

Health Infrastructure NSW
Westmead PSB and MSCP
Construction Noise Monitoring

Noise monitoring report
2024-02-01 to 2024-02-29

AC26

v1 | 14 March 2024

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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Appendix A

Noise Monitoring Daily Results

1 Introduction

Arup has been retained to carry on with the work originally contracted by PwC/Scyne. The work included the installation of noise monitors in various locations within the Westmead Precinct and the reporting of noise levels recorded. The noise loggers are 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.

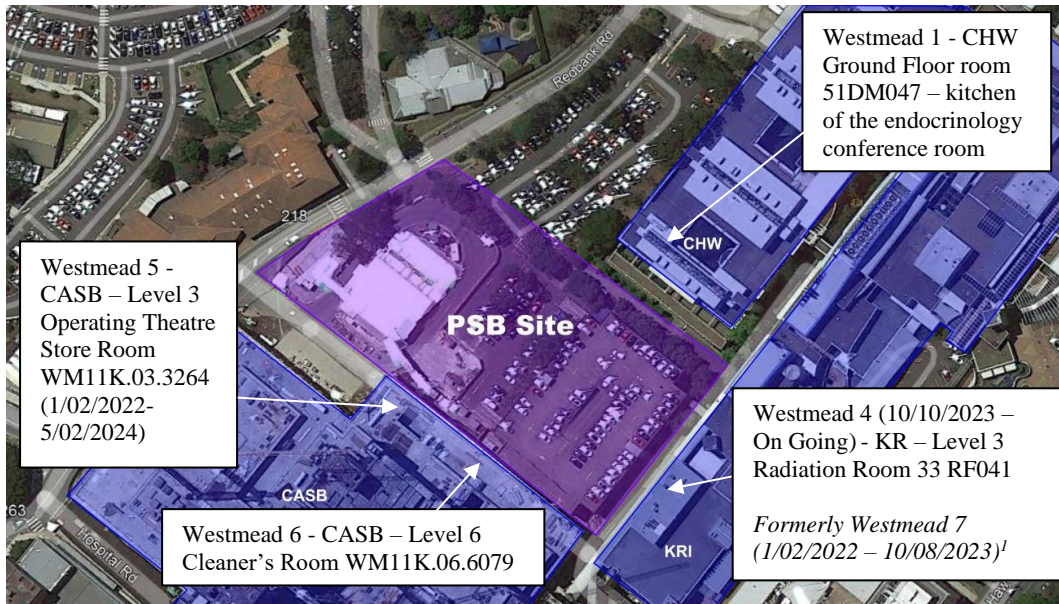
The noise loggers are configured to send email and SMS notifications to stakeholders when construction Noise Management Levels (NMLs) are exceeded.

This report details noise measurement results from **1 February 2024 to 29 February 2024** 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 5 February 2024, several loggers were relocated or removed from site including:

- Westmead 6, removed from site for manufacturer calibration,
- Westmead 4, removed from site for logger repair (faulty screen); and

- Westmead 5, removed from site to support logging works of a different project (VVMF noise monitoring)

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

Table 1: Logger relocation records

Logger ID	Original Location	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 for manufacturer calibration</i>
Westmead 2	CHW Level 2 Parent Kitchen 92BW025	18/10/23	<i>Removed from site for manufacturer calibration</i>
Westmead 3	RMH Level 1 Store Room 101	18/10/23	<i>Removed from site for manufacturer calibration</i>
Westmead 1	<i>Removed from site for manufacturer calibration</i>	6/12/23	CHW Ground Floor room 51DM047
Westmead 2	<i>Removed from site for manufacturer calibration</i>	6/12/23	CHW Level 2 Parent Kitchen 92BW025
Westmead 3	<i>Removed from site for manufacturer calibration</i>	6/12/23	RMH Level 1 Store Room 101
Westmead 4	KR Level 3 Radiation Room 33 RF041	6/12/23	<i>Removed from site for manufacturer calibration</i>

Westmead 5	CASB Level 3 Operating Theatre Store Room WM11K.03.3264	6/12/23	<i>Removed from site for manufacturer calibration</i>
Westmead 4	<i>Removed from site for manufacturer calibration</i>	12/21/23	KR Level 3 Radiation Room 33 RF041
Westmead 5	<i>Removed from site for manufacturer calibration</i>	12/21/23	CASB Level 3 Operating Theatre Store Room WM11K.03.3264
Westmead 6	CASB Level 6 Cleaner's Room WM11K.06.6079	5/02/2024	<i>Removed from site for manufacturer calibration</i>
Westmead 4	KR Level 3 Radiation Room 33 RF041	5/02/2024	<i>Removed from site for repair</i>
Westmead 5	CASB Level 3 Operating Theatre Store Room WM11K.03.3264	5/02/2024	<i>Removed from site to support another project (VVMF project)</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* report [1] 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.

4 Noise monitoring results

4.1 Outages

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

On 28 February 2024 a representative from ARL, the Noise Cloud service provider, informed that it would not be possible to recover the missing data, stating:

“Any data that was stored on the internal flash of the Ngara when it was not uploading, would have been buffered and uploaded to NC when the connection was restored. Any data that was not buffered or is missing is unfortunately unable to be recovered.”

In response to this Arup is exploring possible noise monitoring logger alternatives with a more robust failsafe to avoid future data loss.

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)	1/02/2024 – 5/02/2024
Westmead 5	CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (facing PSB site)	1/02/2024 – 29/02/2024
Westmead 6	CASB Level 6 Cleaner’s Room WM11K.06.6079 (facing PSB site)	1/02/2024 – On Going ²
Westmead 4	KR Level 3 Radiation Room 33 RF041(facing PSB site)	1/02/2024 – On Going ²
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)	1/02/2024 – 5/02/2024
Westmead 3	RMH Level 1 Store Room 101 (facing MSCP site)	1/02/2024 – 5/02/2024

Note:

1. Westmead 7 logger was relocated to the WIMR bike store room on Thursday 10 August 2023 to support the VVMF construction project.
2. Westmead 6 and Westmead 4 loggers were removed for calibration and repair and await instruction for redeployment.

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)	25
Westmead 5	CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (facing PSB site)	-
Westmead 6	CASB Level 6 Cleaner's Room WM11K.06.6079 (facing PSB site)	-
Westmead 4	KR Level 3 Radiation Room 33 RF041(facing PSB site)	-
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)	6
Westmead 3	RMH Level 1 Store Room 101 (facing MSCP site)	27

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 the Principal 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.

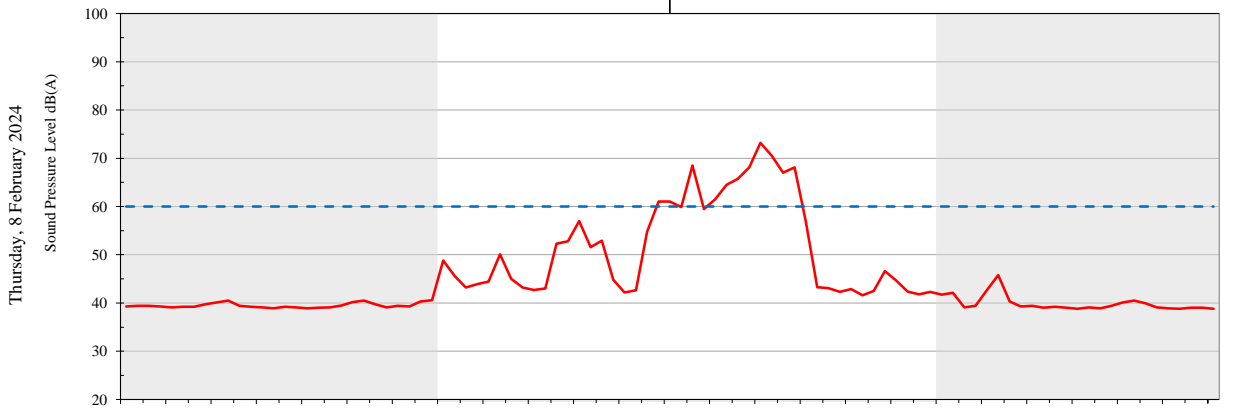
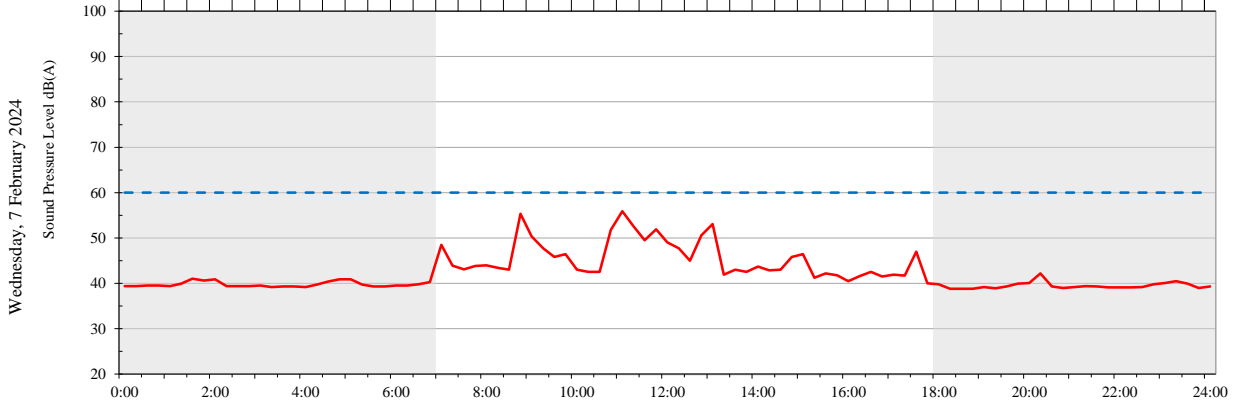
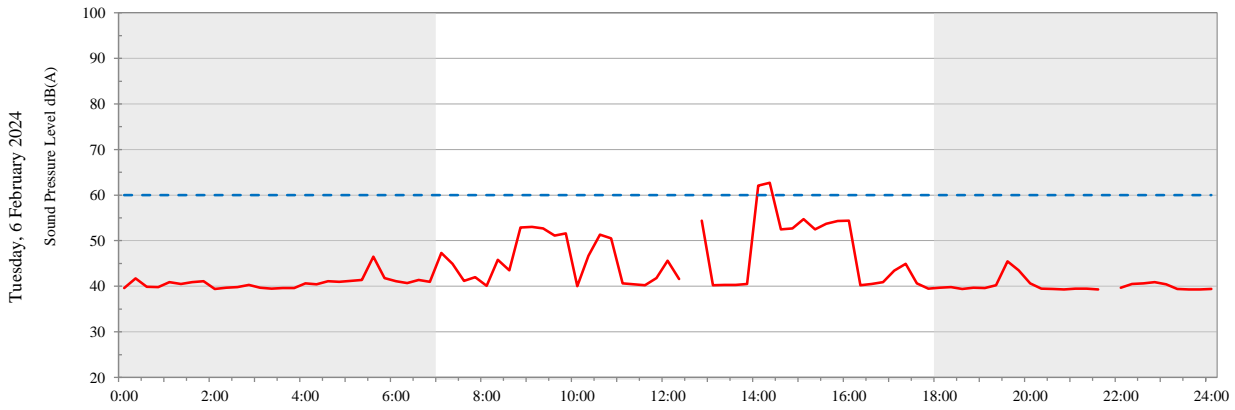
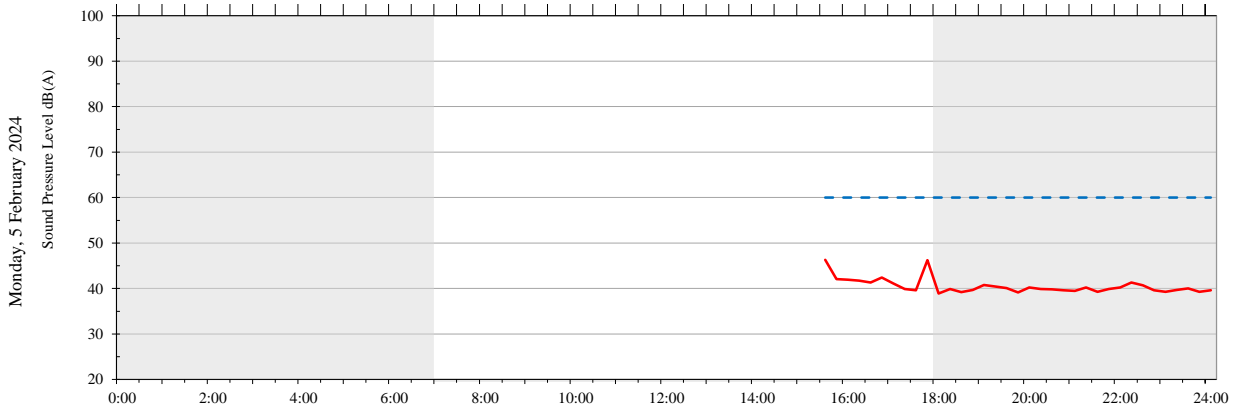
Works Cited

