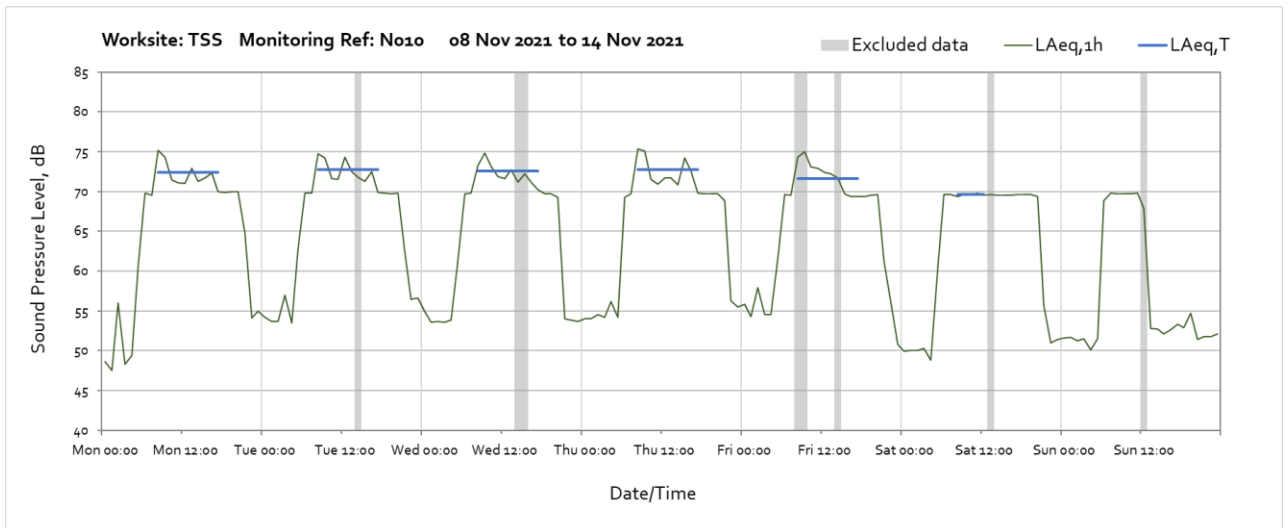
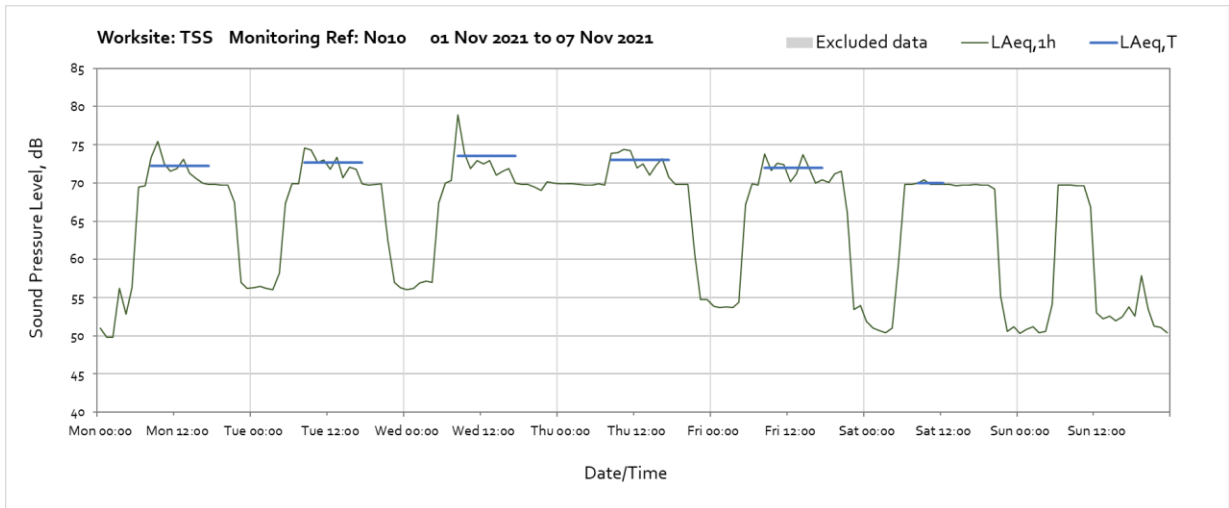


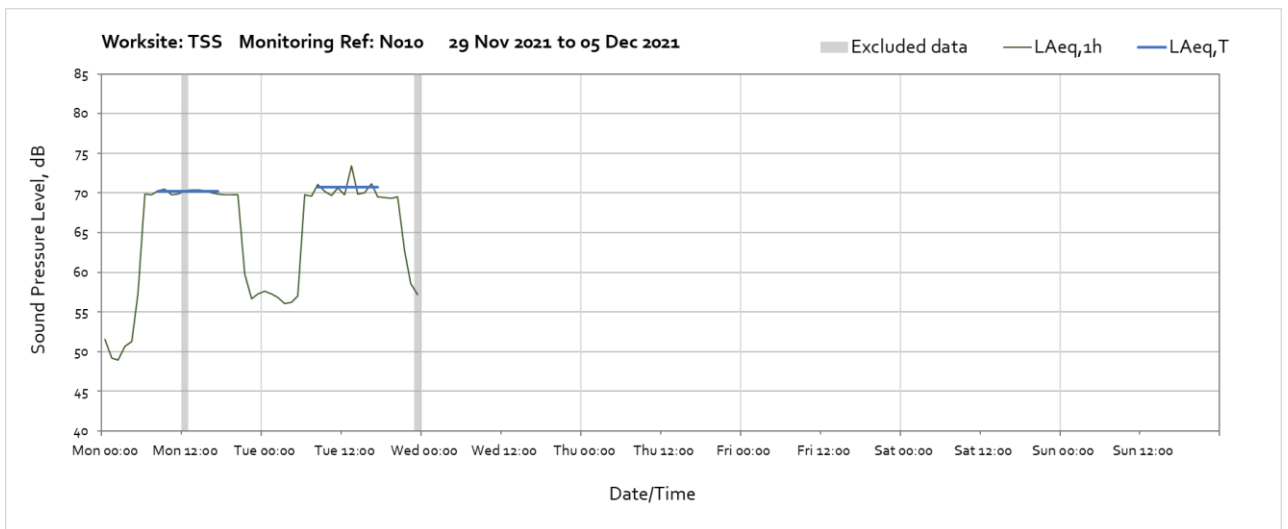
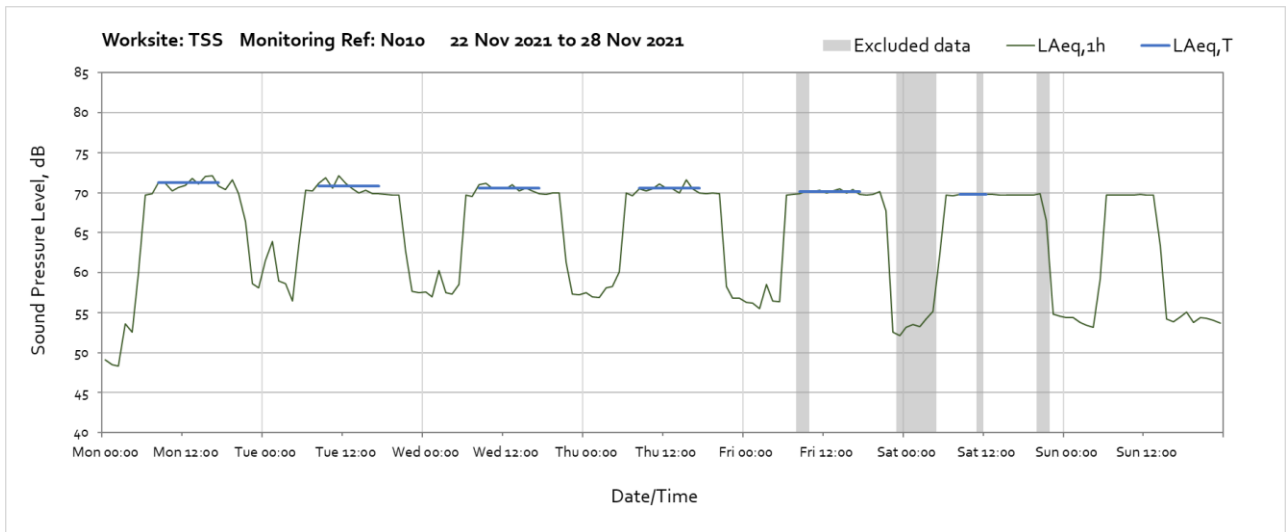
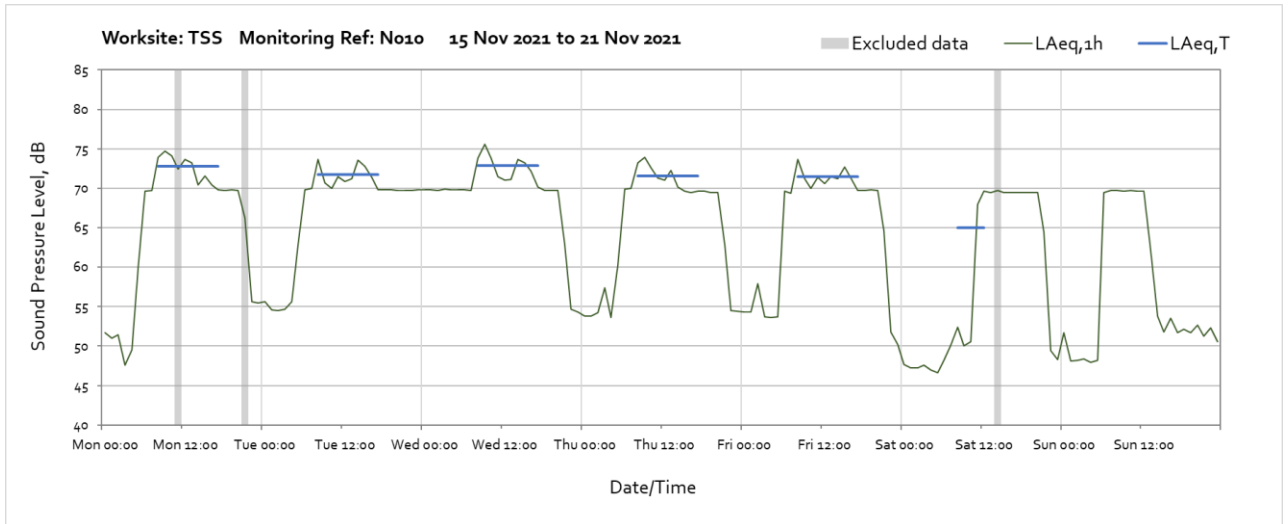




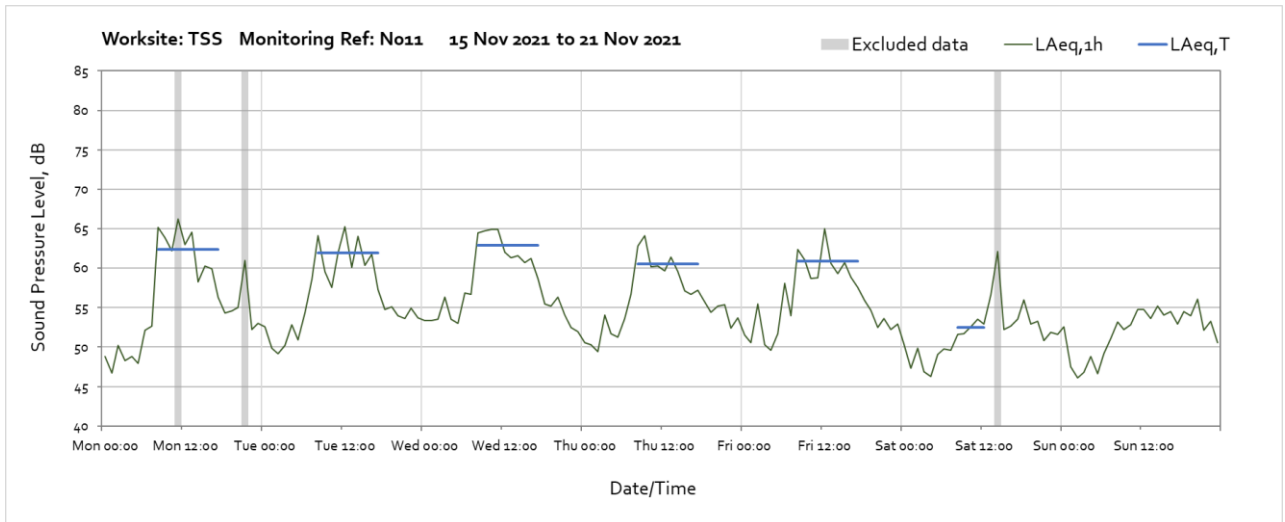
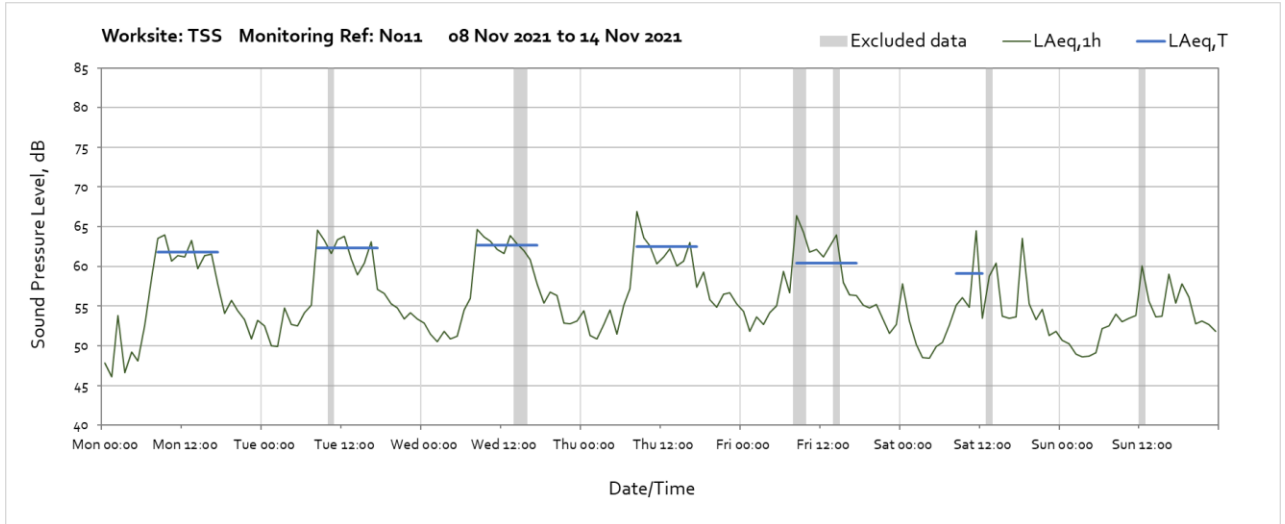
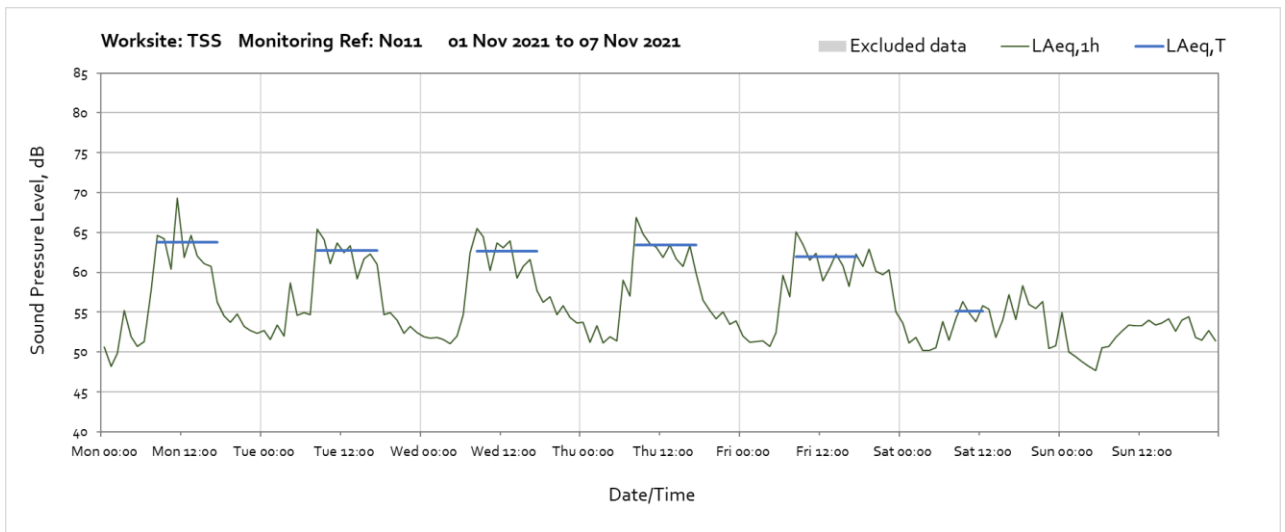


**Worksite: TSS - Monitoring Ref: N010**

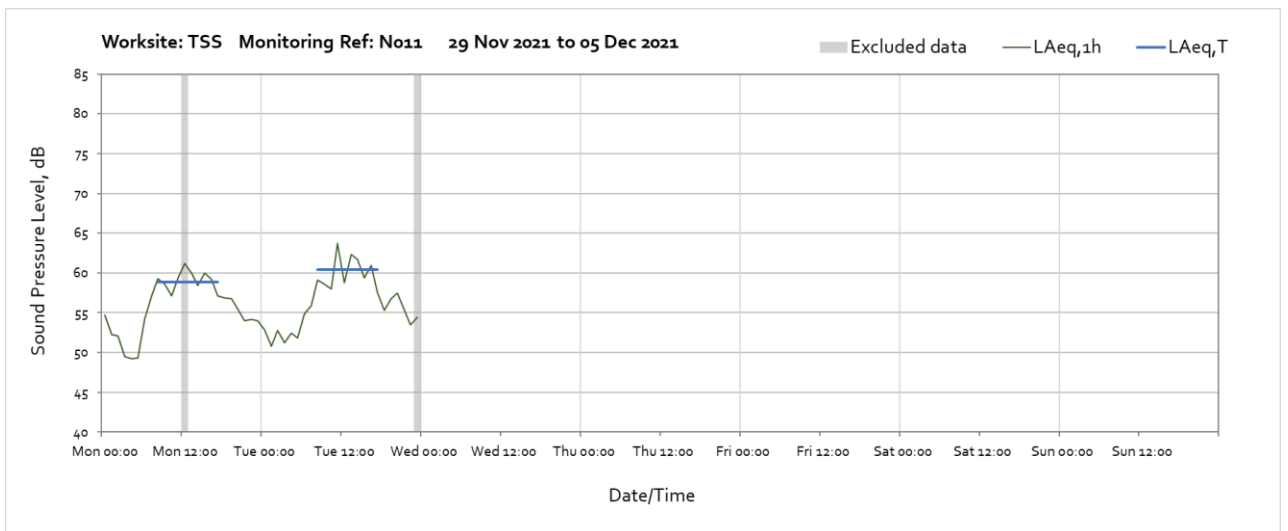
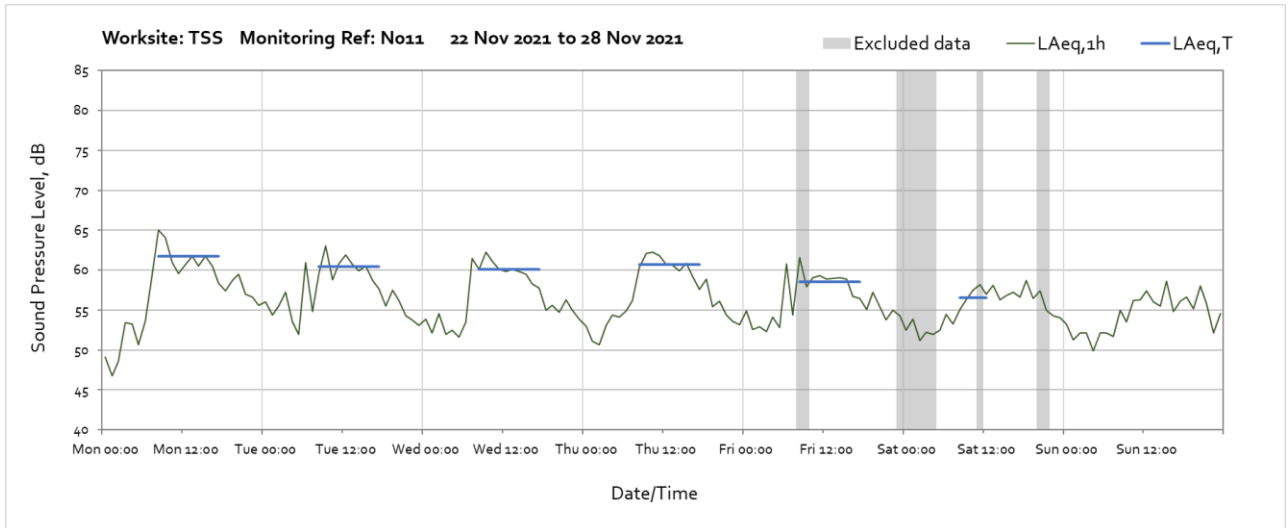




