

Health Infrastructure NSW
Westmead PSB and MSCP
Construction Noise Monitoring

Noise monitoring report
2023-10-01 to 2023-10-31

AC23

v1 | 16 November 2023

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 271985

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Noise Monitoring Daily Results

1 Introduction

Arup has been commissioned by PricewaterhouseCoopers (PwC) on behalf of Health Infrastructure NSW to install noise monitors within the Central Acute Services Building (CASB), Children's Hospital Westmead (CHW) and Kids Research (KR) and Ronald McDonald House (RMH) buildings to monitor construction noise from the Paediatric Service Building (PSB) and Multi Storey Car Park (MSCP) development sites in the Westmead Precinct.

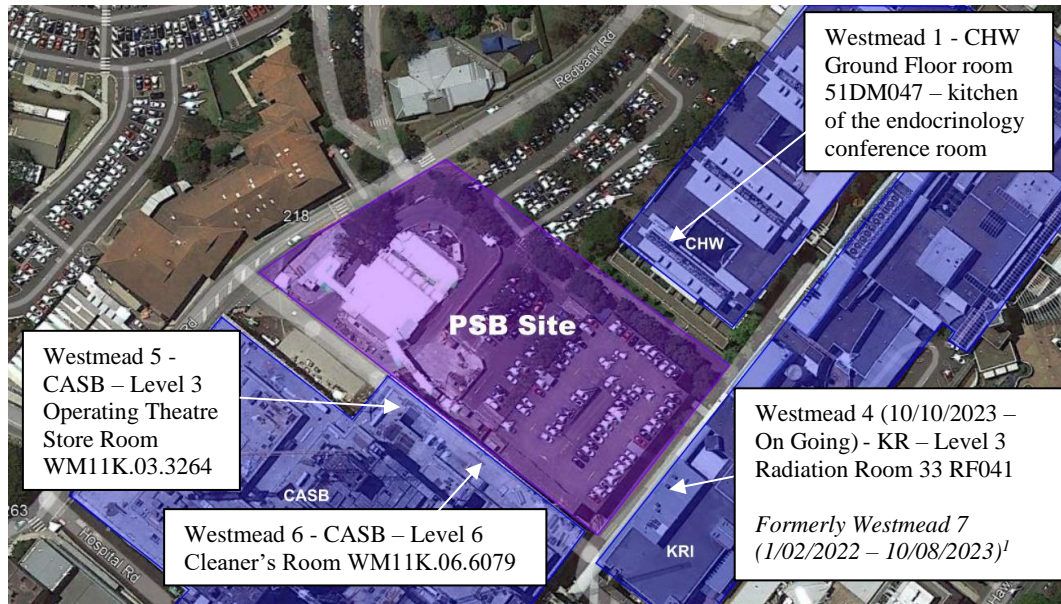
The noise loggers have been setup to send email and SMS notifications to stakeholders when construction Noise Management Levels (NMLs) are exceeded.

This report details noise measurement results from **1 October 2023 to 31 October 2023** inclusive.

2 Noise logger locations

Acoustic Research Labs Ngara noise loggers have been installed in the locations shown in Figure 1 and Figure 2 below.

The noise loggers were calibrated by Acoustic Research Labs (NATA-accredited calibration) in November 2021. In accordance with NATA standards, the noise loggers should be recalibrated every two years. Consequently, Arup has initiated the organisation of the recalibration of the loggers.



Note 1: Westmead 7 noise logger was temporarily repurposed for another project on the 10/8/2023. See Section 2.1.

Figure 1: PSB noise monitoring locations.



Figure 2: MSCP noise monitoring locations.

2.1 Noise Logger relocation

On Monday 10 October 2023, logger Westmead 4 was installed at the KR Level 3 radiation room. This is where Westmead 7 was previously installed before it was removed to support the VVMF noise monitoring on 10/8/2023.

On Monday 18 October 2023, Westmead 1, Westmead 2, and Westmead 3 loggers were removed from site to be sent to the manufacturer for recalibration.

A summary of all noise logger relocations can be found in Table 1 below:

Table 1: Logger relocation records

Logger ID	Original Location	Current Location	
	Location	Date Moved	Location
Westmead 7	KR Level 3 Radiation Room 33 RF041	10/8/23	<i>Removed from site to support another project (VVMF project)</i>
Westmead 4	Off site to support another project (VVMF project)	10/10/23	KR Level 3 Radiation Room 33 RF041
Westmead 1	CHW Ground Floor room 51DM047	18/10/23	<i>Removed from site</i>
Westmead 2	CHW Level 2 Parent Kitchen 92BW025	18/10/23	<i>Removed from site</i>
Westmead 3	RMH Level 1 Store Room 101	18/10/23	<i>Removed from site</i>

3 Noise Management Levels

The current construction Noise Management Levels for each internal monitoring location are set out in Table 2.

Measurement data taken from ‘standard’ construction work hours for the project only are assessed against the Noise Management Level criteria, being:

- 7am-6pm Mon-Fri
- 8am-1pm Sat
- No work on Sundays and Public Holidays.

As part of the previous installation works a baseline noise study was conducted to determine appropriate noise management level. Refer to Arup’s *Baseline noise measurements* report¹ for details regarding how these Management Levels were nominated.

Table 2: Baseline noise measurement results.

Logger ID	Location	Noise Management Level (upper limit), dB L _{Aeq,15min}
Westmead 1	CHW Ground Floor room 51DM047 – kitchen of the endocrinology conference room (facing PSB site)	60
Westmead 5	CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (facing PSB site)	50
Westmead 6	CASB Level 6 Cleaner’s Room WM11K.06.6079 (facing PSB site)	52
Westmead 4	KR Level 3 Radiation Room 33 RF041 (facing PSB site)	58
Westmead 2	CHW Level 2 Parent Kitchen 92BW025 (facing MSCP site)	64
Westmead 3	RMH Level 1 Store Room 101 (facing MSCP site)	47

3.1 Management Level updates

- None to date.

¹ Arup report reference 271985-AC02.

4 Noise monitoring results

4.1 Outages

Noise monitoring outages are shown below. This excludes outages related to logger data collection and calibration.

Table 3: Noise logger outages during monitoring period.

Logger Id	Noise logger location	Outages
Westmead 1	CHW Ground Floor room 51DM047 – kitchen of the endocrinology conference room (facing PSB site)	1/10/2023 to 10/10/2023 18/10/2023 – ongoing ¹
Westmead 5	CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (facing PSB site)	10/10/2023 – 31/10/2023
Westmead 6	CASB Level 6 Cleaner's Room WM11K.06.6079 (facing PSB site)	10/10/2023 (12:30 – 13:45)
Westmead 4	KR Level 3 Radiation Room 33 RF041(facing PSB site)	1/10/2023 to 10/10/2023 ² 15/10/2023 – 31/10/2023
Westmead 7	KR Level 3 Radiation Room 33 RF041(facing PSB site)	N/A ³
Westmead 2	CHW Level 2 Parent Kitchen 92BW025 (facing MSCP site)	1/10/2023 to 10/10/2023 18/10/2023 – ongoing ¹
Westmead 3	RMH Level 1 Store Room 101 (facing MSCP site)	1/10/2023 to 10/10/2023 18/10/2023 – ongoing ¹

Note:

- Noise logger was removed from site to be sent to manufacturer for recalibration.
- Westmead 4 logger was installed on site to replace Westmead 7 on Tuesday 10 October 2023.
- Westmead 7 logger was relocated to the WIMR bike store room on Thursday 10 August 2023 to support the VVMF construction project.

4.2 Exceedances

The number of Management Level exceedances recorded at each noise monitoring location during the assessment period are shown below.

Table 4: Recorded Management Level exceedances.

Logger Id	Noise logger location	Noise Management Level exceedance instances
Westmead 1	CHW Ground Floor room 51DM047 – kitchen of the endocrinology conference room (facing PSB site)	2
Westmead 5	CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (facing PSB site)	49
Westmead 6	CASB Level 6 Cleaner's Room WM11K.06.6079 (facing PSB site)	87

Logger Id	Noise logger location	Noise Management Level exceedance instances
Westmead 4	KR Level 3 Radiation Room 33 RF041(facing PSB site)	155
Westmead 7	KR Level 3 Radiation Room 33 RF041(facing PSB site)	N/A ¹
Westmead 2	CHW Level 2 Parent Kitchen 92BW025 (facing MSCP site)	4
Westmead 3	RMH Level 1 Store Room 101 (facing MSCP site)	7

Note 1: Westmead 7 logger was relocated to the WIMR bike store room on Thursday 10 August 2023 to support the VVMF construction project, hence all potential exceedances recorded by this logger are currently not relevant for this project.

It is the responsibility of Ford Civils (the Head Contractor) to respond to each Noise Management Level exceedance when it occurs and record the outcome of the exceedance investigation (cause of NML exceedance, any noise mitigation measures implemented to address the exceedance, etc.).

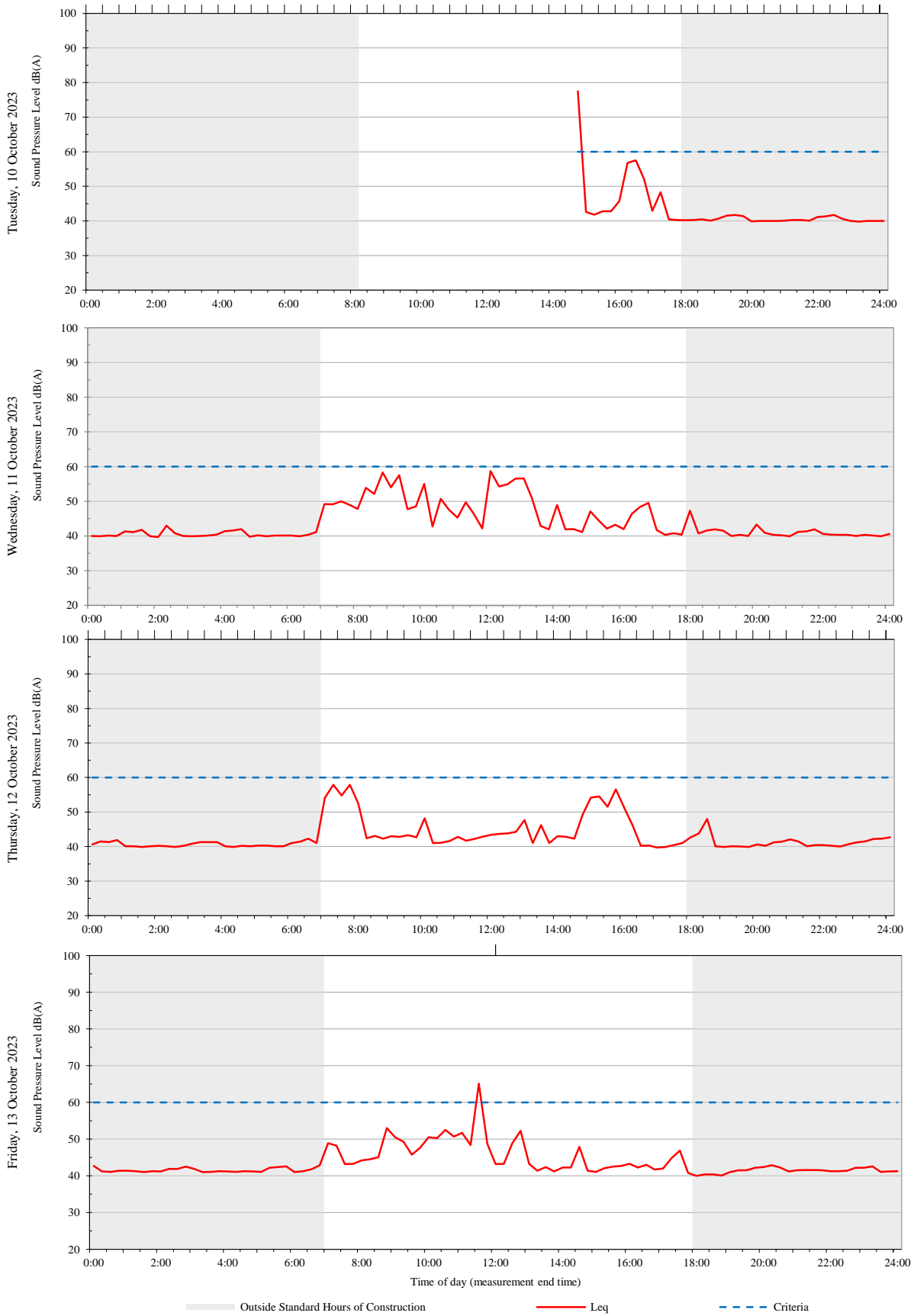
4.3 Daily noise monitoring results

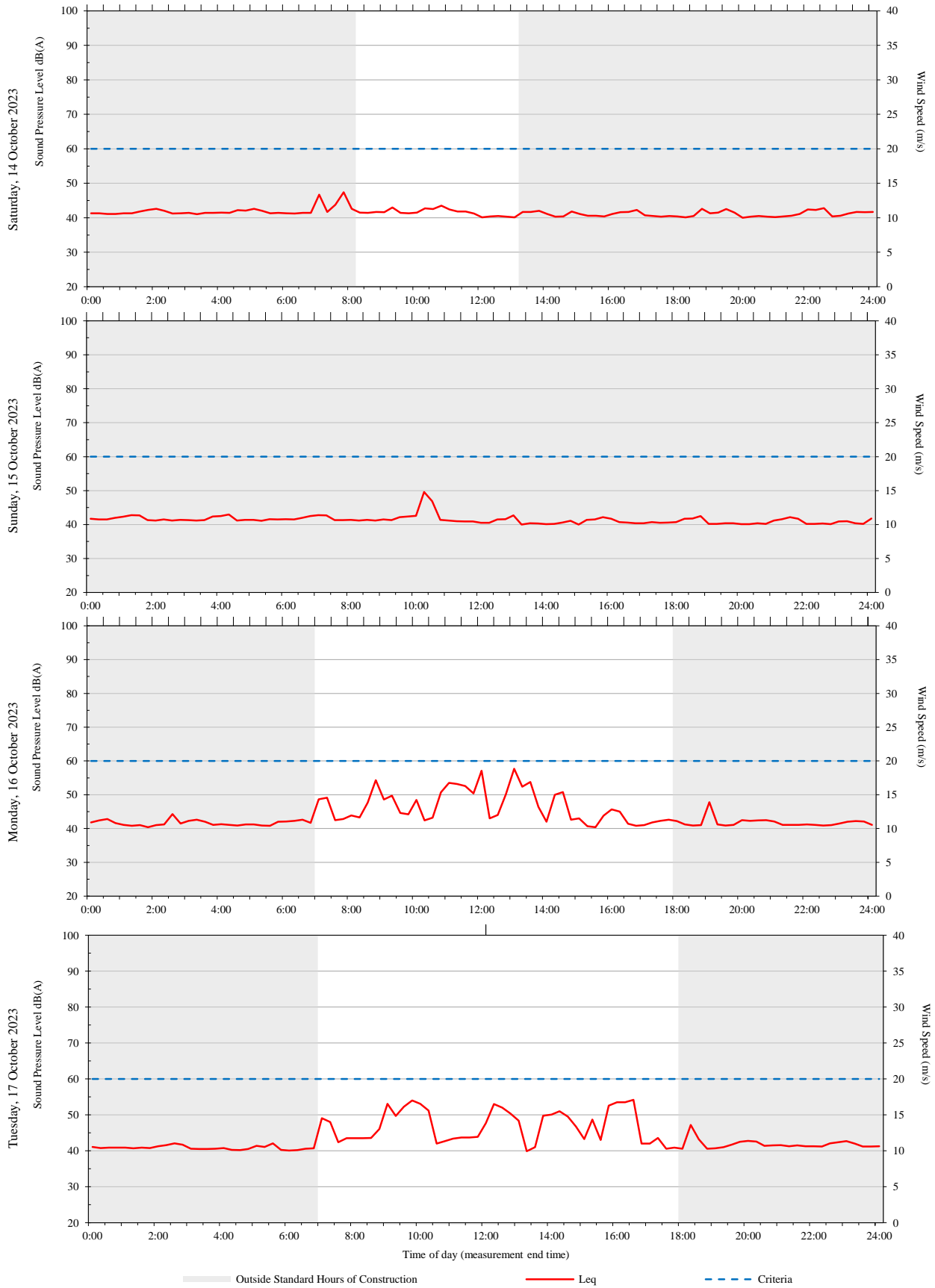
Daily noise monitoring results are showing for each location in Appendix A.

Appendix A

Noise Monitoring Daily Results

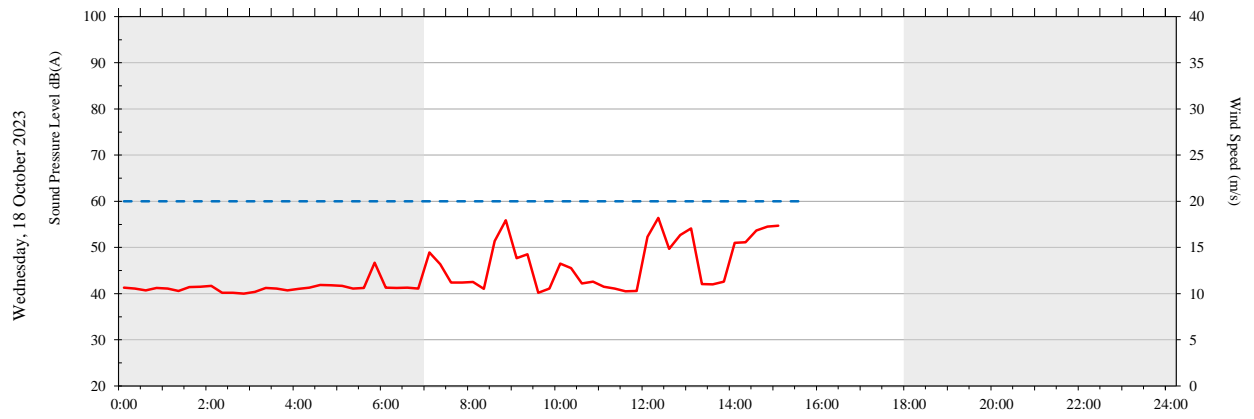
A1 CHW Ground Floor room 51DM047 (Westmead 1)



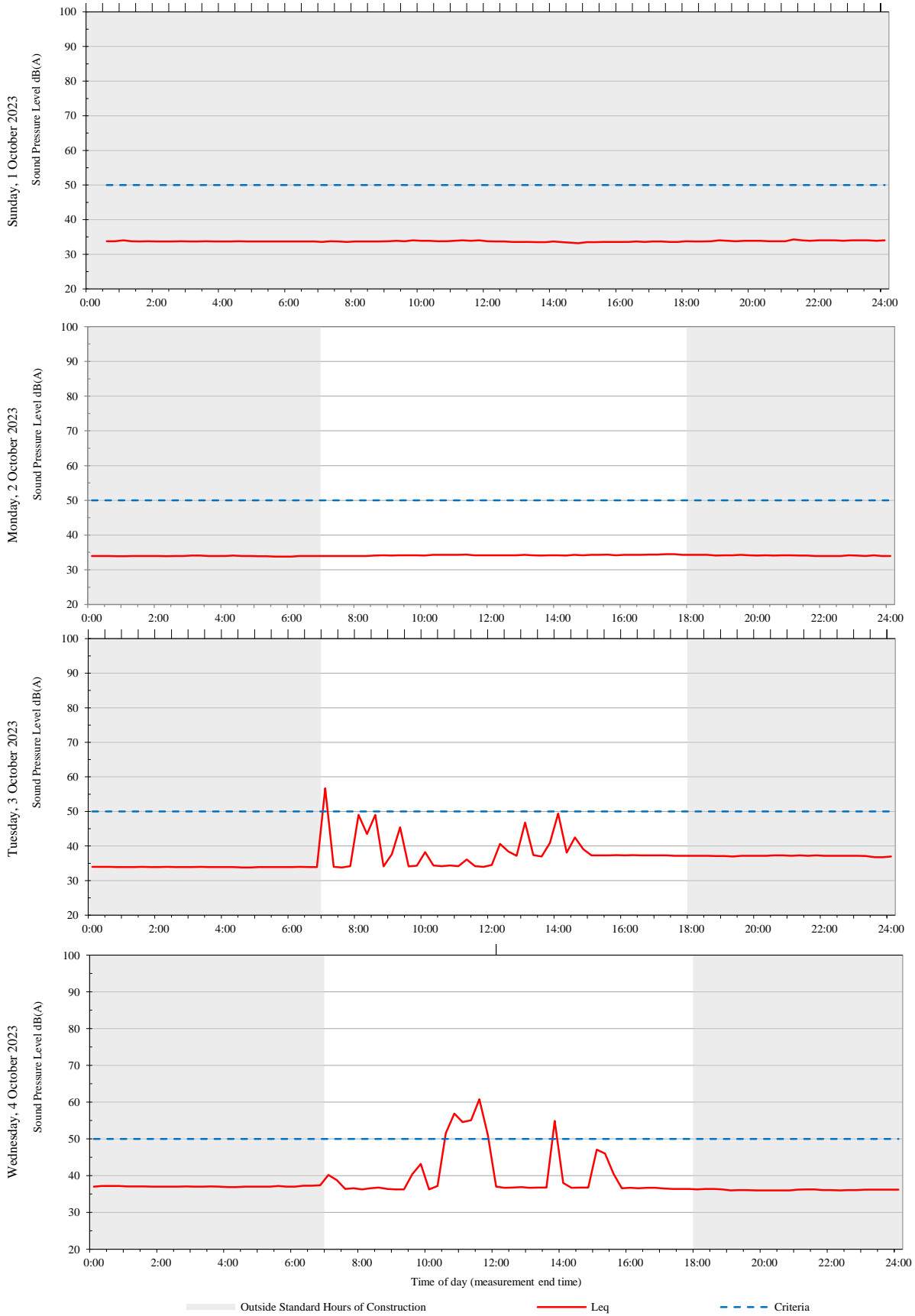


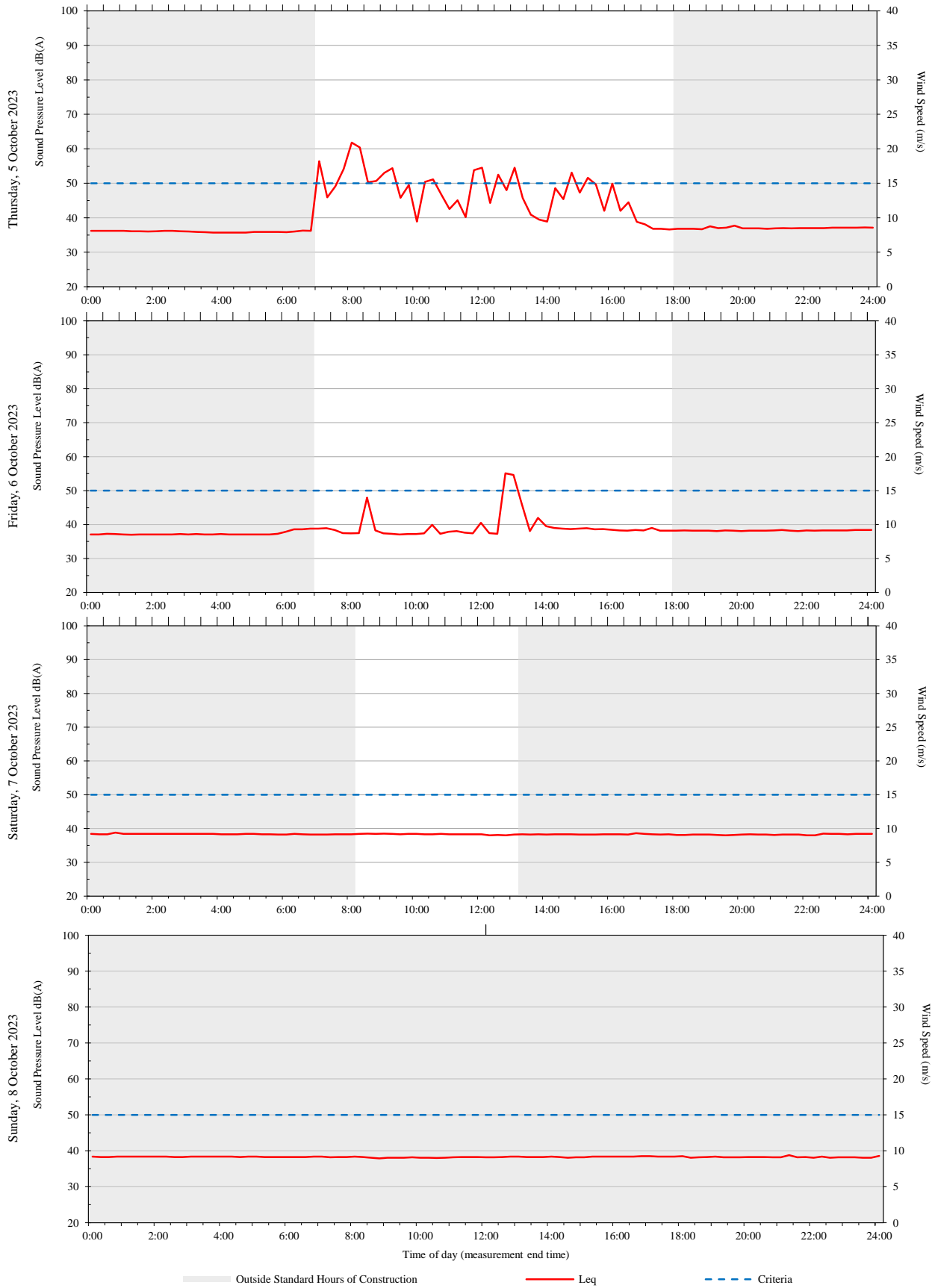
Unattended monitoring: CHW Ground Floor room 51DM047 (Internal)