- [1] Arup, "Baseline noise measurements report," Sydney, 2022.
- [2] Stantec, "Paediatric Services Building, The Children's Hospital at Westmead," Stantec, Sydney, 2021.
- [3] Department of Environment & Climate Change, "Interim Construction Noise Guideline," DECC, Sydney, 2009.
- [4] Stantec, "Multi-storey Carpark, The Children's Hospital at Westmead," Stantec, Sydney, 2021.
- [5] Department of Environment and Climate Change NSW, "Interim Construction Noise Guideline," State of NSW, Sydney, 2009.

Appendix A

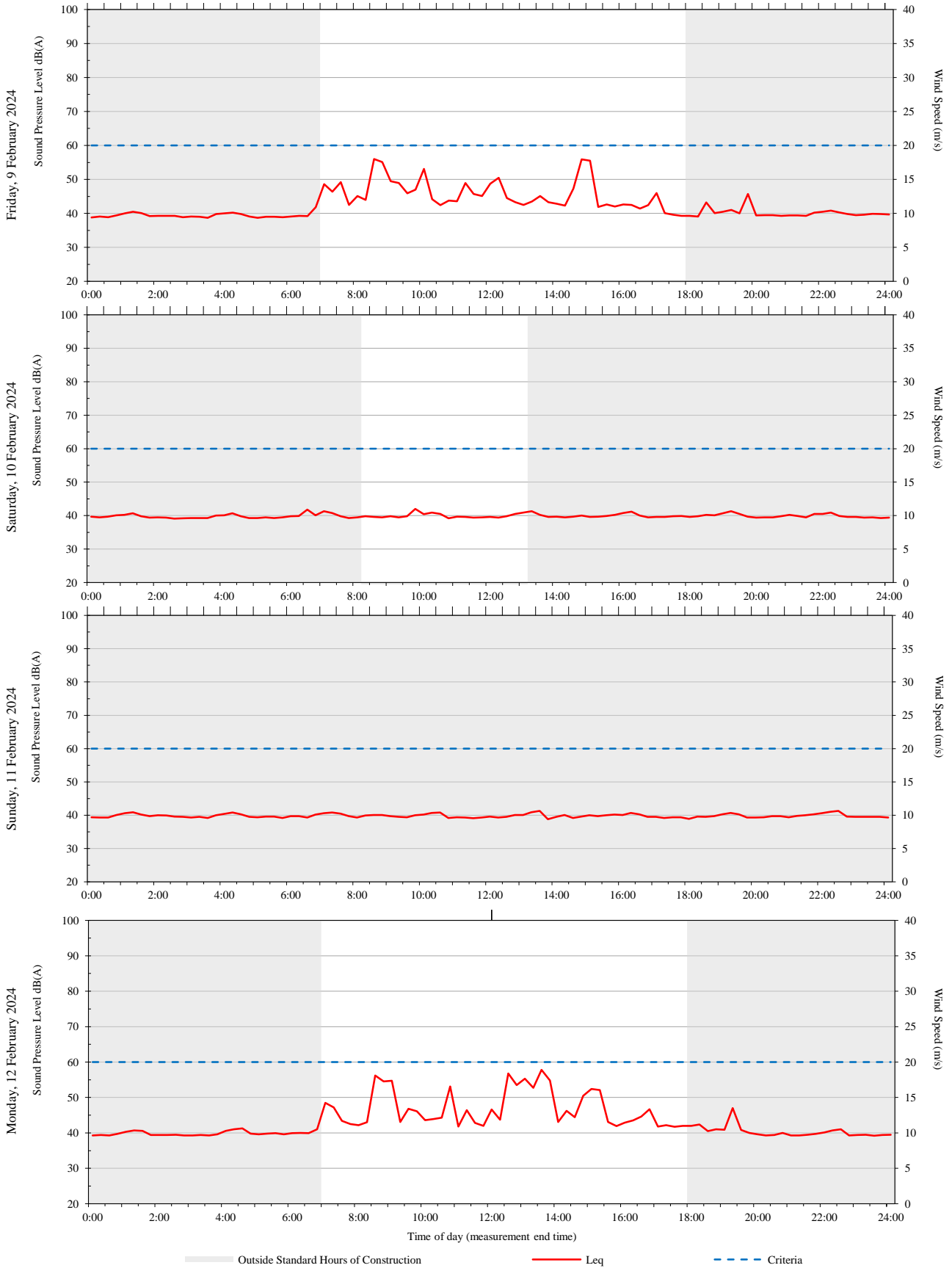
Noise Monitoring Daily Results

A1 CHW Ground Floor room 51DM047 (Westmead 1)