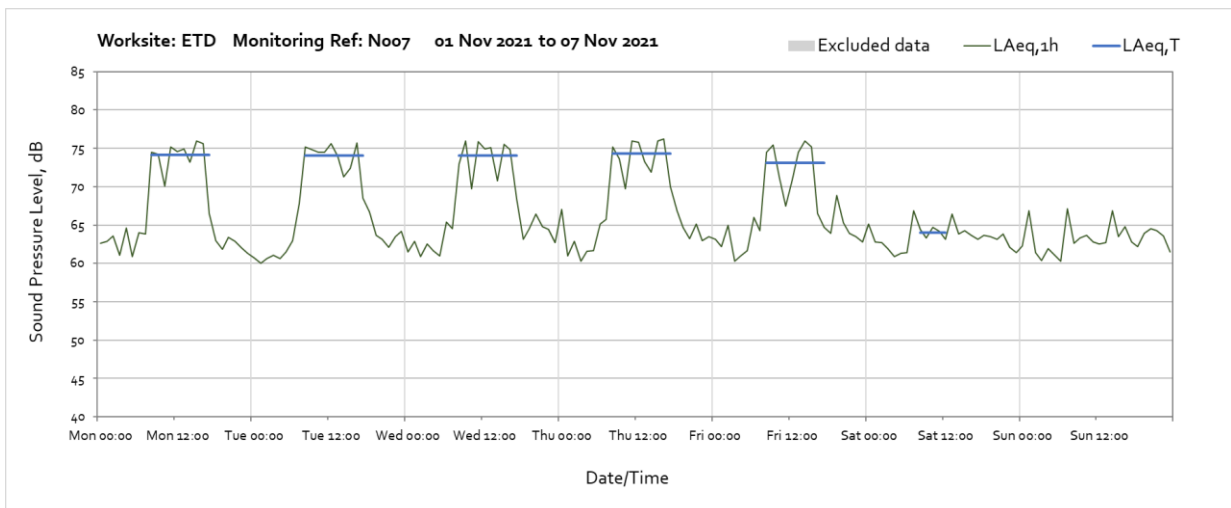
## Worksite: TSS - Monitoring Ref: N011

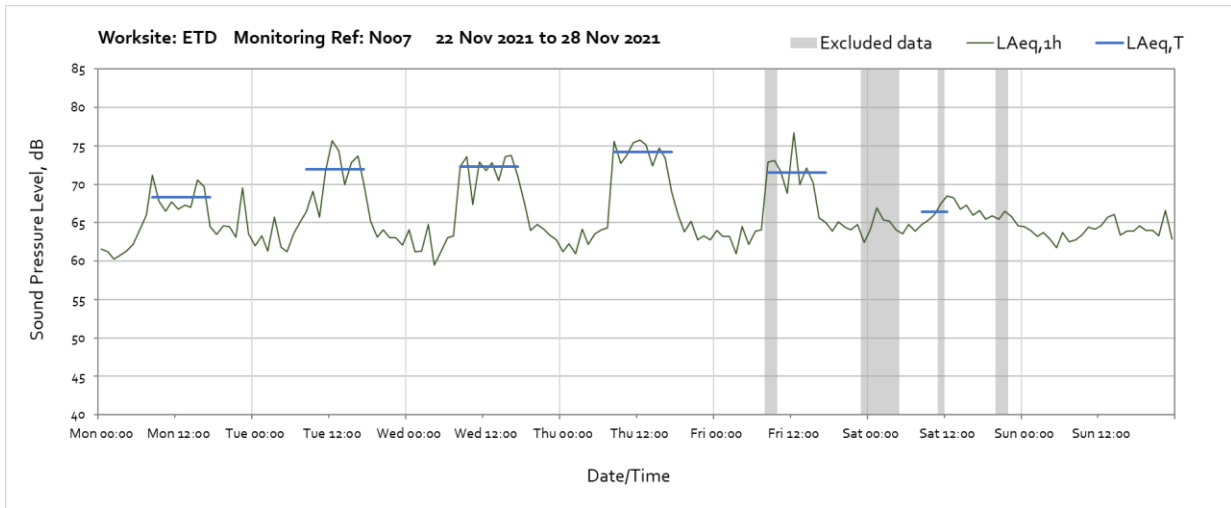
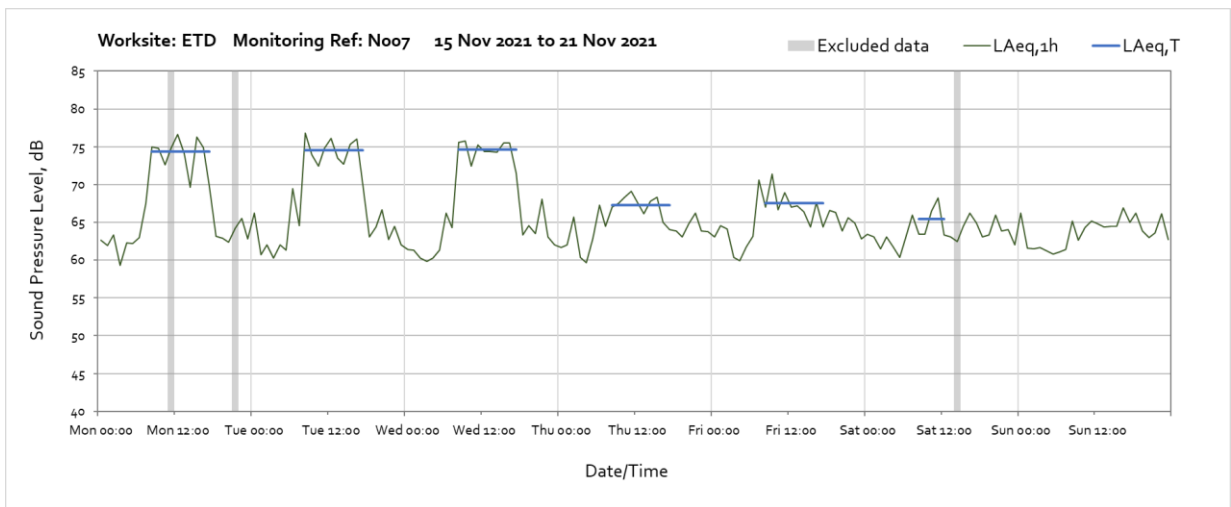
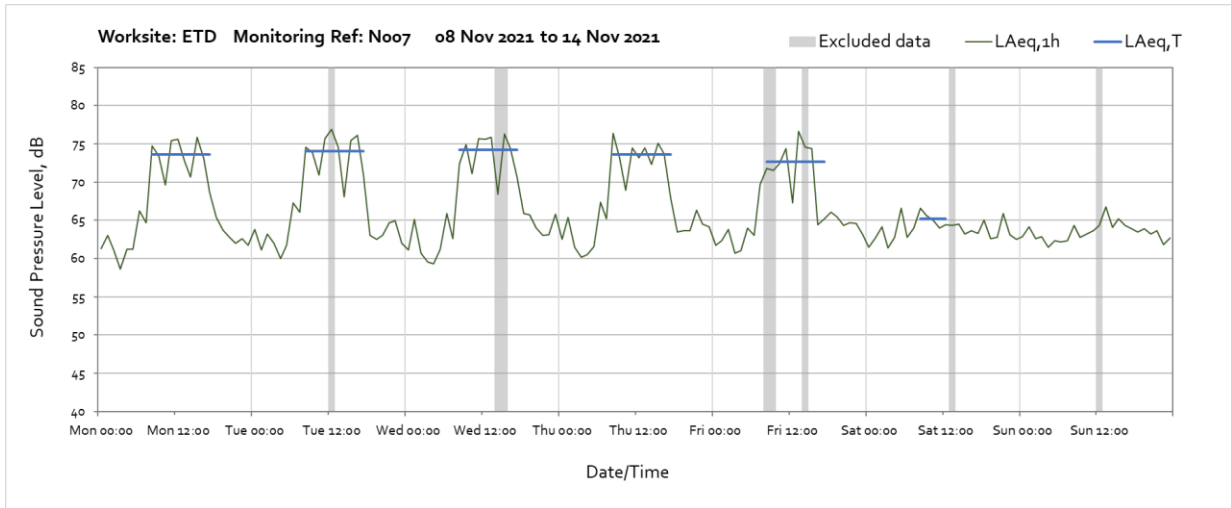


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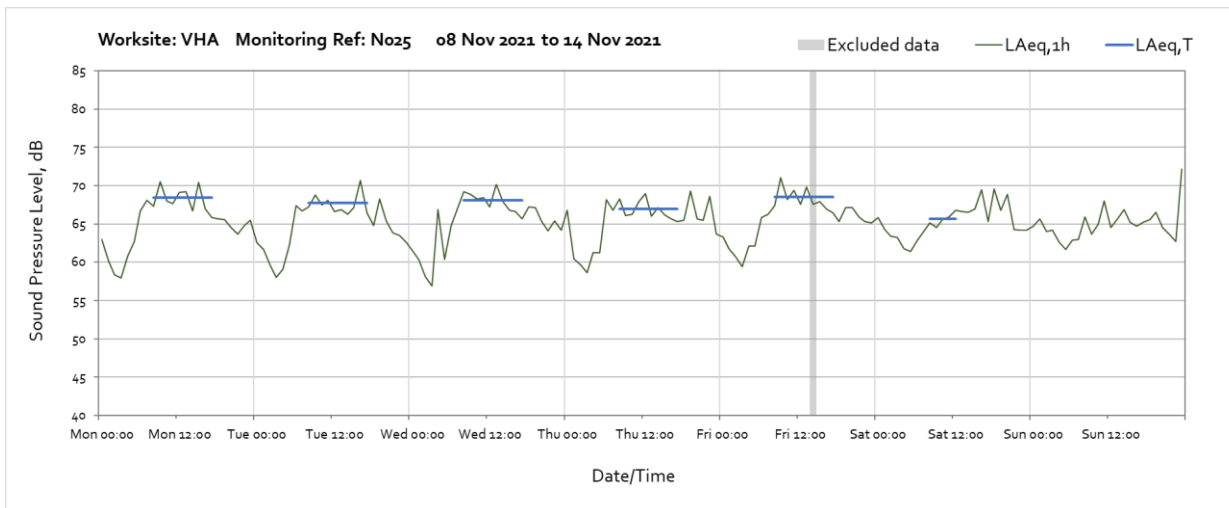
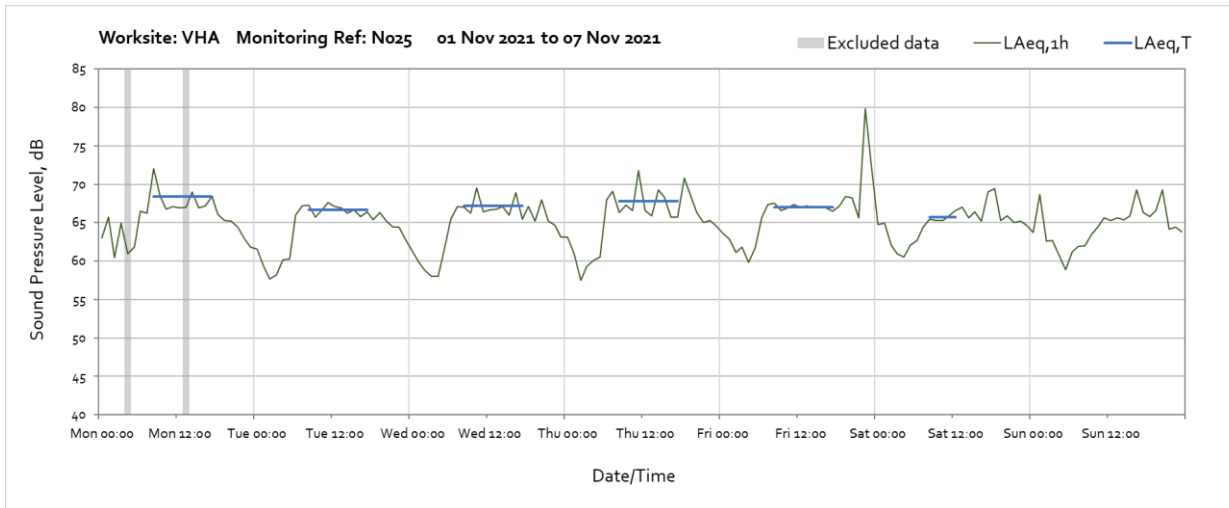
**Worksite: ETD - Monitoring Ref: N007**

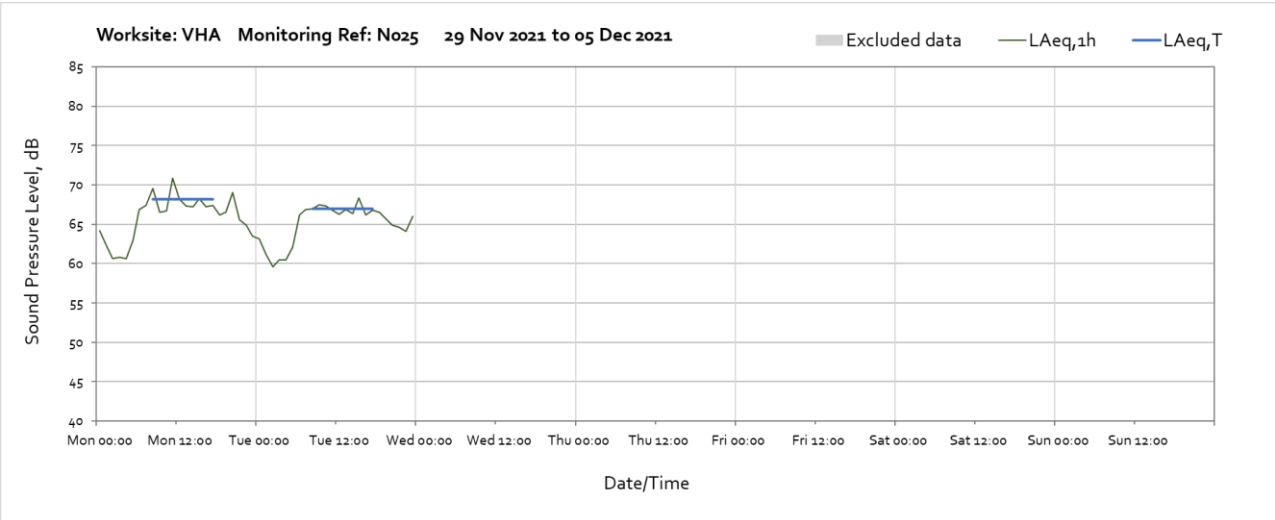
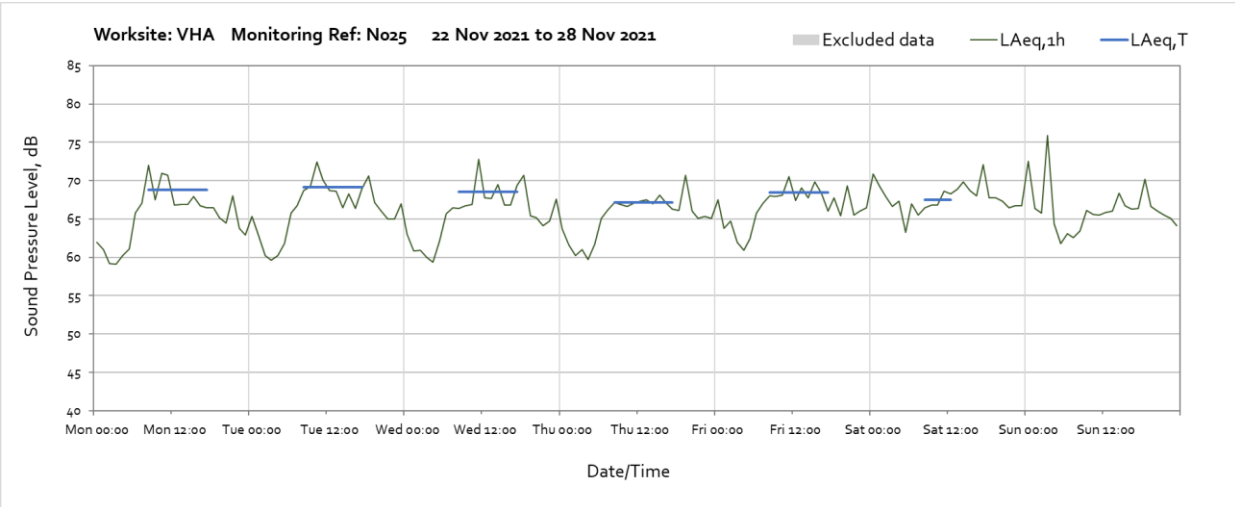
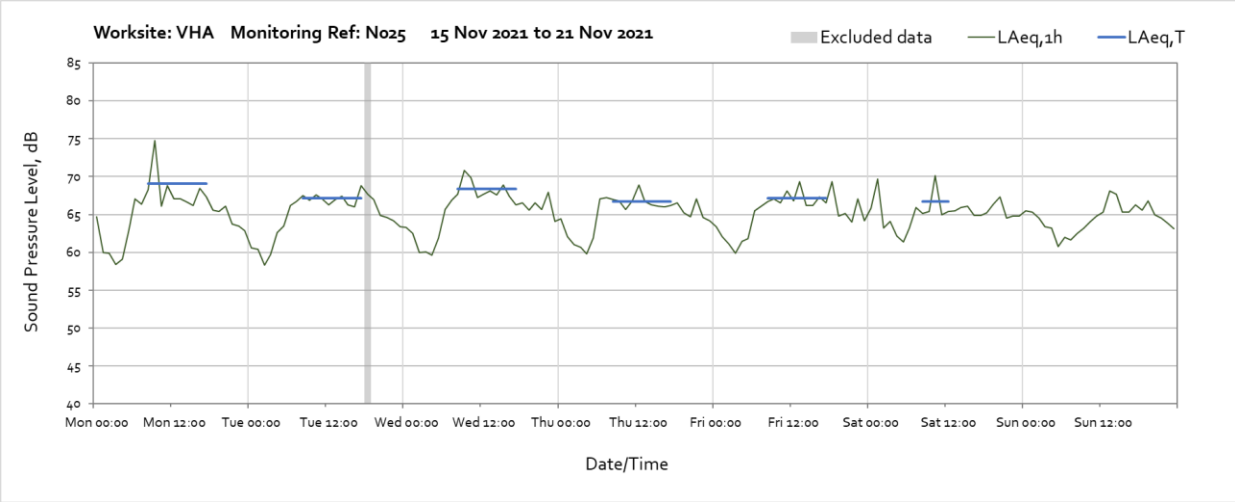






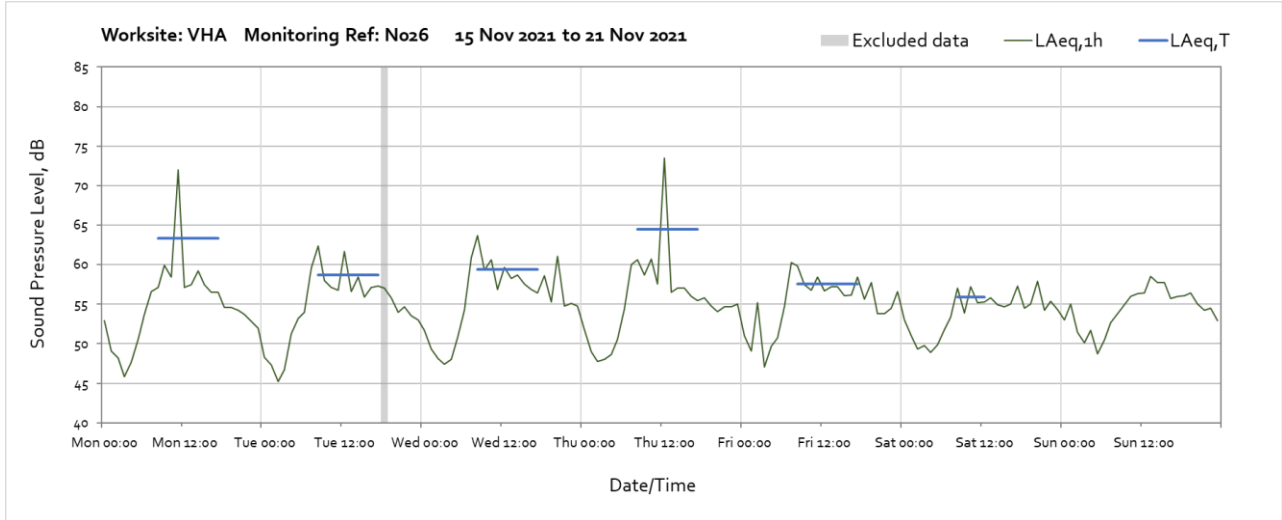
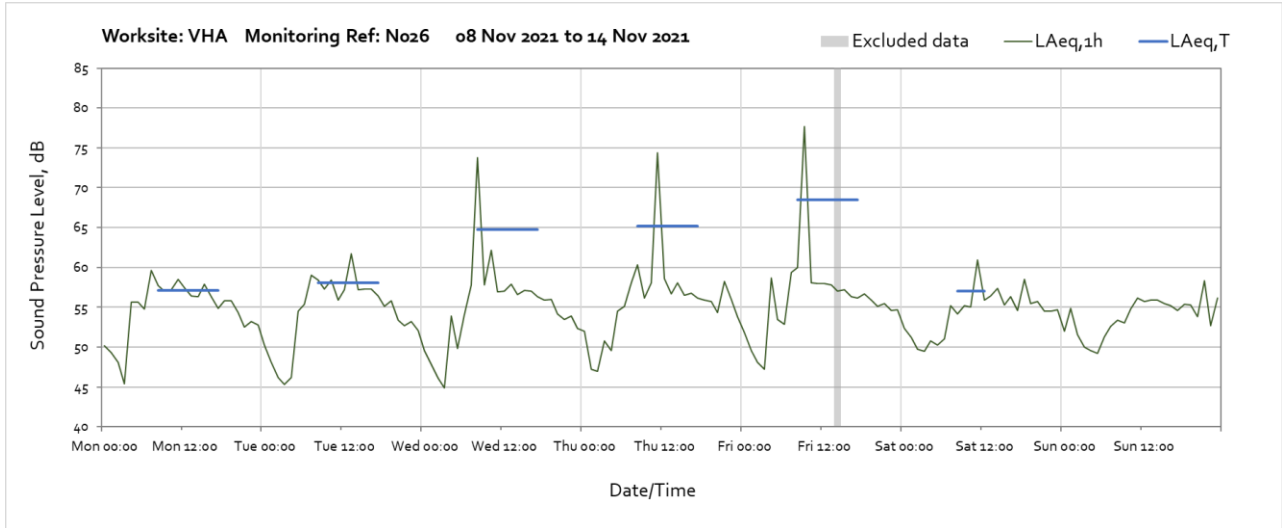
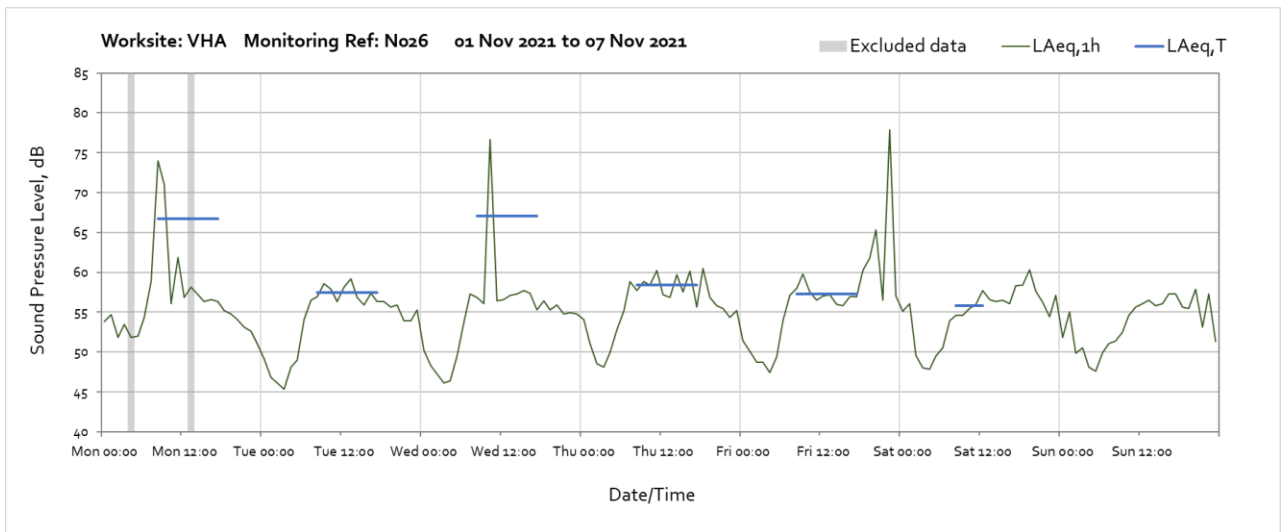
### Vehicle Holding Area (VHA) – Monitoring Ref: N025