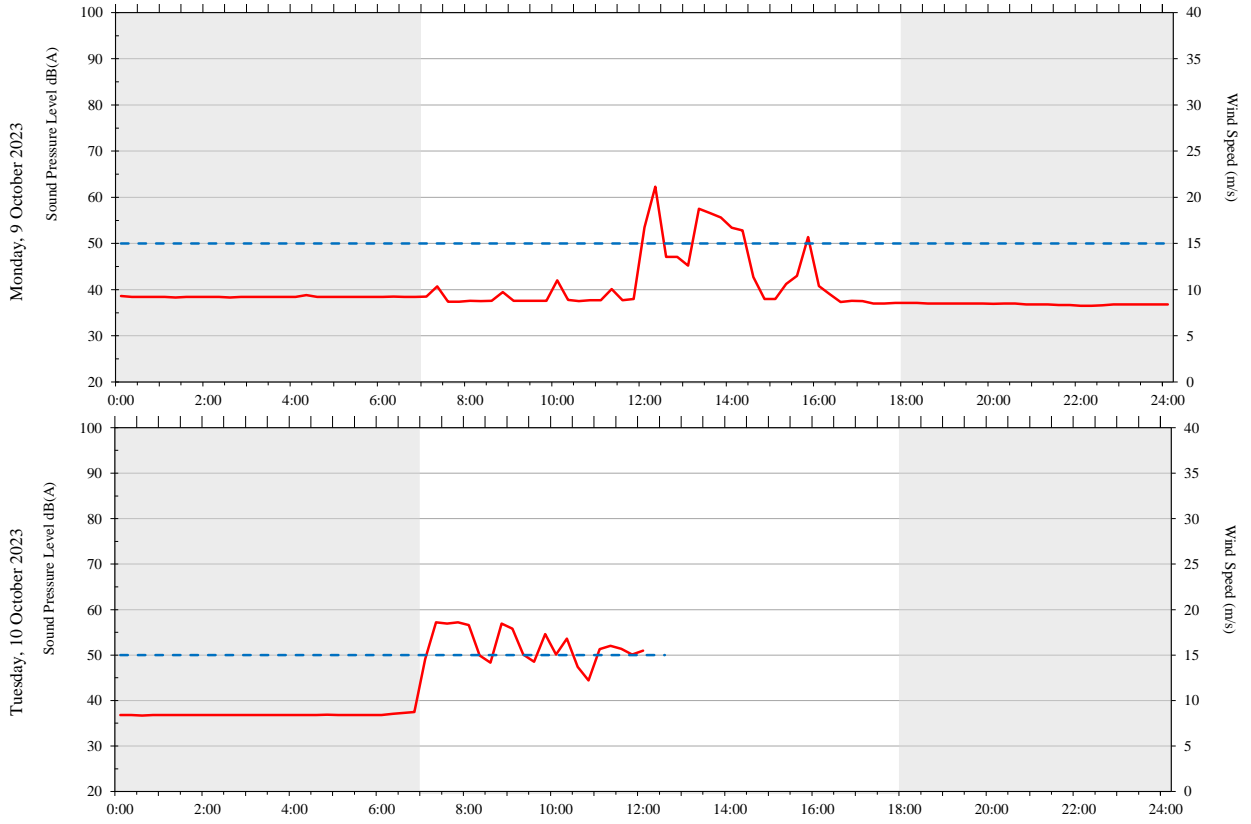
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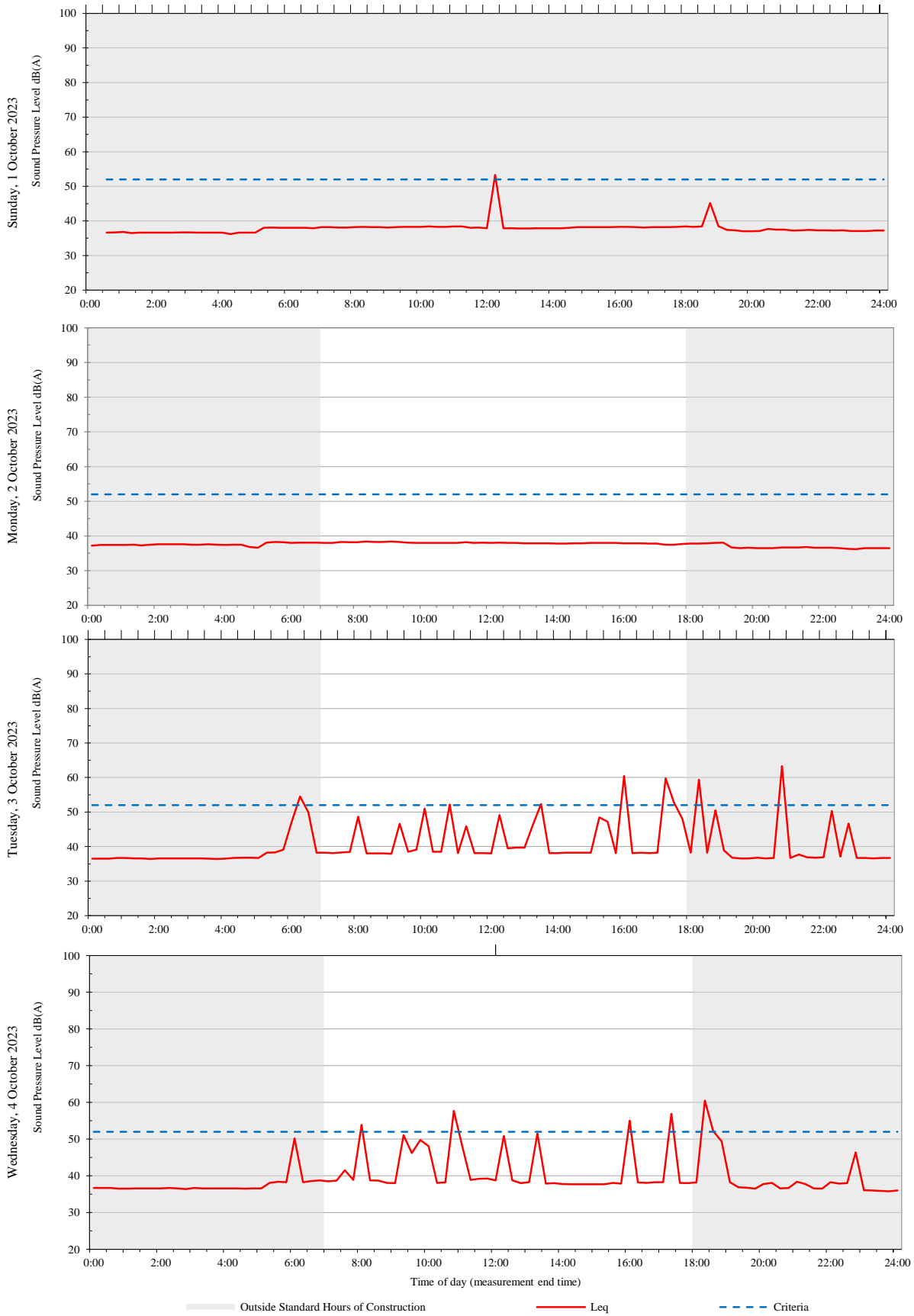
A2 CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (Westmead 5)

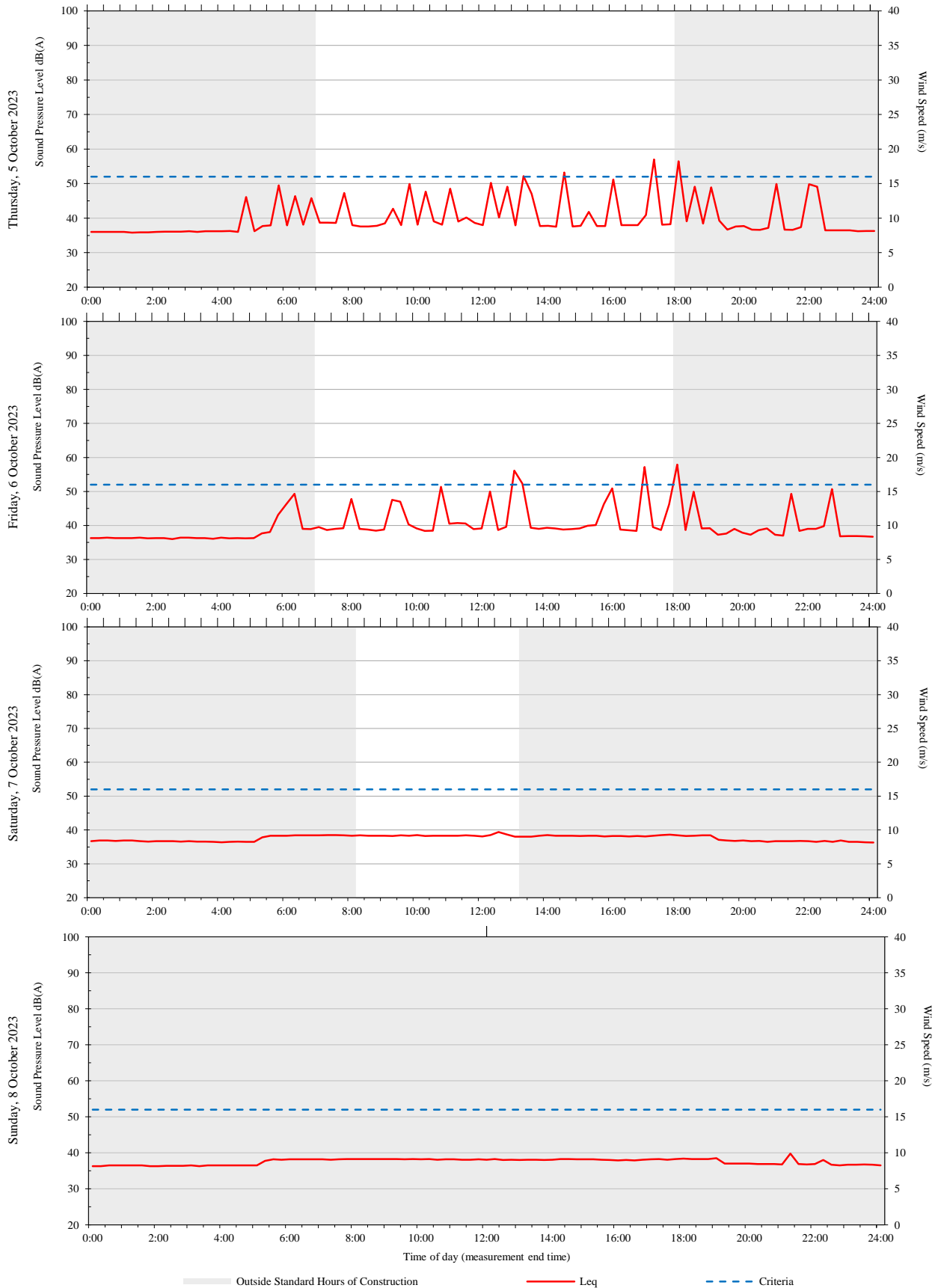


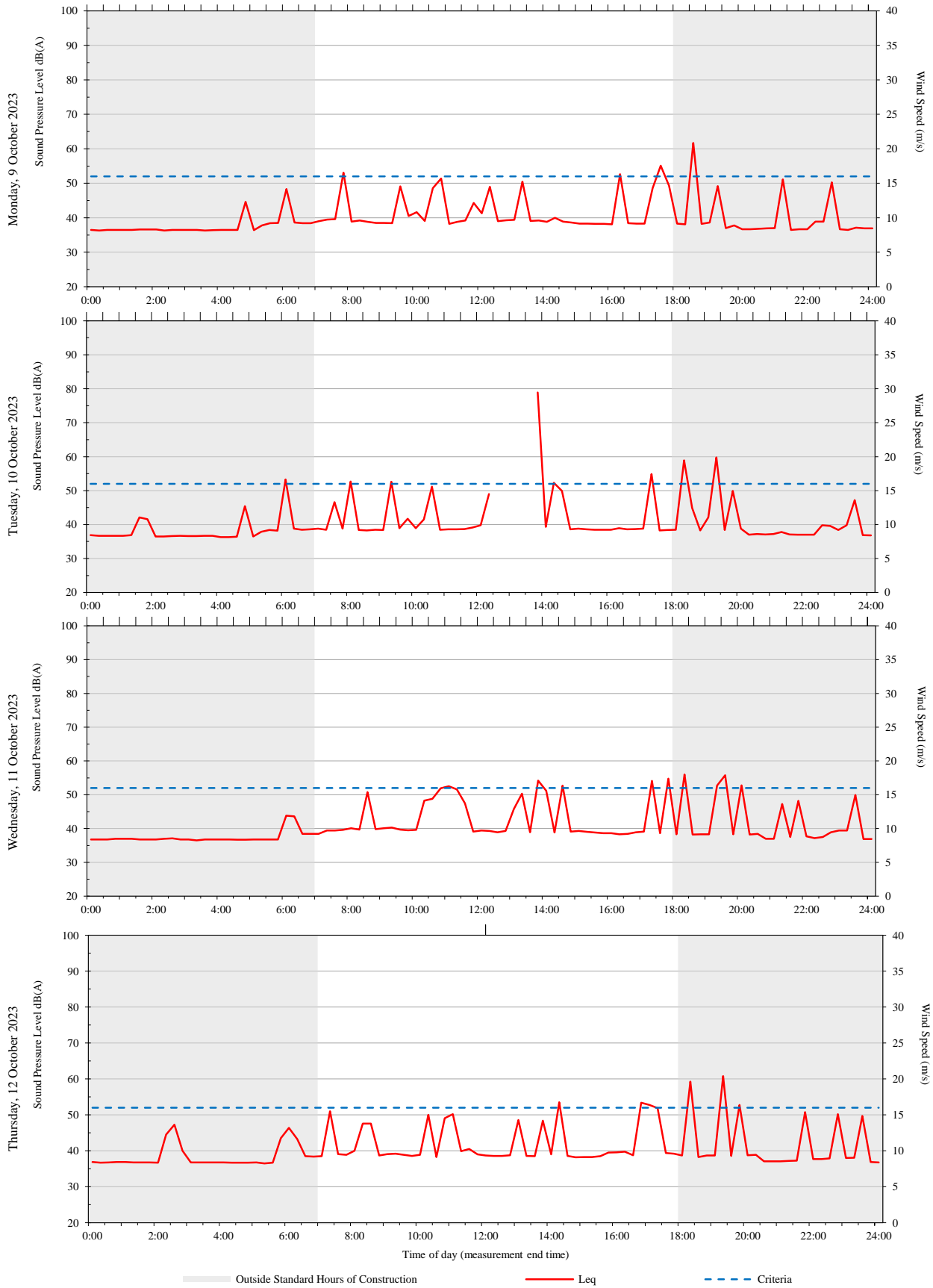


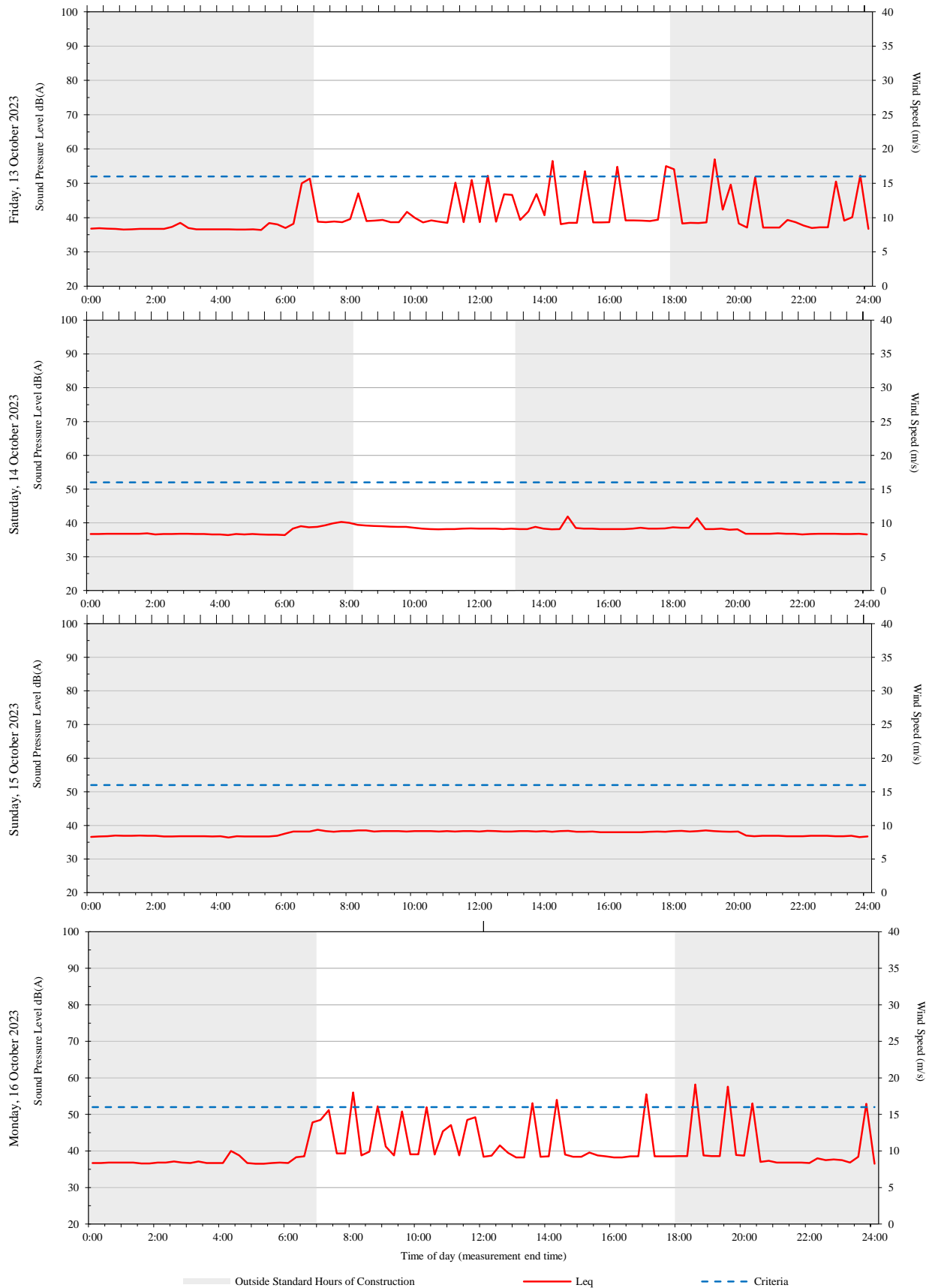


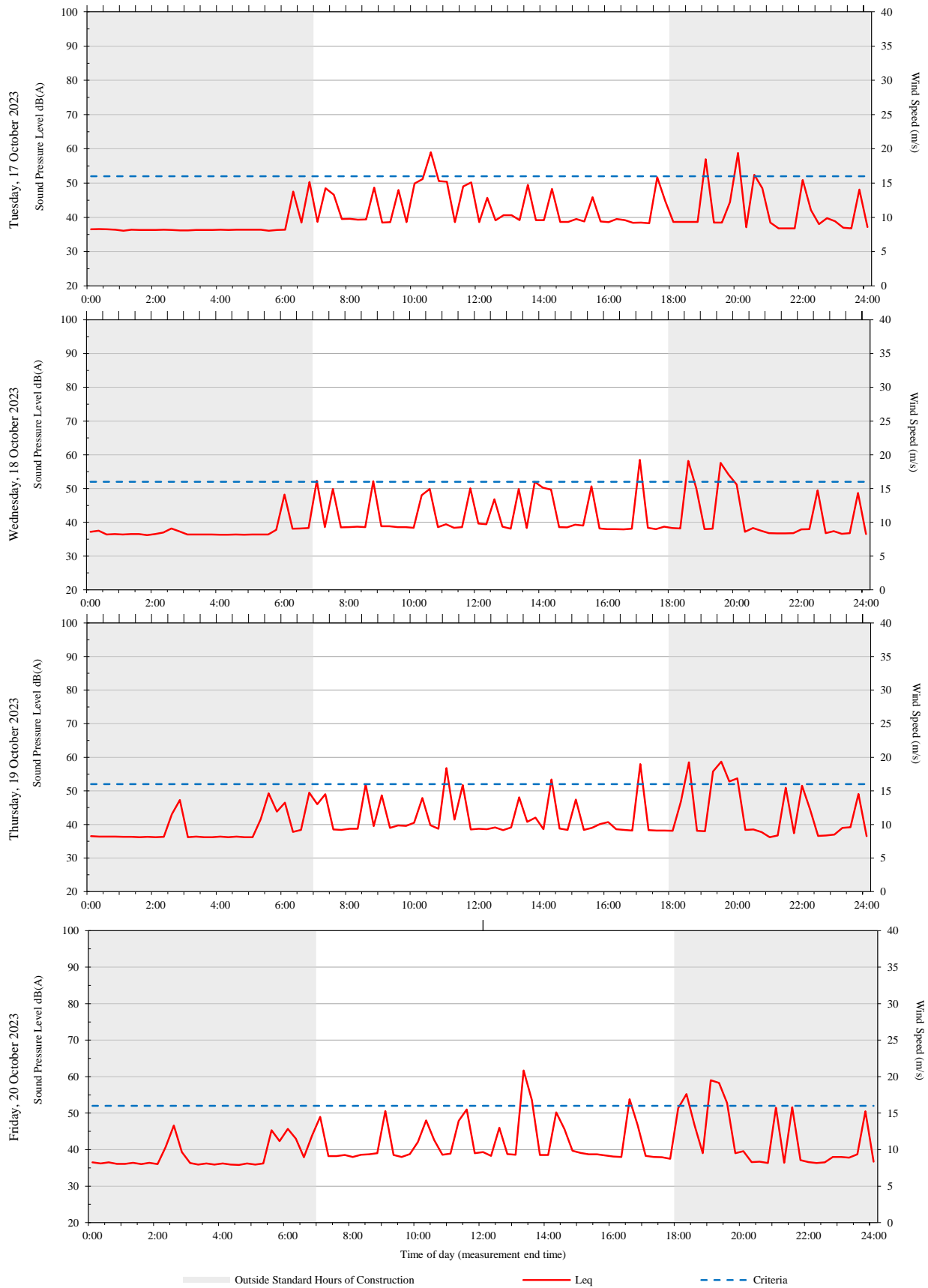
A3 CASB Level 6 Cleaner's Room WM11K.06.6079 (Westmead 6)