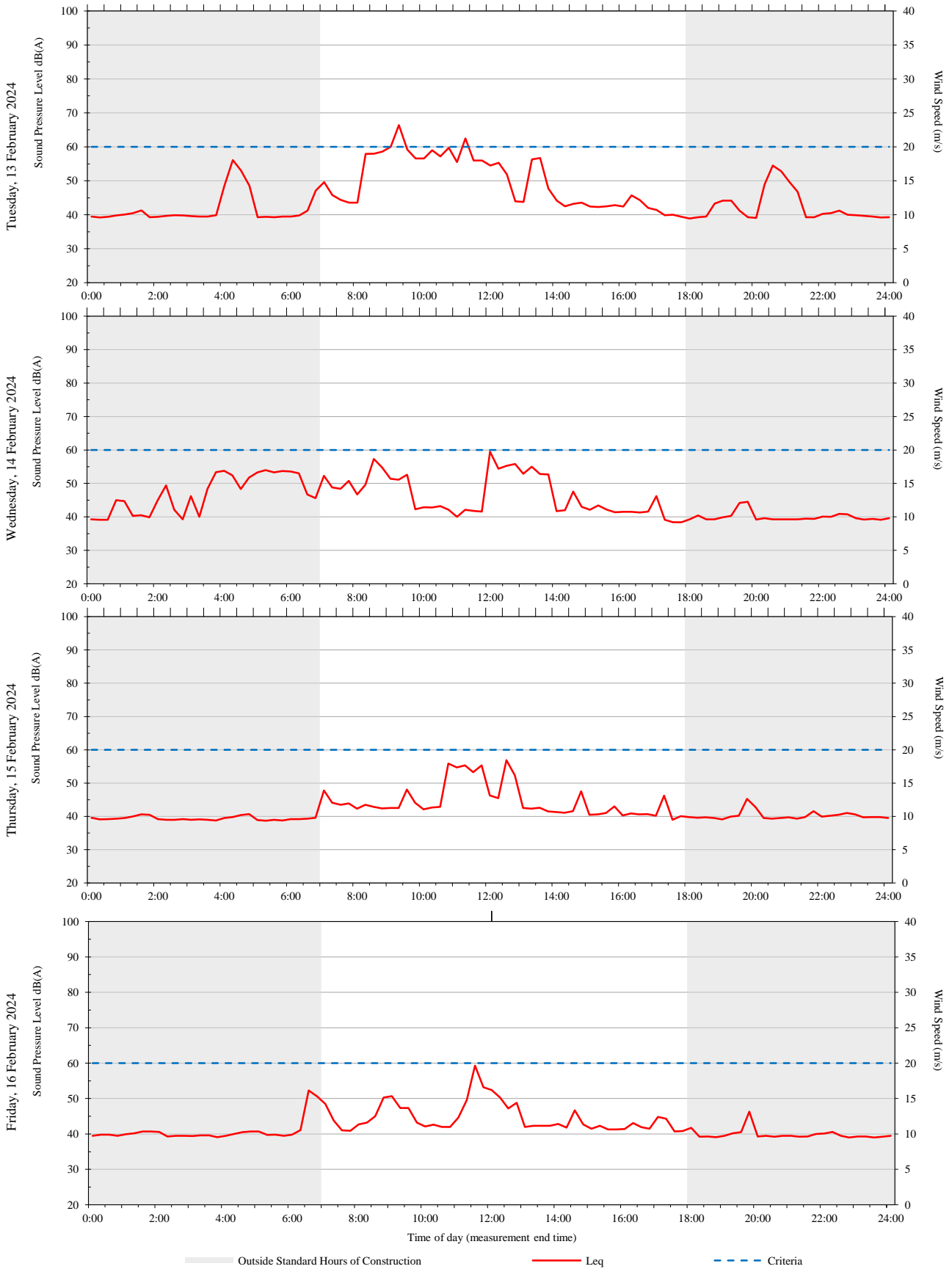


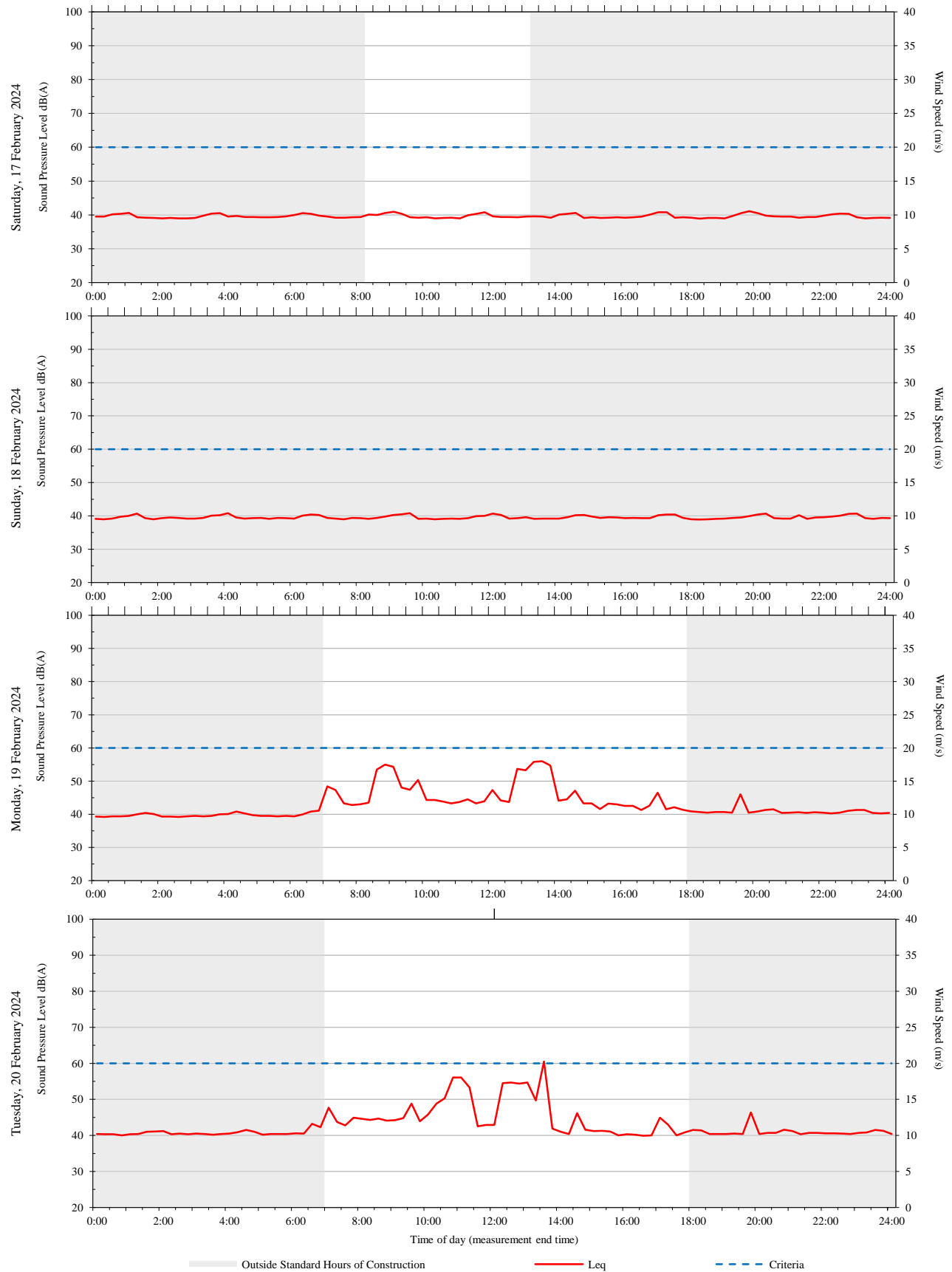
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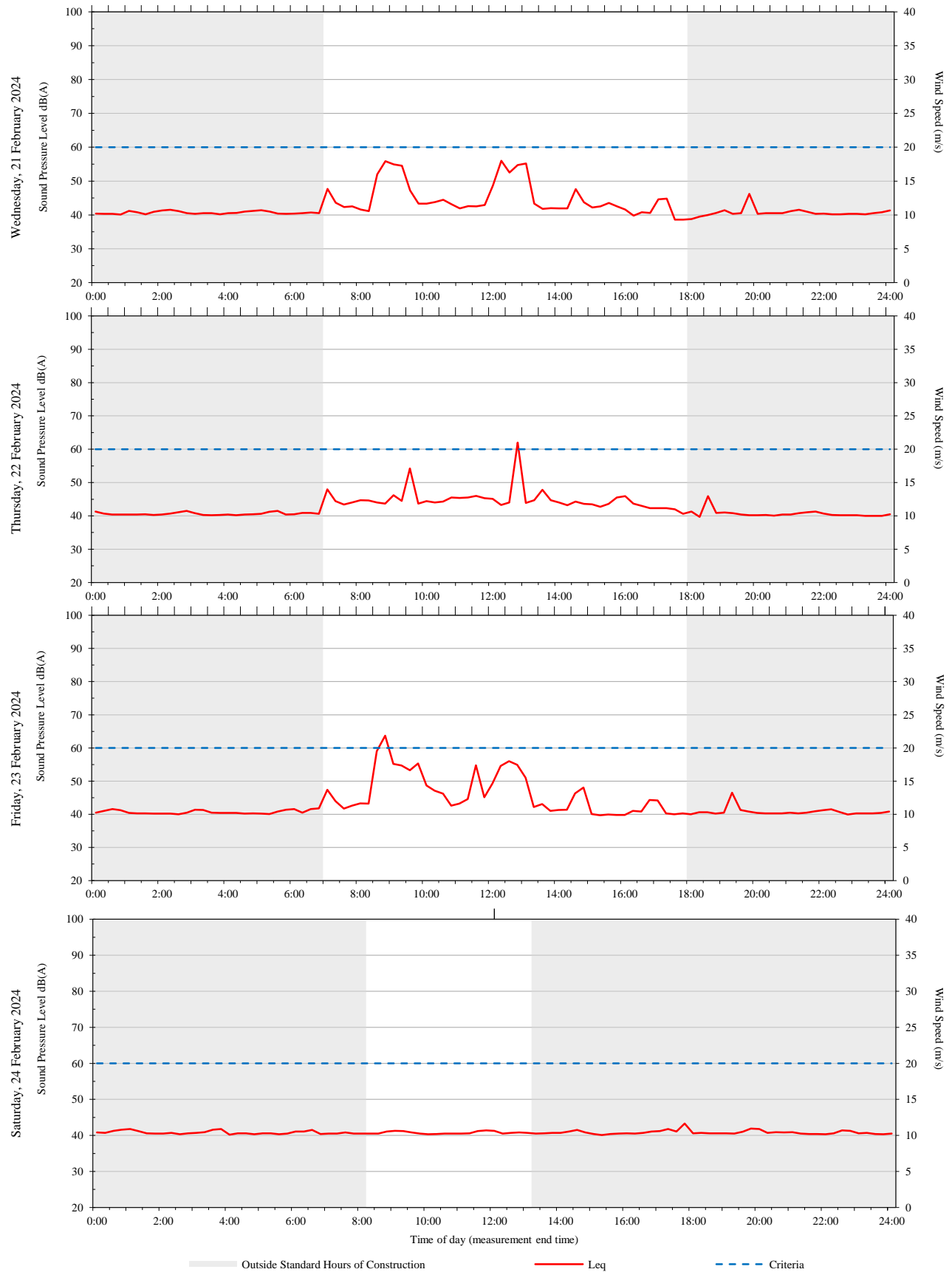
Unattended monitoring: CHW Ground Floor room 51DM047 (Internal)

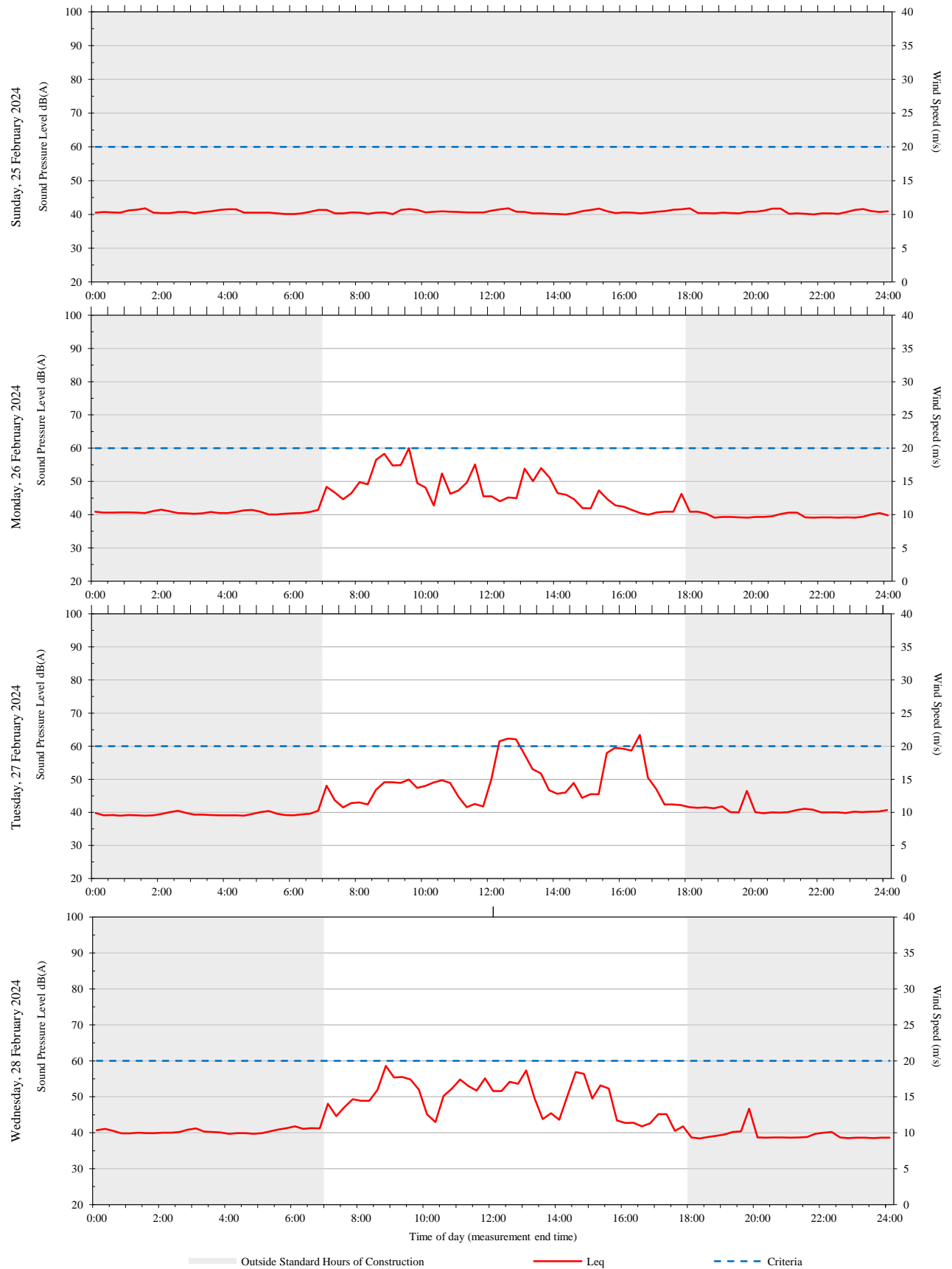


Unattended monitoring: CHW Ground Floor room 51DM047 (Internal)