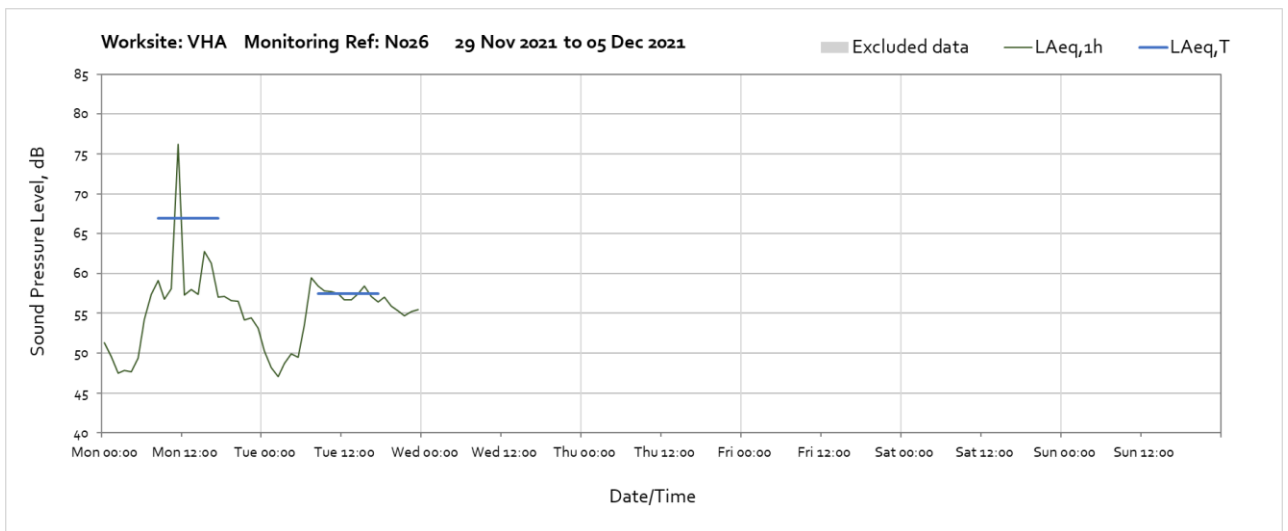
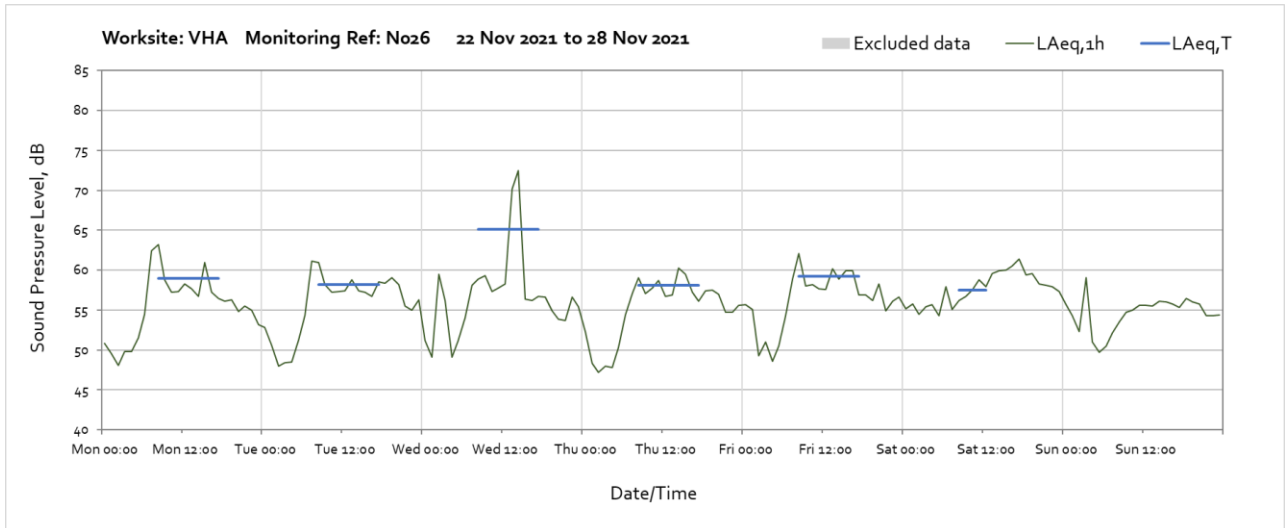




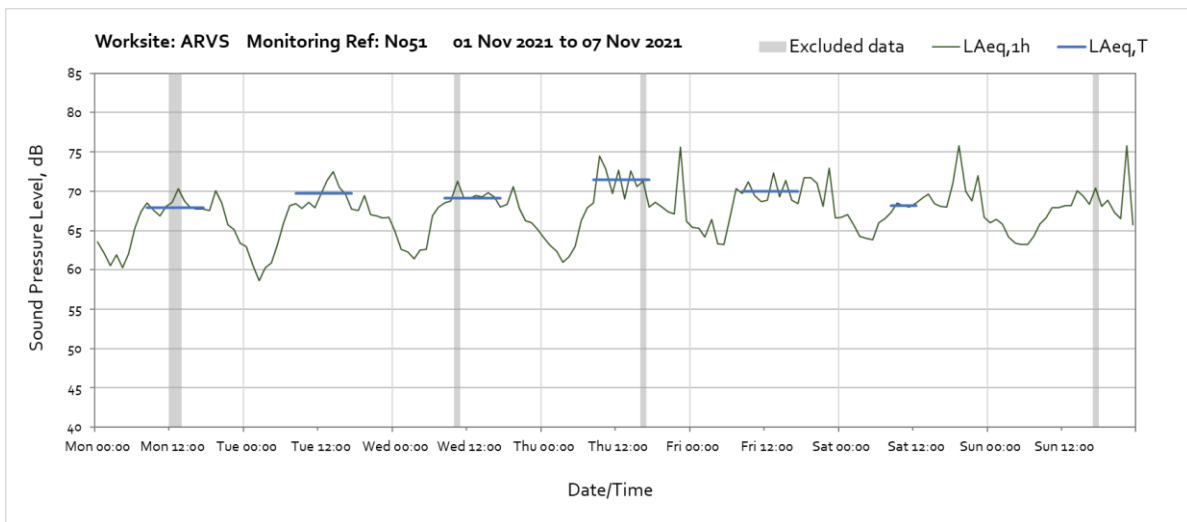
## Vehicle Holding Area (VHA) - Monitoring Ref: N026

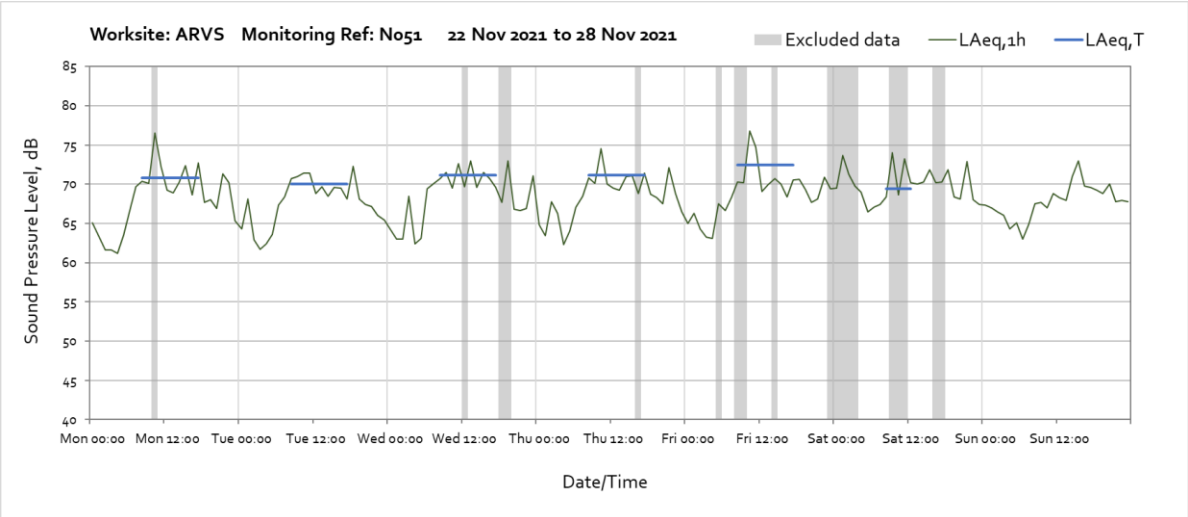
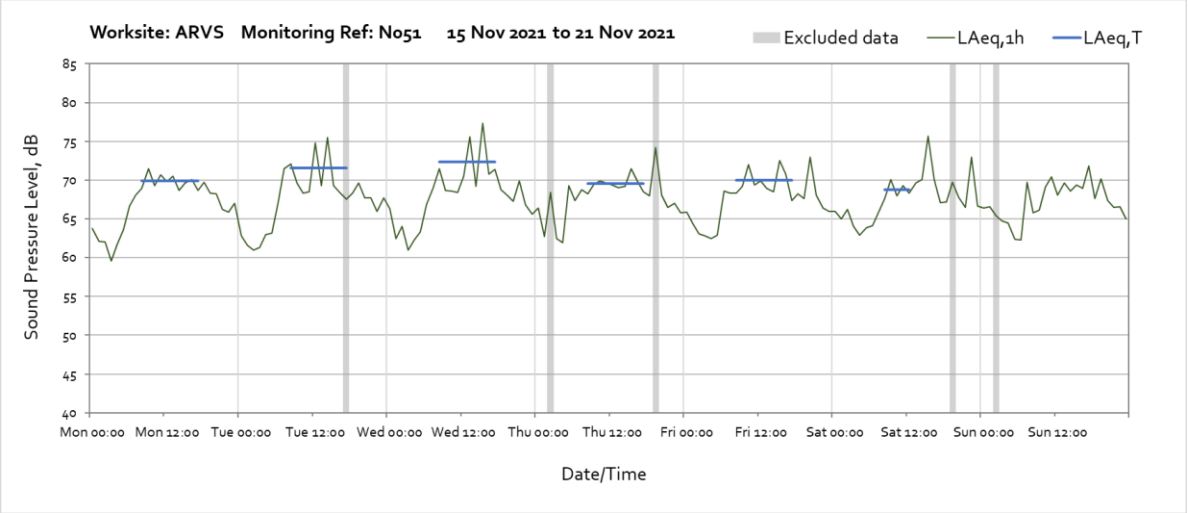
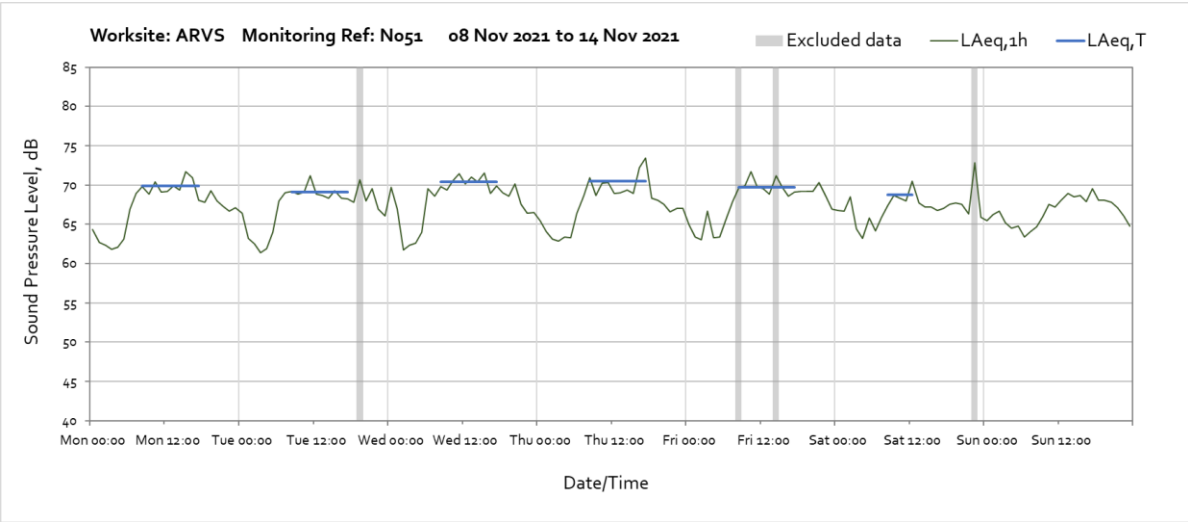


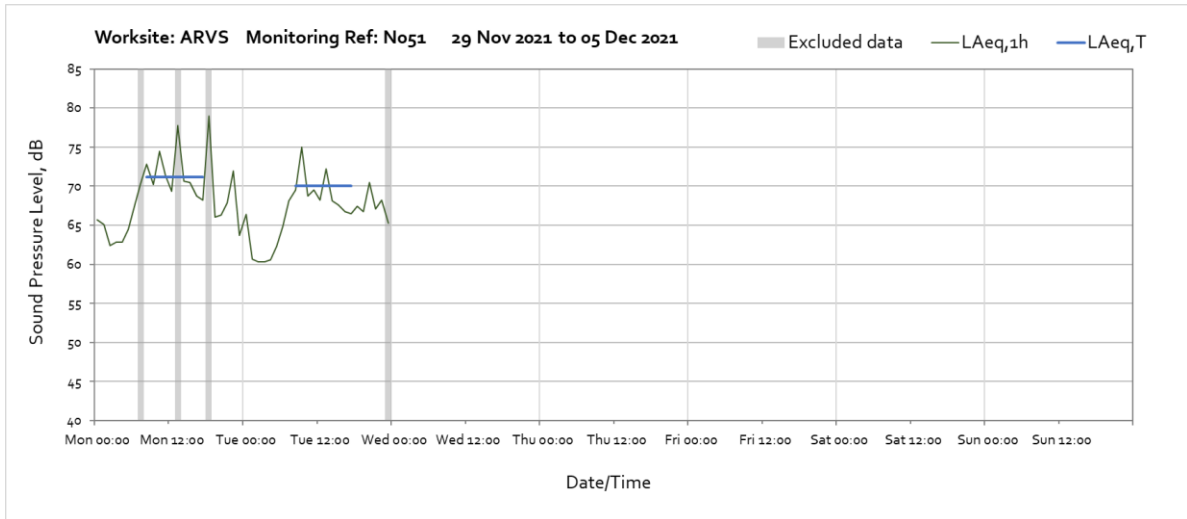
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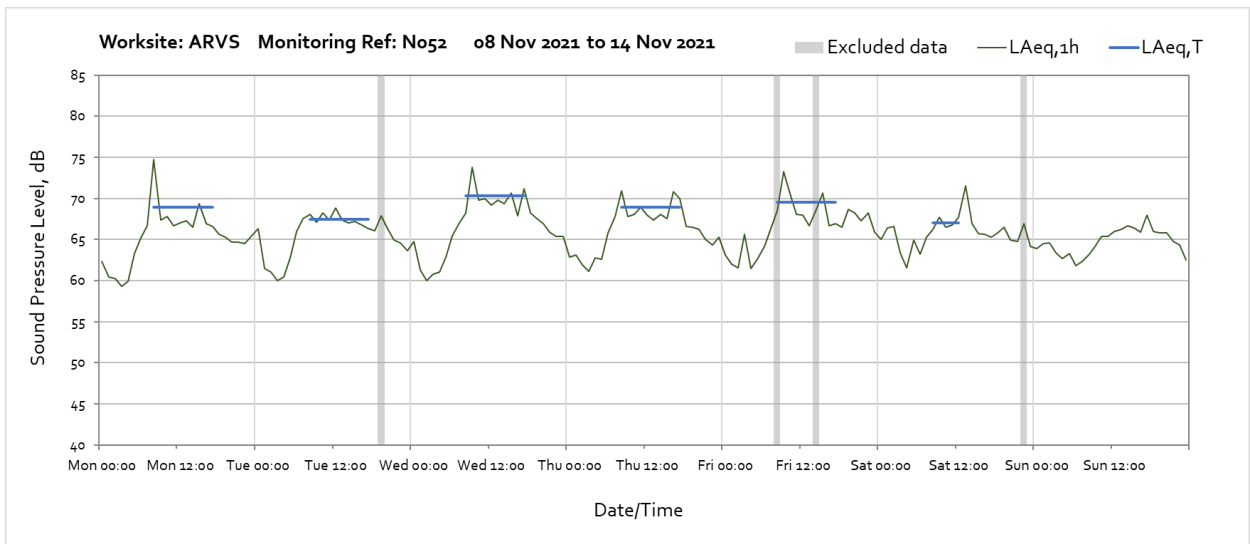
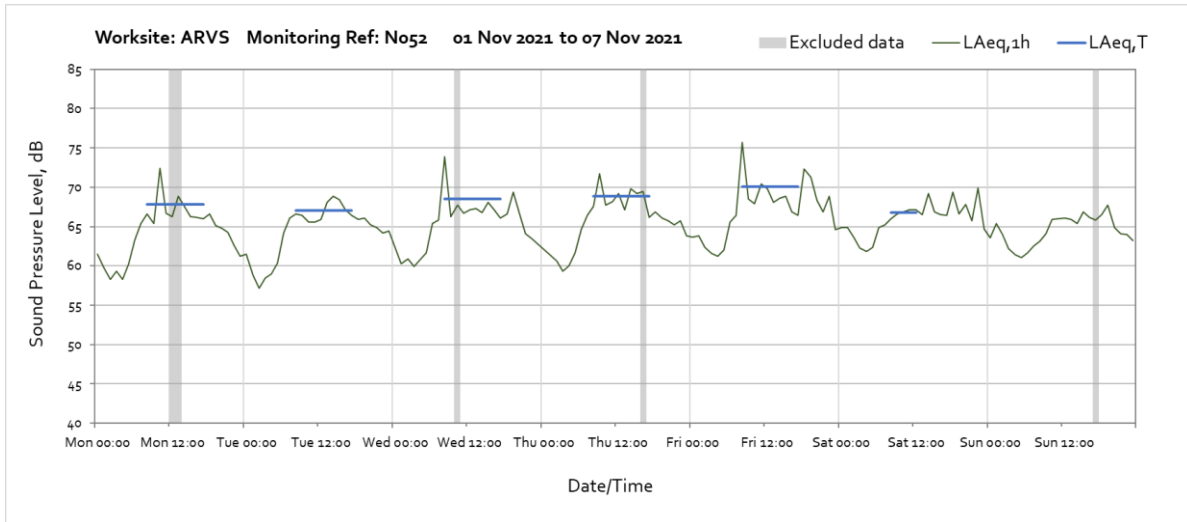
### Adelaide Road Ventilation Shaft (ARVS) – Monitoring Ref: N051