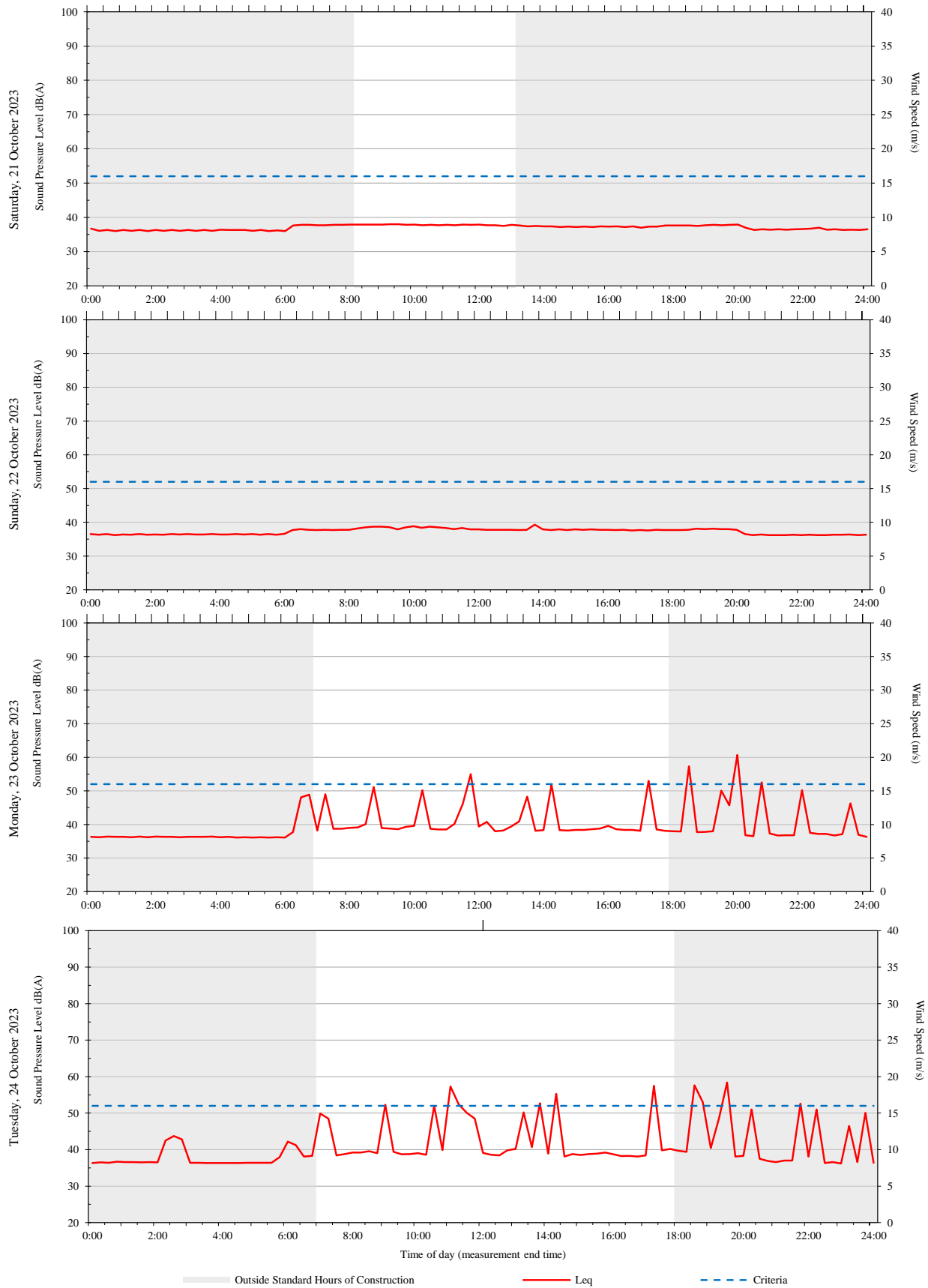


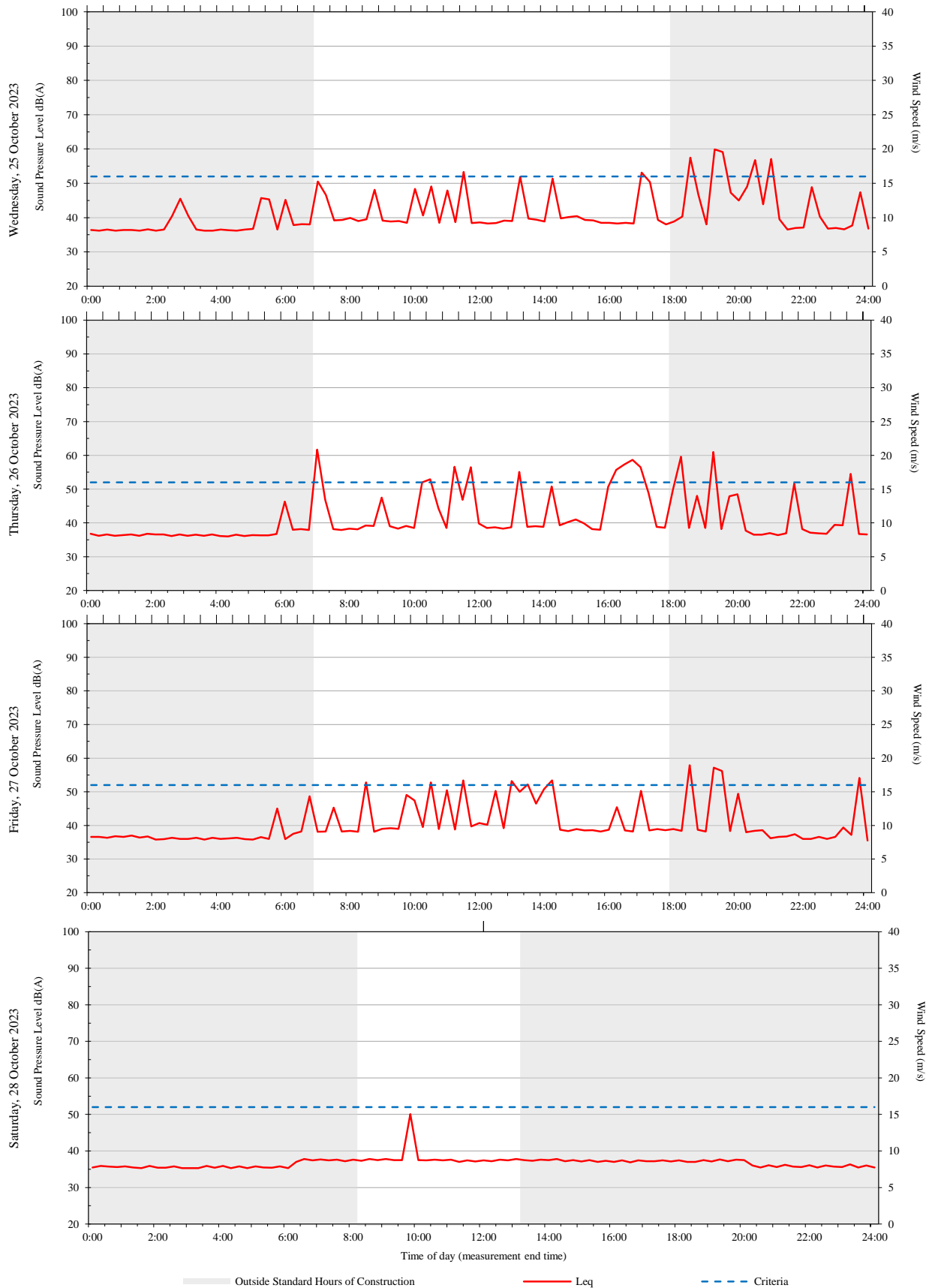


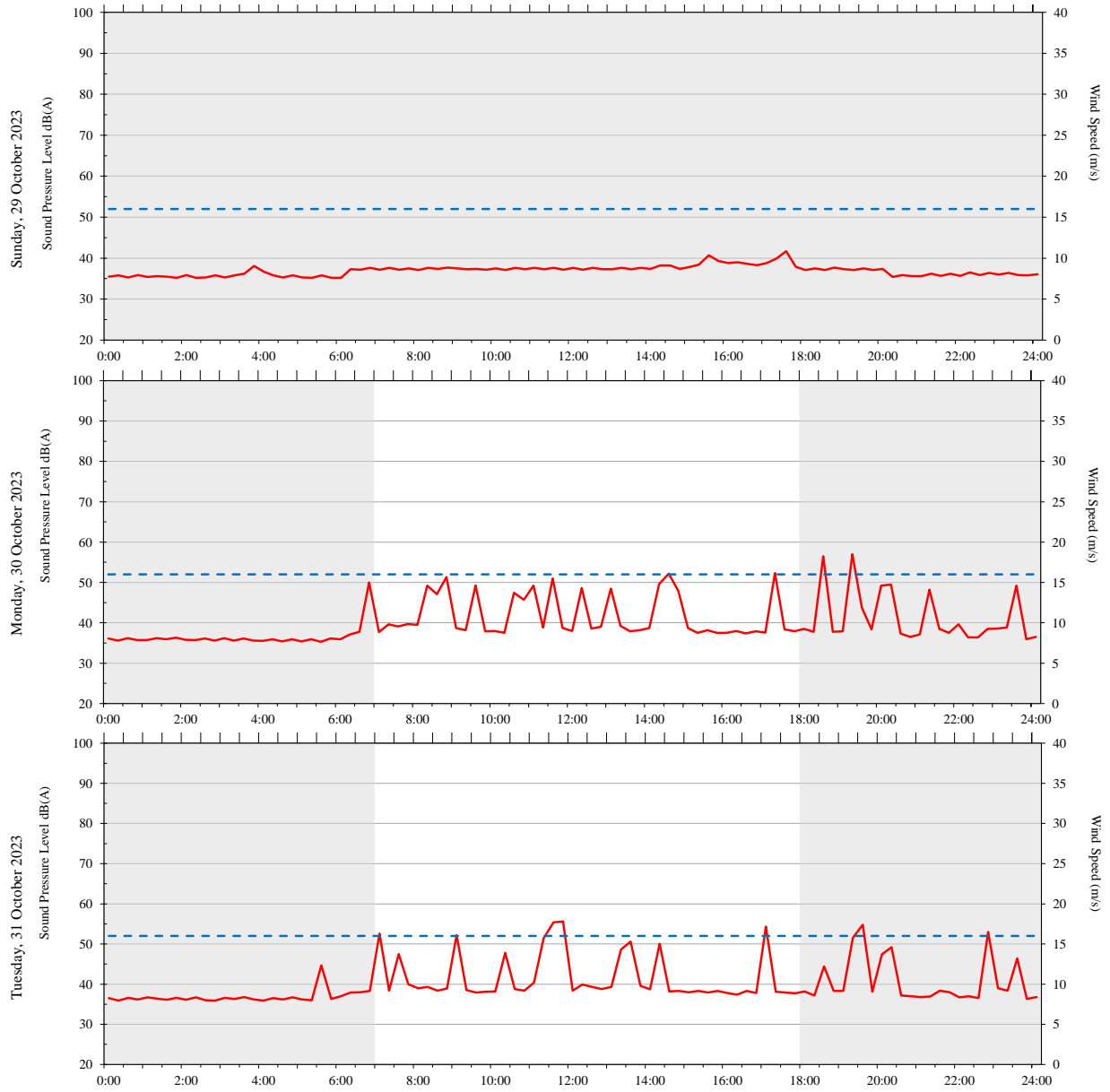






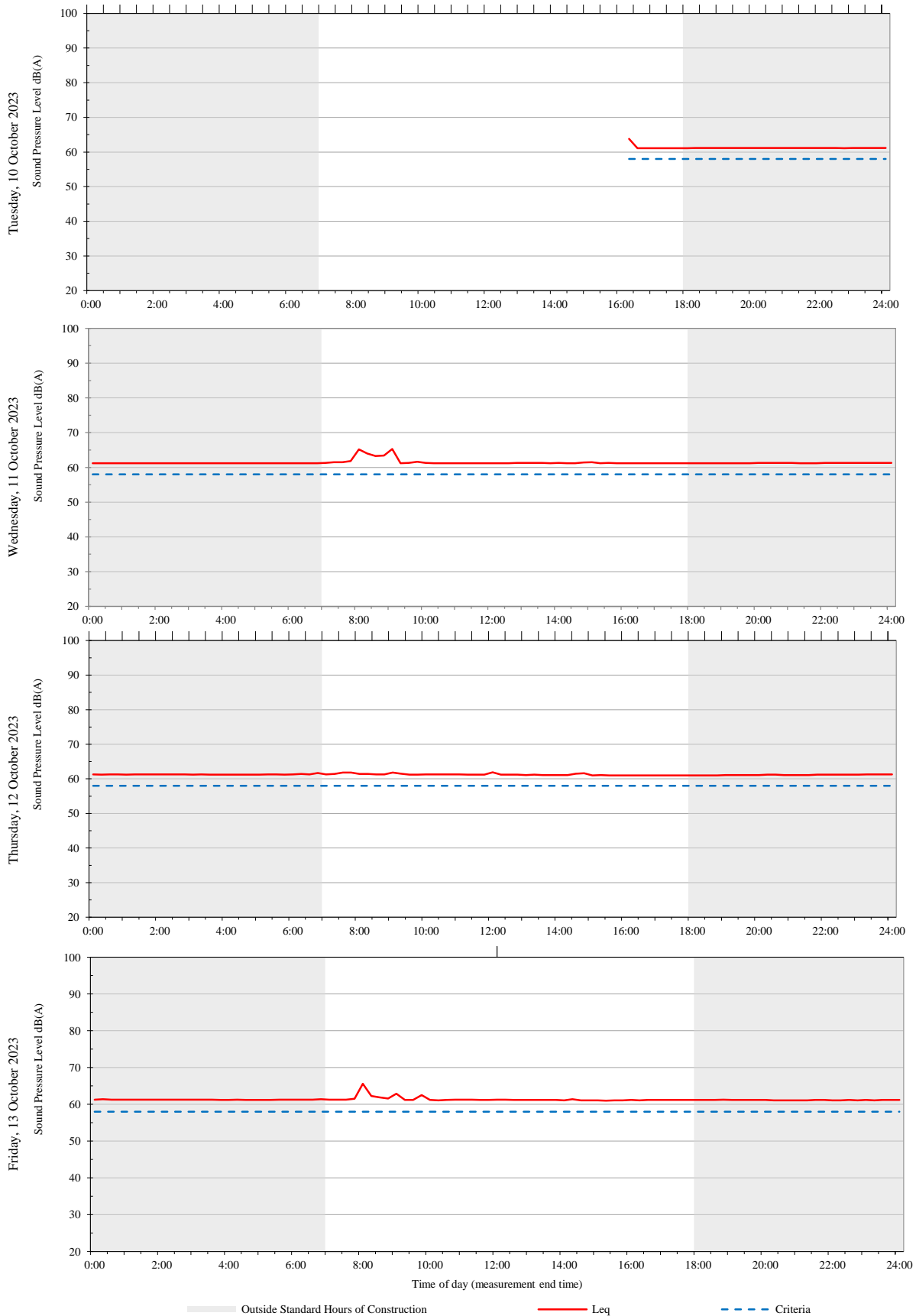






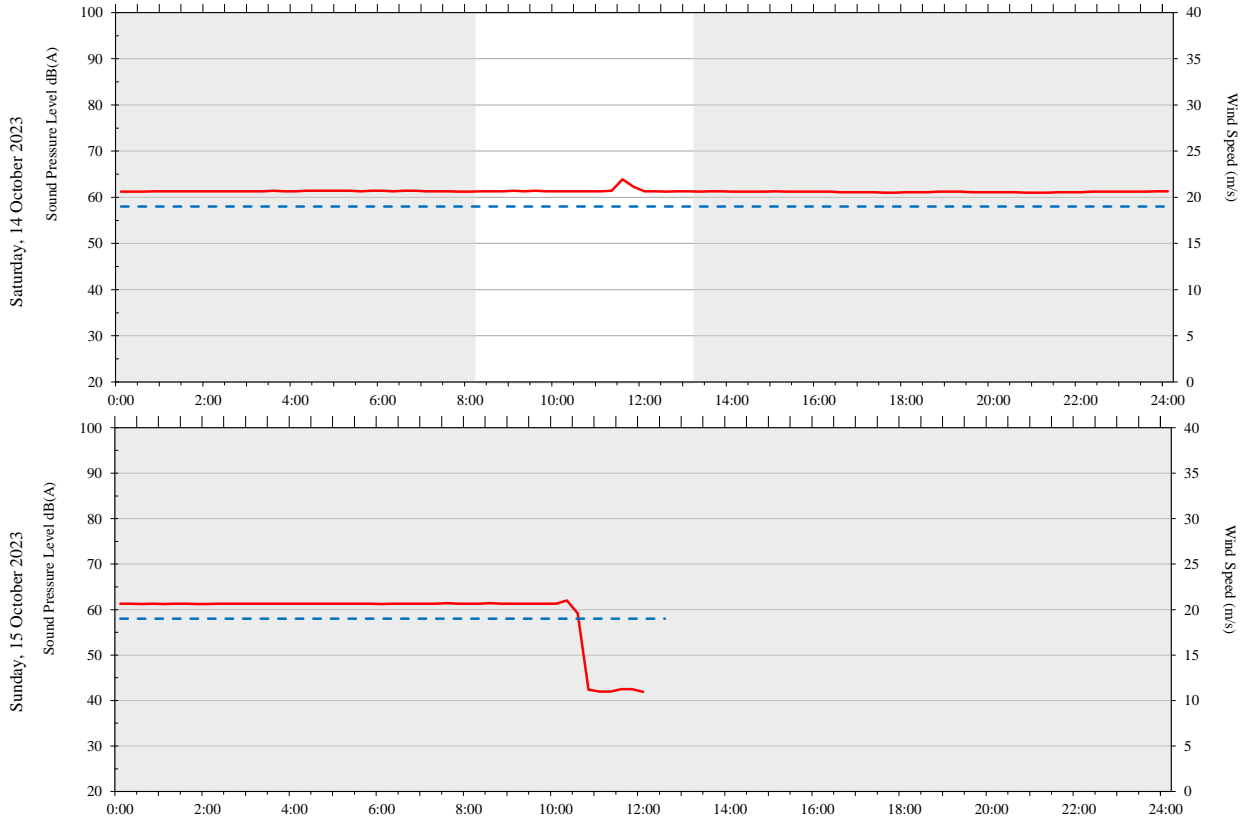
A4 KR Level 3 Radiation Room 33 RF041 (Westmead 4)

Unattended monitoring: KR Level 3 Radiation Room 33 RF041 (Internal)

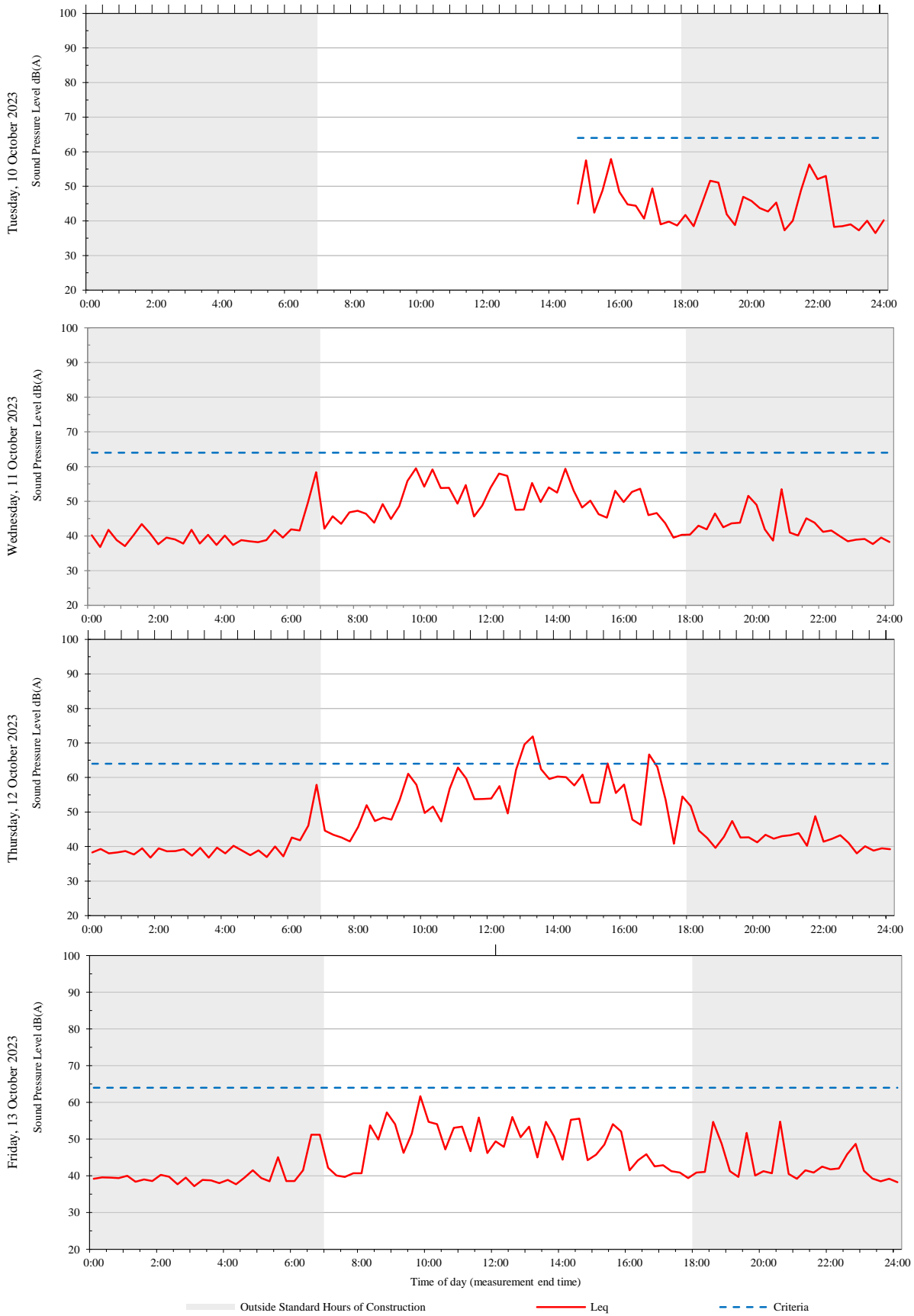


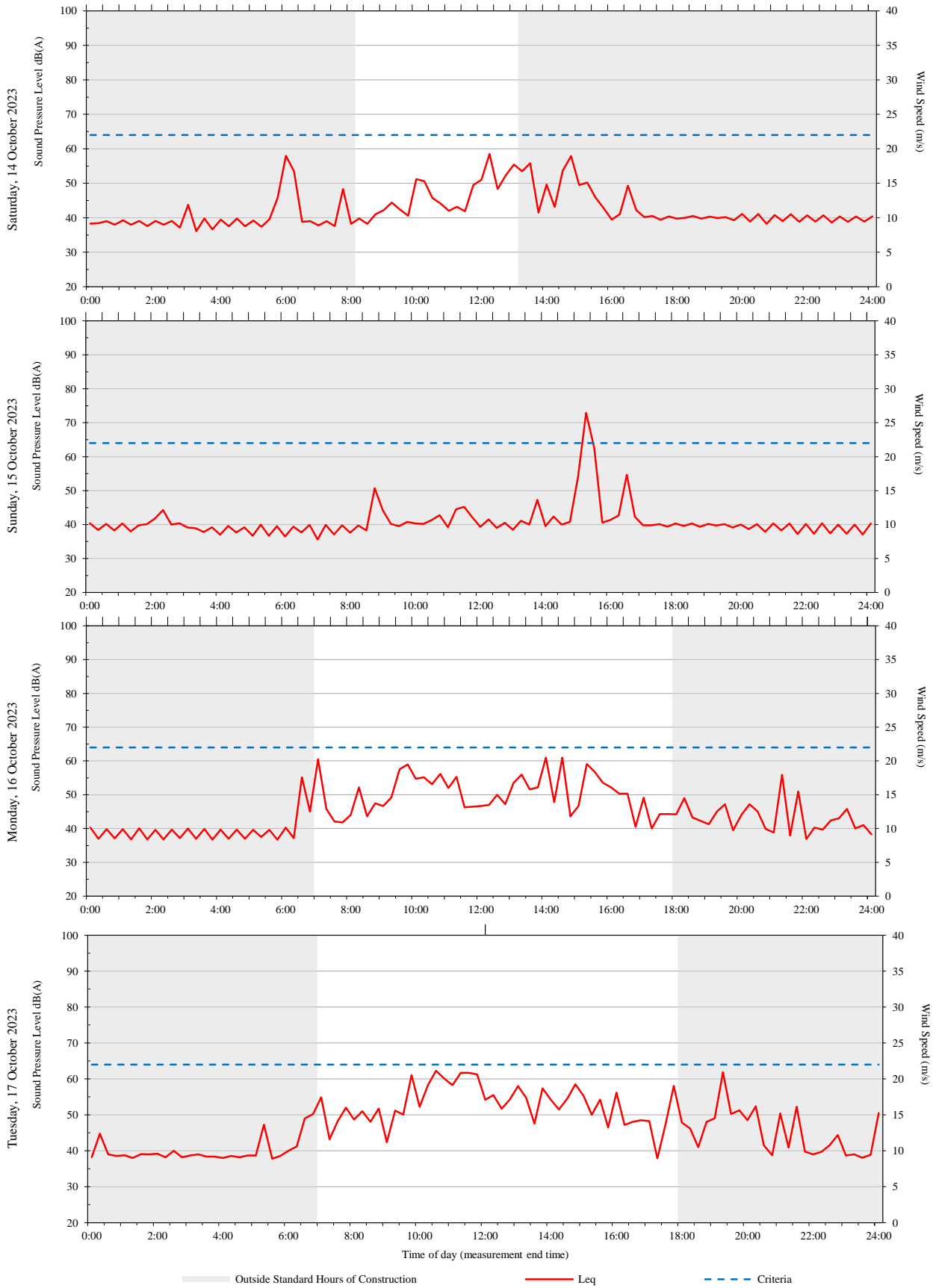
Unattended monitoring: KR Level 3 Radiation Room 33 RF041 (Internal)