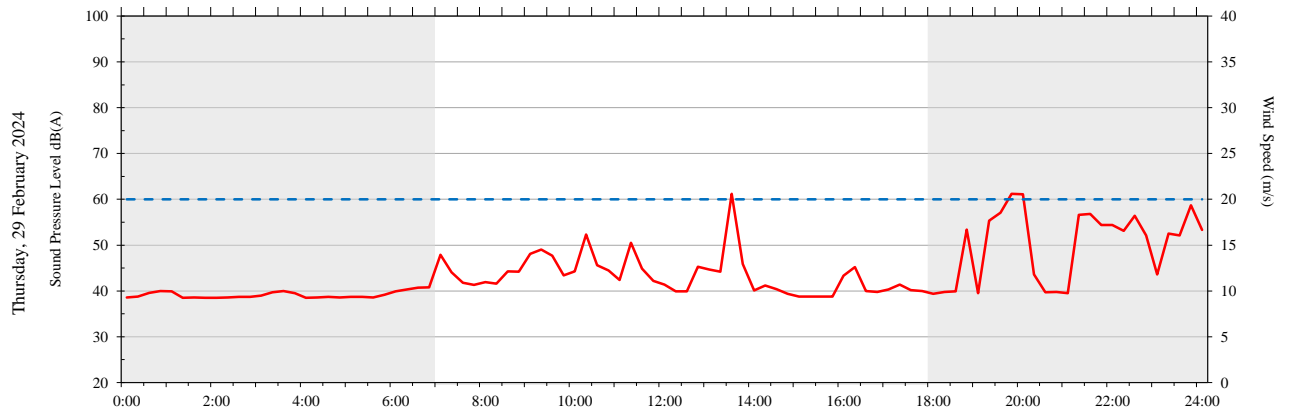




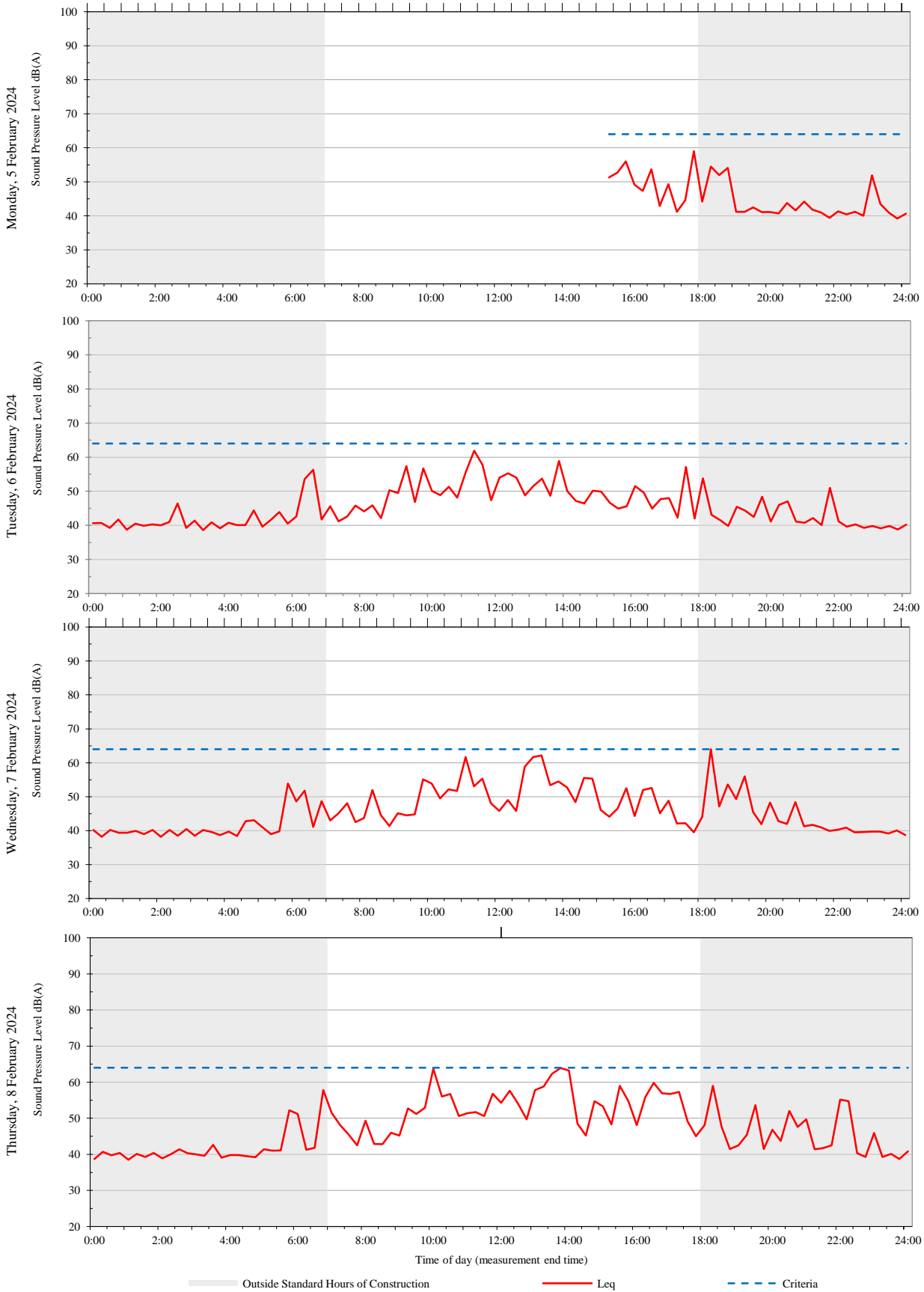
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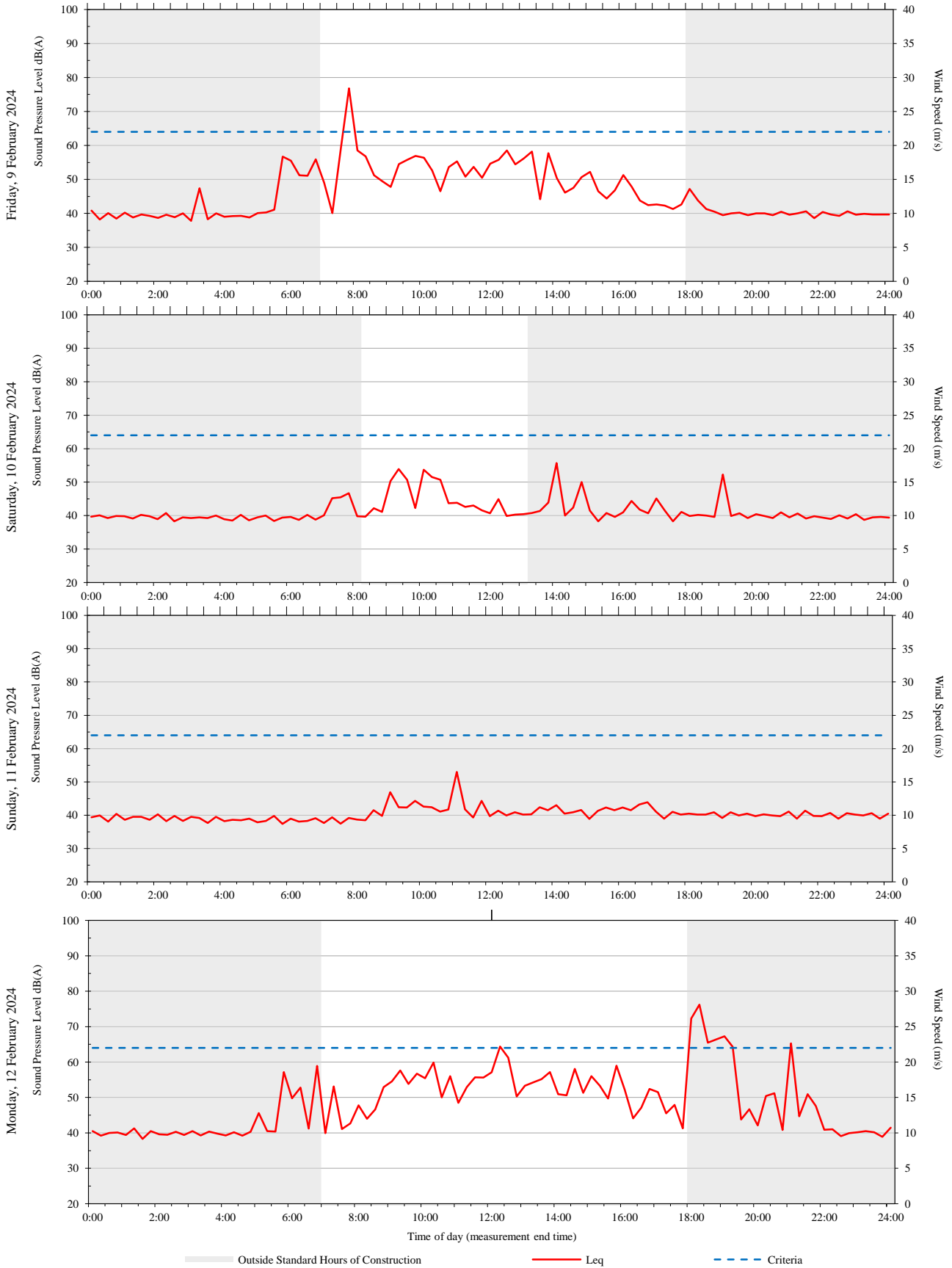
Unattended monitoring: CHW Ground Floor room 51DM047 (Internal)

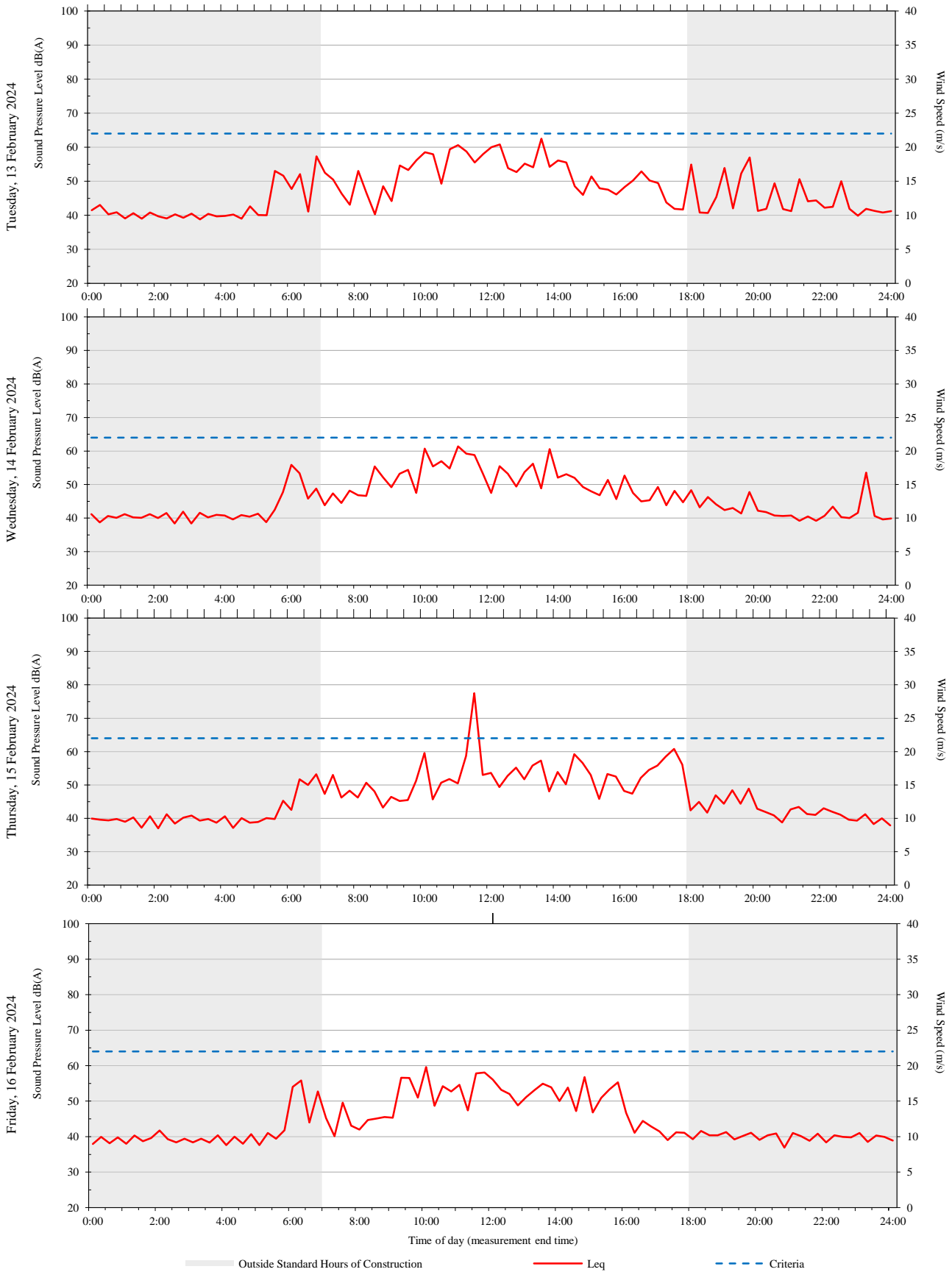
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A2 CHW Level 2 Parent Kitchen 92BW025 (facing MSCP site) (Westmead 2)