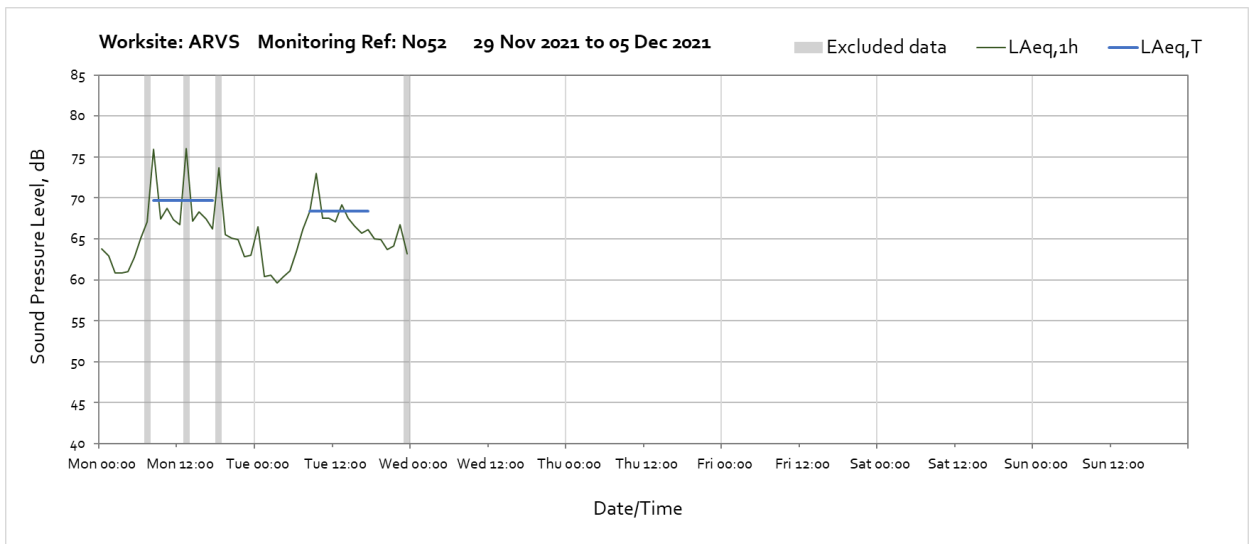
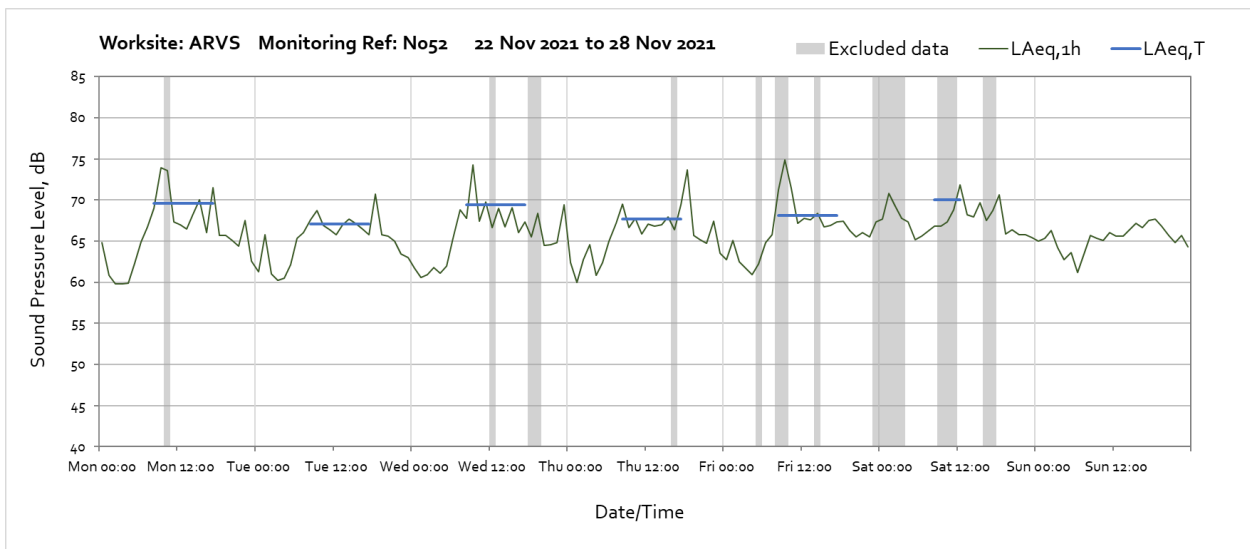
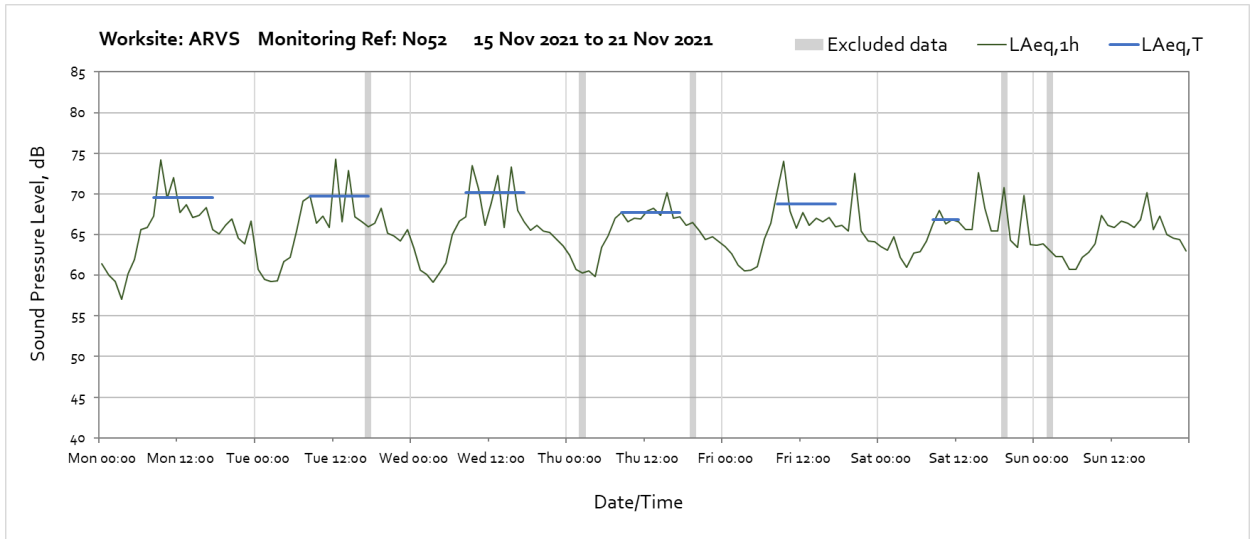






### Adelaide Road Ventilation Shaft (ARVS) – Monitoring Ref: N052

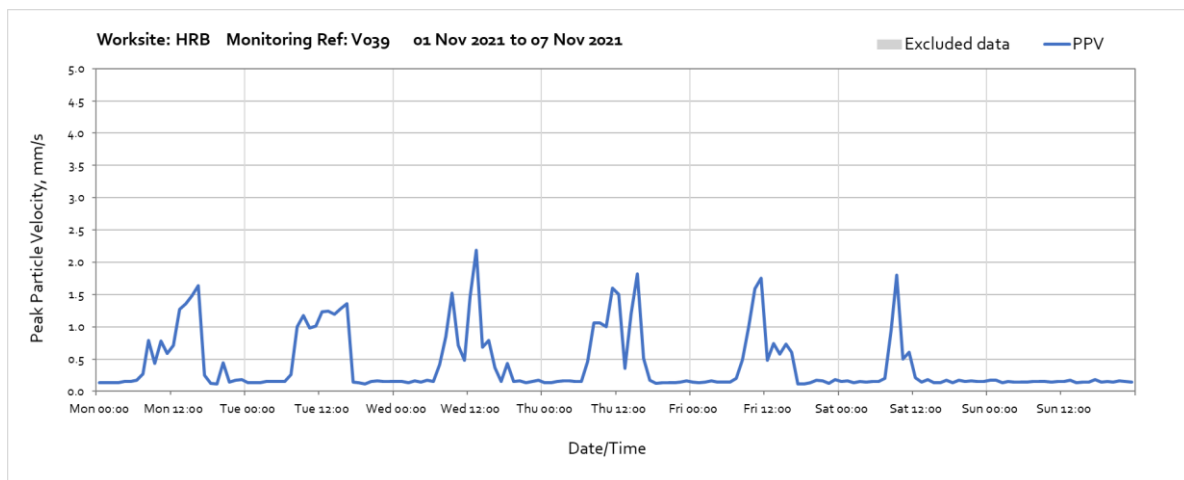


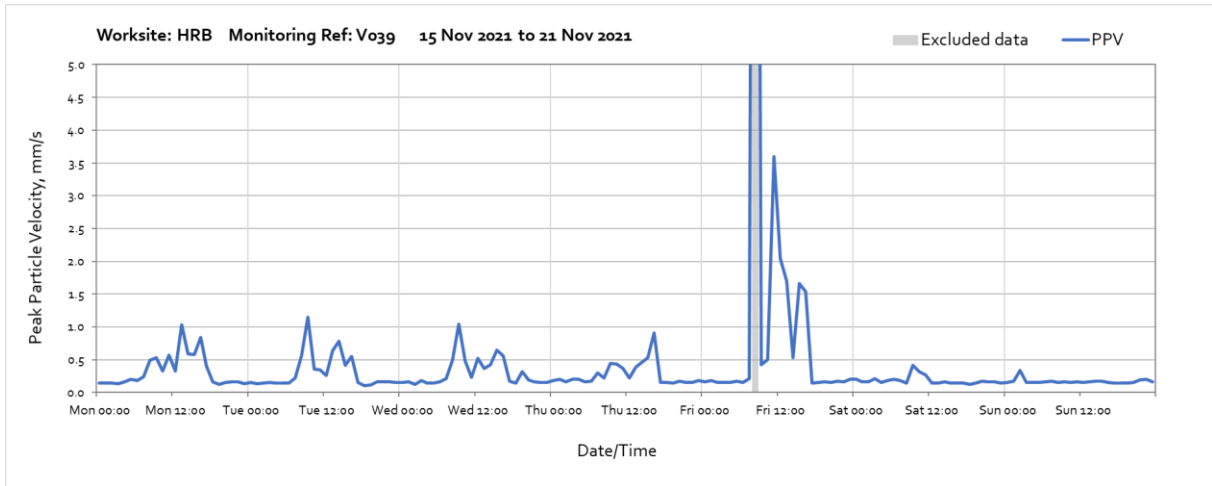


## Vibration

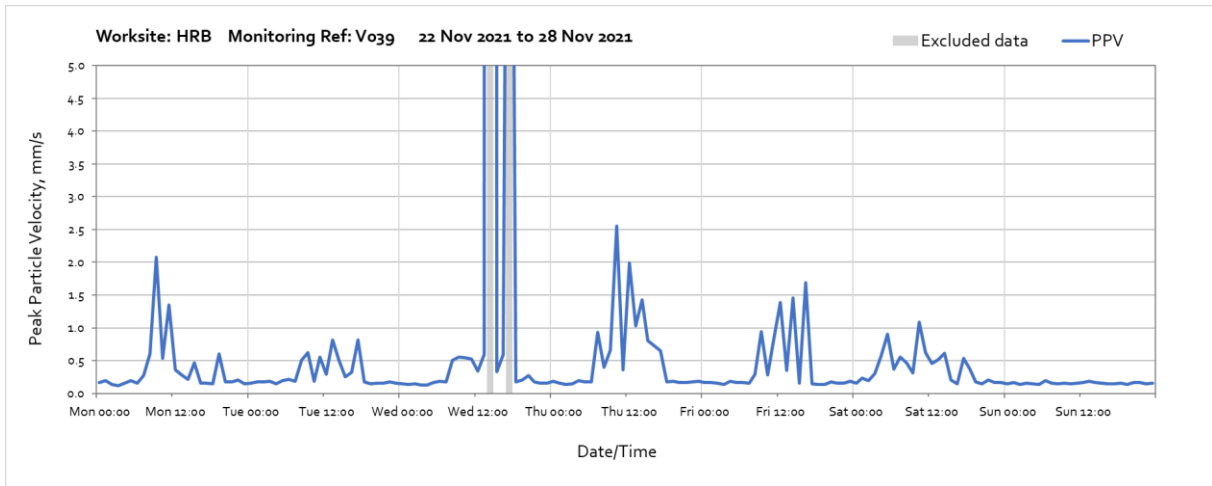
The following graphs show the hourly measured peak particle velocity PPV recorded during the monitoring period. The graphs show the resultant PPV due to vibration components on three orthogonal axes x, y and z. Where resultant PPV data is not available (monitors V039 and V043), the highest vibration component in either of the three axes is presented for each 1hr measurement period respectively. Where high values of PPV were caused by local interference with the vibration monitor, which are not representative of HS2 construction works, these values have been greyed out in the following charts and have been excluded to calculate values in Table 4 of the main report.

### Worksite: HRB – Monitoring Ref: V039

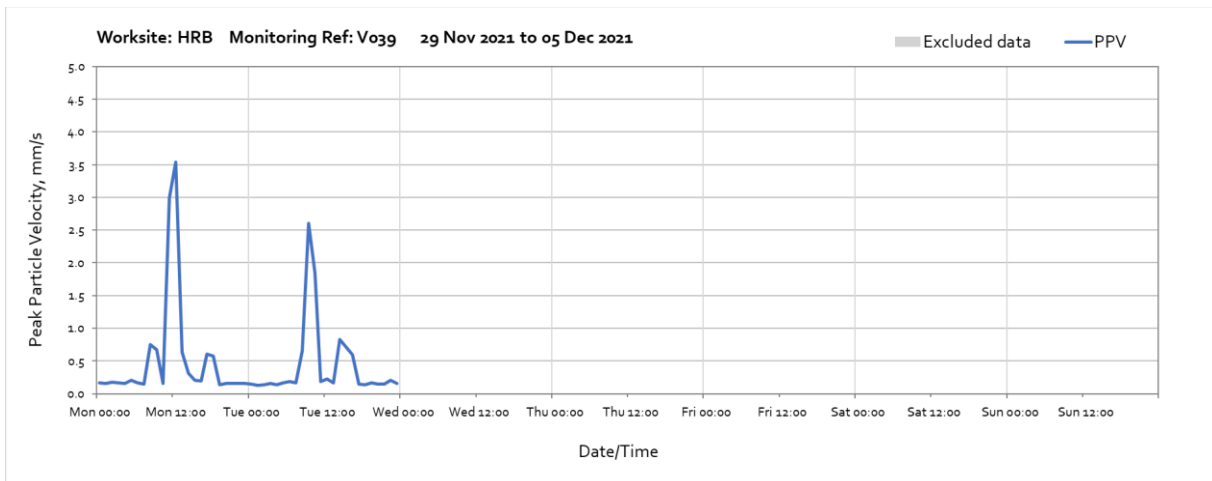




Note: High vibration levels measured between 08:00 until 09:00 on Friday 19<sup>th</sup> November were due to local interference of the monitor and are not representative of HS2 vibration levels at the receptor.

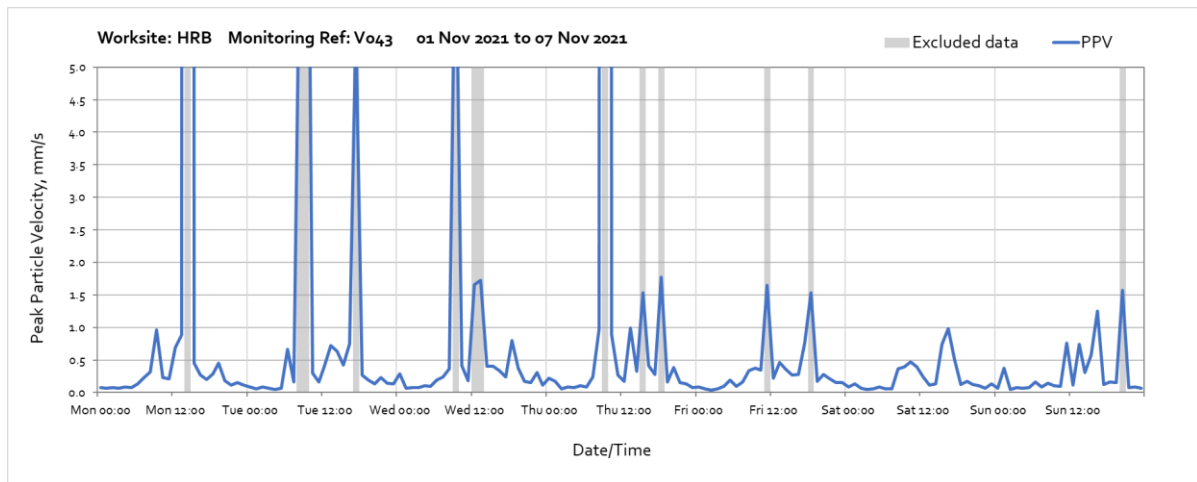


Note: High vibration levels measured between 14:00 until 15:00 and 17:00 until 18:00 on Wednesday 24<sup>th</sup> November were due to local interference of the monitor and are not representative of HS2 vibration levels at the receptor.

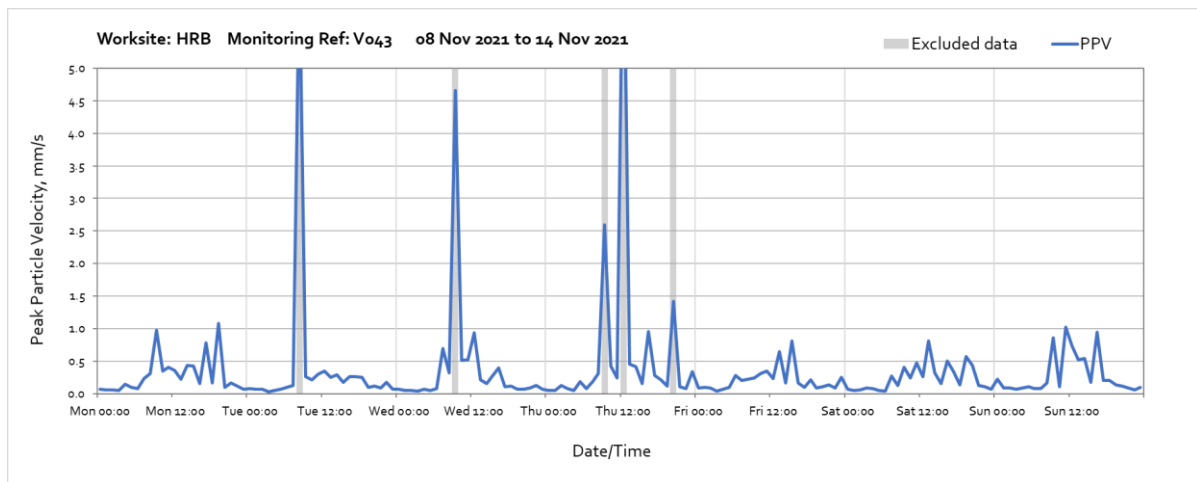




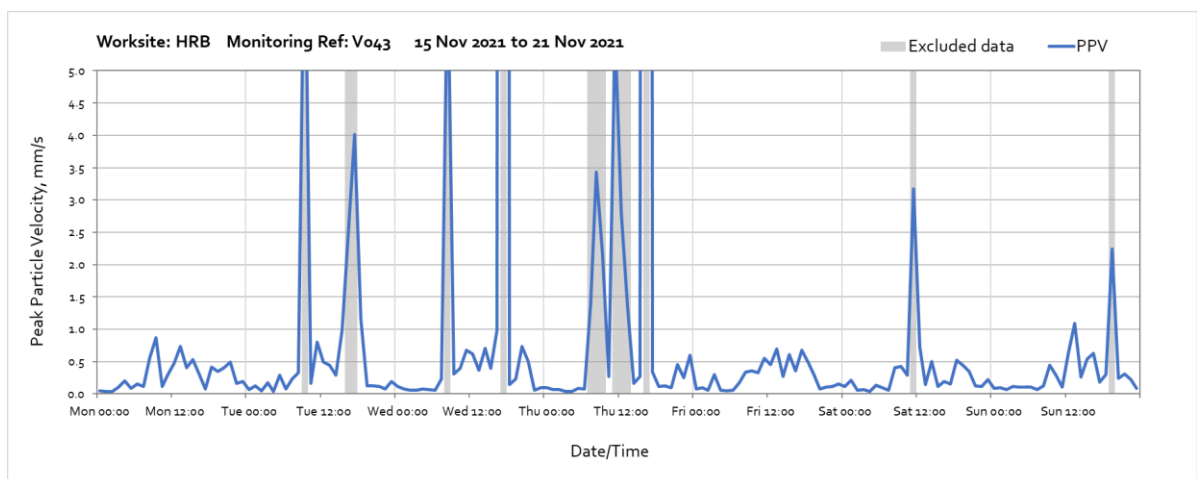
## Worksite: HRB – Monitoring Ref: V043



Note: High vibration levels measured throughout the week were due to local interference of the monitor and are not representative of HS2 vibration levels at the receptor.

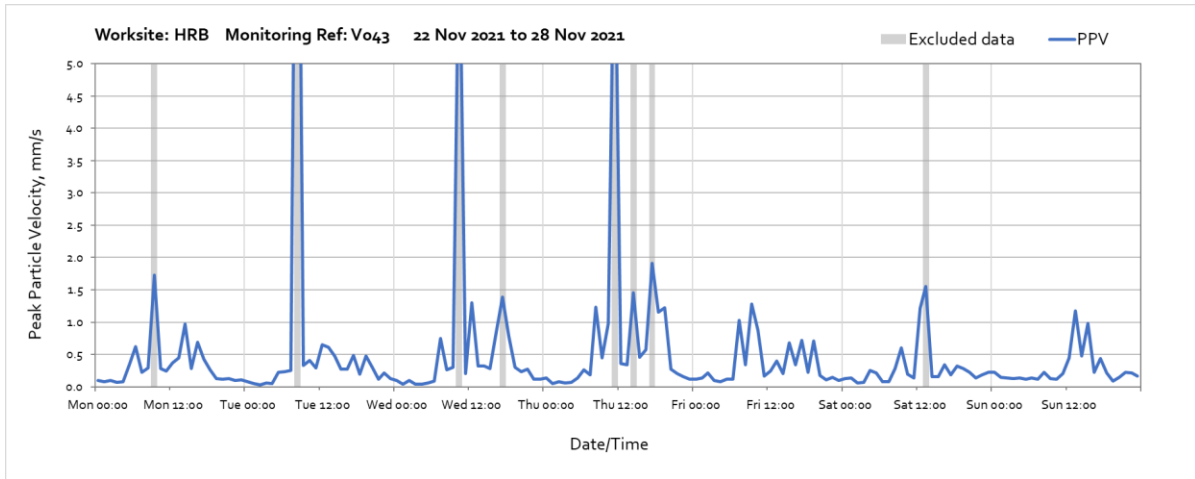


Note: High vibration levels measured throughout the week were due to local interference of the monitor and are not representative of HS2 vibration levels at the receptor.