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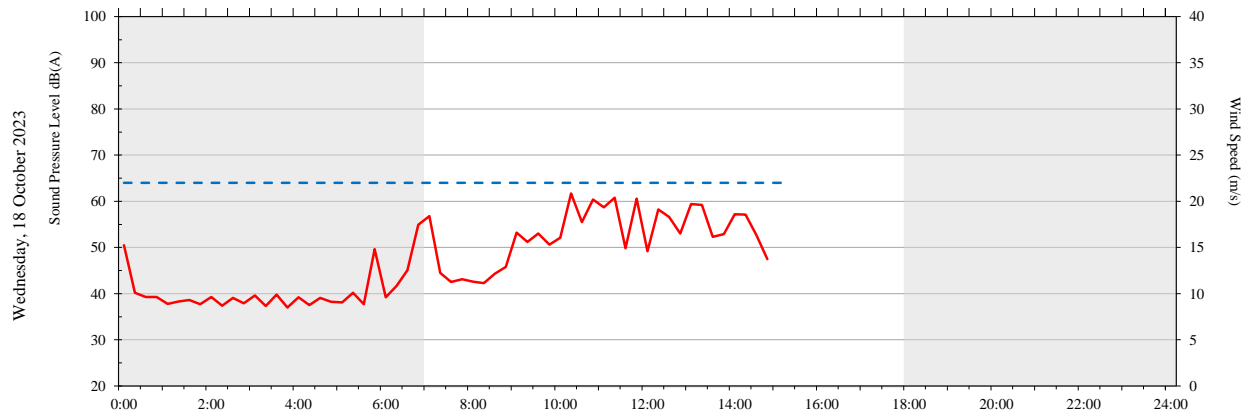
A5 CHW Level 2 Parent Kitchen 92BW025 (facing MSCP site) (Westmead 2)



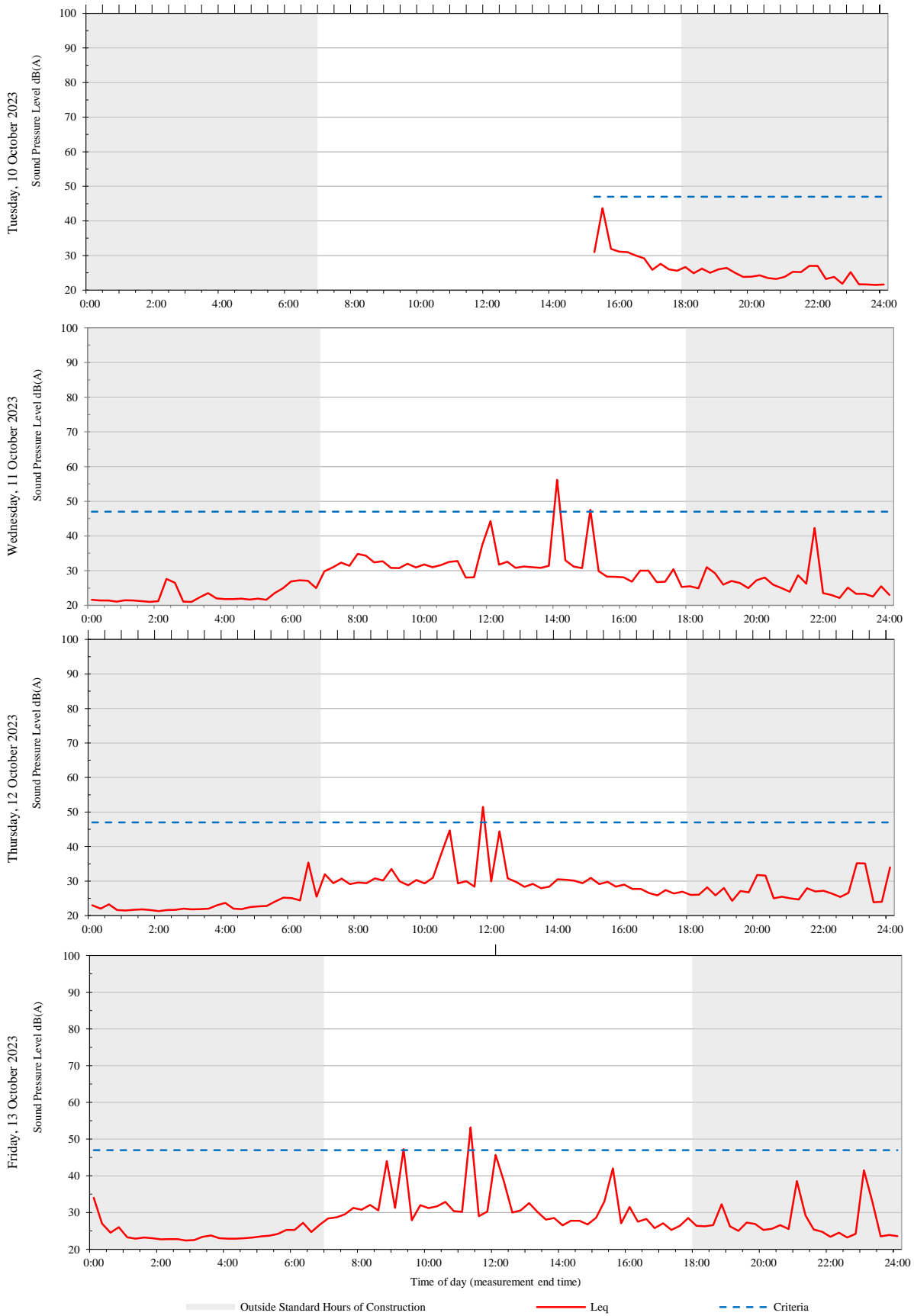


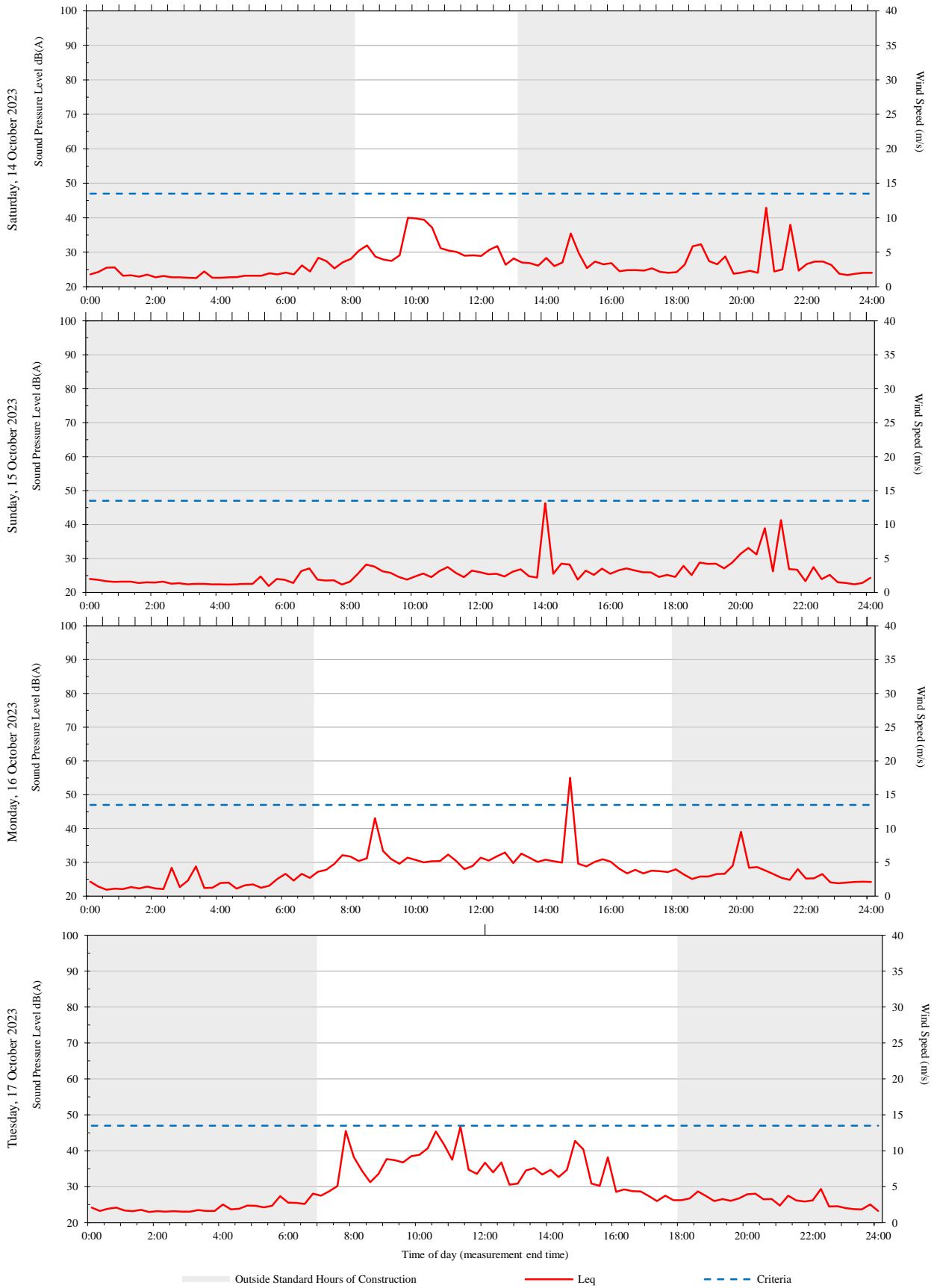
Unattended monitoring: CHW Level 2 Parent Kitchen 92BW025 (Internal)

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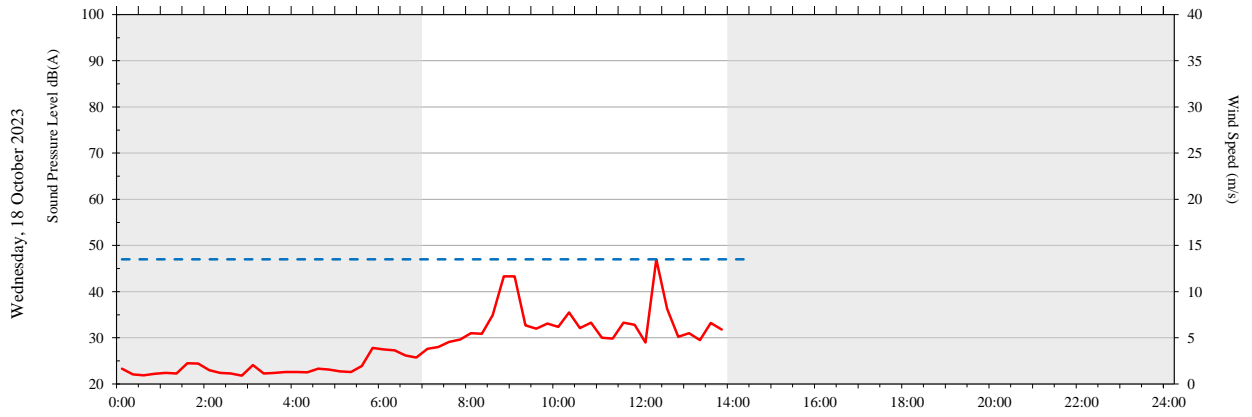
A6 RMH Level 1 Store Room 101 (Westmead 3)





Unattended monitoring: RMH Level 1 Store Room 101 (Internal)

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Health Infrastructure NSW

Westmead VVMF Construction Noise Monitoring

Noise monitoring report 2023-10-01 to 2023-10-31

Reference: AC07

v1 | 16 November 2023

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Description

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Name			
Signature			

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1. Introduction

Arup has been commissioned by PricewaterhouseCoopers (PwC) on behalf of Health Infrastructure NSW to install a noise monitor within the Westmead Institute for Medical Research (WIMR) to monitor and manage noise from the construction of the Viral Vector Manufacturing Facility (VVMF) in the Westmead Precinct.

The noise logger was deployed on the 8th of March 2023 and has been setup to send email and SMS notifications to stakeholders when construction Noise Management Levels (NMLs) are exceeded.

This report details noise measurement results from **1 October 2023** to **31 October 2023** inclusive.

2. Noise logger location

One Acoustic Research Labs Ngara noise logger is installed at the location shown in Figure 1 below.

The noise logger was calibrated by Acoustic Research Labs (NATA accredited calibration) in November 2021.

On Thursday 10 August 2023, the Ngara noise logger Westmead 4 (previously installed in WIMR Clean prep room) was replaced by the Ngara noise logger Westmead 7 (previously installed in KR radiation room as part of the PSB and MSCP noise monitoring project). The decision to swap Westmead 4 noise logger with Westmead 7 noise logger was driven by concerns about the performance of Westmead 4 noise logger.

The noise loggers were calibrated by Acoustic Research Labs (NATA accredited calibration) in November 2021.

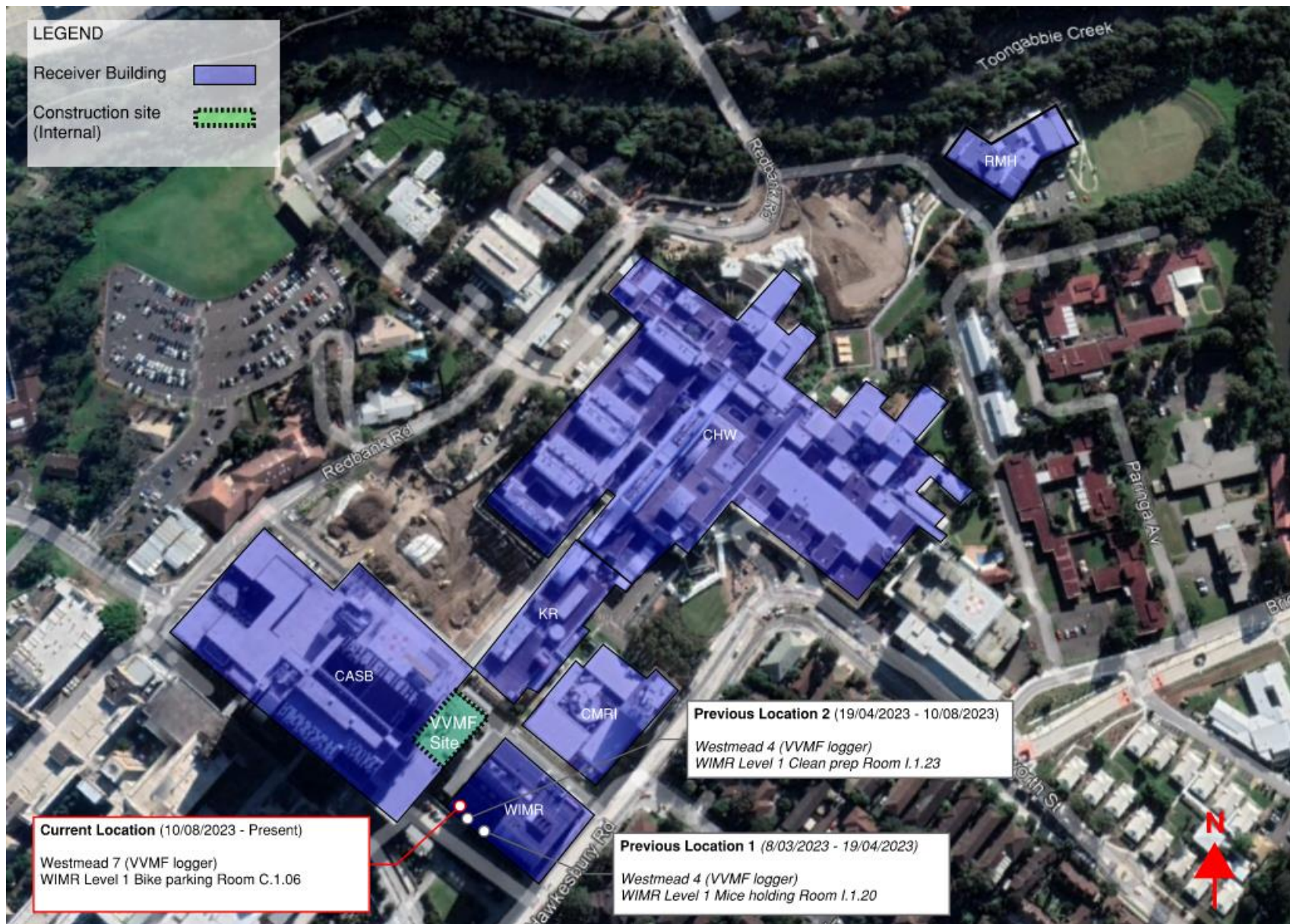


Figure 1: VVMF noise monitoring locations

2.1 Noise logger relocation

No logger relocation to report within this period.

A summary of all logger relocations can be found in Table 1 below.

Table 1: Logger relocation records

Logger ID	Original Location	Current location	
	Location	Date moved	Location
Westmead 4	WIMR Level 1 Mice holding room	19/4/2023	WIMR Level 1 Clean Prep Room
Westmead 4	WIMR Level 1 Clean Prep Room	10/08/2023	<i>Removed from site</i>
Westmead 7	KR Level 3 Radiation Room	10/08/2023	WIMR Level 1 Bike Parking room

3. Noise Management Levels

The current Construction Noise Management Levels (NMLs) are set out in Table 2. The NMLs have been determined following a baseline noise study conducted in April 2023. (Refer to Arup’s *Westmead Hospital N&V Monitoring – Attended Noise Measurements – VVMF Construction Activity*¹ memo for details regarding how these NMLs were nominated.)

Measurement data taken from ‘standard’ construction work hours for the project only are assessed against the Noise Management Level criteria, being:

- 7am-6pm Mon-Fri
- 8am-1pm Sat
- No work on Sundays and Public Holidays.

The NMLs levels in Table 2 were determined following both the review of current noise levels within the mice holding room when no construction was conducted, and available information with regards to the sensitivity to noise of research animals. The NMLs below represent the level of construction noise if exceeded may result in a negative impact on research animals.

To safeguard the research animals, the previously established NMLs were retained despite relocating the logger. However, it is important to note that the results may be conservative due to the logger's closer proximity to the construction works.

Table 2: Noise Management Levels

Logger ID	Location	Noise Management Level, dB	Description
Westmead 4 (8/03/2023 – 19/04/2023)	WIMR Level 1 Mice holding room (I.1.20)	L _{Amax} 85	For short duration high noise levels
		L _{Aeq(1minute)} 69	For more continuous noise generation
Westmead 4 (19/04/2023 – 10/08/2023)	WIMR L1 Clean Prep Room (I.1.23)	L _{Amax} 85	For short duration high noise levels
		L _{Aeq(1minute)} 69	For more continuous noise generation
Westmead 7 (10/08/2023 – On Going)	WIMR L1 Bike Room (C.1.06)	L _{Amax} 85	For short duration high noise levels
		L _{Aeq(1minute)} 69	For more continuous noise generation

3.1 Management Level updates

The following provides a progressive record of management level updates:

- None-to-date

¹ Arup report reference: 283812-16

4. Noise monitoring results

4.1 Outages

Noise monitoring outages are shown below. This excludes outages related to logger data collection and calibration.

Table 3: Noise logger outages during monitoring period

Logger ID	Noise logger location	Outages
Westmead 7	WIMR L1 Bike Room (C.1.06)	<i>None to report</i>

4.2 Exceedances

The number of Noise Management Level exceedances recorded during the assessment period are shown below.

Table 4: Recorded NML exceedances

Logger Id	Noise logger location	Noise Management Level exceedance instances	
		Short duration L_{Amax} criteria	Continuous $L_{Aeq(1minute)}$ criteria
Westmead 7	WIMR L1 Bike Room (C.1.06)	2	0

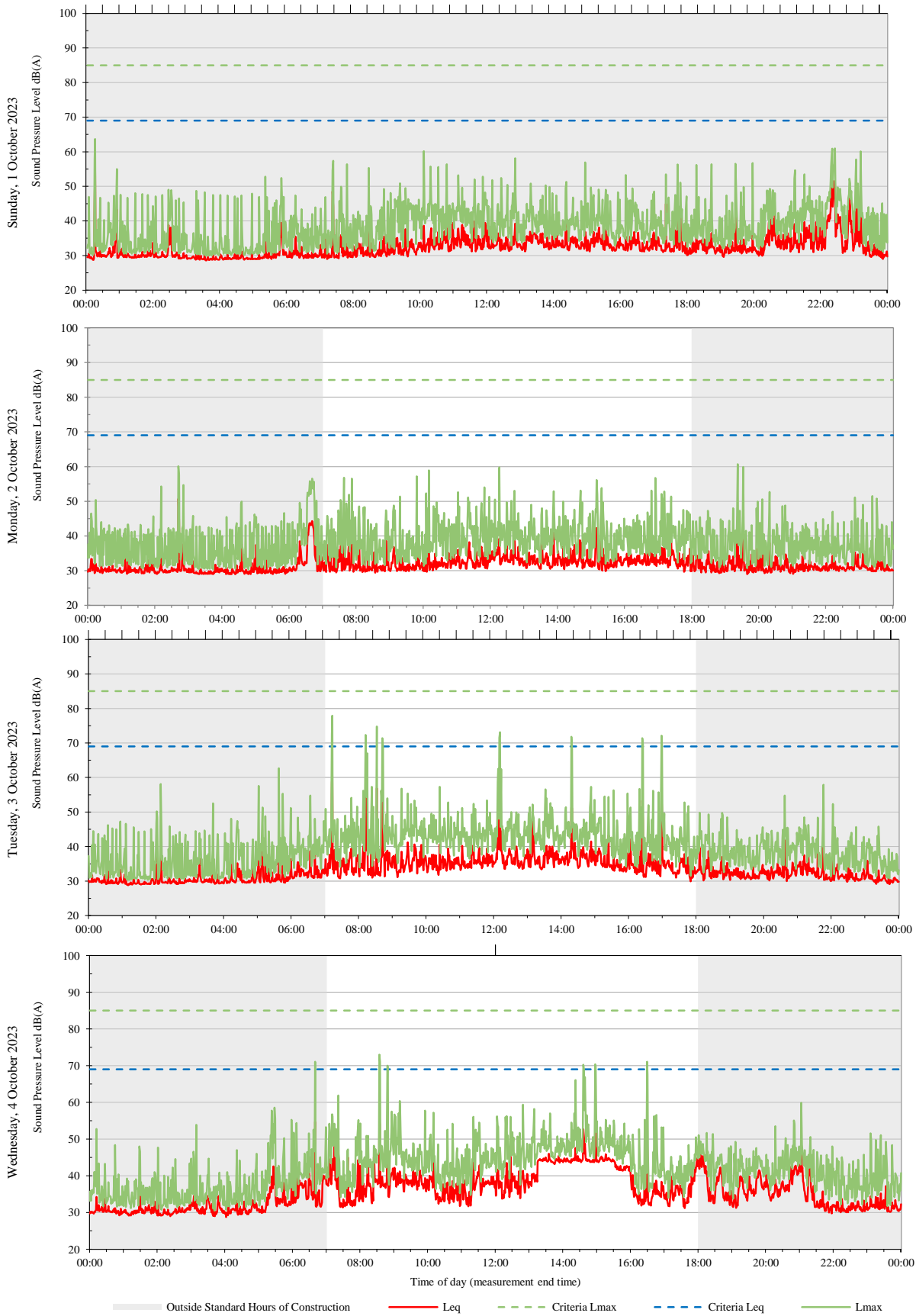
It is noted that the exceedances of the NMLs may be the result of noise generated by either internal activities unrelated to construction, or by construction activities.