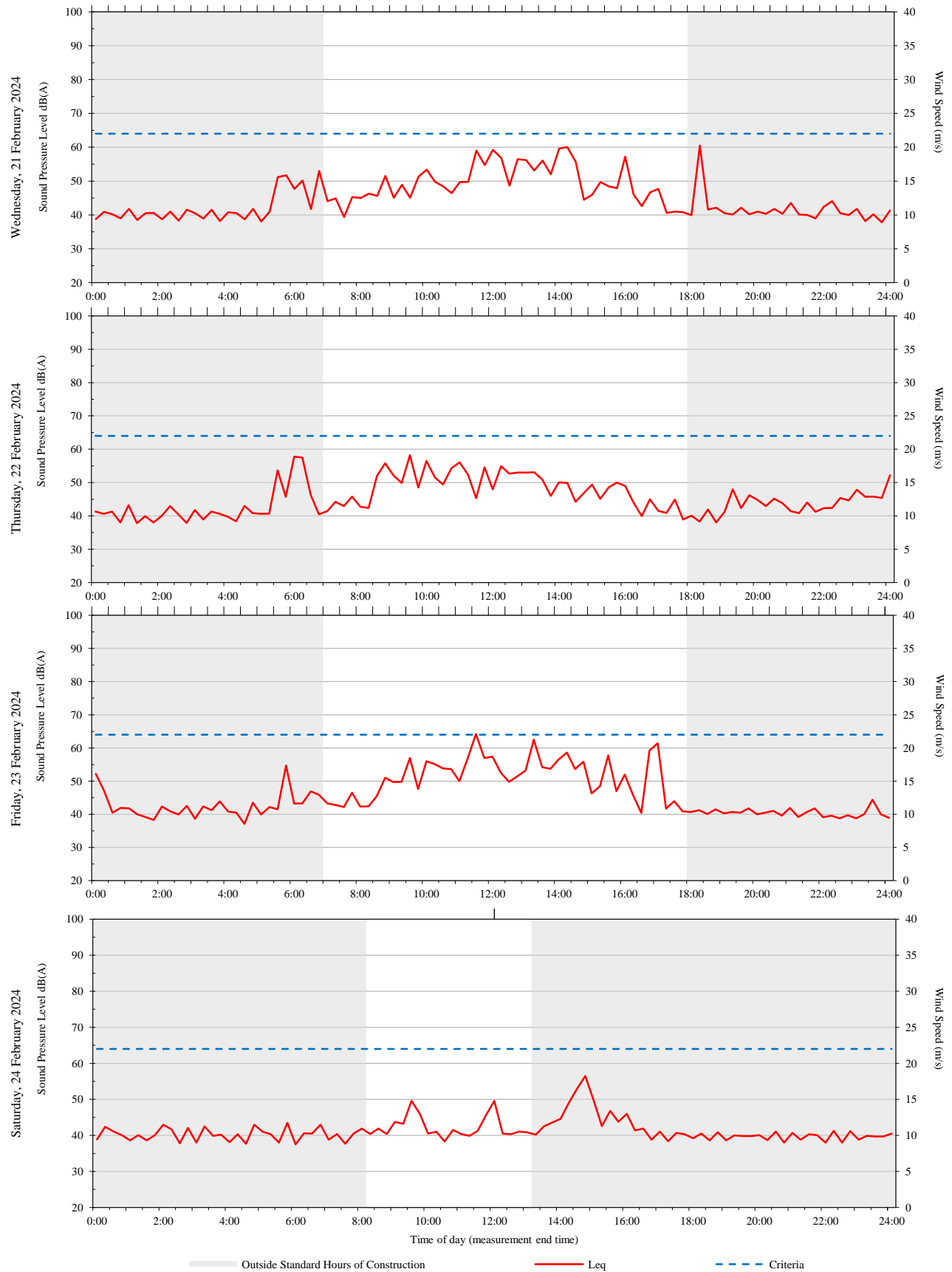


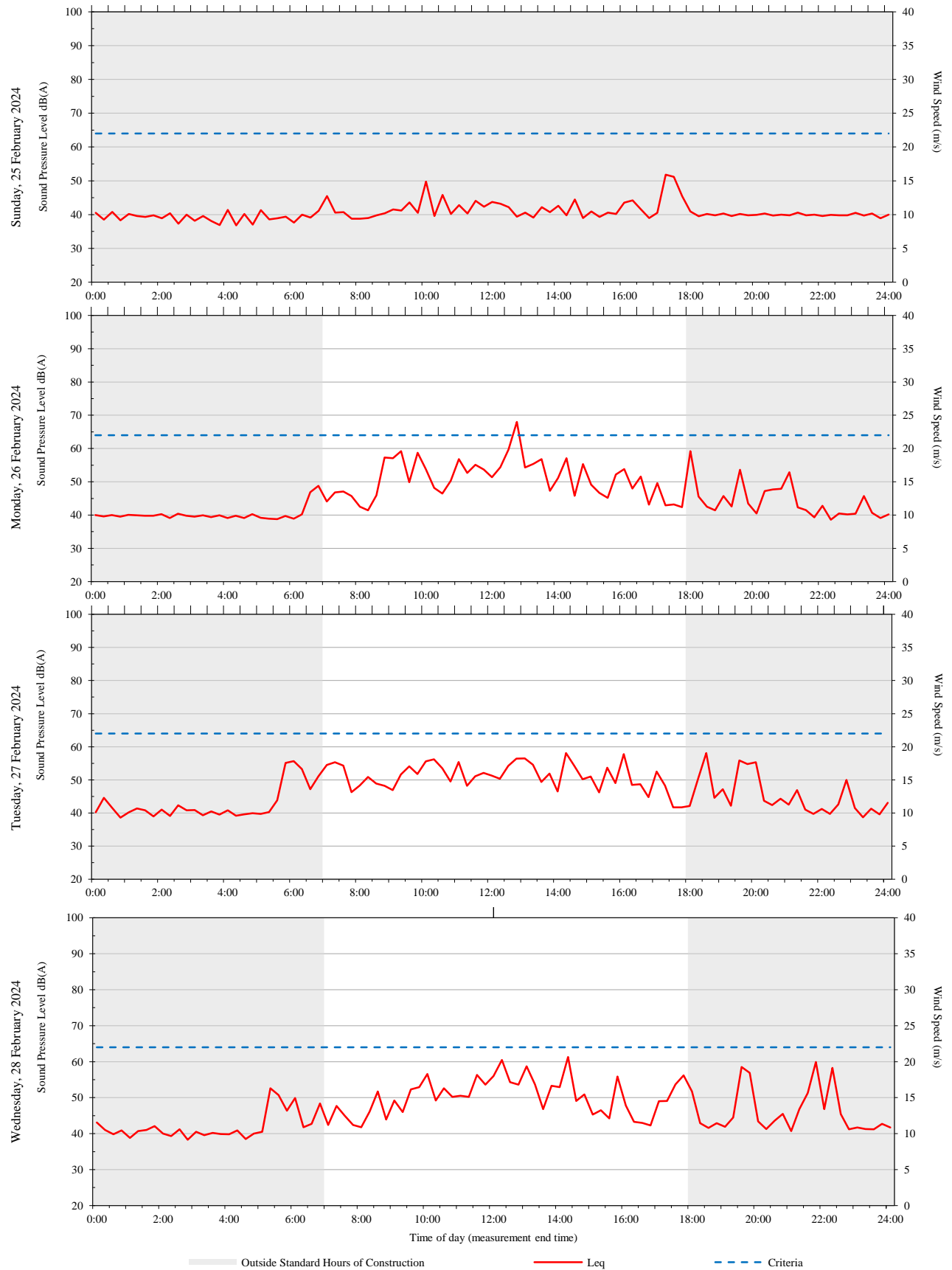






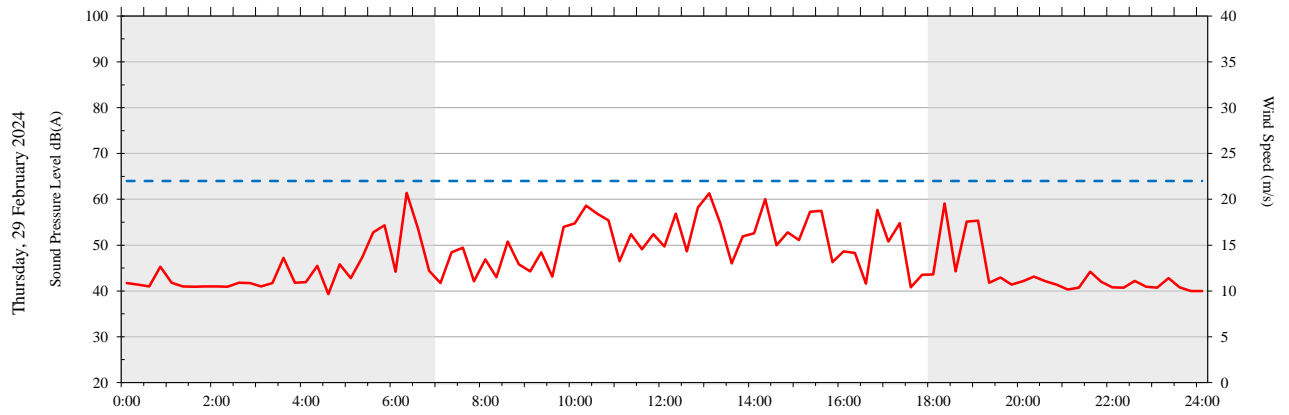
Unattended monitoring: CHW Level 2 Parent Kitchen 92BW025 (Internal)