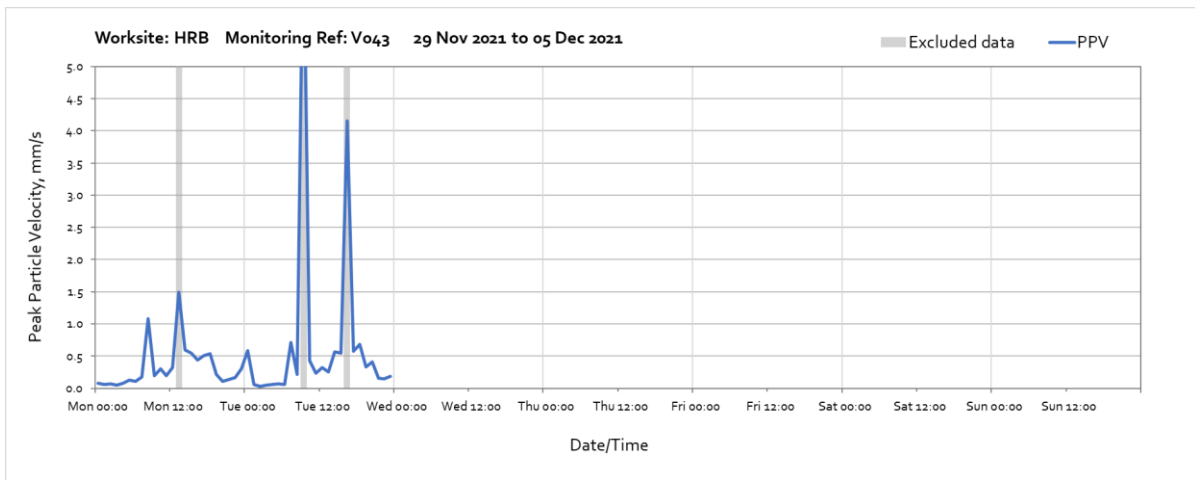


Note: High vibration levels measured throughout the week were due to local interference of the monitor and are not representative of HS2 vibration levels at the receptor.

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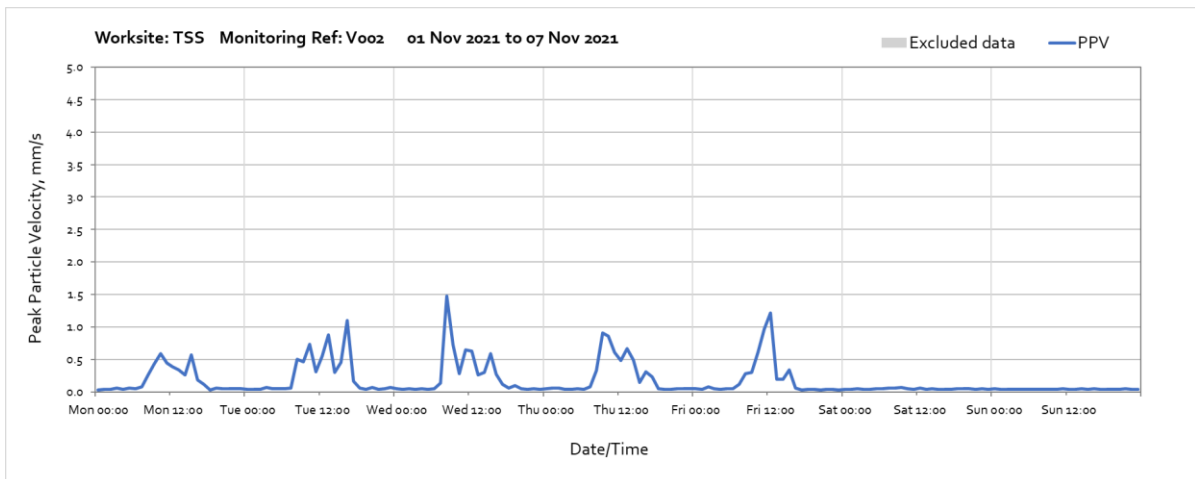


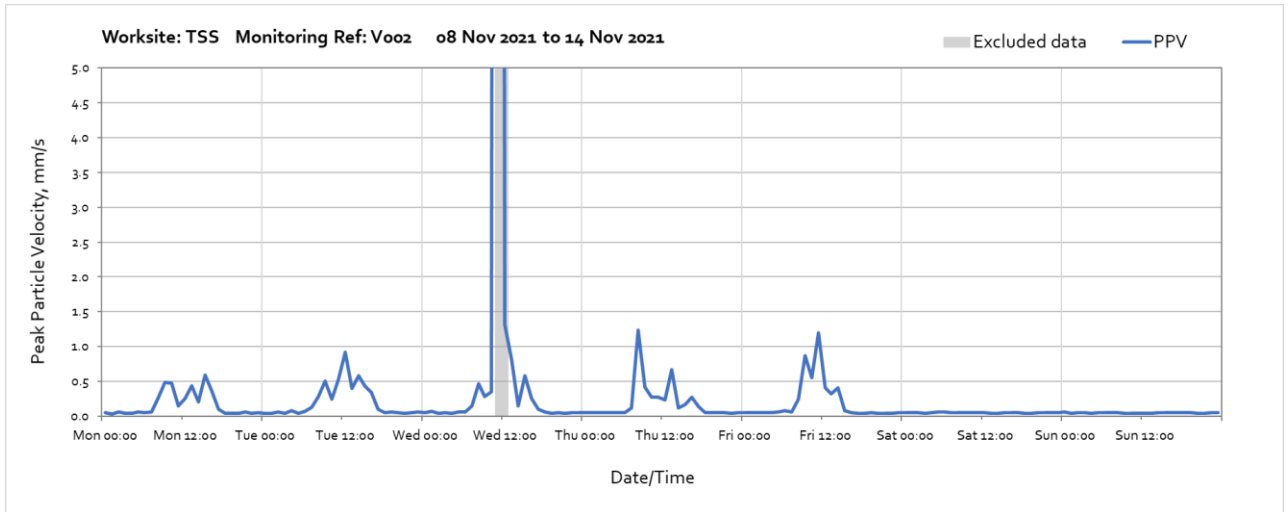
Note: High vibration levels measured throughout the week were due to local interference of the monitor and are not representative of HS2 vibration levels at the receptor.



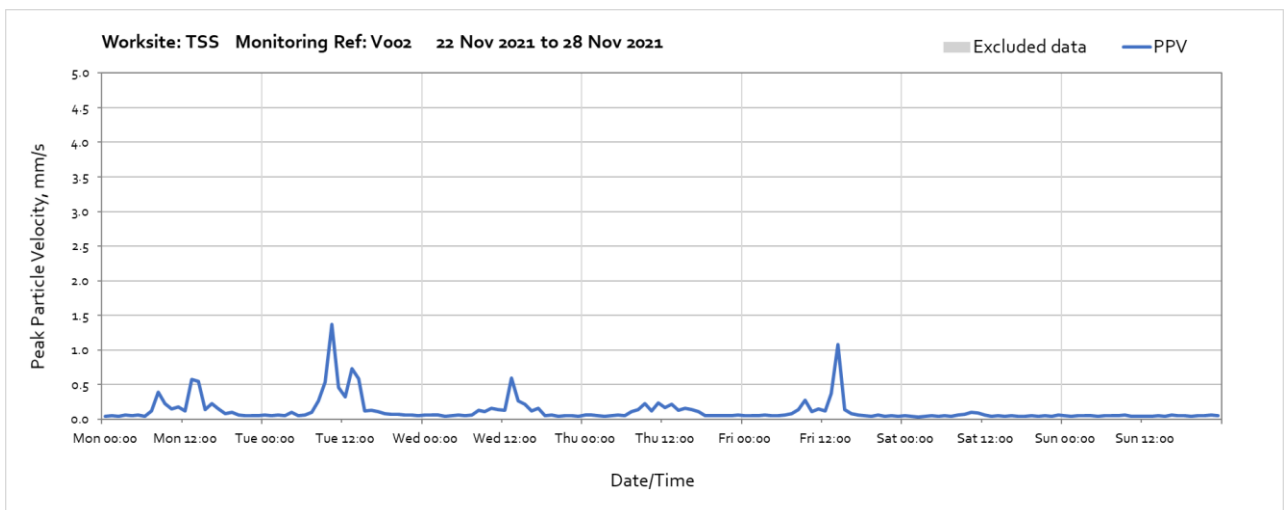
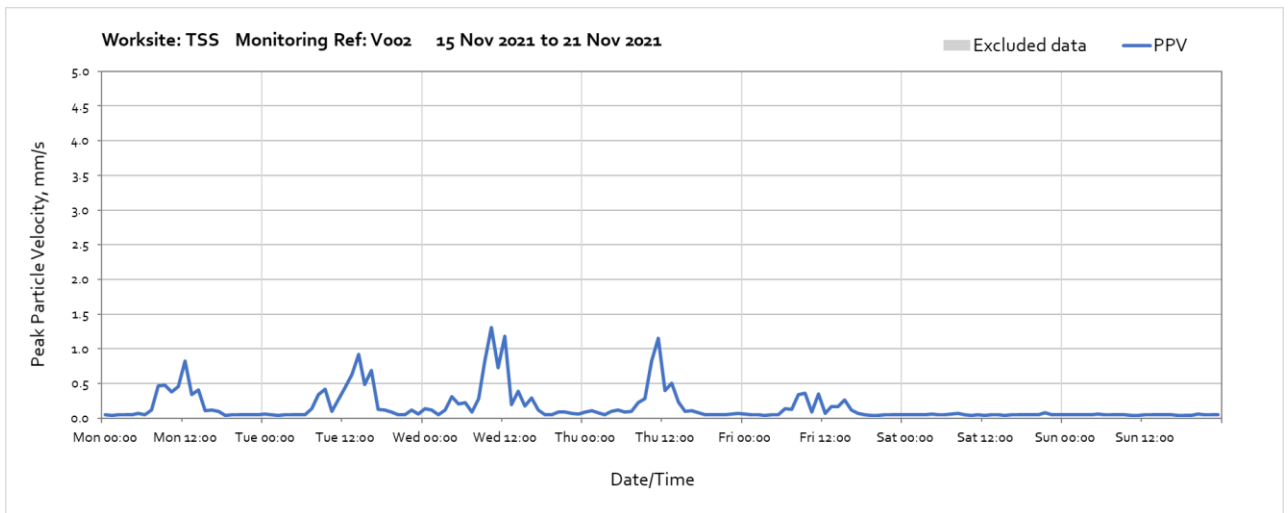
Note: High vibration levels measured throughout the week were due to local interference of the monitor and are not representative of HS2 vibration levels at the receptor.

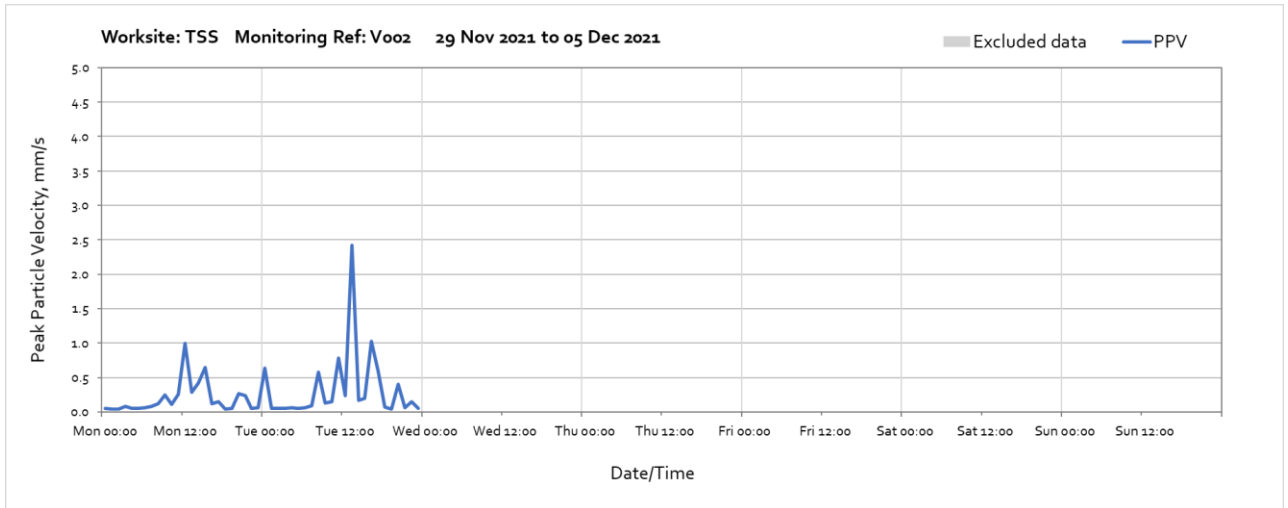
### Worksite: TSS - Monitoring Ref: V002



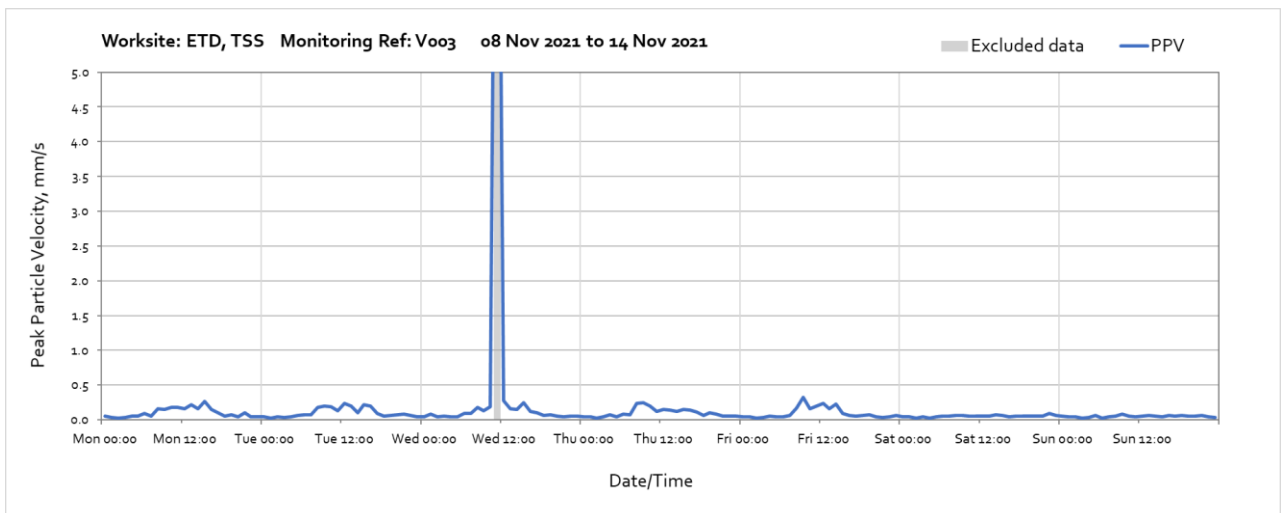
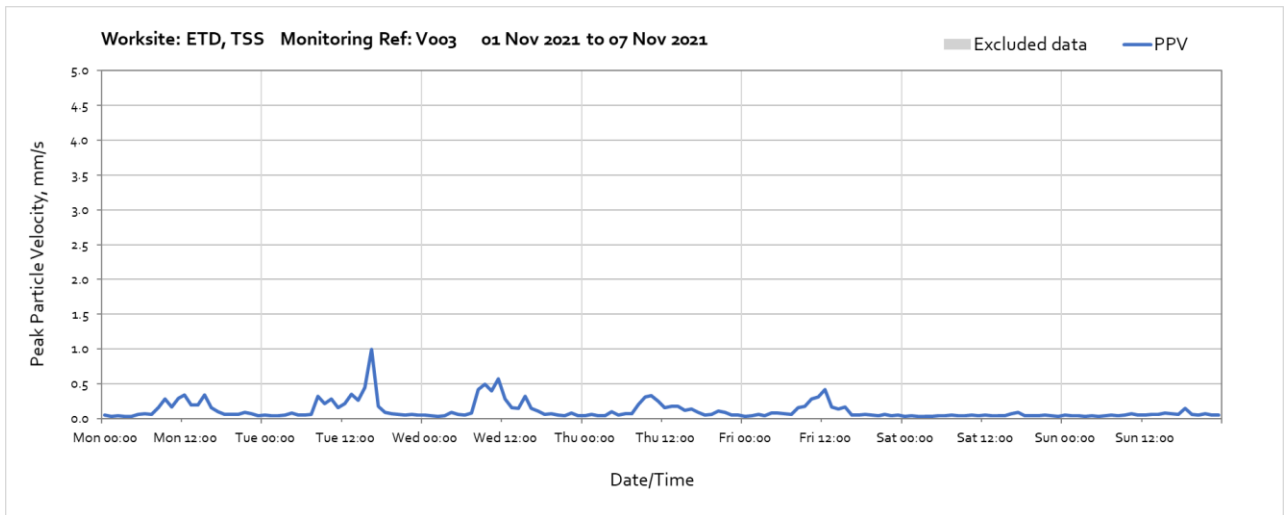


Note: High vibration levels measured between 11:00 until 13:00 on Wednesday 10<sup>th</sup> November were due to routine maintenance of the monitor and are not representative of HS2 vibration levels at the receptor.

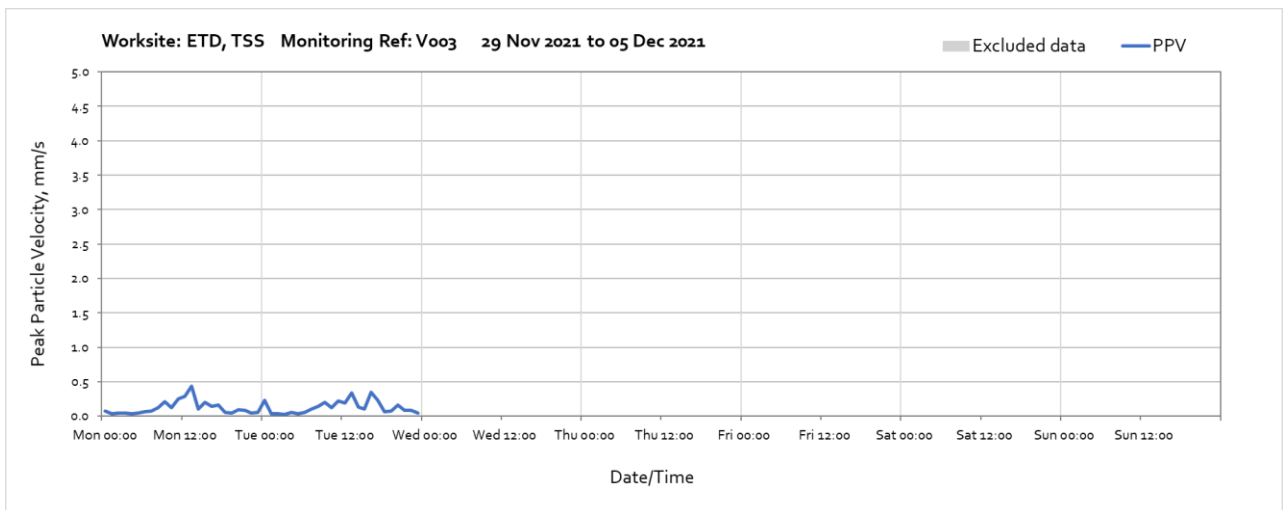
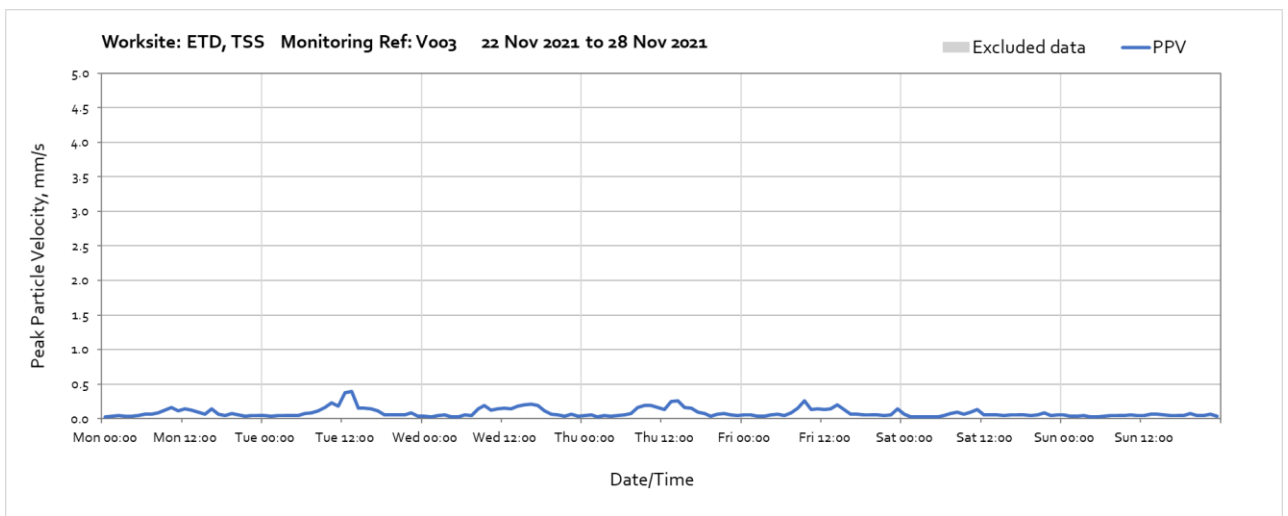
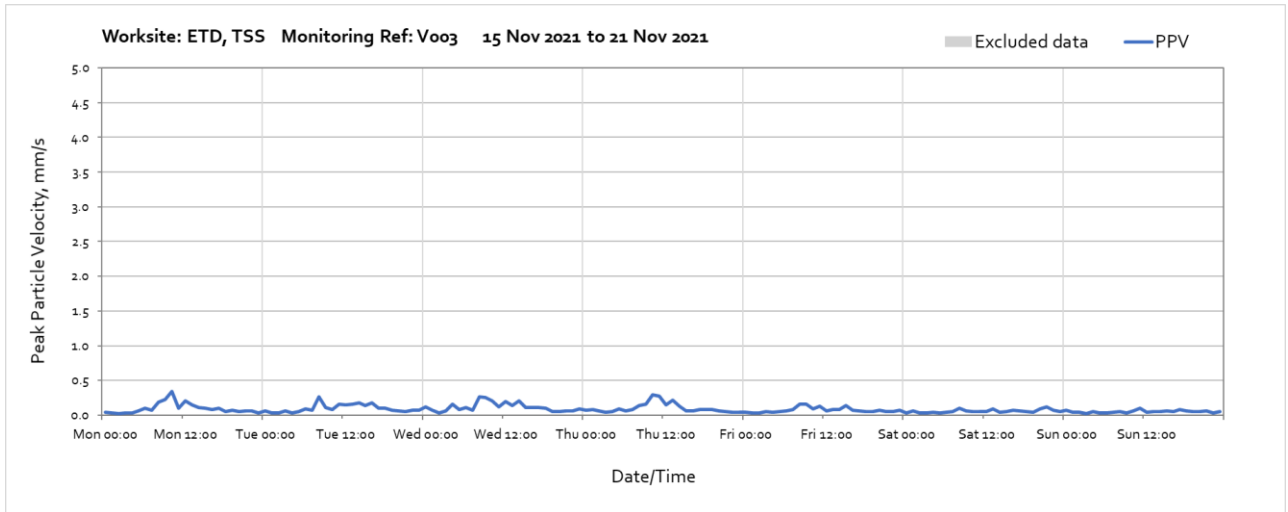