It is the responsibility of Ford Civils (the Head Contractor) to respond to each NML exceedance when it occurs and record the outcome of the exceedance investigation (cause of NML exceedance, any noise mitigation measures implemented to address the exceedances, etc.).

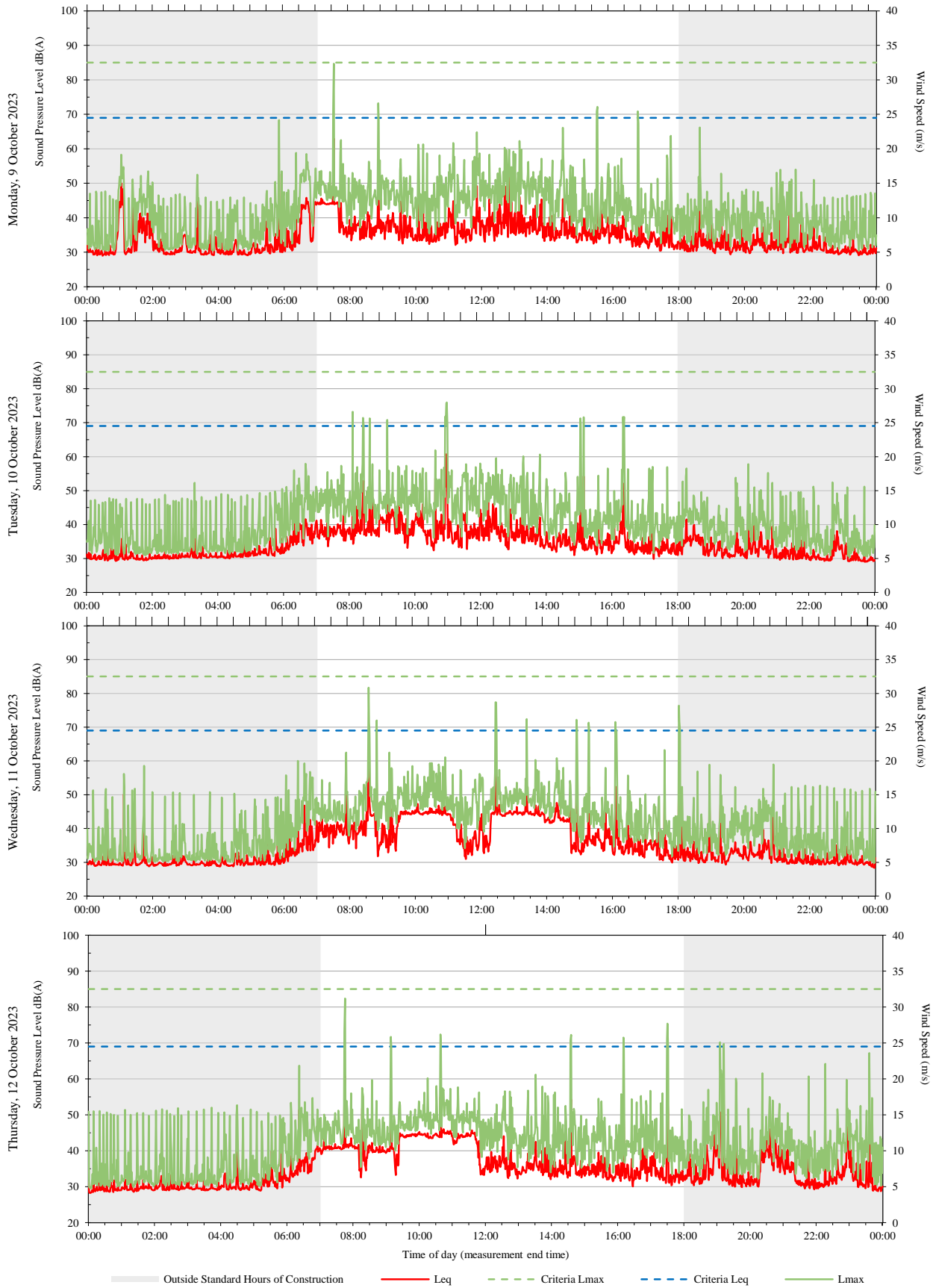
Appendix A

Noise monitoring results

A.1 WIMR L1 Bike Room (C.1.06)

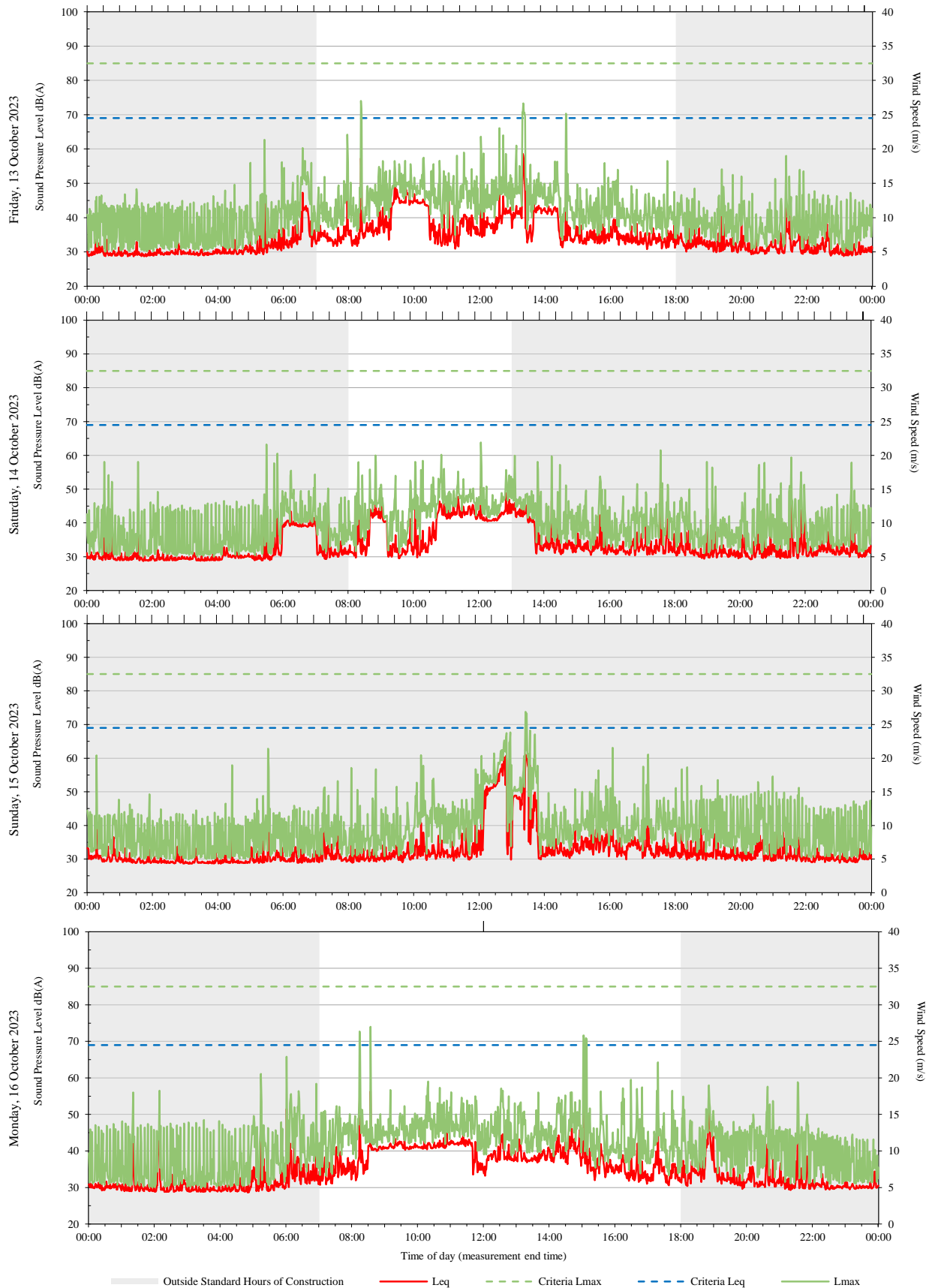






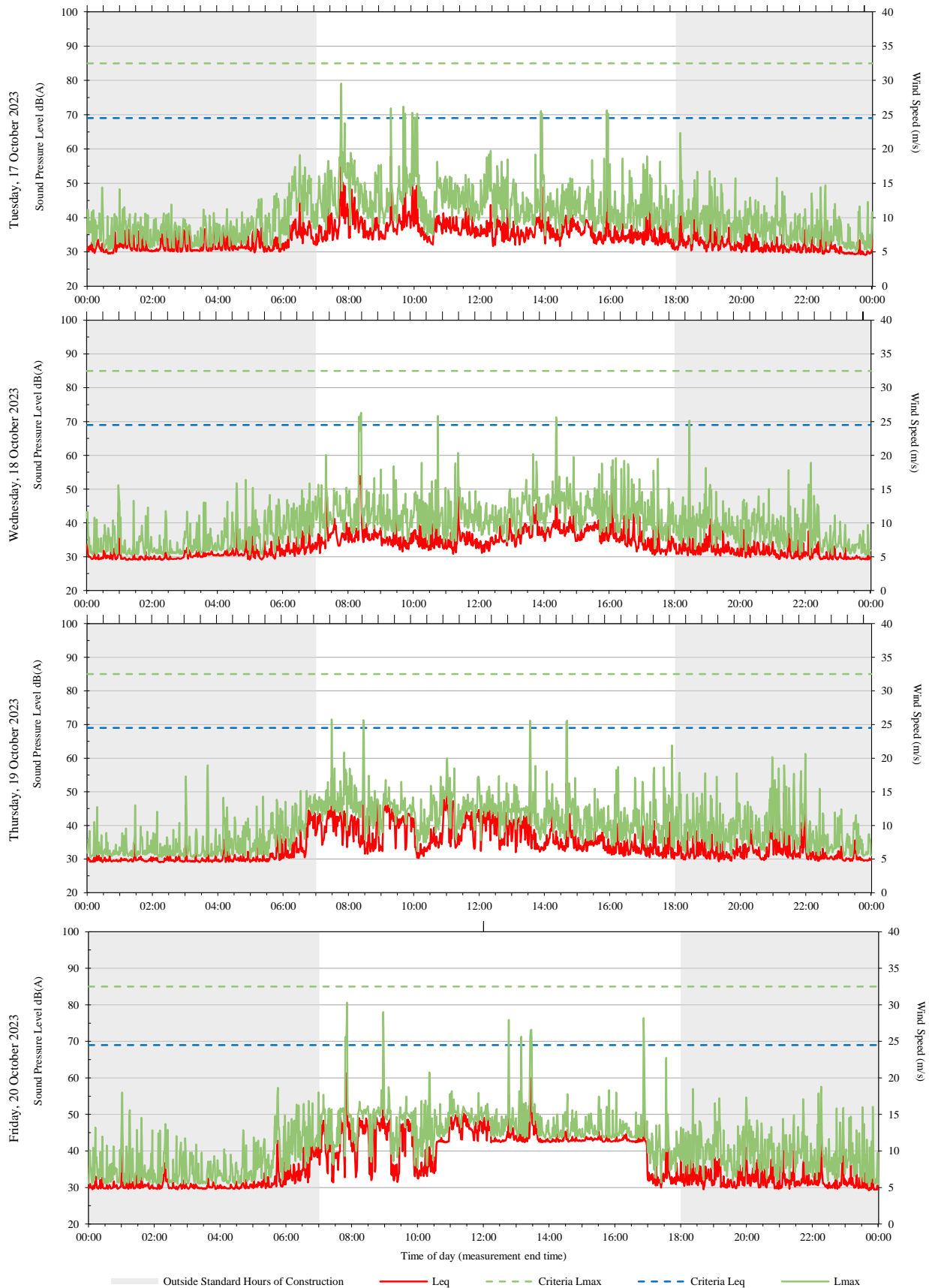
Unattended monitoring: WIMR Level 1 Bike Parking room (C.1.06) (Internal)

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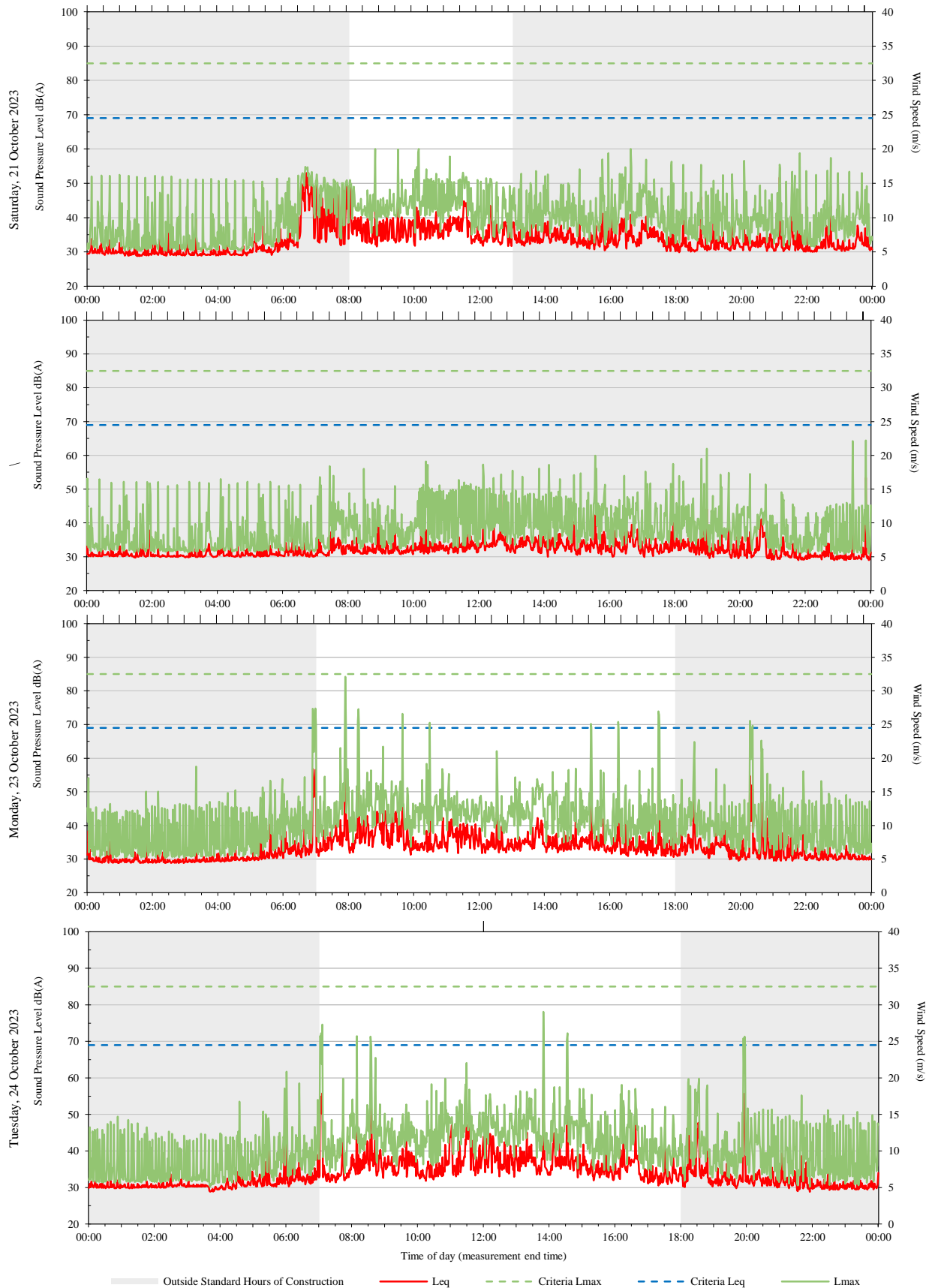
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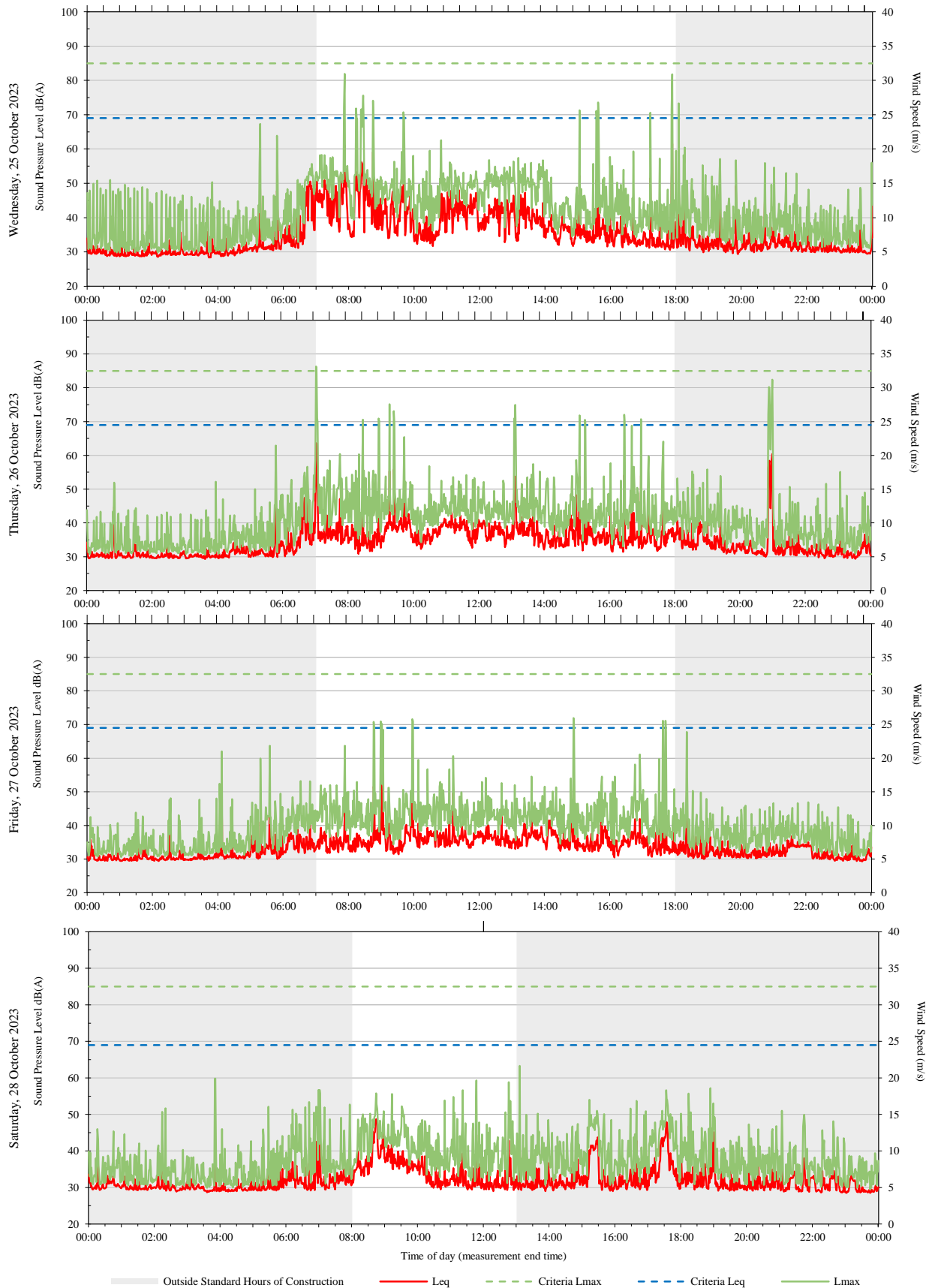
Unattended monitoring: WIMR Level 1 Bike Parking room (C.1.06) (Internal)

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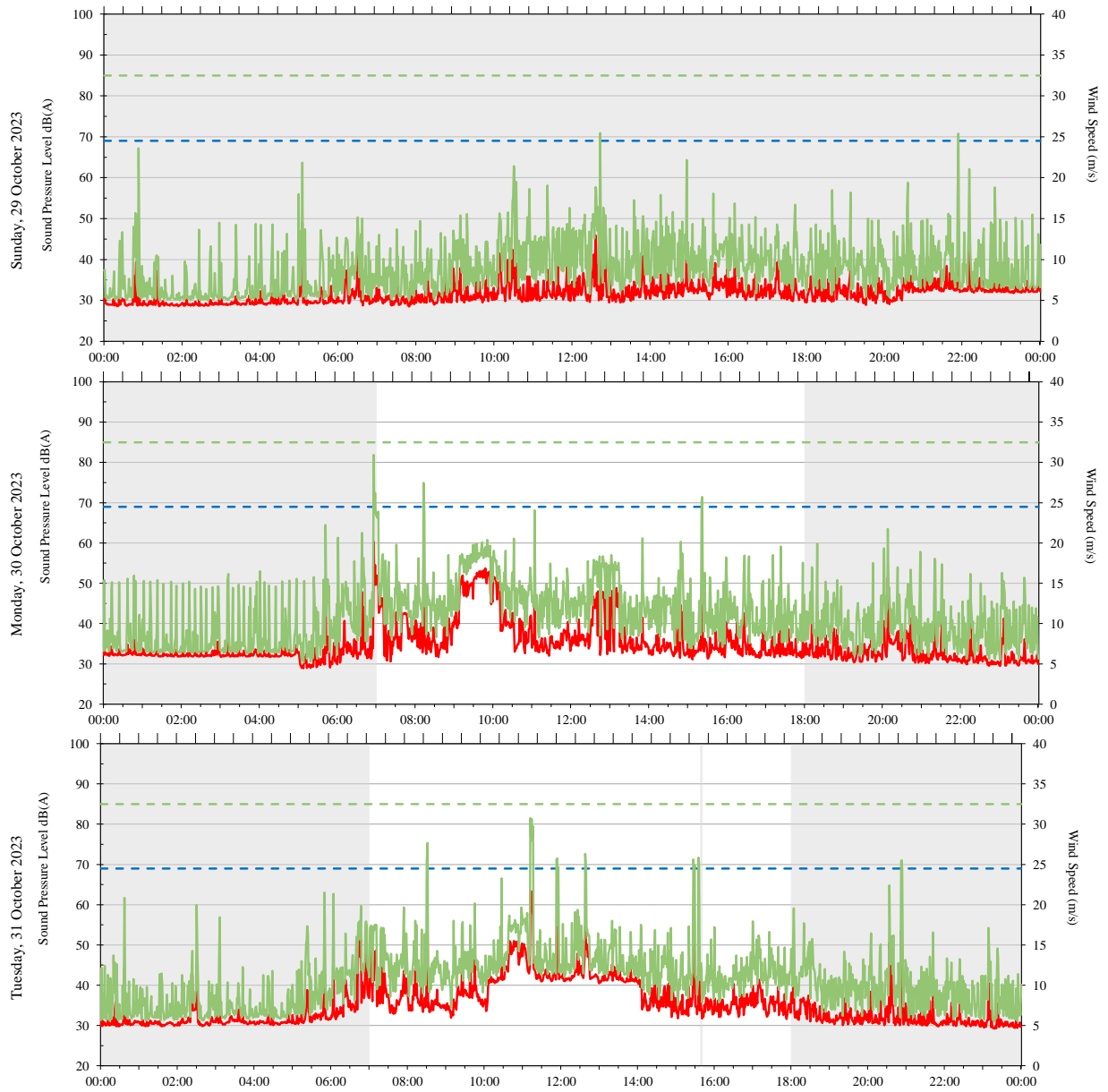
Unattended monitoring: WIMR Level 1 Bike Parking room (C.1.06) (Internal)

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Unattended monitoring: WIMR Level 1 Bike Parking room (C.1.06) (Internal)

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Health Infrastructure

Children's Hospital Westmead

**Vibration Monitoring - KR - Gait Lab -
October 2023**

CVM/ KR/202310

Issue 1 | 06/11/2023

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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Signature			

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Executive Summary

This report summarises the vibration monitoring data recorded at KR - Gait Lab, over one month – from 01/10/2023 to 31/10/2023. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

The logger was serviced on 10/10/2023, leading to the step change in measurements seen in Figures 1 and 2. This is an artefact of the re-calibration process and its effects have been deemed minor.