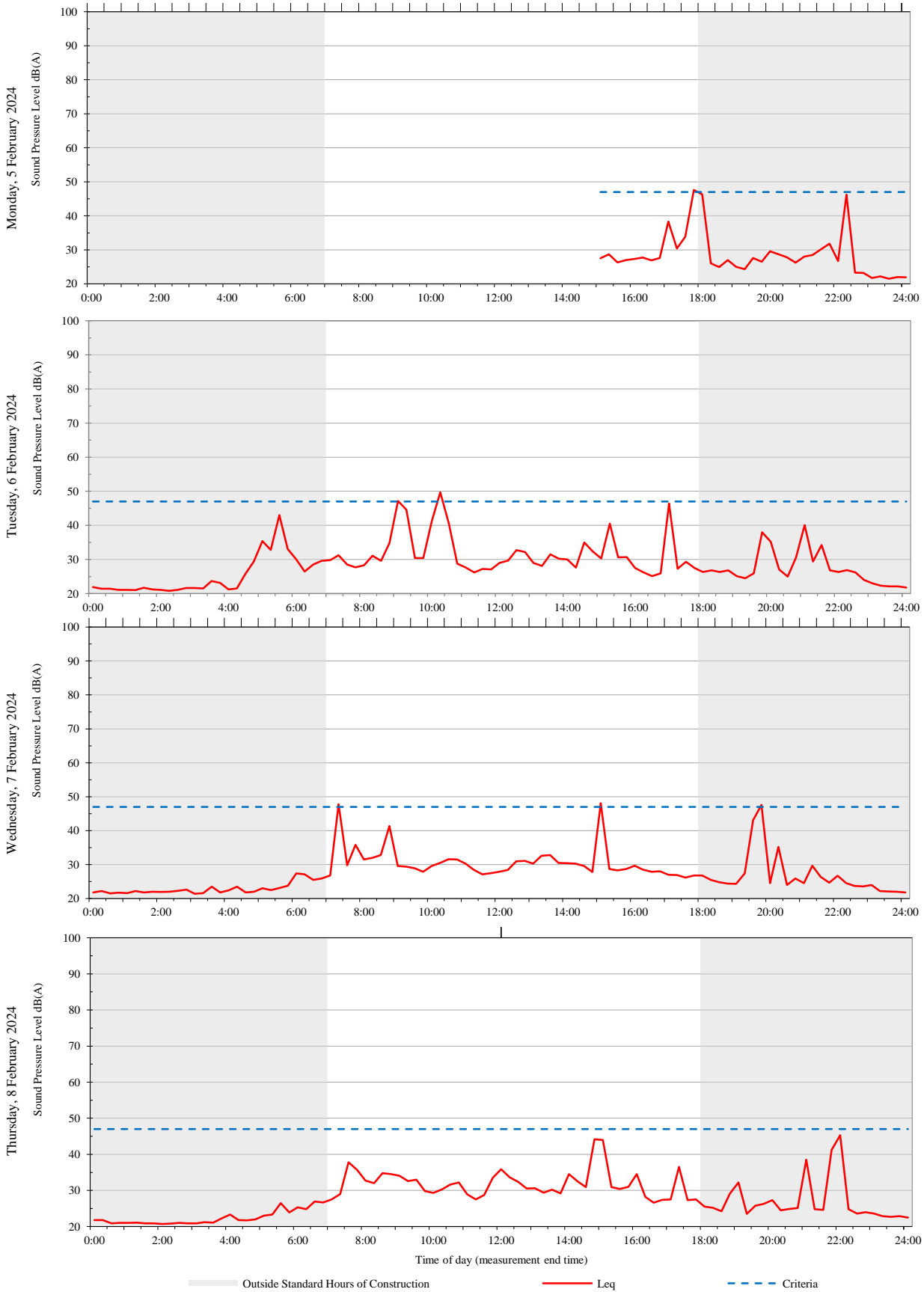


Unattended monitoring: CHW Level 2 Parent Kitchen 92BW025 (Internal)

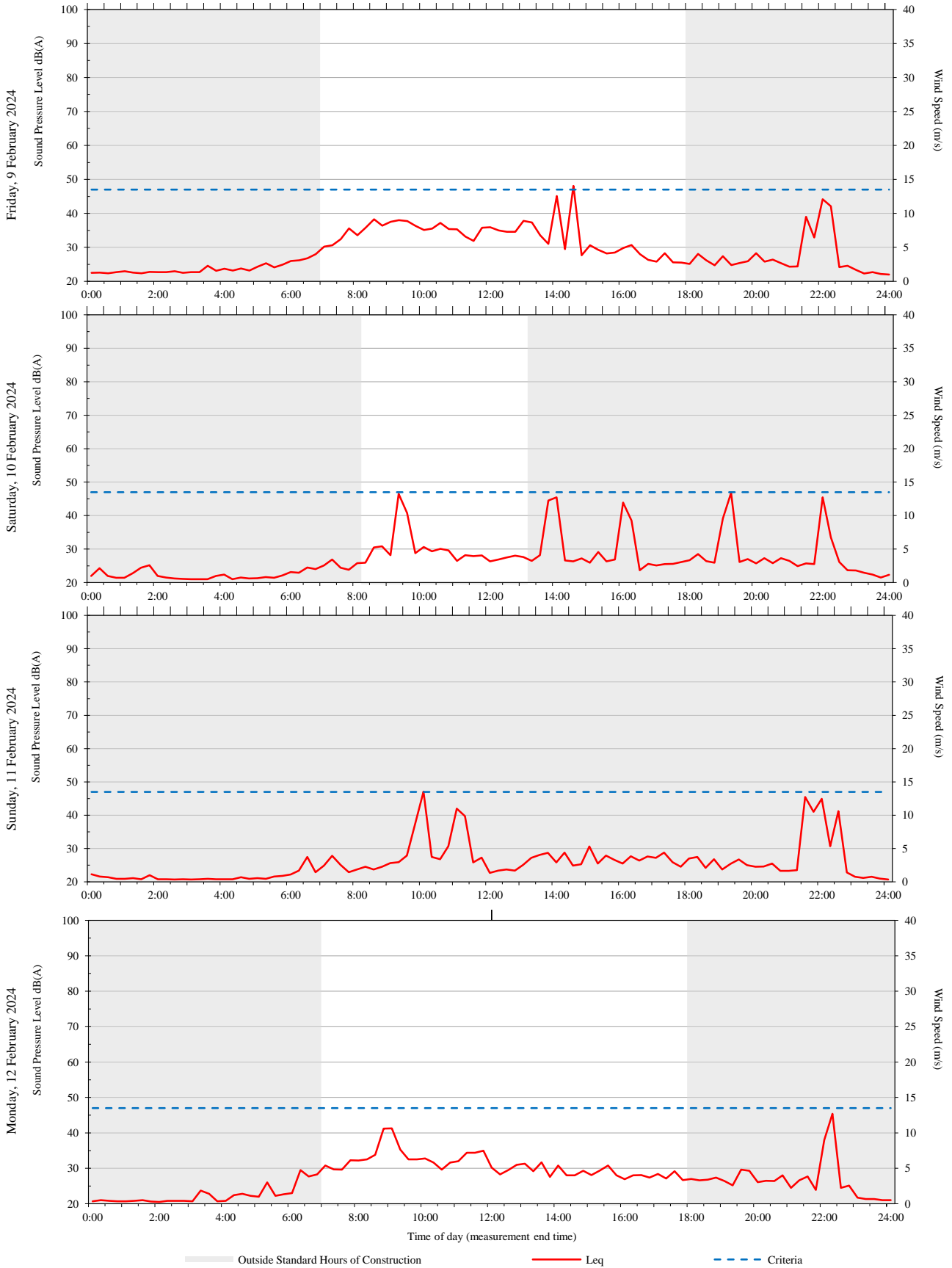
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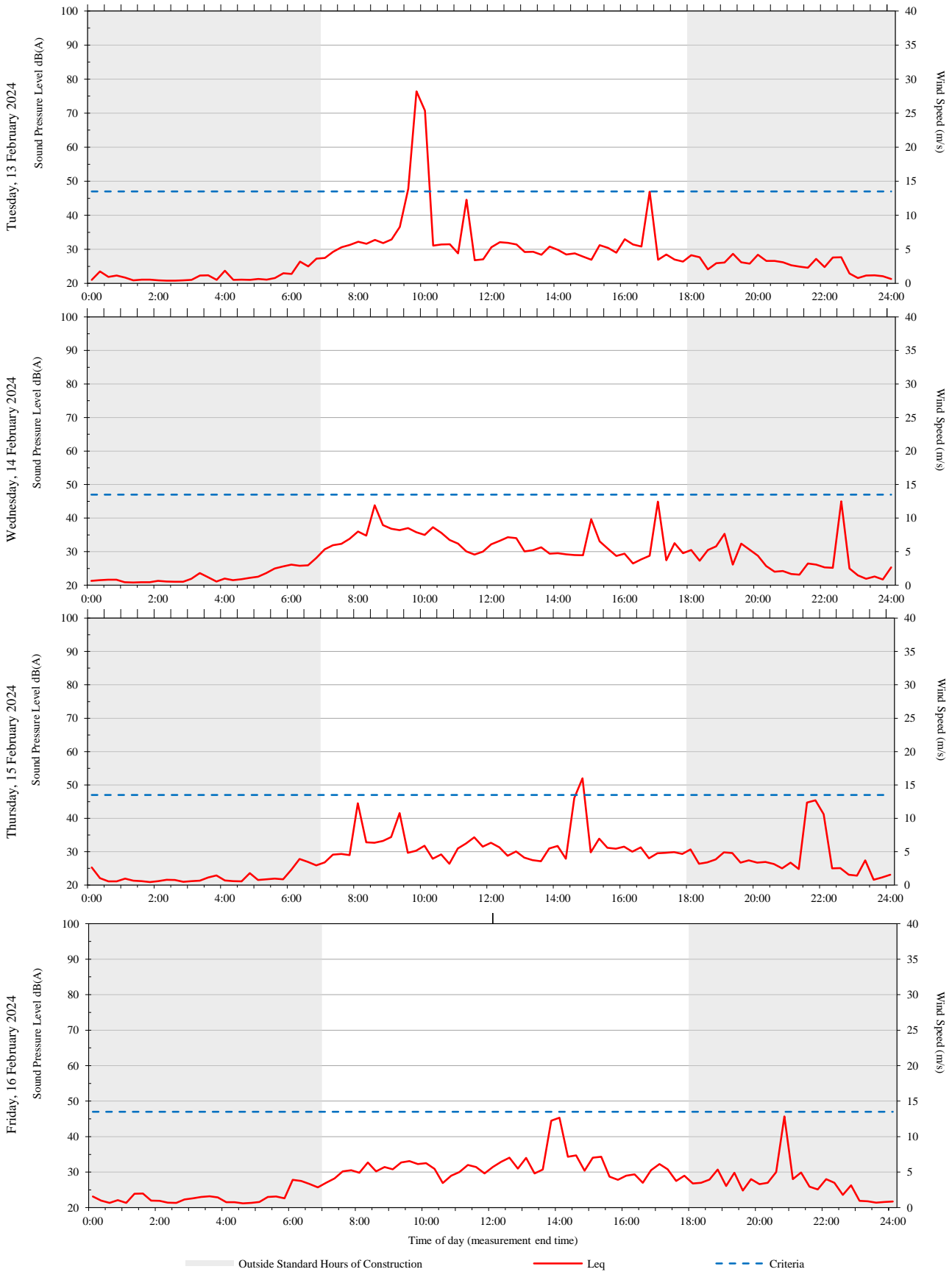
A3 RMH Level 1 Store Room 101 (Westmead 3)