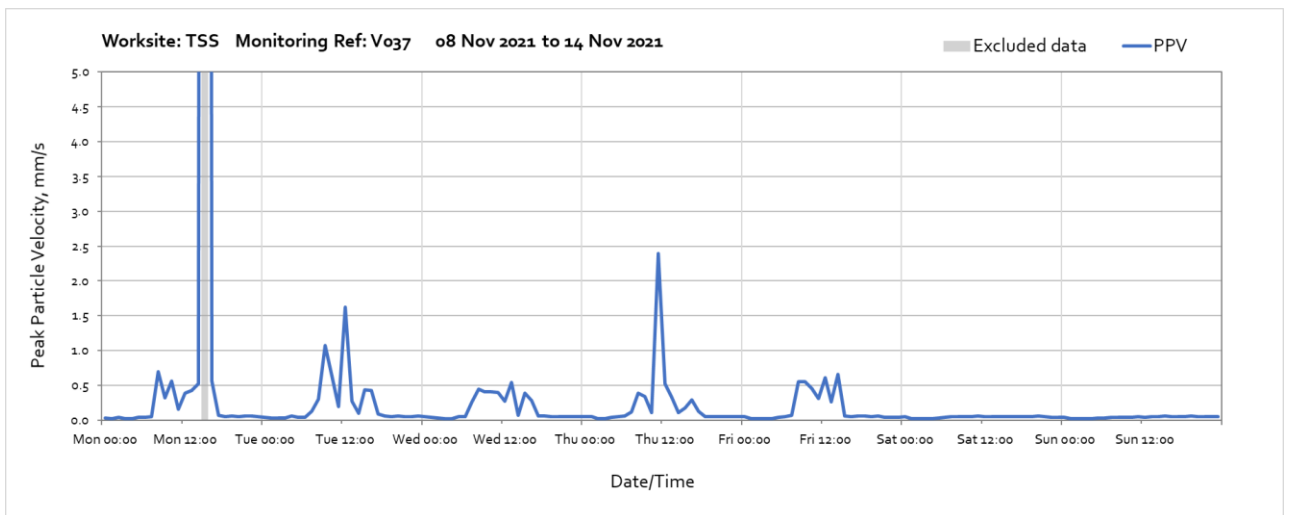
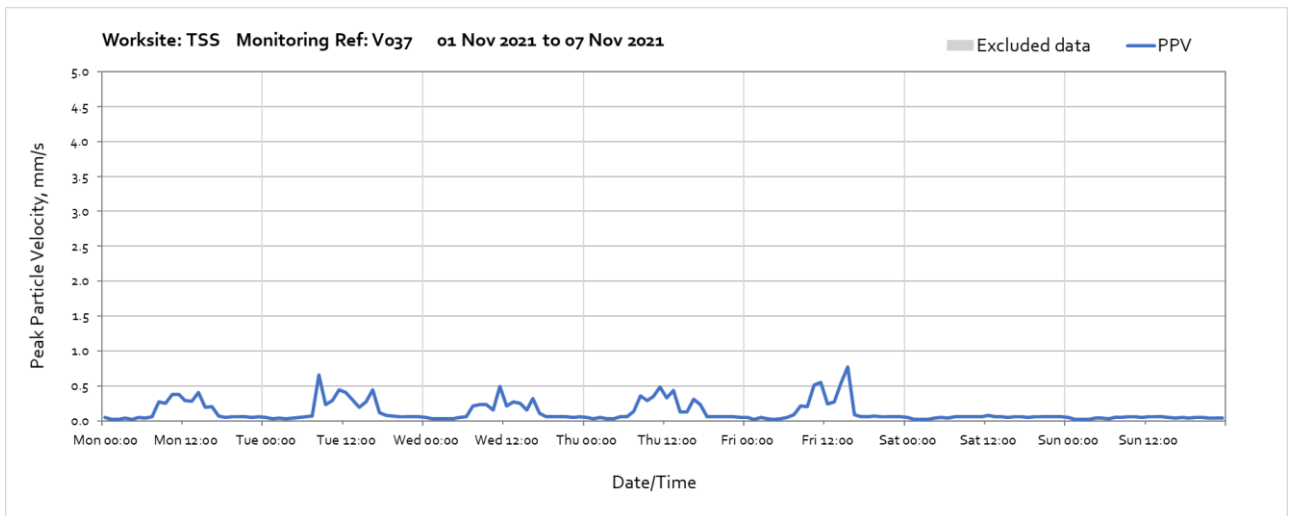
**Worksite: ETD, TSS – Monitoring Ref: V003**



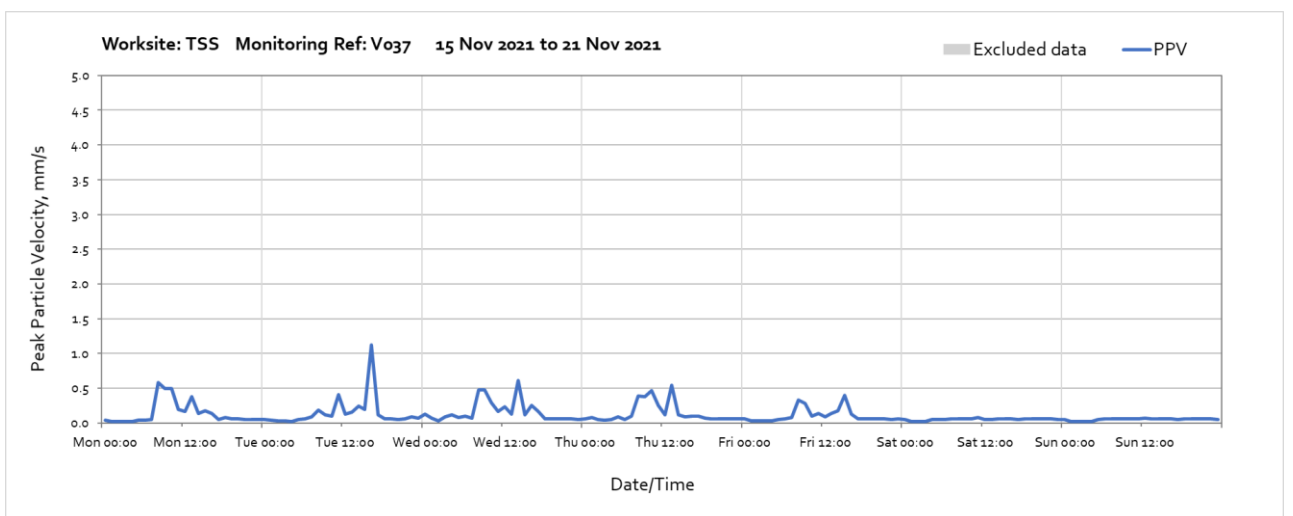
Note: High vibration levels measured between 11:00 until 12:00 on Wednesday 10<sup>th</sup> November were due to routine maintenance of the monitor and are not representative of HS2 vibration levels at the receptor.

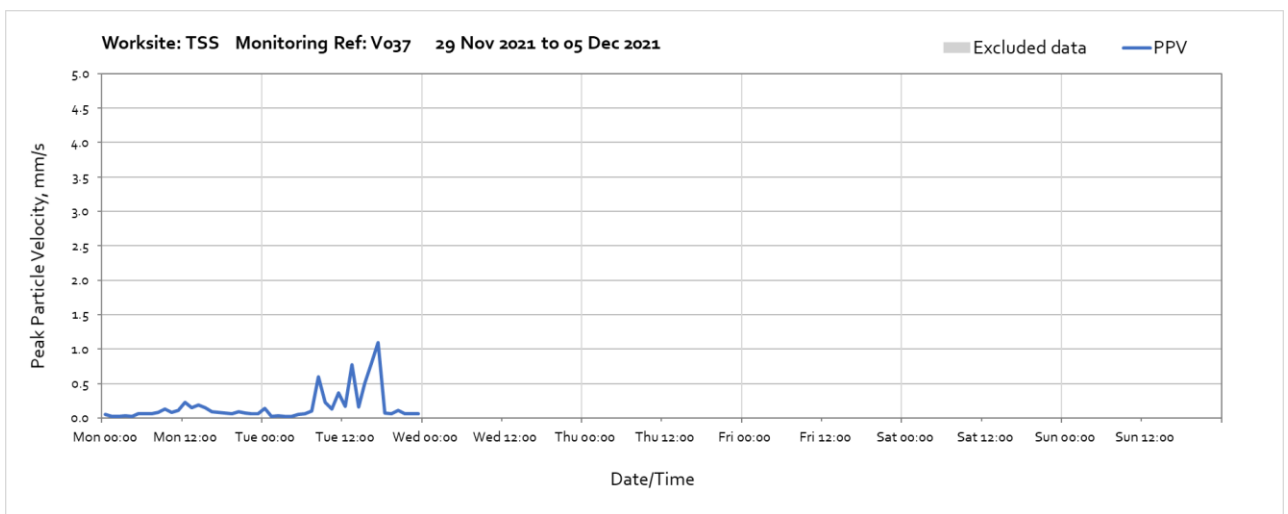
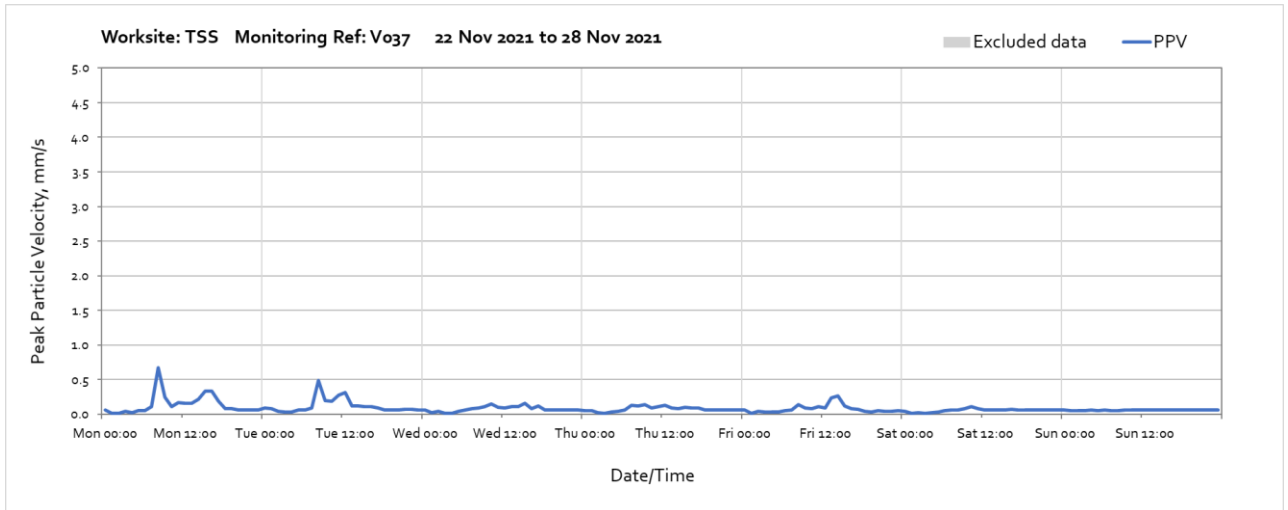


## Worksite: TSS – Monitoring Ref: V037

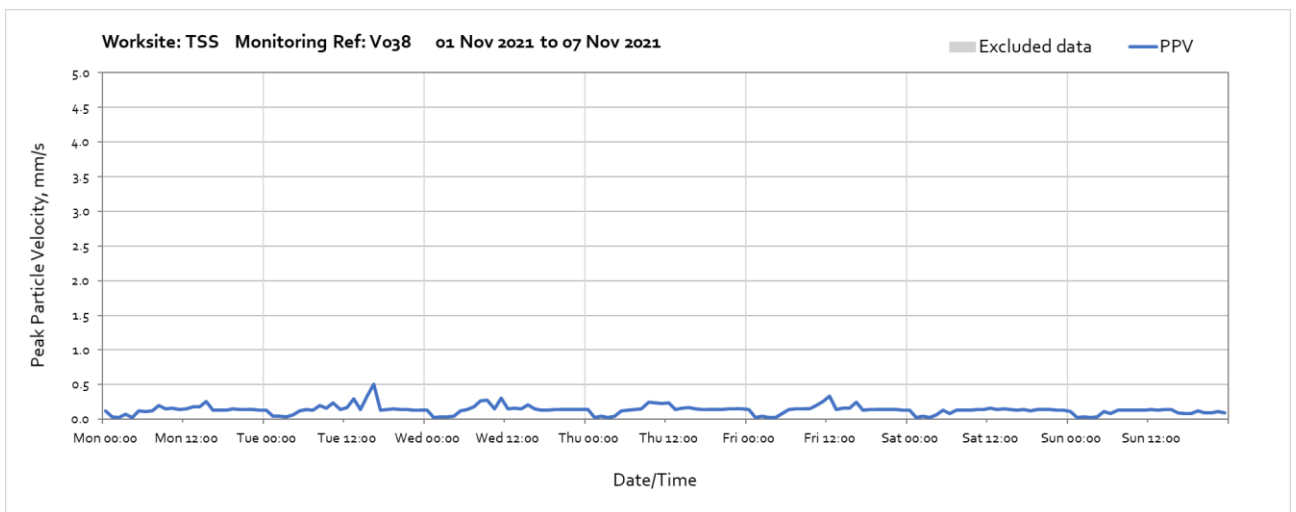


Note: High vibration levels measured between 15:00 until 16:00 on Monday 8<sup>th</sup> November were due to routine maintenance of the monitor and are not representative of HS2 vibration levels at the receptor.

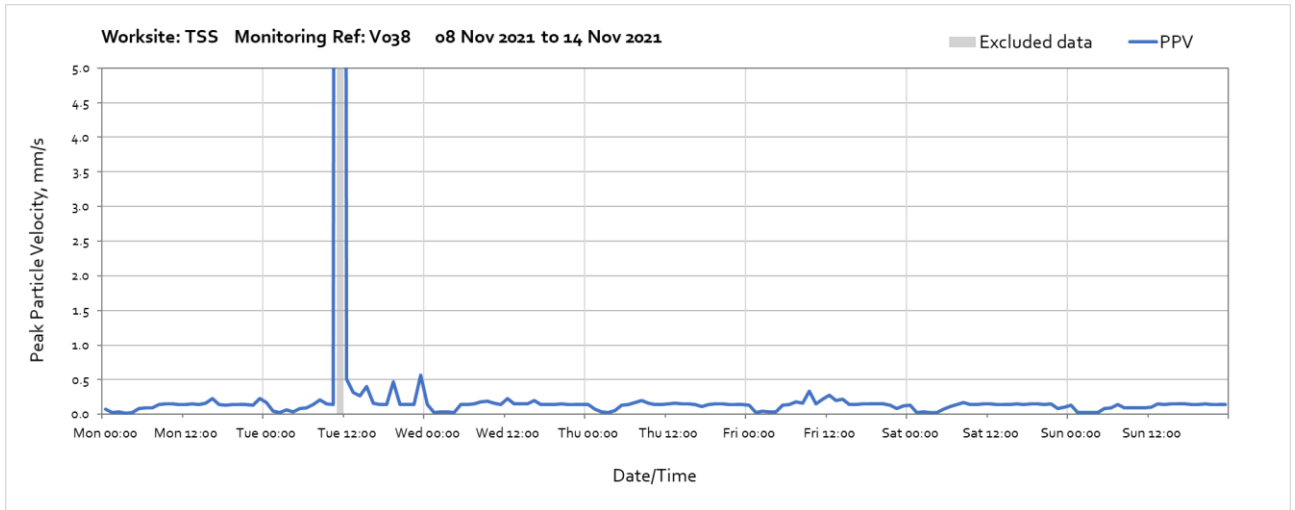




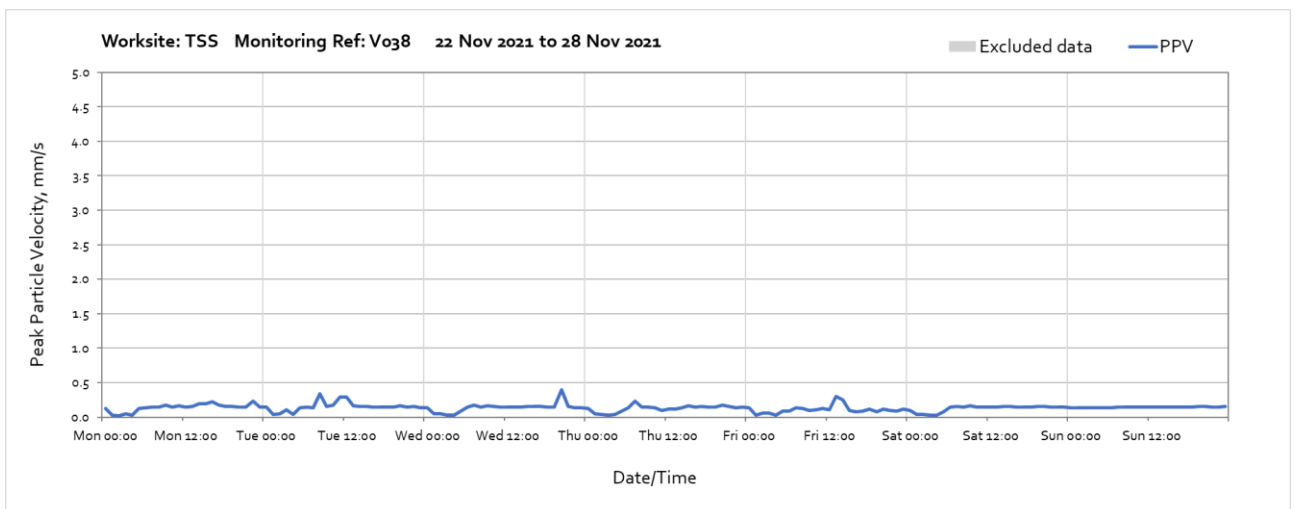
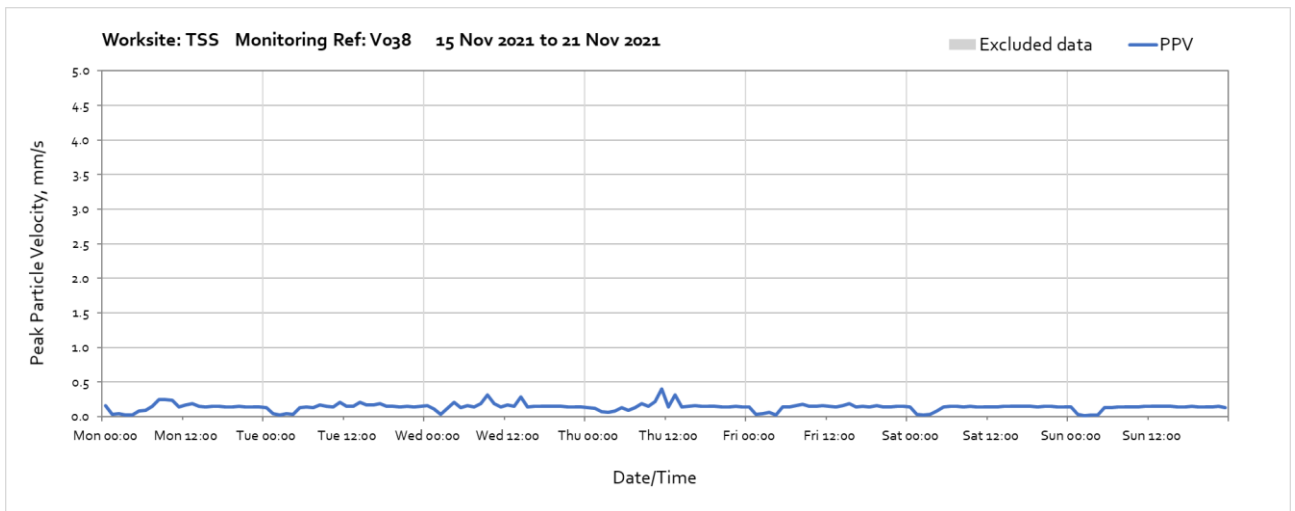
### Worksite: TSS - Monitoring Ref: V038