RMSV Vibration Levels

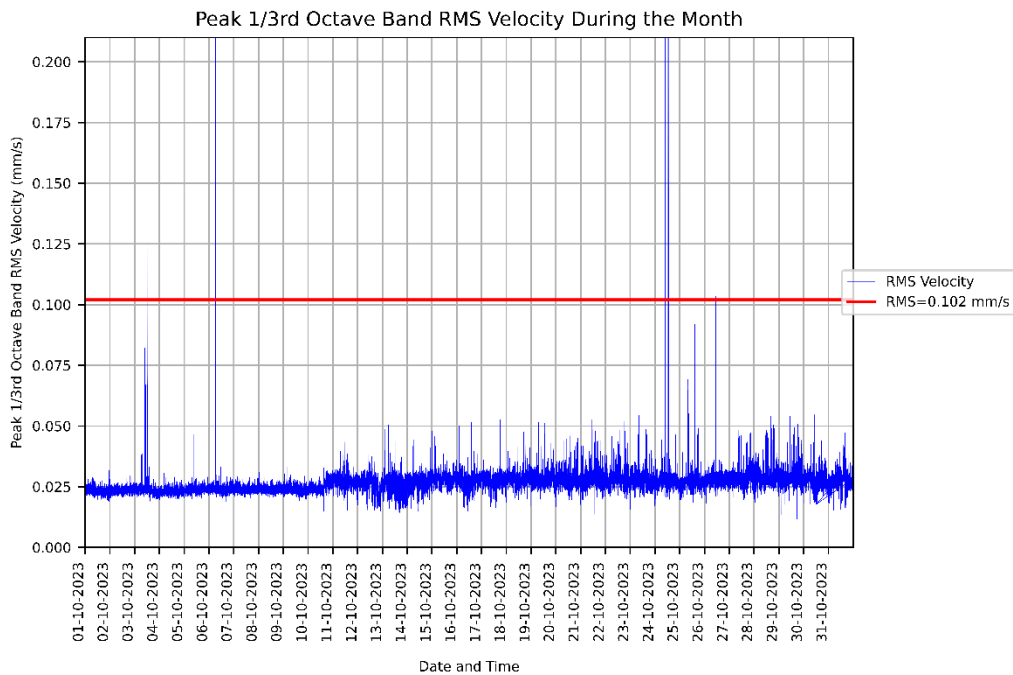


Figure 1: Measured RMSV vibration levels for 01/10/2023 to 31/10/2023 at the KR - Gait Lab.

The table below summarises the number of Root-Mean-Square Velocity (RMSV) limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
17	2

PPV Vibration Levels

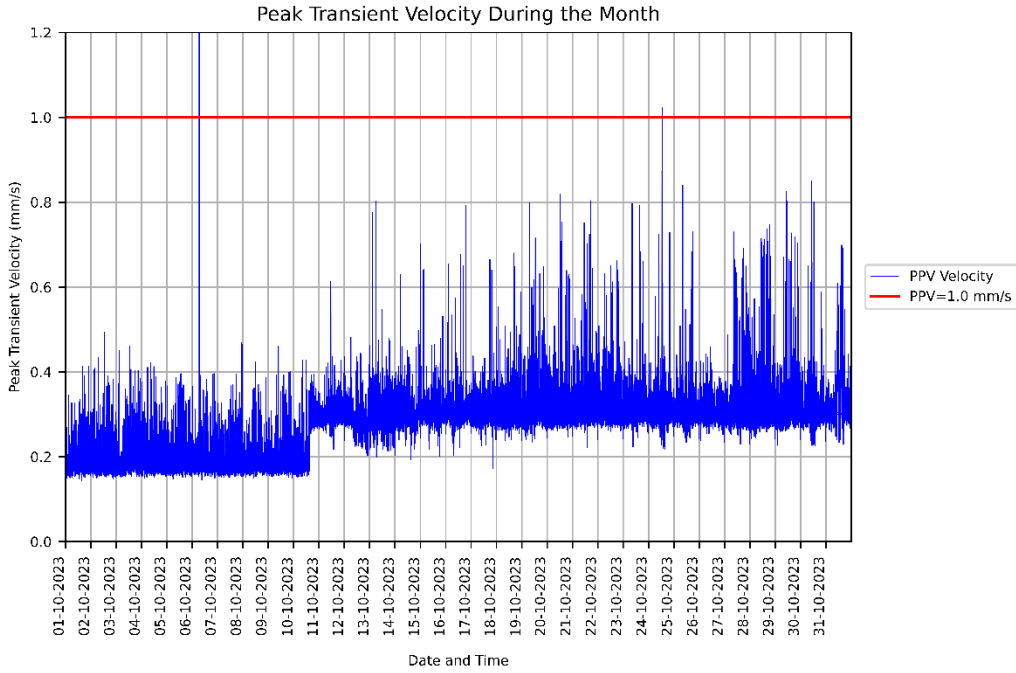


Figure 2: Measured vibration levels for 01/10/2023 to 31/10/2023 at the KR - Gait Lab.

The table below summarises the number of Peak Particle Velocity (PPV) limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
1	2

1. Introduction

Arup has been commissioned by PricewaterhouseCoopers (PwC) on behalf of NSW Health Infrastructure to monitor vibration levels in facilities adjacent to the Forecourt development sites to ensure facility operations are not excessively impacted by the construction works. This report summarises the vibration monitoring data recorded at KR - Gait Lab during the period of the 01/10/2023 to 31/10/2023.

For the purposes of reporting, construction works are considered to be occurring at the following times:

Day	Construction Hours
Monday to Friday	7:00am to 6:00pm
Saturday	8:00am to 1:00pm
Sunday	No works
Public Holidays	No works

3. Recorded Data

The logger was serviced on 10/10/2023, leading to the step change in measurements seen below in Figures 4 and 5. This is an artefact of the re-calibration process and its effects have been deemed minor.

Figure 4 below shows the vibration levels (RMS velocity) recorded between 01/10/2023 and 31/10/2023. The recorded data is shown in blue, while the limit of 0.102mm/s (V_{RMS}) is shown in red.

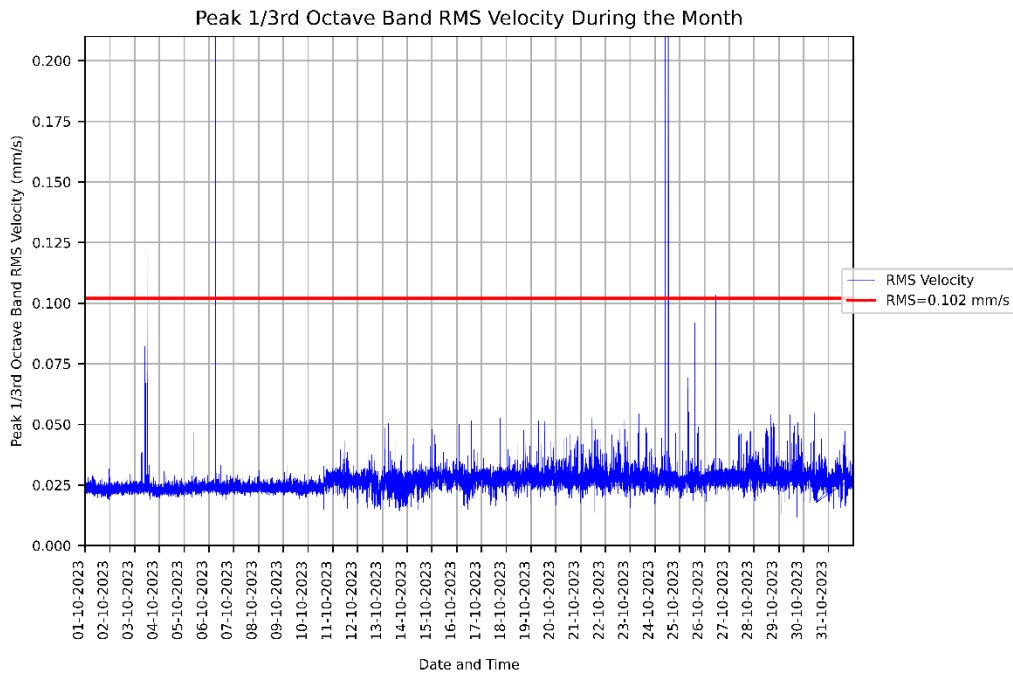


Figure 4: Measured RMSV vibration levels for 01/10/2023 to 31/10/2023 at the KR - Gait Lab.

The table below summarises the number of RMS Velocity limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
17	2

Figure 5 below shows the peak particle vibration levels (PPV velocity) recorded between 01/10/2023 and 31/10/2023. The recorded data is shown in blue, while the limit of 1.0mm/s (V_{PPV}) is shown in red.

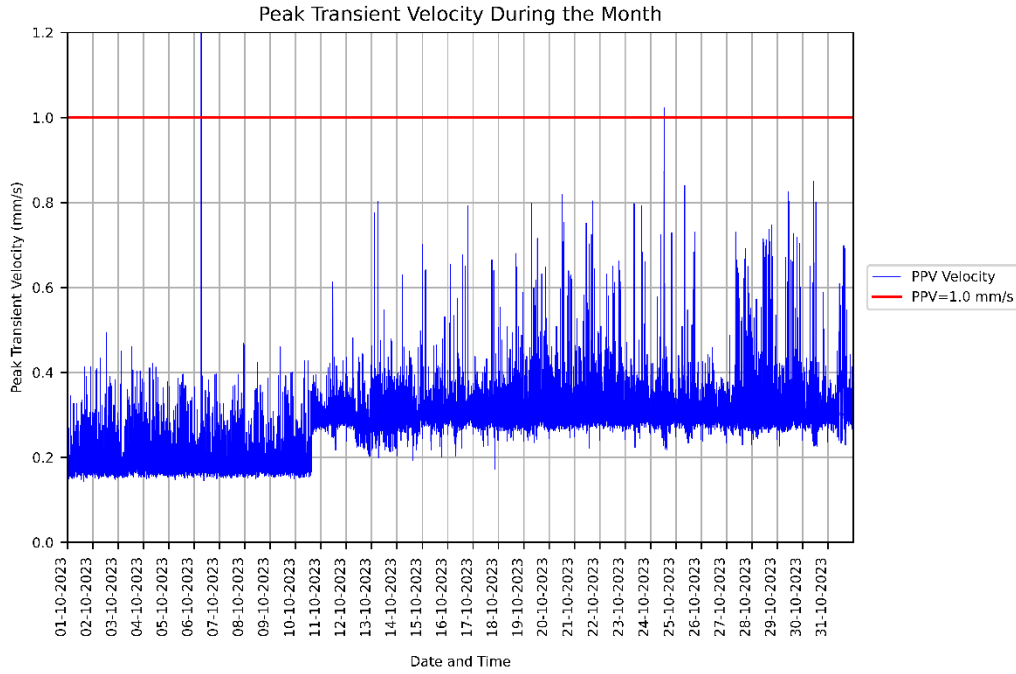


Figure 5: Measured PPV vibration levels for 01/10/2023 to 31/10/2023 at the KR - Gait Lab.

The table below summarises the number of PPV limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
1	2

Frequency response and linearity characteristics for
GeoSIG Velocity Geophone **VE-11** Serial No. **55908**
Constant velocity of 10 mm/sec Peak applied for response
(Except at 200.0 Hz where applied level limited to 1.0 mm/s peak)
For amplitude linearity applied level varied at 15.92 Hz

12VDC Power Supply

Geophone Orientation.: Vertical

Frequency		Velocity mm/sec Peak	Indicated Sensitivity $mV/mm\cdot s^{-1}$	Expanded uncertainty
Hz	Radians/sec		Vertical Sensitivity	$U_{95} \%$
3.00	18.85	10.0	110.73	1.00%
4.00	25.13	10.0	110.65	0.90%
6.00	37.70	10.0	107.04	0.90%
10.00	62.83	10.0	101.63	0.90%
15.00	94.25	10.0	99.12	0.90%
15.92	94.25	1.0	N/A	0.90%
15.92	94.25	5.0	93.34	0.90%
15.92	94.25	10.0	93.15	0.90%
15.92	94.25	50.0	93.10	0.90%
15.92	94.25	100	N/A	0.50%
30.00	188.50	10.0	97.57	0.50%
60.00	376.99	10.0	98.58	0.50%
120.00	753.98	10.0	110.55	0.50%
150.00	942.48	10.0	125.20	0.50%
Hz	Radians/sec	Velocity mm/sec Peak	Vertical Sensitivity	$U_{95} \%$

Note1:

The laboratory has accreditation under ISO/IEC 17025 from NATA for calibration to ISO 16063-21 at frequencies from 0.5 Hz. Measurements at all frequencies and levels shown in the table above are made using reference equipment traceably calibrated to Australian National Standards.

Note2:

The uncertainties quoted are estimated at a confidence level of 95% and a coverage factor of $k=2$ applies unless otherwise stated.



Health Infrastructure

Children's Hospital Westmead

**Vibration Monitoring - WIMR - BSF
Mice Holding Room - Floor - October
2023**

CVM/ WIMR/202310

Issue 1 | 06/11/2023

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 271985

Arup Pty Ltd ABN 18 000 966 165

Arup Pty Ltd

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151 Clarence Street

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Document Verification

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		Westmead Hospital – 103158 WIMR - BSF Mice Holding Room - Floor - Summary of Recent Vibration Measurements (01-10 to 31-10).docx

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Issue 1	06/11/2023	Issue

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Executive Summary

This report summarises the vibration monitoring data recorded at WIMR - BSF Mice Holding Room - Floor, over one month – from 01/10/2023 to 31/10/2023. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

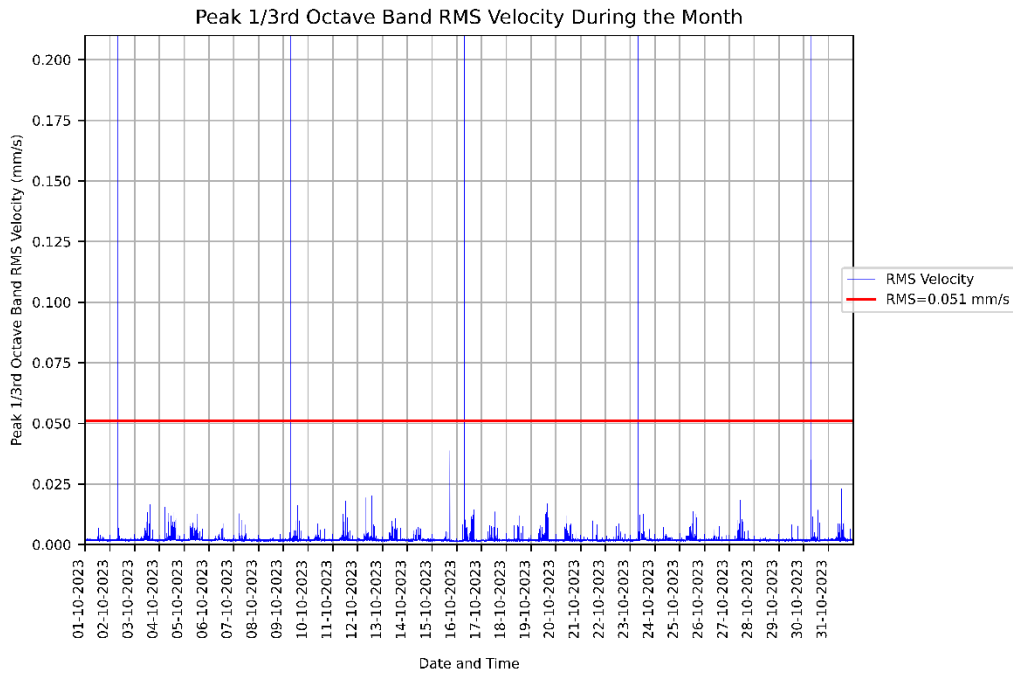


Figure 1: Measured RMSV vibration levels for 01/10/2023 to 31/10/2023 at the WIMR - BSF Mice Holding Room - Floor.

The table below summarises the number of Root-Mean-Square Velocity (RMSV) limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
6	1

PPV Vibration Levels

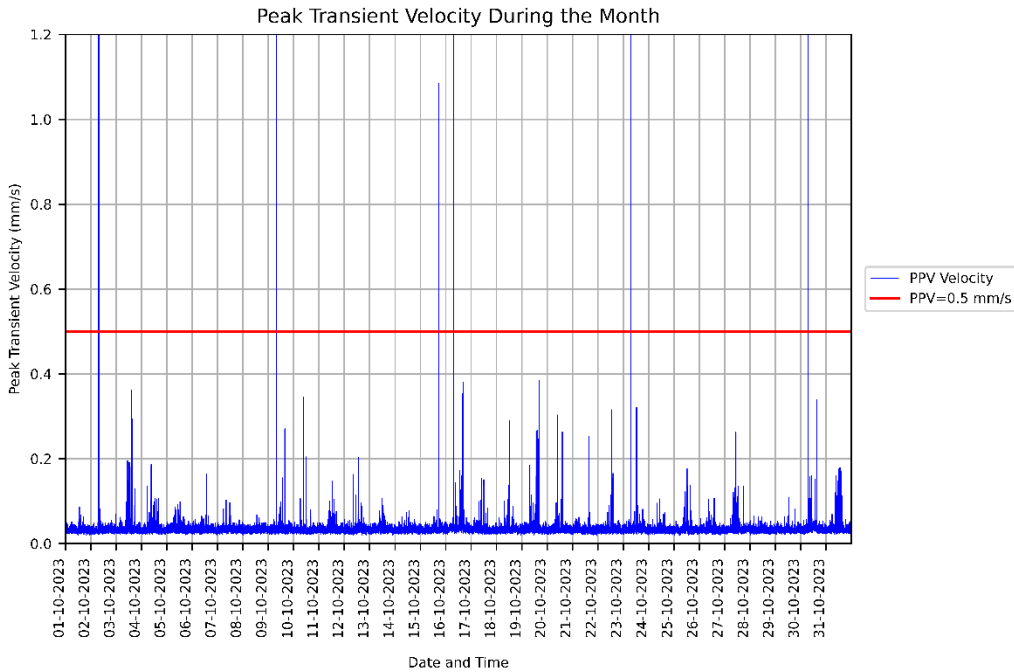


Figure 2: Measured vibration levels for 01/10/2023 to 31/10/2023 at the WIMR - BSF Mice Holding Room - Floor.

The table below summarises the number of Peak Particle Velocity (PPV) limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
11	1

1. Introduction

Arup has been commissioned by PricewaterhouseCoopers (PwC) on behalf of NSW Health Infrastructure to monitor vibration levels in facilities adjacent to the VVMF development sites to ensure facility operations are not excessively impacted by the construction works. This report summarises the vibration monitoring data recorded at WIMR - BSF Mice Holding Room - Floor during the period of the 01/10/2023 to 31/10/2023.

For the purposes of reporting, construction works are considered to be occurring at the following times:

Day	Construction Hours
Monday to Friday	7:00am to 6:00pm
Saturday	8:00am to 1:00pm
Sunday	No works
Public Holidays	No works

2. Monitor Location

The location of this monitor is shown below in Figure 3.

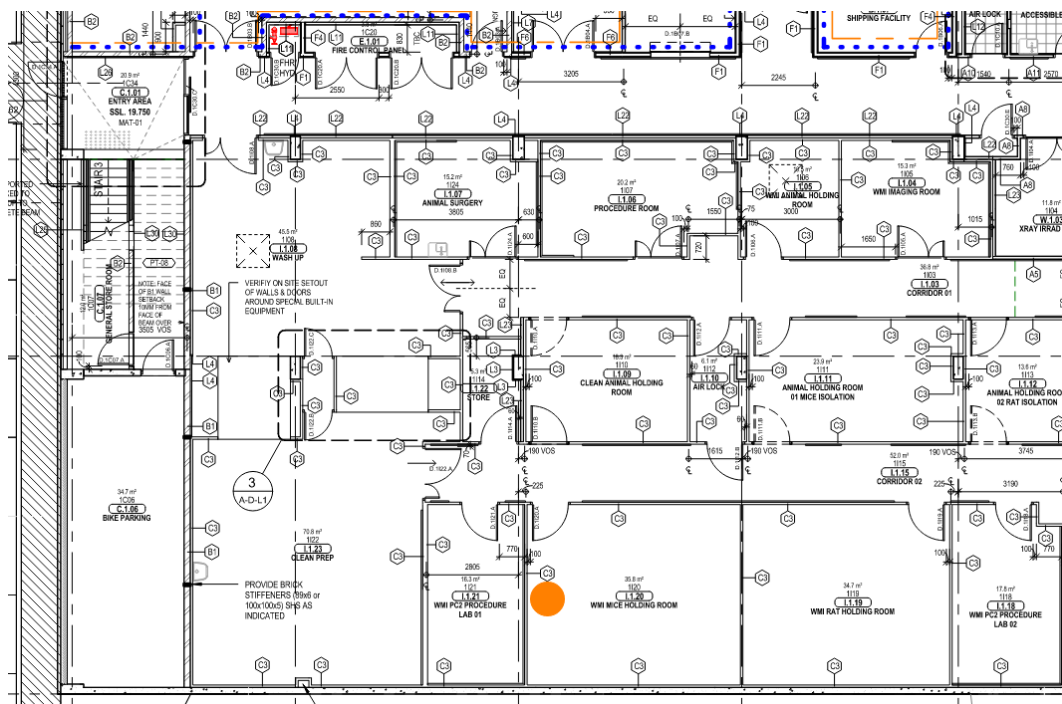


Figure 3: WIMR - BSF Mice Holding Room - Floor vibration monitor location

Monitoring at this location utilises a GeoSIG GMSplus with a GeoSIG VE-11 geophone. The calibration certificate for the geophone is included in Appendix A.

3. Recorded Data

Figure 4 below shows the vibration levels (RMS velocity) recorded between 01/10/2023 and 31/10/2023. The recorded data is shown in blue, while the limit of 0.051mm/s (V_{RMS}) is shown in red.

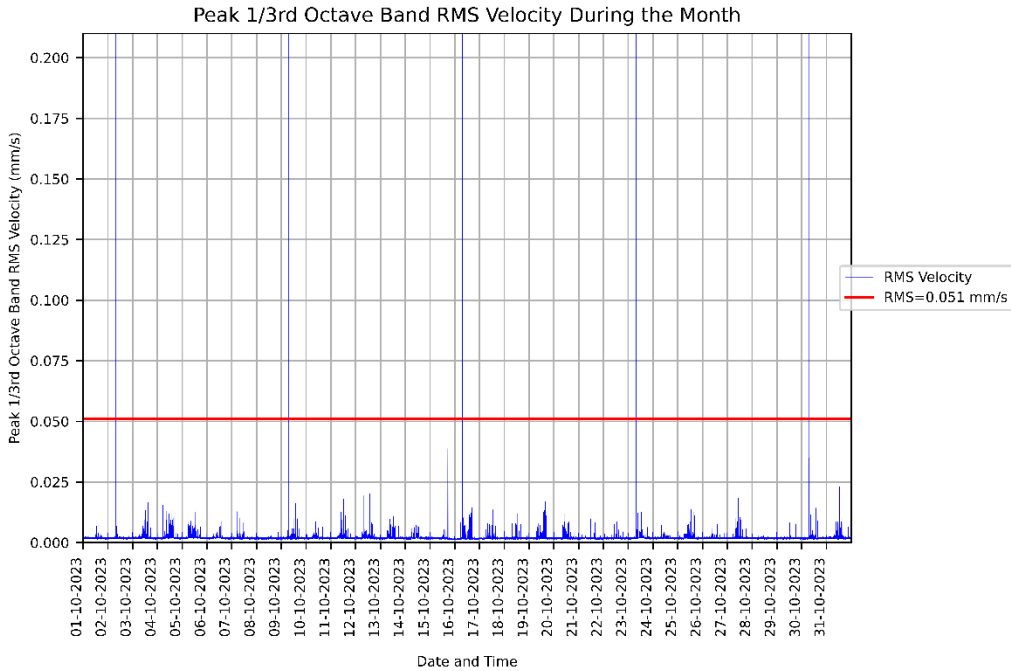


Figure 4: Measured RMSV vibration levels for 01/10/2023 to 31/10/2023 at the WIMR - BSF Mice Holding Room - Floor.