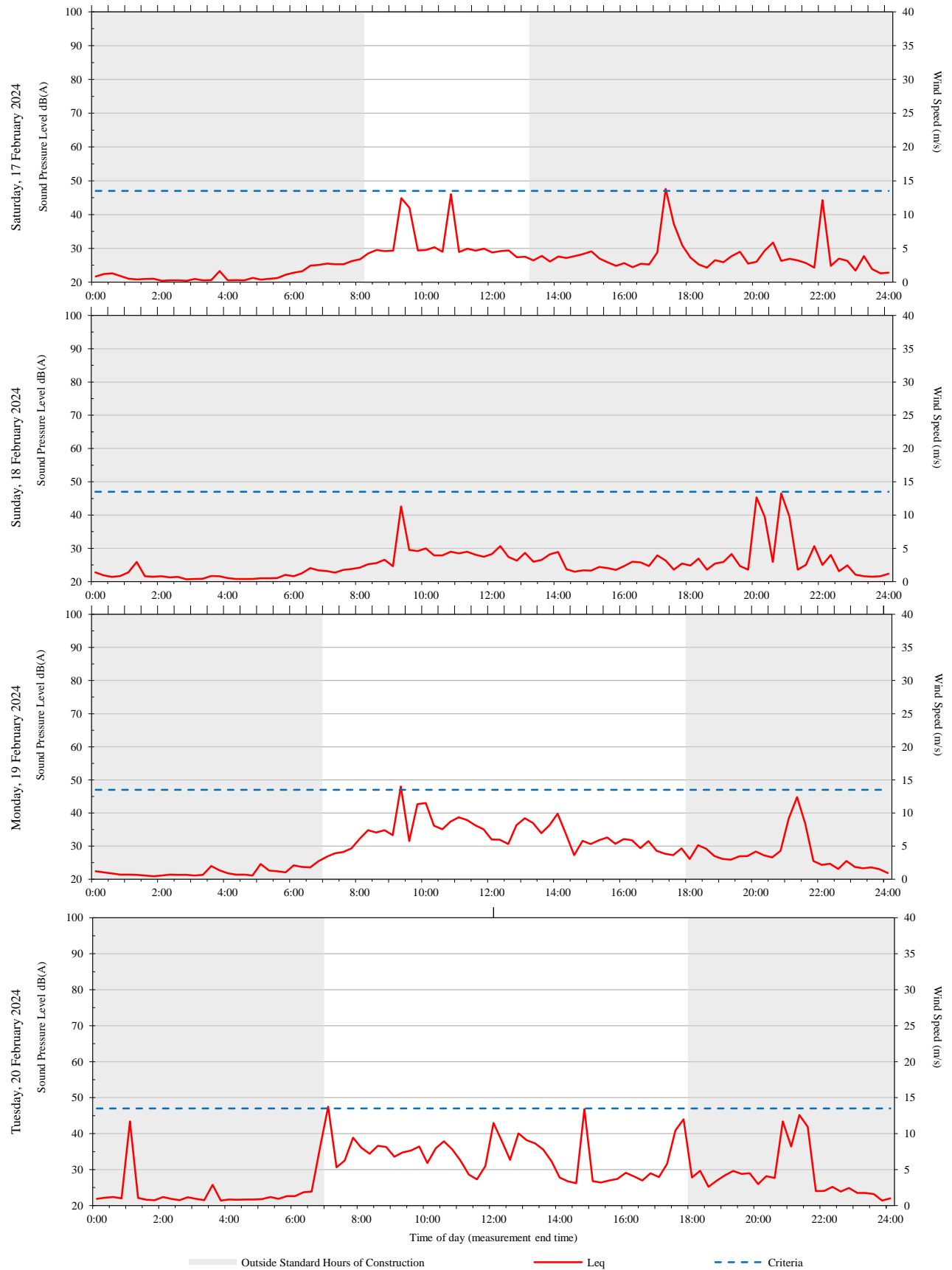
Unattended monitoring: RMH Level 1 Store Room 101 (Internal)



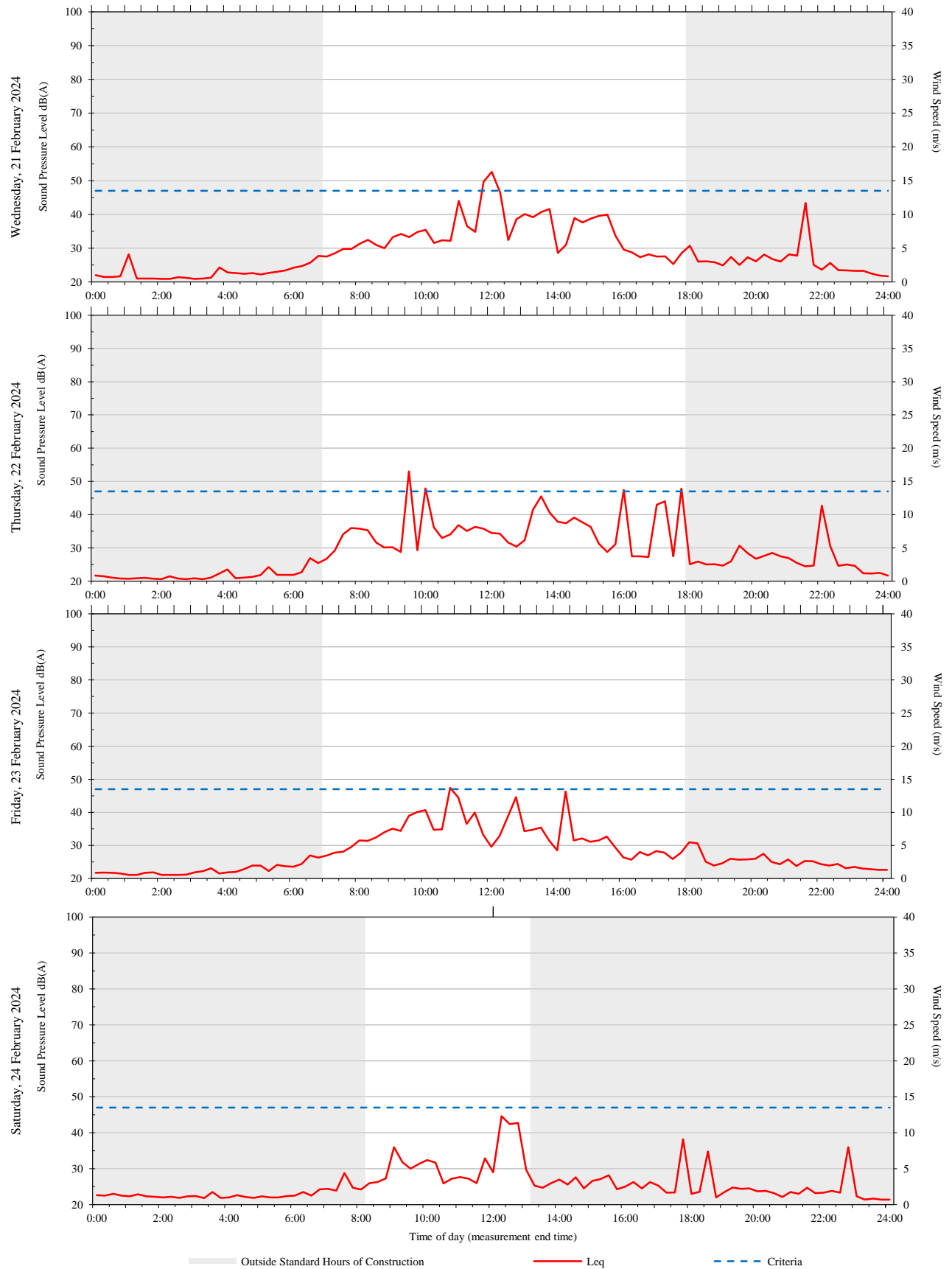
Unattended monitoring: RMH Level 1 Store Room 101 (Internal)



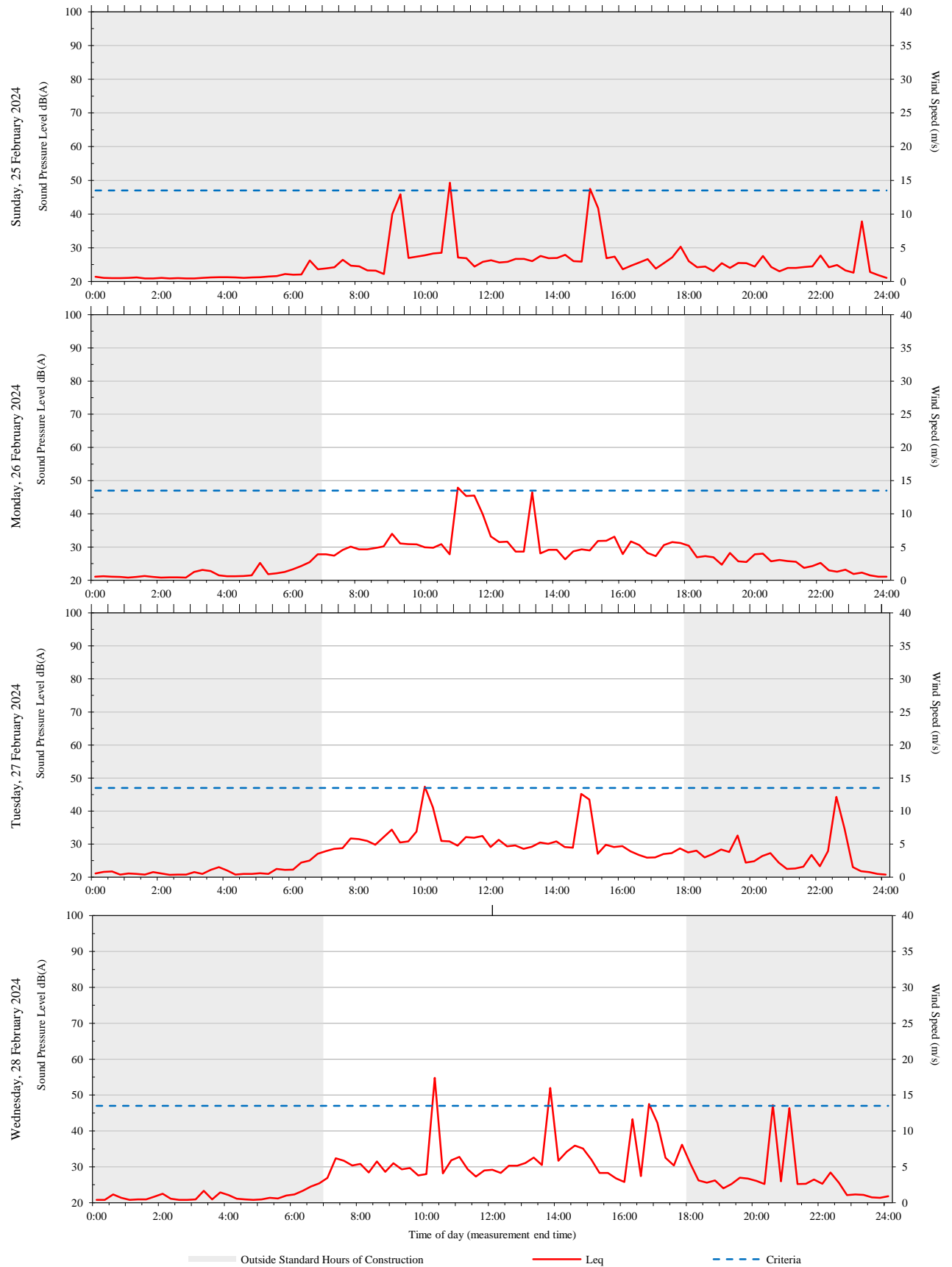
Unattended monitoring: RMH Level 1 Store Room 101 (Internal)