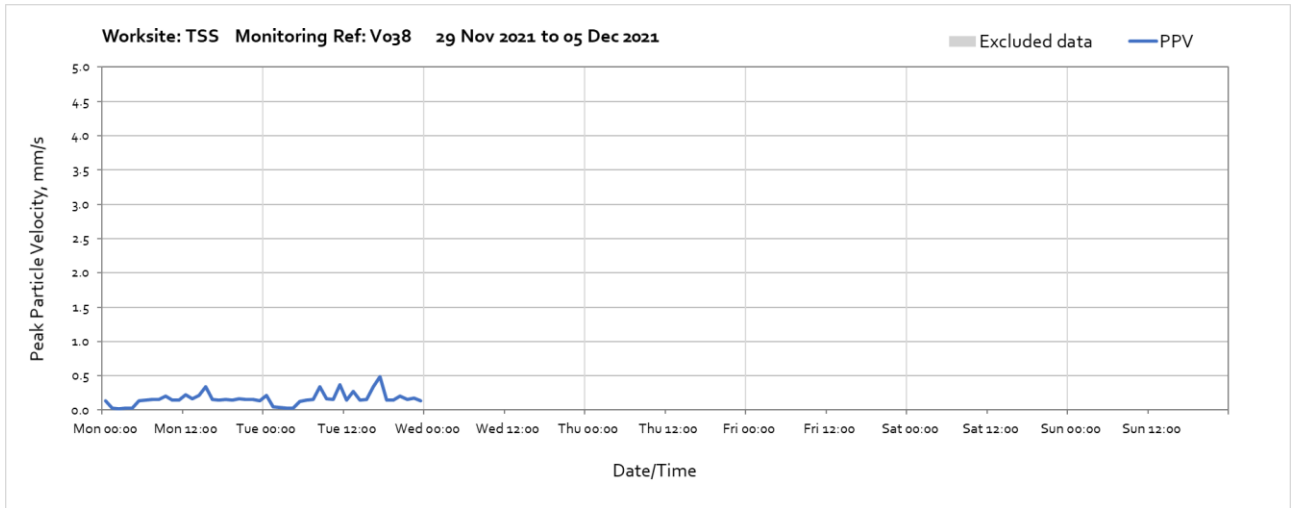




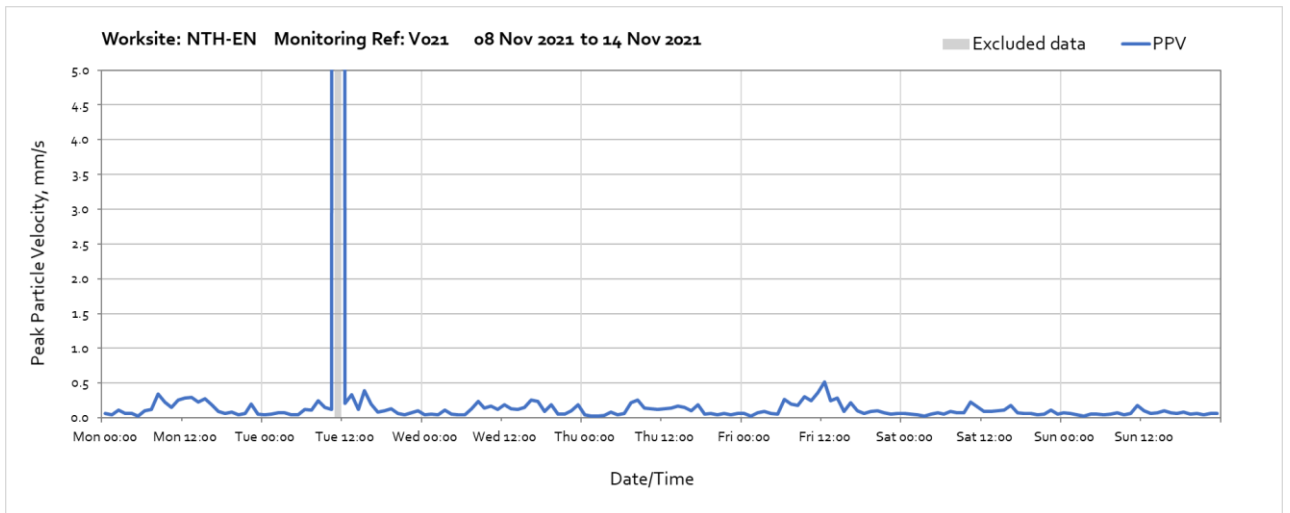
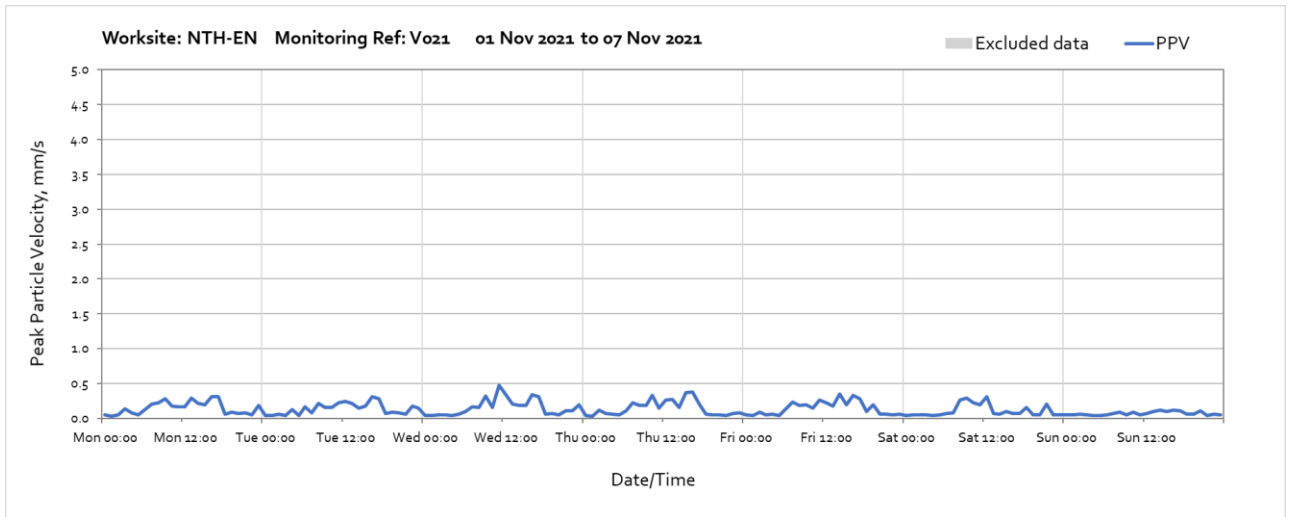


Note: High vibration levels measured between 11:00 until 12:00 on Tuesday 9<sup>th</sup> November were due to routine maintenance of the monitor and are not representative of HS2 vibration levels at the receptor.

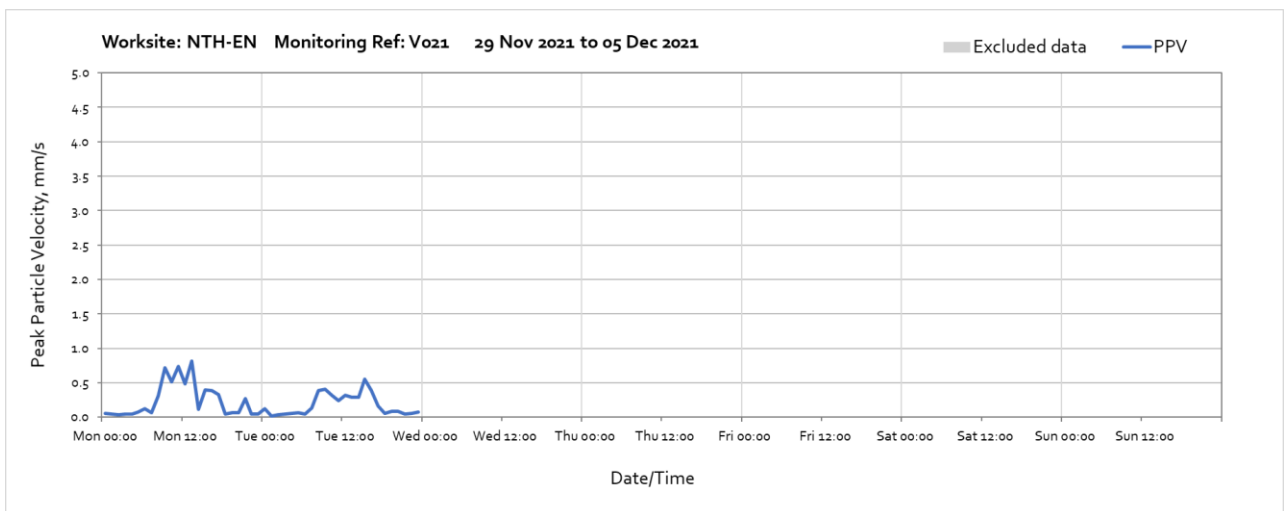
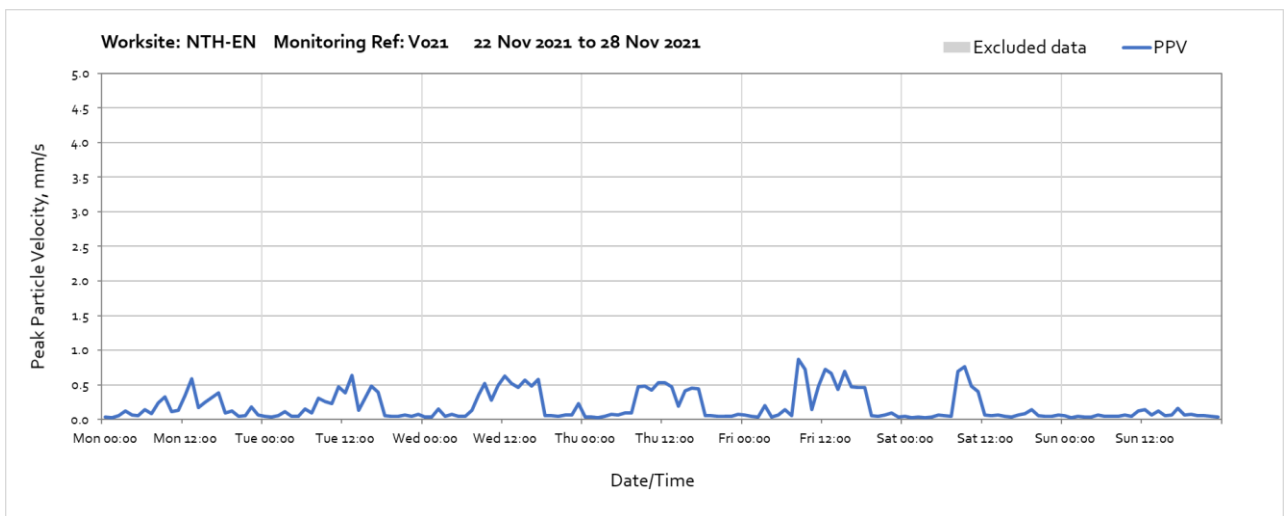
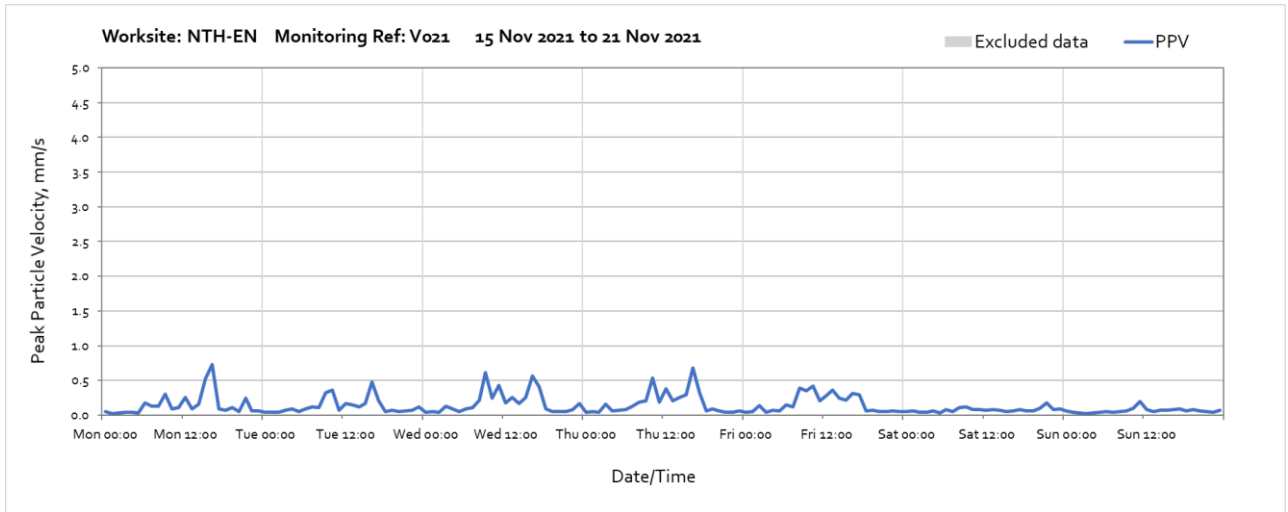




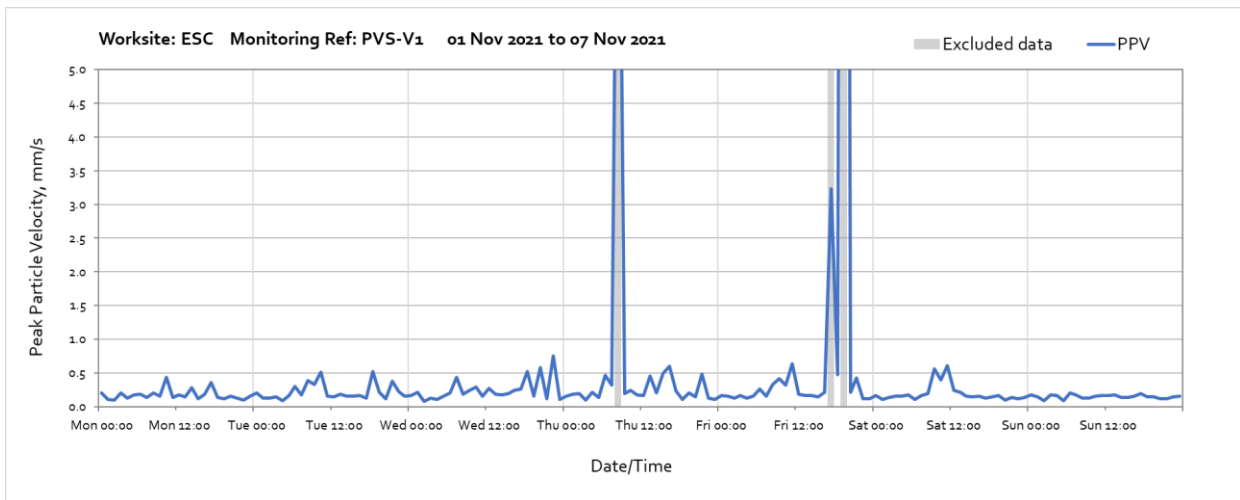
### Worksite: NTH-EN - Monitoring Ref: V021



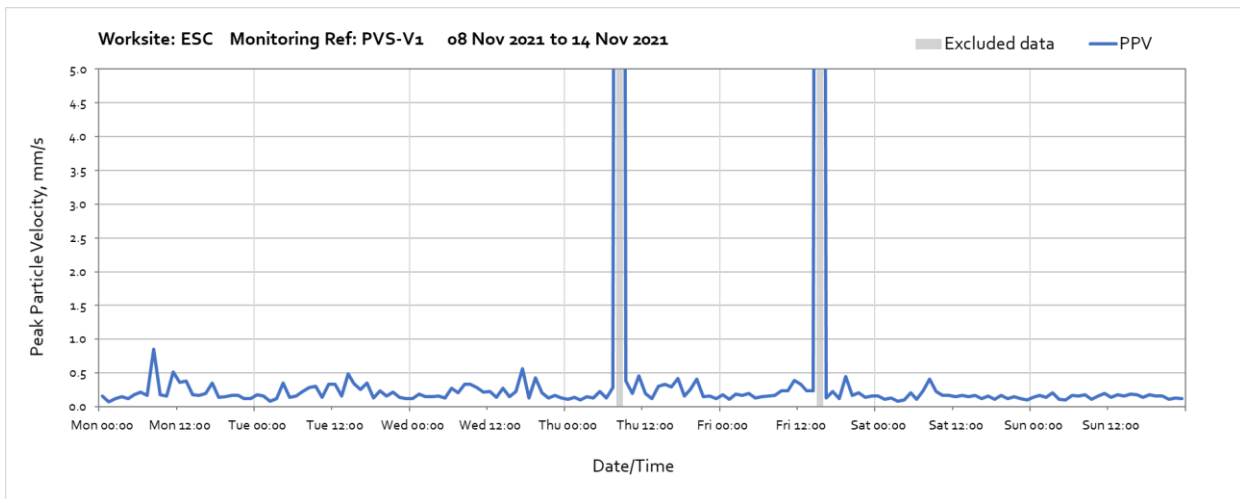
Note: High vibration levels measured between 11:00 until 12:00 on Tuesday 9<sup>th</sup> November were due to routine maintenance of the monitor and are not representative of HS2 vibration levels at the receptor.



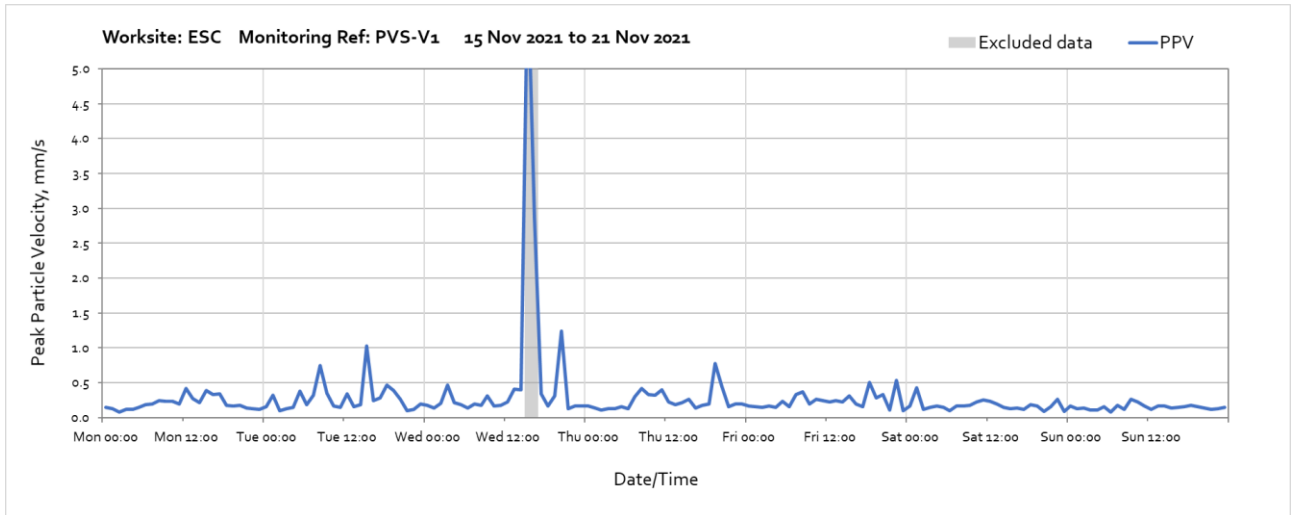
## Worksite: ESC – Monitoring Ref: PVS-V1



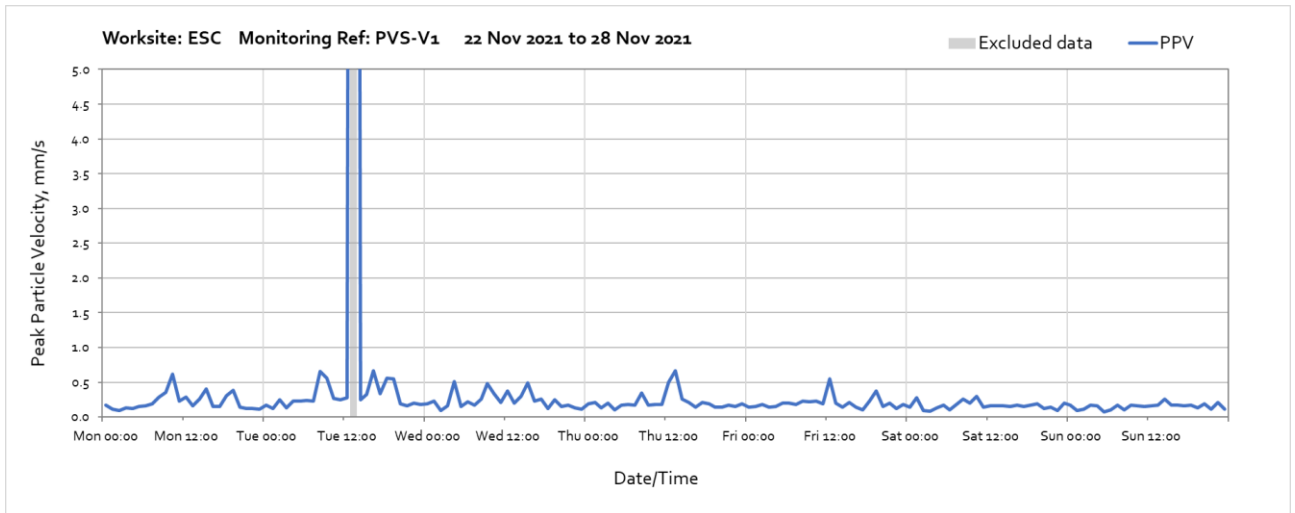
Note: High vibration levels measured throughout the week were due to local interference of the monitor and are not representative of HS2 vibration levels at the receptor.



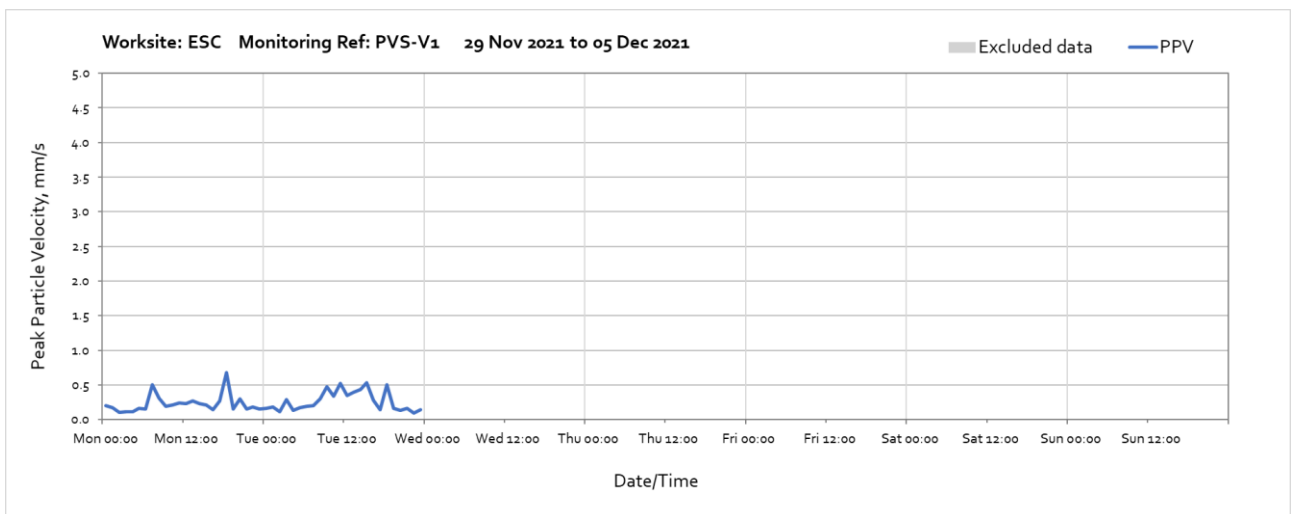
Note: High vibration levels measured from 08:00 until 09:00 on Thursday 11<sup>th</sup> November and 15:00 until 16:00 on Friday 12<sup>th</sup> November were due to local interference of the monitor and are not representative of HS2 vibration levels at the receptor.