The table below summarises the number of RMS Velocity limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
6	1

Figure 5 below shows the peak particle vibration levels (PPV velocity) recorded between 01/10/2023 and 31/10/2023. The recorded data is shown in blue, while the limit of 0.5mm/s (V_{PPV}) is shown in red.

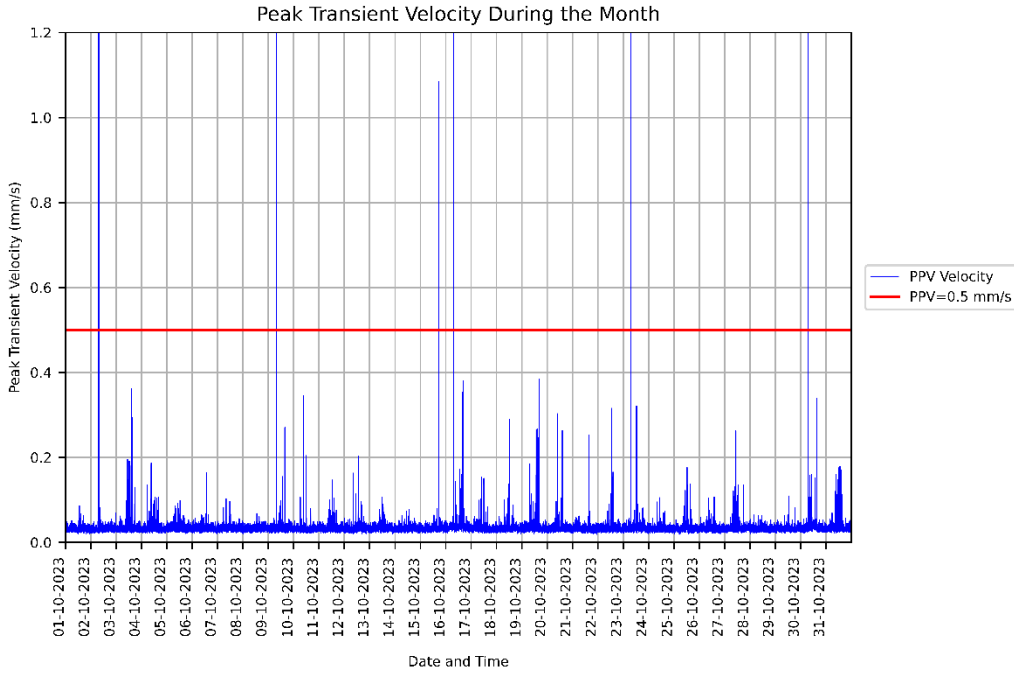


Figure 5: Measured PPV vibration levels for 01/10/2023 to 31/10/2023 at the WIMR - BSF Mice Holding Room - Floor.

The table below summarises the number of PPV limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
11	1

Frequency response and linearity characteristics for
GeoSIG Velocity Geophone **VE-11** Serial No. **55911**
Constant velocity of 10 mm/sec Peak applied for response
(Except at 200.0 Hz where applied level limited to 1.0 mm/s peak)
For amplitude linearity applied level varied at 15.92 Hz

12VDC Power Supply

Geophone Orientation.: Vertical

Frequency		Velocity mm/sec Peak	Indicated Sensitivity $\text{mV}/\text{mms}^{-1}$	Expanded uncertainty
Hz	Radians/sec		Vertical Sensitivity	U_{95} %
3.00	18.85	10.0	112.66	1.00%
4.00	25.13	10.0	112.97	0.90%
6.00	37.70	10.0	108.80	0.90%
10.00	62.83	10.0	101.91	0.90%
15.00	94.25	10.0	98.58	0.90%
15.92	94.25	1.0	N/A	0.90%
15.92	94.25	5.0	92.57	0.90%
15.92	94.25	10.0	92.49	0.90%
15.92	94.25	50.0	92.48	0.90%
15.92	94.25	100	N/A	0.50%
30.00	188.50	10.0	95.98	0.50%
60.00	376.99	10.0	96.13	0.50%
120.00	753.98	10.0	106.11	0.50%
150.00	942.48	10.0	116.46	0.50%
Hz	Radians/sec	Velocity mm/sec Peak	Vertical Sensitivity	U_{95} %

Note1:

The laboratory has accreditation under ISO/IEC 17025 from NATA for calibration to ISO 16063-21 at frequencies from 0.5 Hz. Measurements at all frequencies and levels shown in the table above are made using reference equipment traceably calibrated to Australian National Standards.

Note2:

The uncertainties quoted are estimated at a confidence level of 95% and a coverage factor of $k=2$ applies unless otherwise stated.



Health Infrastructure

Children's Hospital Westmead

**Vibration Monitoring - CASB level 3
Surgical Suite - October 2023**

CVM/ CASB/202310

Issue 1 | 06/11/2023

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 271985

Arup Pty Ltd ABN 18 000 966 165

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		Westmead Hospital – 103160 CASB level 3 Surgical Suite - Summary of Recent Vibration Measurements (01-10 to 31-10).docx

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Executive Summary

This report summarises the vibration monitoring data recorded at CASB level 3 Surgical Suite, over one month – from 01/10/2023 to 31/10/2023. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

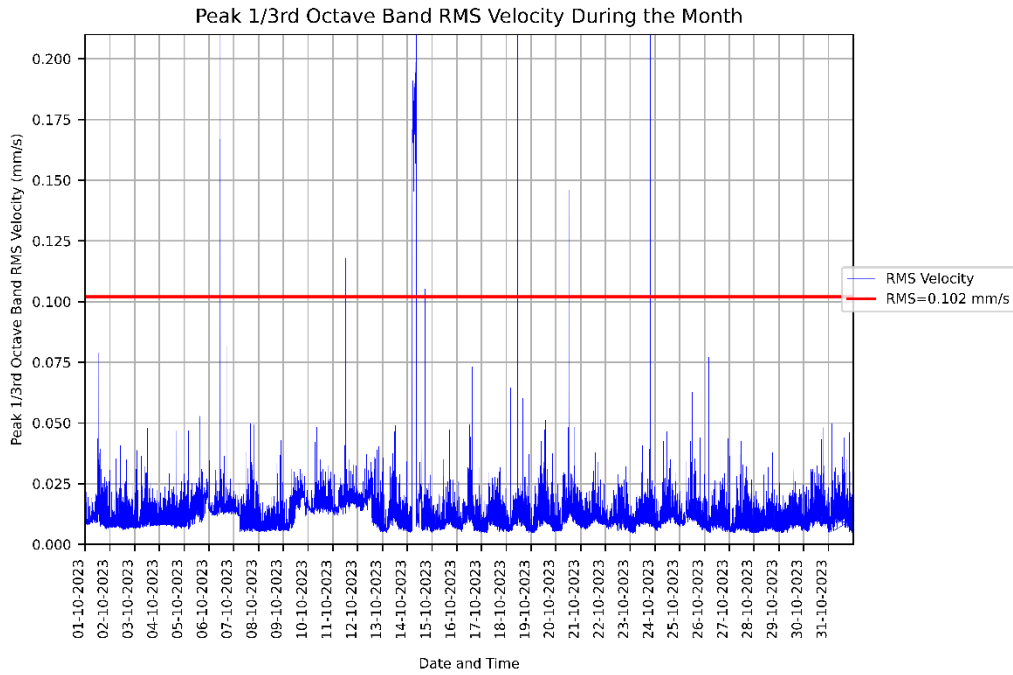


Figure 1: Measured RMSV vibration levels for 01/10/2023 to 31/10/2023 at the CASB level 3 Surgical Suite.

The table below summarises the number of Root-Mean-Square Velocity (RMSV) limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
38	93

1. Introduction

Arup has been commissioned by PricewaterhouseCoopers (PwC) on behalf of NSW Health Infrastructure to monitor vibration levels in facilities adjacent to the Paediatric Services Building and Multi-storey Car Park development sites to ensure facility operations are not excessively impacted by the construction works. This report summarises the vibration monitoring data recorded at CASB level 3 Surgical Suite during the period of the 01/10/2023 to 31/10/2023.

For the purposes of reporting, construction works are considered to be occurring at the following times:

Day	Construction Hours
Monday to Friday	7:00am to 6:00pm
Saturday	8:00am to 1:00pm
Sunday	No works
Public Holidays	No works

2. Monitor Location

The location of this monitor is shown below in Figure 3.

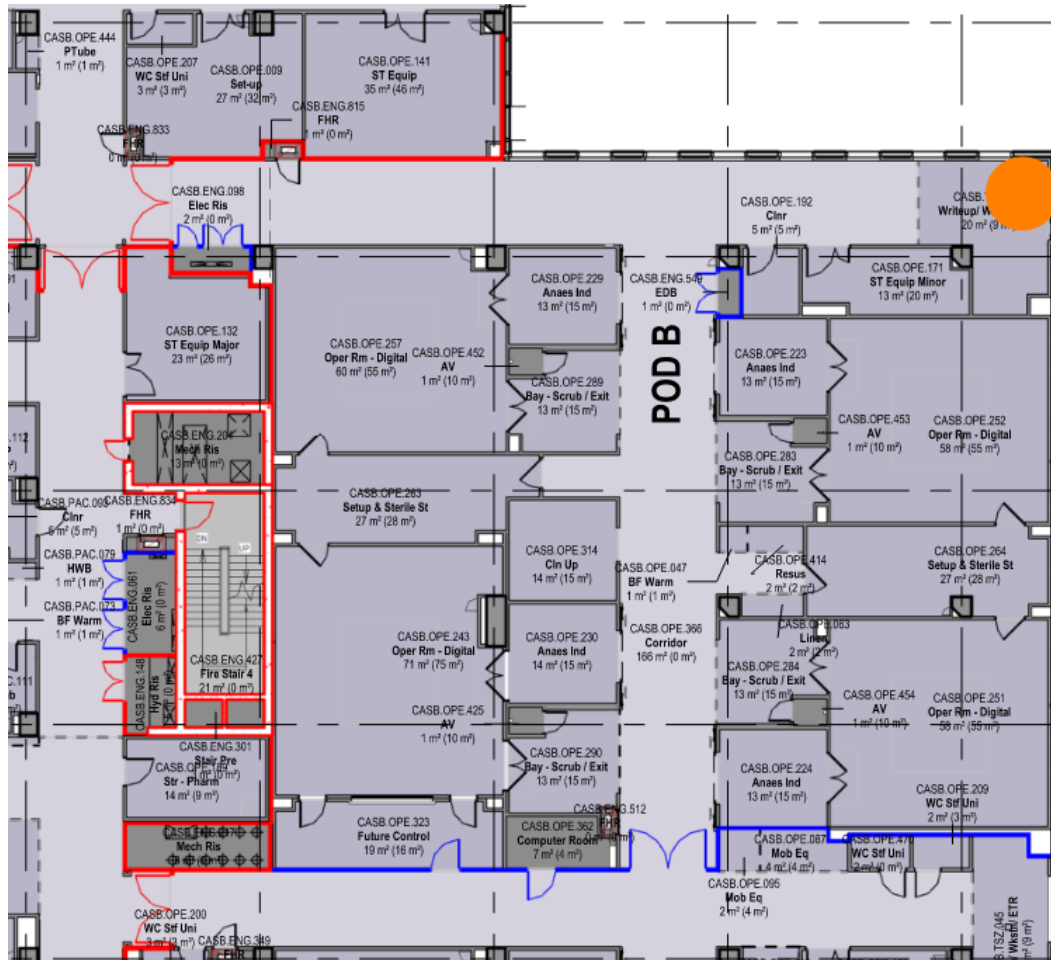


Figure 3: CASB level 3 Surgical Suite vibration monitor location

Monitoring at this location utilises a GeoSIG GMSplus with a GeoSIG VE-11 geophone. The calibration certificate for the geophone is included in Appendix A.

3. Recorded Data

Figure 4 below shows the vibration levels (RMS velocity) recorded between 01/10/2023 and 31/10/2023. The recorded data is shown in blue, while the limit of 0.102mm/s (V_{RMS}) is shown in red.

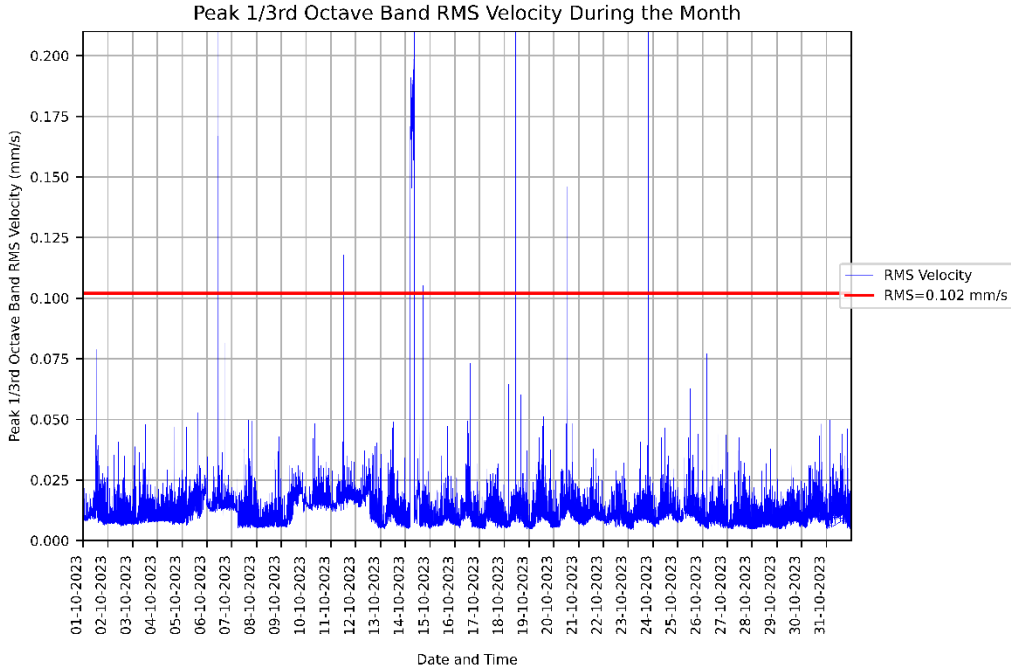


Figure 4: Measured RMSV vibration levels for 01/10/2023 to 31/10/2023 at the CASB level 3 Surgical Suite.

The table below summarises the number of RMS Velocity limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
38	93

Appendix A: Calibration Certificates

Frequency response and linearity characteristics for
GeoSIG Velocity Geophone **VE-11** Serial No. **55912**
Constant velocity of 10 mm/sec Peak applied for response
(Except at 200.0 Hz where applied level limited to 1.0 mm/s peak)
For amplitude linearity applied level varied at 15.92 Hz

12VDC Power Supply

Geophone Orientation.: Vertical

Frequency		Velocity mm/sec Peak	Indicated Sensitivity $\text{mV}/\text{mms}^{-1}$	Expanded uncertainty
Hz	Radians/sec		Vertical Sensitivity	U_{95} %
3.00	18.85	10.0	112.74	1.00%
4.00	25.13	10.0	113.82	0.90%
6.00	37.70	10.0	109.59	0.90%
10.00	62.83	10.0	100.79	0.90%
15.00	94.25	10.0	96.12	0.90%
15.92	94.25	1.0	N/A	0.90%
15.92	94.25	5.0	90.09	0.90%
15.92	94.25	10.0	89.99	0.90%
15.92	94.25	50.0	89.89	0.90%
15.92	94.25	100	N/A	0.50%
30.00	188.50	10.0	92.45	0.50%
60.00	376.99	10.0	92.89	0.50%
120.00	753.98	10.0	100.92	0.50%
150.00	942.48	10.0	117.80	0.50%
Hz	Radians/sec	Velocity mm/sec Peak	Vertical Sensitivity	U_{95} %

Note1:

The laboratory has accreditation under ISO/IEC 17025 from NATA for calibration to ISO 16063-21 at frequencies from 0.5 Hz. Measurements at all frequencies and levels shown in the table above are made using reference equipment traceably calibrated to Australian National Standards.

Note2:

The uncertainties quoted are estimated at a confidence level of 95% and a coverage factor of $k=2$ applies unless otherwise stated.



Health Infrastructure

Children's Hospital Westmead

**Vibration Monitoring - CMRI Animal
Holding Facility - October 2023**

CVM/ CMRI/202310

Issue 1 | 06/11/2023

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 271985

Arup Pty Ltd ABN 18 000 966 165

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Executive Summary

This report summarises the vibration monitoring data recorded at CMRI Animal Holding Facility, over one month – from 01/10/2023 to 31/10/2023. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

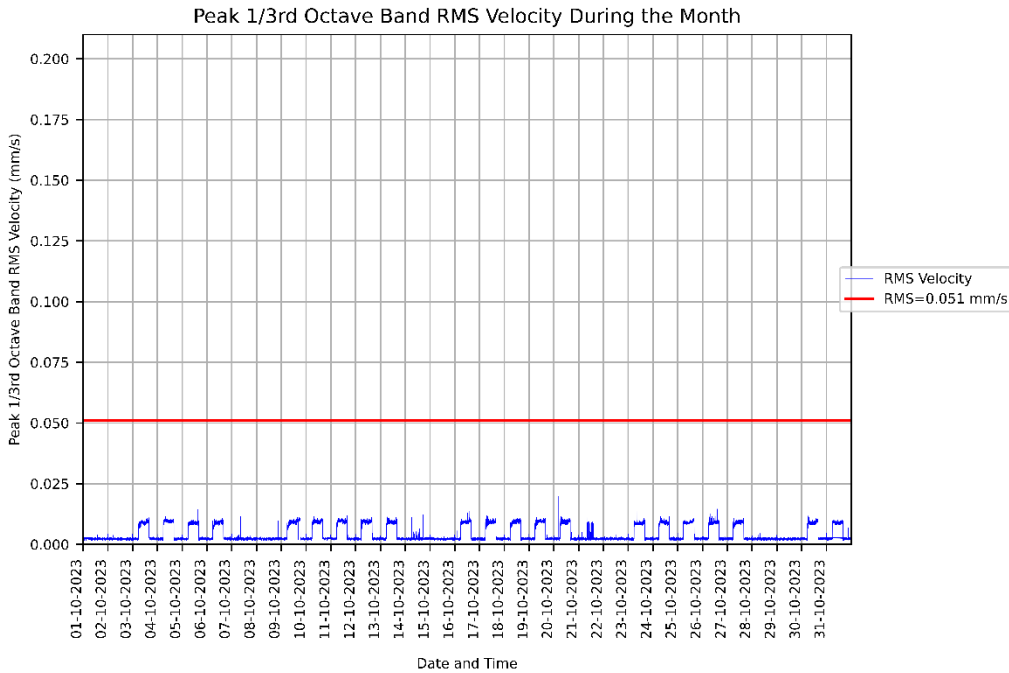


Figure 1: Measured RMSV vibration levels for 01/10/2023 to 31/10/2023 at the CMRI Animal Holding Facility.

The table below summarises the number of Root-Mean-Square Velocity (RMSV) limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
0	0

PPV Vibration Levels

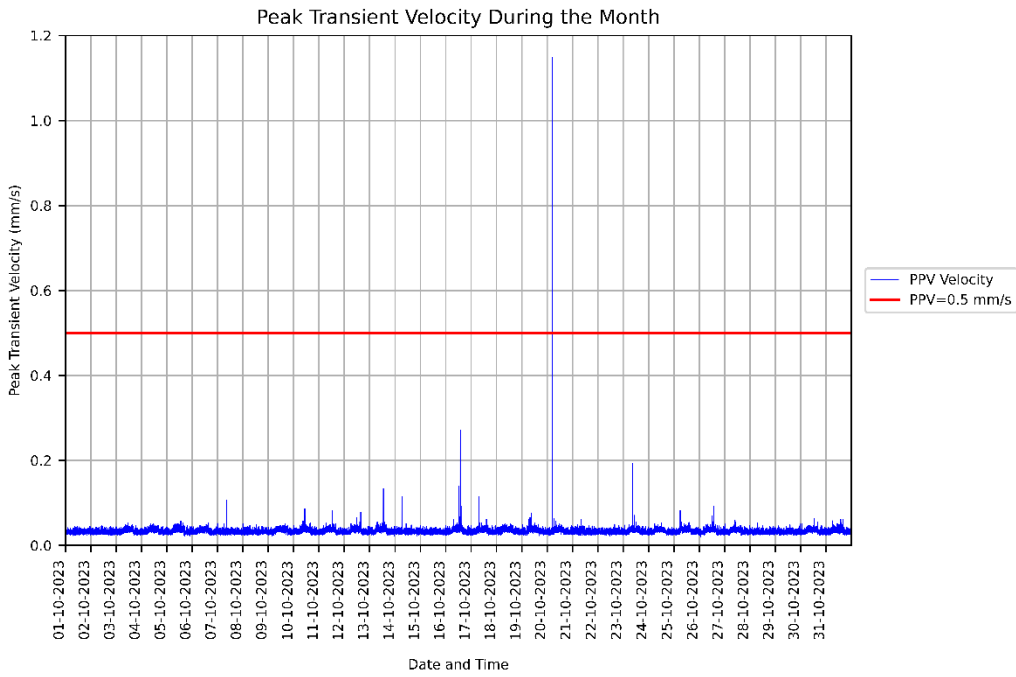


Figure 2: Measured vibration levels for 01/10/2023 to 31/10/2023 at the CMRI Animal Holding Facility.

The table below summarises the number of Peak Particle Velocity (PPV) limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
0	1

1. Introduction

Arup has been commissioned by PricewaterhouseCoopers (PwC) on behalf of NSW Health Infrastructure to monitor vibration levels in facilities adjacent to the Forecourt development sites to ensure facility operations are not excessively impacted by the construction works. This report summarises the vibration monitoring data recorded at CMRI Animal Holding Facility during the period of the 01/10/2023 to 31/10/2023.

For the purposes of reporting, construction works are considered to be occurring at the following times:

Day	Construction Hours
Monday to Friday	7:00am to 6:00pm
Saturday	8:00am to 1:00pm
Sunday	No works
Public Holidays	No works

2. Monitor Location

The location of this monitor is shown below in Figure 3Figure .



Figure 3: CMRI Animal Holding Facility vibration monitor location

Monitoring at this location utilises a GeoSIG GMSplus with a GeoSIG VE-11 geophone. The calibration certificate for the geophone is included in Appendix A.

3. Recorded Data

Figure 4 below shows the vibration levels (RMS velocity) recorded between 01/10/2023 and 31/10/2023. The recorded data is shown in blue, while the limit of 0.051mm/s (V_{RMS}) is shown in red.

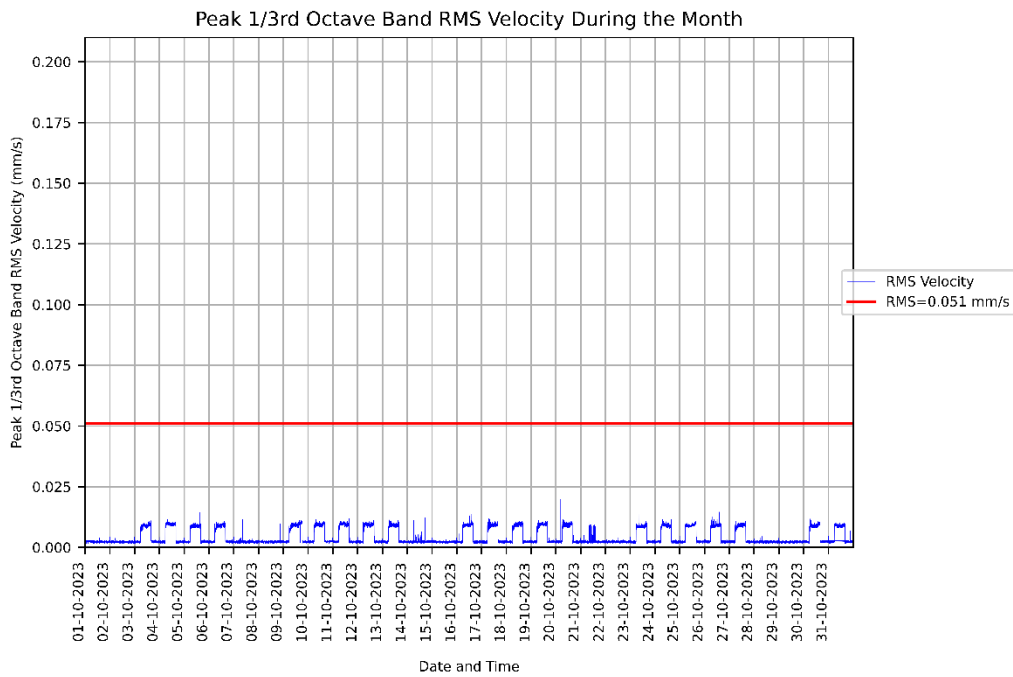


Figure 4: Measured RMSV vibration levels for 01/10/2023 to 31/10/2023 at the CMRI Animal Holding Facility.

The table below summarises the number of RMS Velocity limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
0	0

Figure 5 below shows the peak particle vibration levels (PPV velocity) recorded between 01/10/2023 and 31/10/2023. The recorded data is shown in blue, while the limit of 0.5mm/s (V_{PPV}) is shown in red.

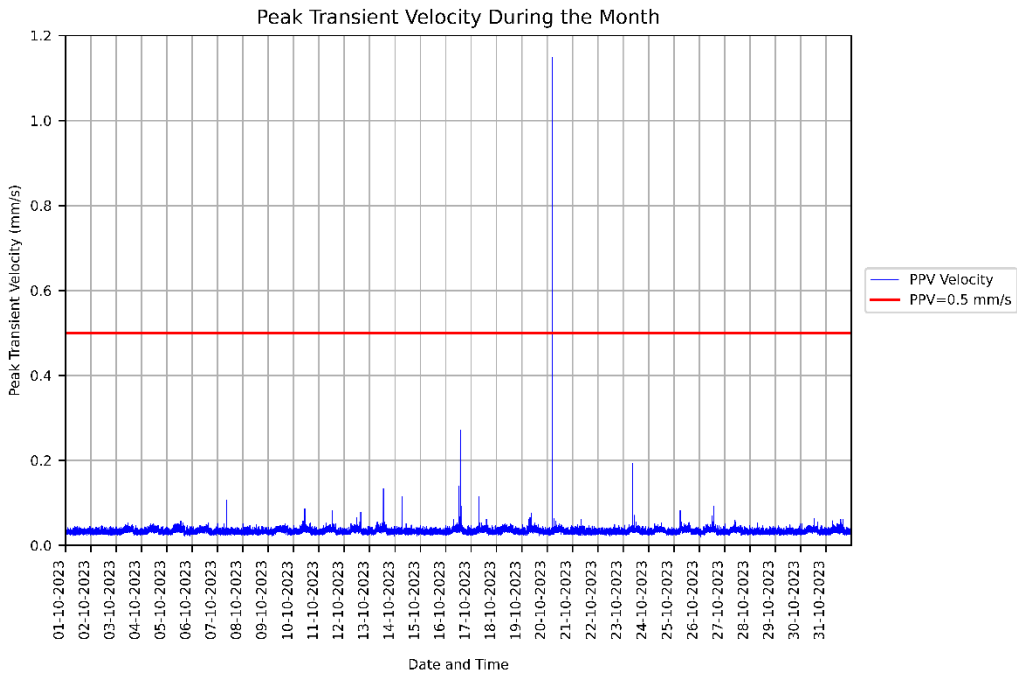


Figure 5: Measured PPV vibration levels for 01/10/2023 to 31/10/2023 at the CMRI Animal Holding Facility.

The table below summarises the number of PPV limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
0	1

Frequency response and linearity characteristics for
GeoSIG Velocity Geophone **VE-11** Serial No. **55913**
Constant velocity of 10 mm/sec Peak applied for response
(Except at 200.0 Hz where applied level limited to 1.0 mm/s peak)
For amplitude linearity applied level varied at 15.92 Hz

12VDC Power Supply

Geophone Orientation.: Vertical

Frequency		Velocity mm/sec Peak	Indicated Sensitivity mV/mms ⁻¹ Vertical Sensitivity	Expanded uncertainty U ₉₅ %
Hz	Radians/sec			
3.00	18.85	10.0	106.24	1.00%
4.00	25.13	10.0	105.59	0.90%
6.00	37.70	10.0	100.69	0.90%
10.00	62.83	10.0	94.25	0.90%
15.00	94.25	10.0	91.31	0.90%
15.92	94.25	1.0	N/A	0.90%
15.92	94.25	5.0	85.93	0.90%
15.92	94.25	10.0	85.77	0.90%
15.92	94.25	50.0	85.76	0.90%
15.92	94.25	100	N/A	0.50%
30.00	188.50	10.0	89.27	0.50%
60.00	376.99	10.0	90.17	0.50%
120.00	753.98	10.0	100.67	0.50%
150.00	942.48	10.0	115.82	0.50%
Hz	Radians/sec	Velocity mm/sec Peak	Vertical Sensitivity	U ₉₅ %

Note1:

The laboratory has accreditation under ISO/IEC 17025 from NATA for calibration to ISO 16063-21 at frequencies from 0.5 Hz. Measurements at all frequencies and levels shown in the table above are made using reference equipment traceably calibrated to Australian National Standards.

Note2:

The uncertainties quoted are estimated at a confidence level of 95% and a coverage factor of k=2 applies unless otherwise stated.



Health Infrastructure

Children's Hospital Westmead

**Vibration Monitoring - WIMR - BSF
Mice Holding Room - Rack - October
2023**

CVM/ WIMR/202310

Issue 1 | 06/11/2023

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 271985

Arup Pty Ltd ABN 18 000 966 165

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Document Verification

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Name			
Signature			

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Executive Summary

This report summarises the vibration monitoring data recorded at WIMR - BSF Mice Holding Room - Rack, over one month – from 01/10/2023 to 31/10/2023. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

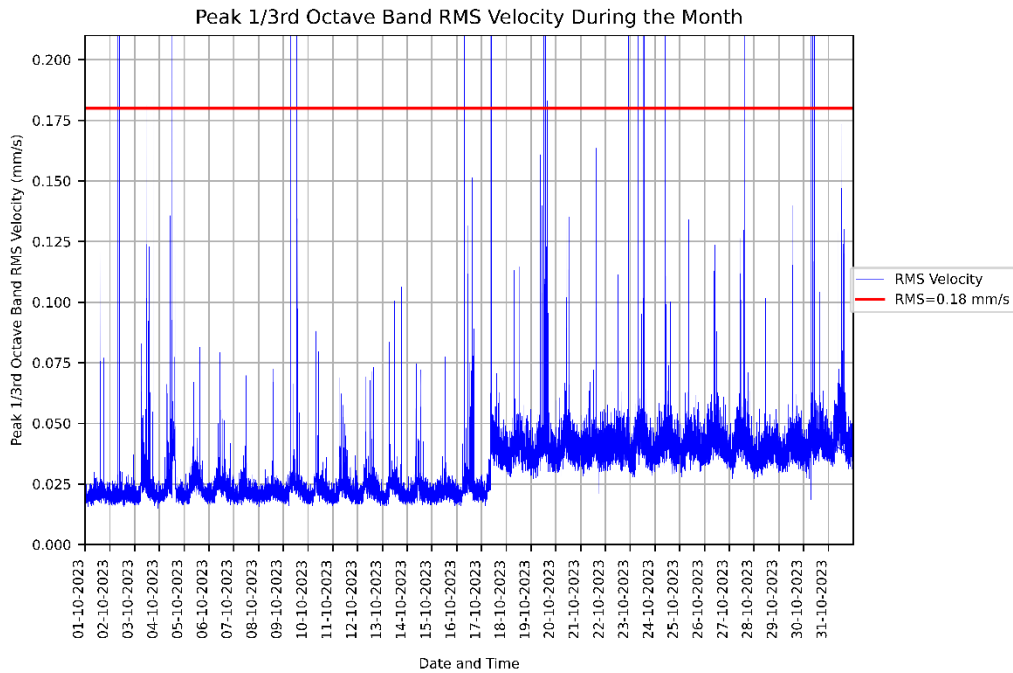


Figure 1: Measured RMSV vibration levels for 01/10/2023 to 31/10/2023 at the WIMR - BSF Mice Holding Room - Rack.

The slight increase in baseline vibration levels evident in Figure 1 is likely due to a knock to the rack. The impact of this increase is minor. In the next visit, Arup staff will ensure that the logger is centred as required.

The table below summarises the number of Root-Mean-Square Velocity (RMSV) limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
26	1

PPV Vibration Levels

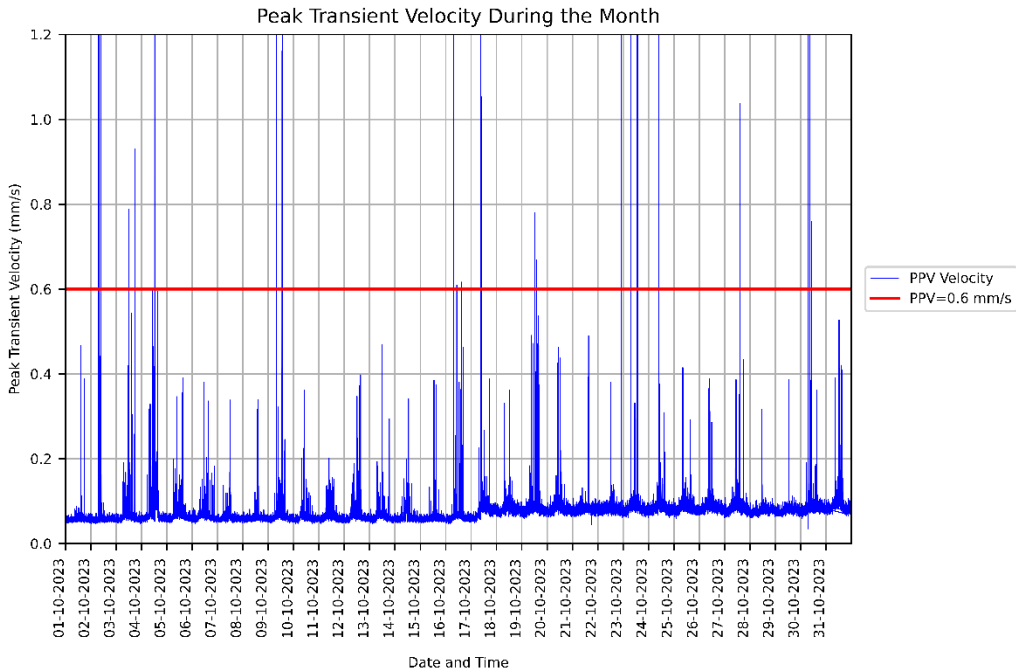


Figure 2: Measured vibration levels for 01/10/2023 to 31/10/2023 at the WIMR - BSF Mice Holding Room - Rack.

The table below summarises the number of Peak Particle Velocity (PPV) limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
23	6

1. Introduction

Arup has been commissioned by PricewaterhouseCoopers (PwC) on behalf of NSW Health Infrastructure to monitor vibration levels in facilities adjacent to the VVMF Innovation Centre development sites to ensure facility operations are not excessively impacted by the construction works. This report summarises the vibration monitoring data recorded at WIMR - BSF Mice Holding Room - Rack during the period of the 01/10/2023 to 31/10/2023.

For the purposes of reporting, construction works are considered to be occurring at the following times:

Day	Construction Hours
Monday to Friday	7:00am to 6:00pm
Saturday	8:00am to 1:00pm
Sunday	No works
Public Holidays	No works

2. Monitor Location

The location of this monitor is shown below in Figure 3.

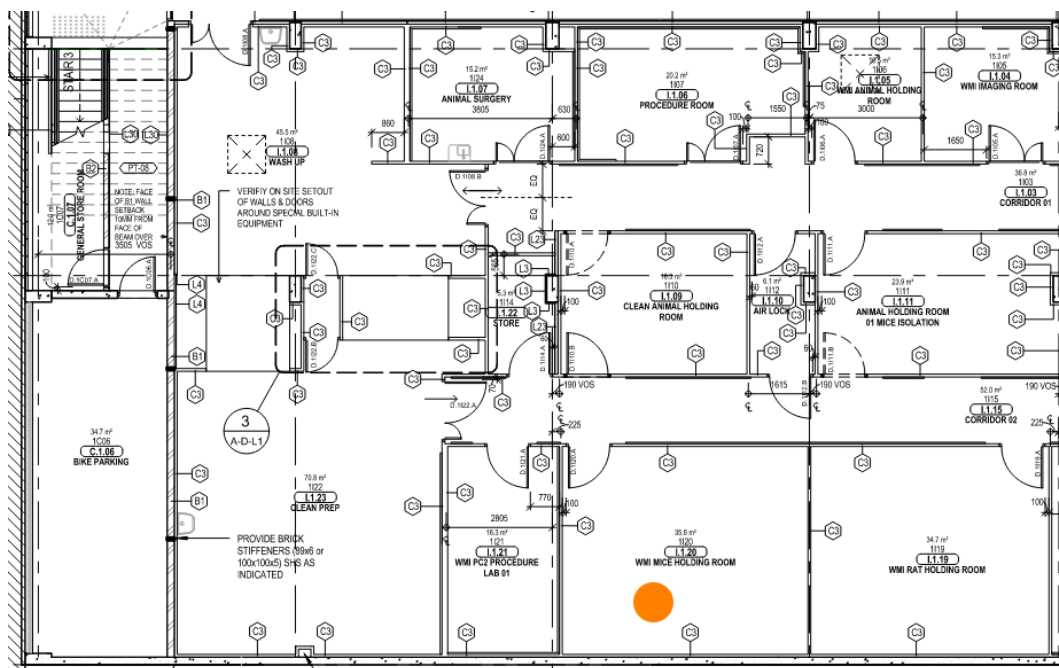


Figure 3: WIMR - BSF Mice Holding Room - Rack vibration monitor location

Monitoring at this location utilises a GeoSIG GMSplus with a GeoSIG VE-11 geophone. The calibration certificate for the geophone is included in Appendix A.

3. Recorded Data

Figure 4 below shows the vibration levels (RMS velocity) recorded between 01/10/2023 and 31/10/2023. The recorded data is shown in blue, while the limit of 0.18mm/s (V_{RMS}) is shown in red.

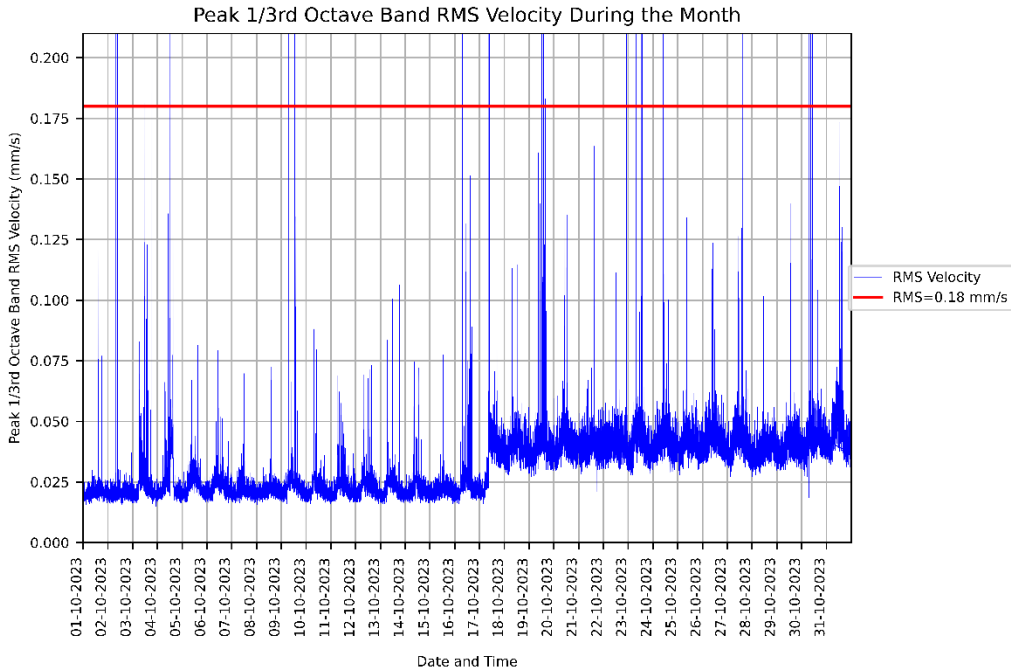


Figure 4: Measured RMSV vibration levels for 01/10/2023 to 31/10/2023 at the WIMR - BSF Mice Holding Room - Rack.

The slight increase in baseline vibration levels evident in Figure 4 is likely due to a knock to the rack. The impact of this increase is minor. In the next visit, Arup staff will ensure that the logger is centred as required.

The table below summarises the number of RMS Velocity limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
26	1

Figure 5 below shows the peak particle vibration levels (PPV velocity) recorded between 01/10/2023 and 31/10/2023. The recorded data is shown in blue, while the limit of 0.6mm/s (V_{PPV}) is shown in red.

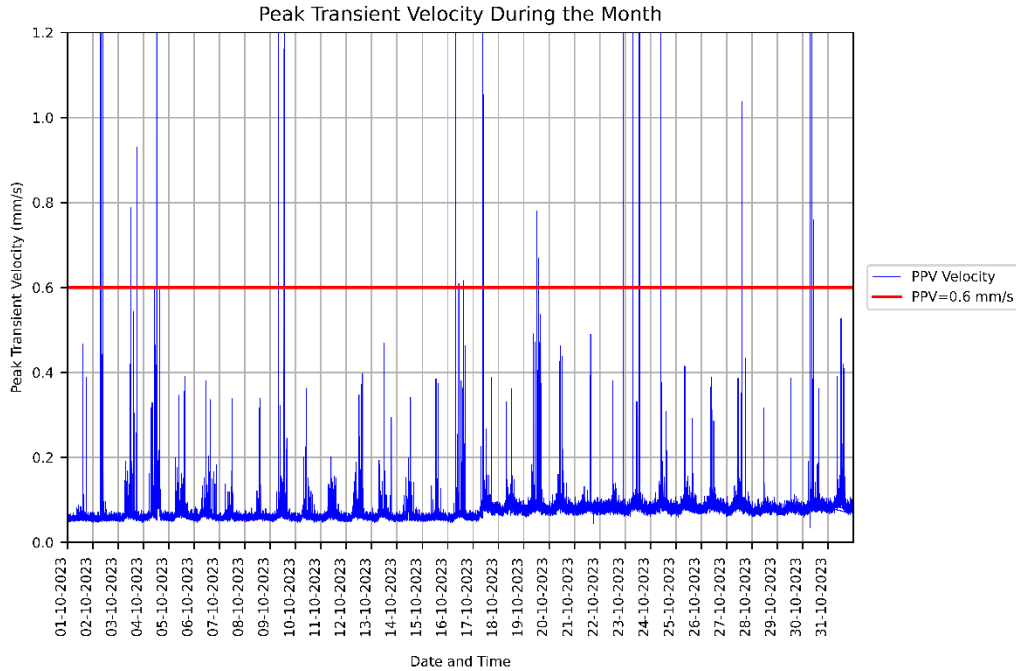


Figure 5: Measured PPV vibration levels for 01/10/2023 to 31/10/2023 at the WIMR - BSF Mice Holding Room - Rack.

The table below summarises the number of PPV limit exceedances recorded during and outside of construction hours.

During Construction Hours	Outside of Construction Hours
23	6

Appendix A: Calibration Certificates

Test Record GMSplus

Test Record	1	Job	31057
S/N	103677	Test Procedure	GS_GMSplus_TestProcedure_V01

Customer	AU_ARUP_Riddet	Date	01.02.2018
		Tested by	Ross Baradoy

Model	GMSplus	103677	Option 1		
Type	3Ch		Option 2		
Description	Recorder		Option 3		
Main board	GS_IA18_S-MN.V06.H2	160281	Option 4		
Conn. board	GS_IA18_S-MN.V06.H2	160305	Option 5		
Input range	± 10 V DIFF		Option 6		
Sensor 1	VE-11	56865	Ext. Option 1	GXX-3GUE	17738
Sensor 2	0		Ext. Option 2		
Power	15 VDC		Ext. Option 3		
Armdas/Predas	21.12.16		MAC	8C:8E:76:00:C2:01	
Linux	gms-linux-firmware-r121_20170321.gsfw		DSP	51.03.05	
			RTC	80.02.03	

Remarks:

1. Test Equipment

1.1. Test equipment is as per list and ready	<input checked="" type="checkbox"/> Ok
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2. Visual Check

2.1. No defects found during visual check	<input checked="" type="checkbox"/> Ok
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3. Configuration

3.1. Description	GMSplus GeoSIG Ltd
3.2. Memory	8 GB
3.3. Station	GSGMS
3.4. Location	Australia
3.5. Sampling rate	200 SPS
3.6. Units	mm/s
3.7. LSB value	0.0000132500000mm/s /count
3.8. Pre event	5 s
3.9. Post event	10 s
3.10. Trigger level	2 and 3 mm/s
3.11. Alarms Trigger level	n/a

4. Sensor input test

4.1. AC input test	<input checked="" type="checkbox"/> Ok
4.2. DC input test	<input checked="" type="checkbox"/> Ok
4.3. Noise test	<input checked="" type="checkbox"/> Ok

5. Real sensor test

5.1. Test pulse	<input checked="" type="checkbox"/> Ok	<input type="checkbox"/> n/a
5.2. Event X-Y-Z	<input checked="" type="checkbox"/> Ok	<input type="checkbox"/> n/a
5.3. Tilt	<input checked="" type="checkbox"/> Ok	<input type="checkbox"/> n/a
5.4. Over range	<input checked="" type="checkbox"/> Ok	<input type="checkbox"/> n/a

6. Options testing

6.1. GMS-Wi-Fi	<input type="checkbox"/> Ok	<input checked="" type="checkbox"/> n/a
6.2. GMS-GPS	<input type="checkbox"/> Ok	<input checked="" type="checkbox"/> n/a
6.3. GXX-3GUM	<input checked="" type="checkbox"/> Ok	<input type="checkbox"/> n/a
6.4. ALC, Config:	<input type="checkbox"/> Ok	<input checked="" type="checkbox"/> n/a
6.5. GMS-Interconnection	<input type="checkbox"/> Ok	<input checked="" type="checkbox"/> n/a
6.6. Serial modem	<input type="checkbox"/> Ok	<input checked="" type="checkbox"/> n/a
6.7. Ethernet modem	<input type="checkbox"/> Ok	<input checked="" type="checkbox"/> n/a
6.8. Sensor junction box	<input type="checkbox"/> Ok	<input checked="" type="checkbox"/> n/a

7. Physical inspection

7.1. Housing	<input checked="" type="checkbox"/> Ok
7.2. Fixation and screws	<input checked="" type="checkbox"/> Ok
7.3. Cables and connectors	<input checked="" type="checkbox"/> Ok
7.4. Labels	<input checked="" type="checkbox"/> Ok
7.5. Cleanness	<input checked="" type="checkbox"/> Ok


8. Configuration backup

8.1. Instrument configuration (*.xml)	<input checked="" type="checkbox"/> Ok
8.2. Software configuration (*.gsc)	<input checked="" type="checkbox"/> Ok
8.3. Test files archived	<input checked="" type="checkbox"/> Ok

Final Acceptance

All tests were executed according to the test procedure and all results were checked and are according to the specifications.

Tested by Ross Baradoy  on 26.02.2018

Approved by Tobias Liesching  on 02.03.2018