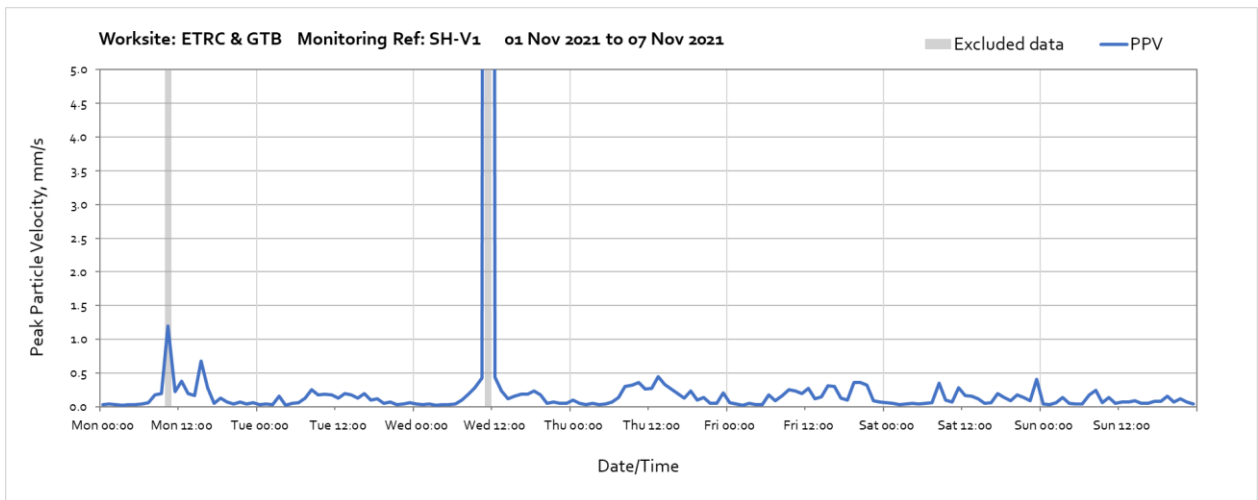
Note: High vibration levels measured from 15:00 until 17:00 on Wednesday 17<sup>th</sup> November were due to local interference of the monitor and are not representative of HS2 vibration levels at the receptor.



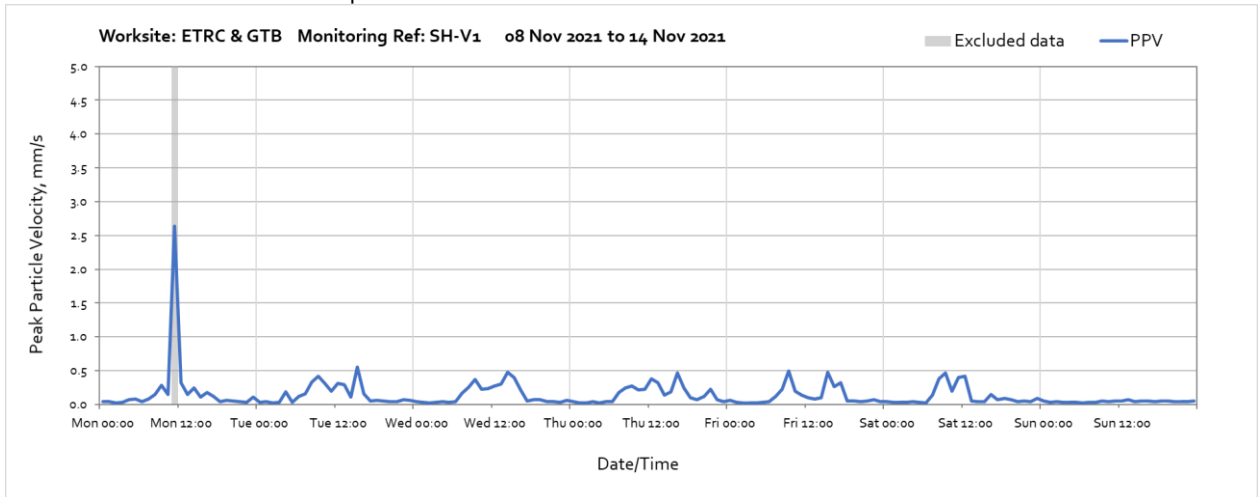
Note: High vibration levels measured from 13:00 until 14:00 on Tuesday 23<sup>rd</sup> November were due to local interference of the monitor and are not representative of HS2 vibration levels at the receptor.



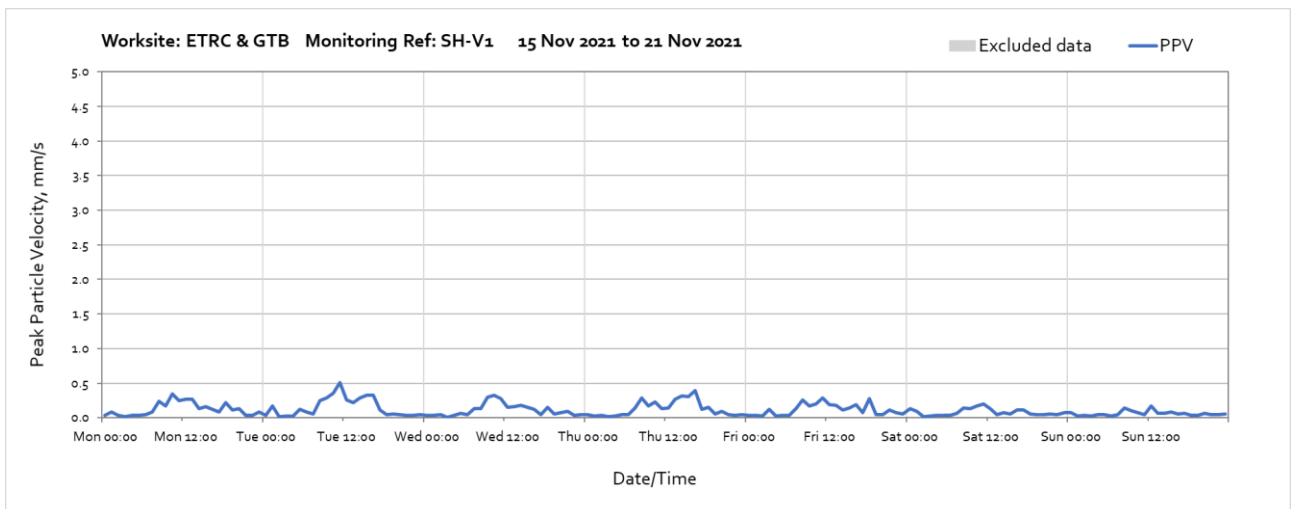
## Worksite: ETRC & GTB – Monitoring Ref: SH-V1

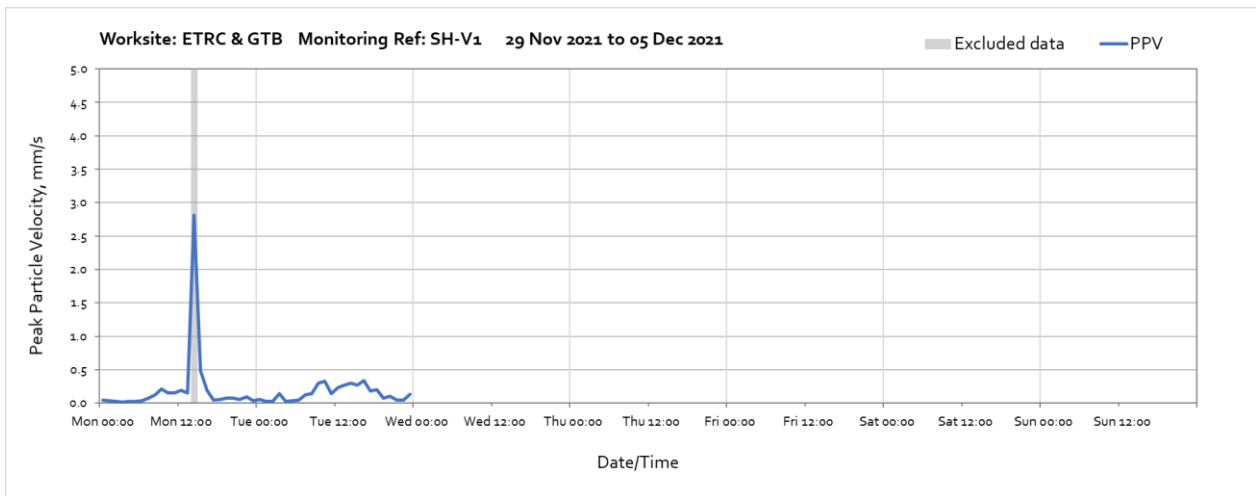
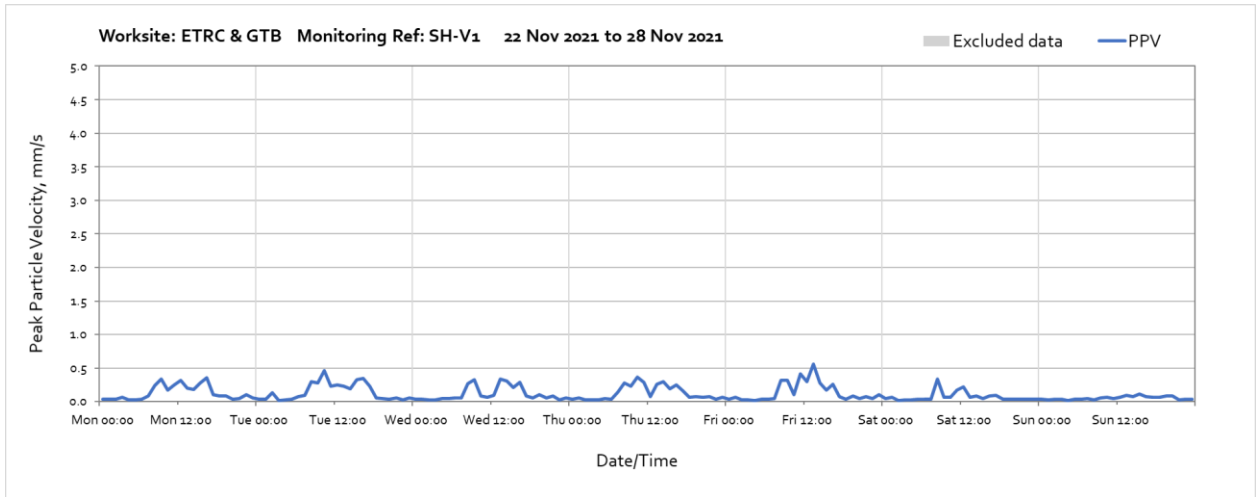


Note: High vibration levels measured from 10:00 until 11:00 on Monday 1<sup>st</sup> November and 11:00 until 12:00 on Wednesday 3<sup>rd</sup> November were due to local interference of the monitor and are not representative of HS2 vibration levels at the receptor.



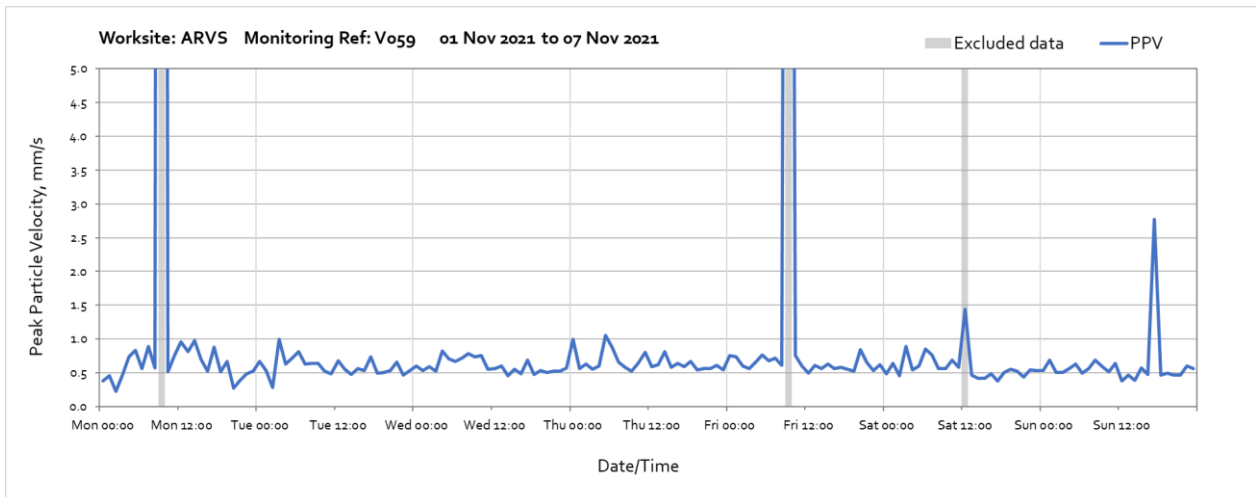
Note: High vibration levels measured from 11:00 until 12:00 on Monday 8<sup>th</sup> November were due to local interference of the monitor and are not representative of HS2 vibration levels at the receptor.



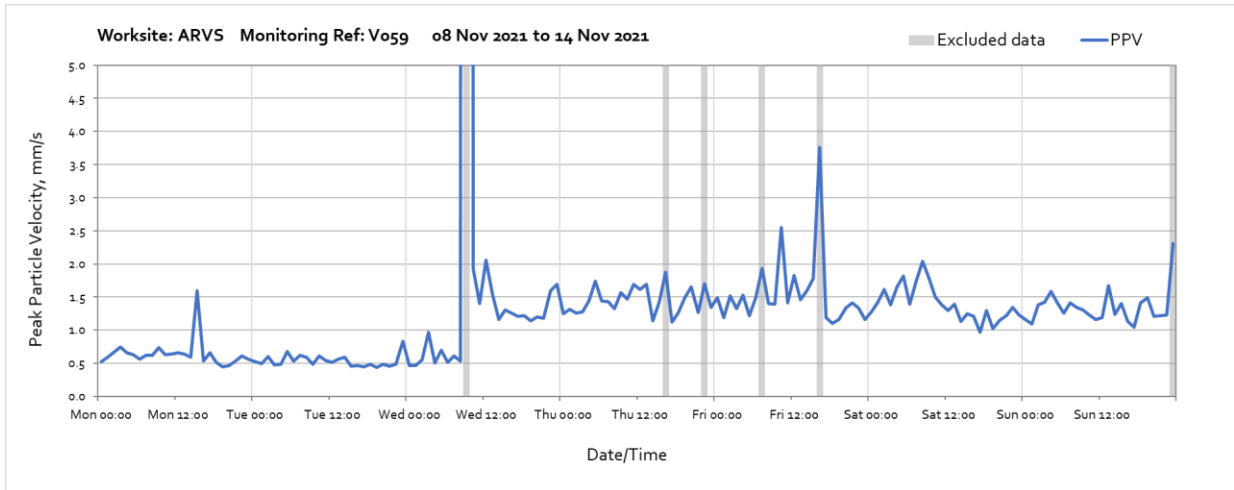


Note: High vibration levels measured from 14:00 until 15:00 on Monday 29<sup>th</sup> November were due to local interference of the monitor and are not representative of HS2 vibration levels at the receptor.

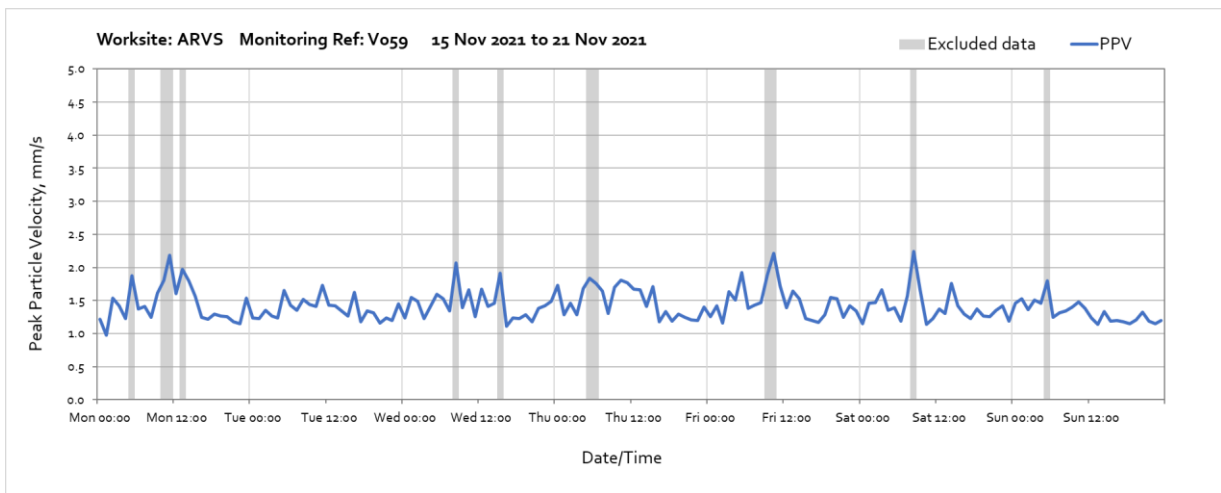
### Worksite: ARVS – Monitoring Ref: V059



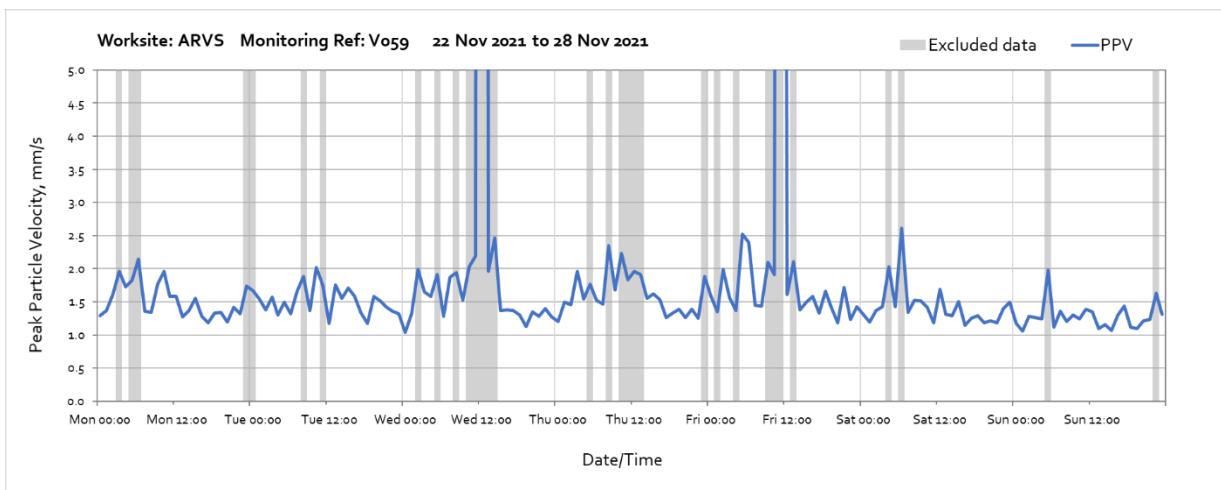
Note: High vibration levels measured throughout the week were due to local interference of the monitor and are not representative of HS2 vibration levels at the receptor.



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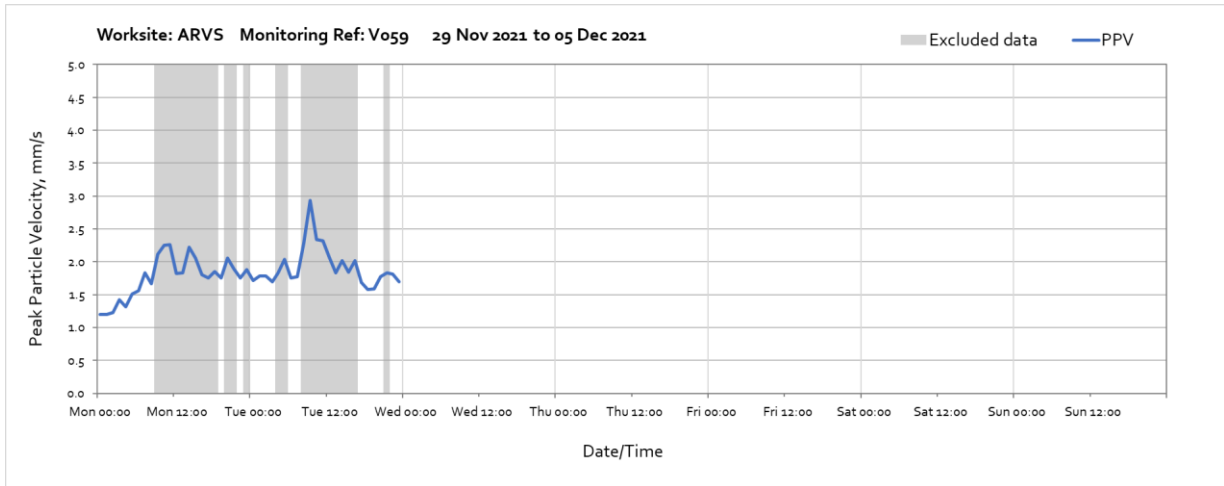


Note: High vibraton levels measured throughout the week were due to local interference of the monitor and are not representative of HS2 vibration levels at the receptor.



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