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

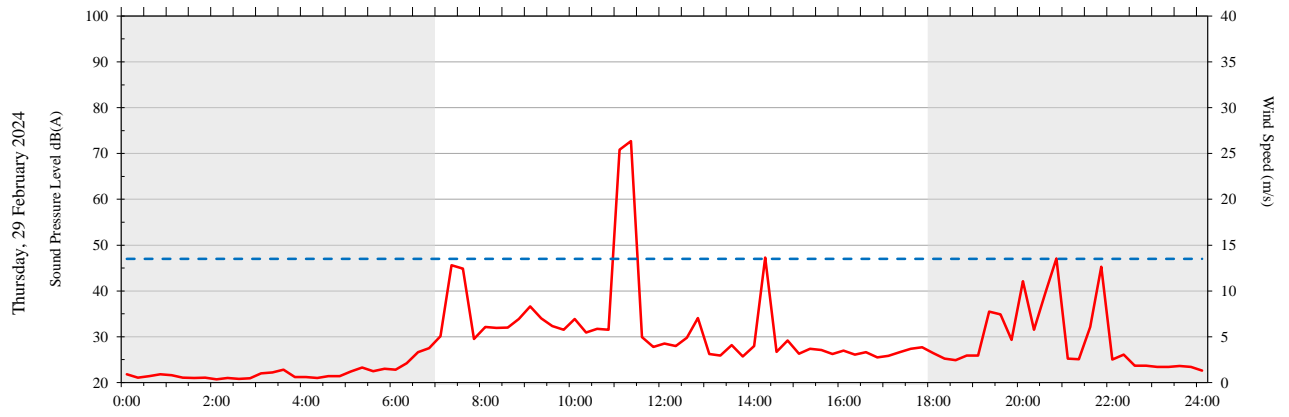


Unattended monitoring: RMH Level 1 Store Room 101 (Internal)



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

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Health Infrastructure NSW

Westmead VVMF Construction Noise Monitoring

Noise monitoring report 2024-02-01 to 2024-02-29

Reference: AC11

v1 | 14 March 2024

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Name			
Signature			

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Description

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Appendices

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A.1	WIMR L1 Bike Room (C.1.06)	A-8

1. Introduction

Arup has been commissioned by 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 February 2024** to **29 February 2024** inclusive.

2. Noise logger location

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

On Monday February 5 Ngara noise logger Westmead 7 was taken off-site to undergo calibration by the manufacturer. It was replaced by Ngara noise logger Westmead 5, which had been previously installed in CASB Level 3 Operation room as part of the PSB and MSCP noise monitoring project. Currently, Ngara noise logger Westmead 5 remains in use.

Ngara noise logger Westmead 5 was calibrated by Acoustic Research Labs (NATA accredited calibration) in December 2023.

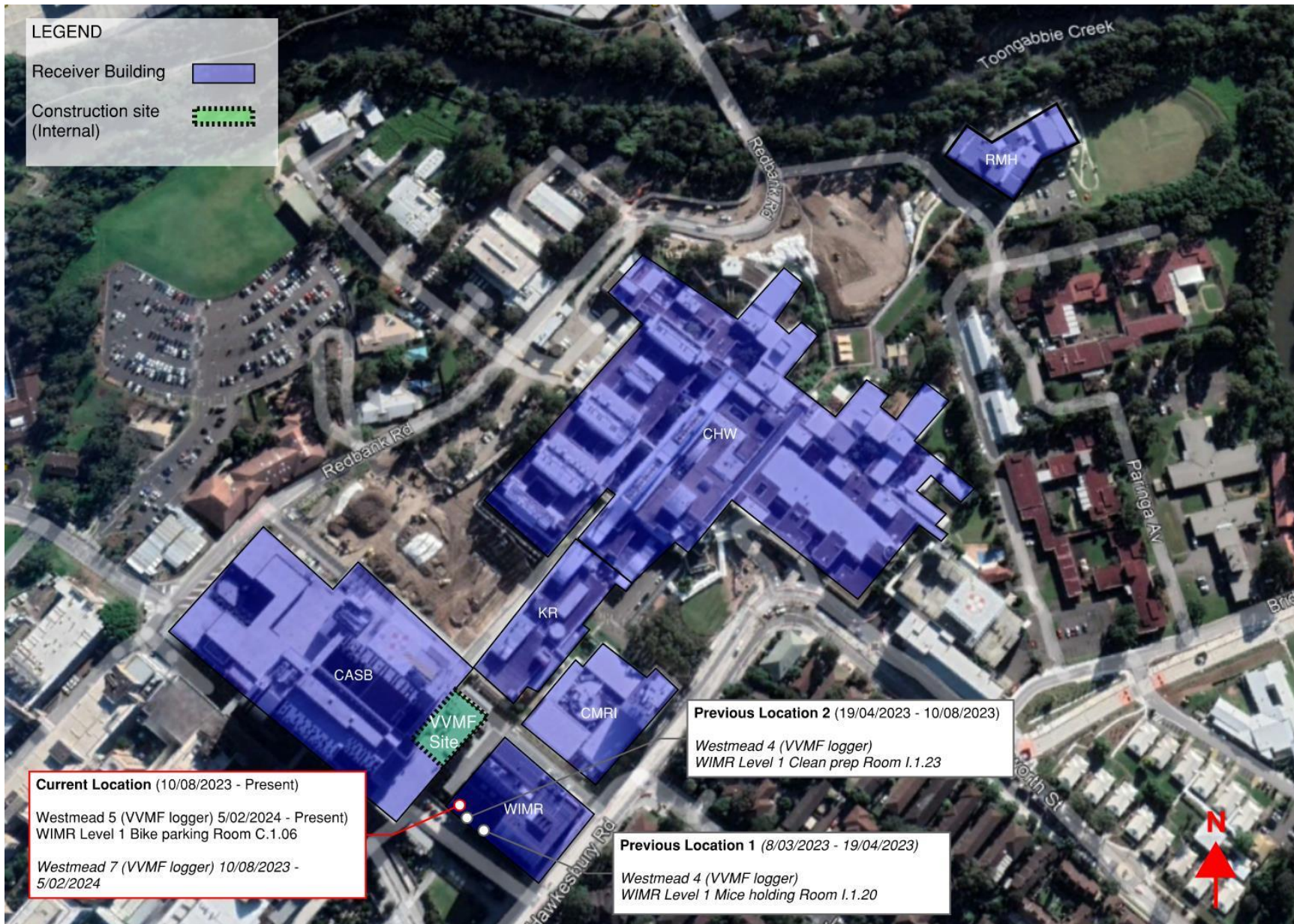


Figure 1: VVMF noise monitoring locations

2.1 Noise logger relocation

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

Table 1: Logger relocation records

Logger ID	Original Location	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
Westmead 7	WIMR Level 1 Bike Parking room	5/02/2024	<i>Removed from site</i>
Westmead 5	<i>Supporting a different project</i>	5/02/2024 (Current)	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 – 5/02/2024)	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
Westmead 5 (5/02/2024 – 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.

During the noise monitoring month, the logger experienced connection issues with Noise Cloud which prevented the upload of data. Arup is currently investigating the matter with ARL, the Noise Cloud service provider, to attempt to recover the missing data and determine a solution to prevent future service disconnections.

Table 3: Noise logger outages during monitoring period

Logger ID	Noise logger location	Outages
Westmead 7	WIMR L1 Bike Room (C.1.06)	1/02/2024-5/02/2024
Westmead 5	WIMR L1 Bike Room (C.1.06)	-

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 5	WIMR L1 Bike Room (C.1.06)	6	7

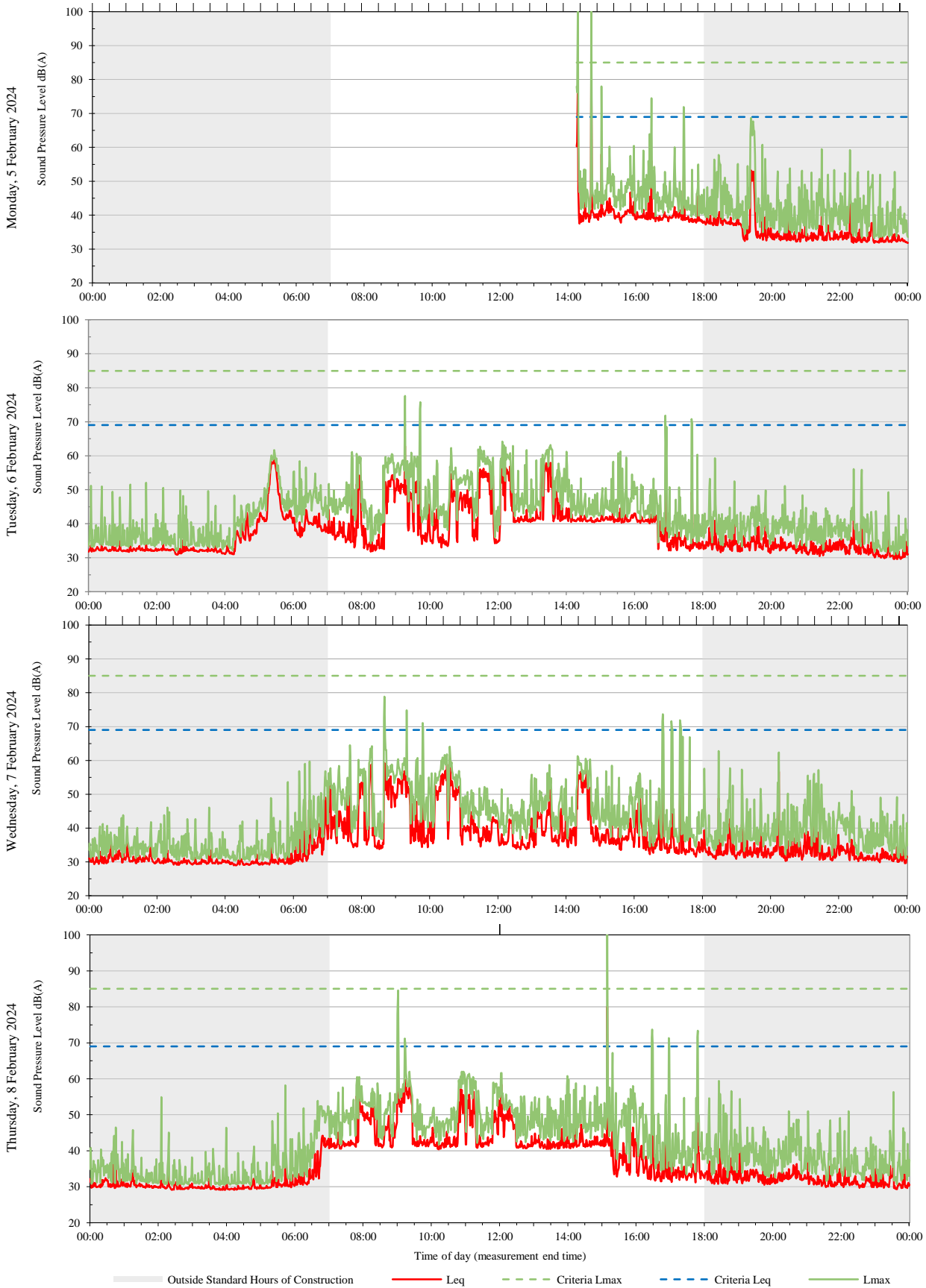
It is noted that the exceedances of the NMLs may be the result of noise generated by either internal activities unrelated to construction, or by construction activities.

It is the responsibility of the Principal 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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Unattended monitoring: WIMR Level 1 Bike Parking room (C.1.06) (Internal)

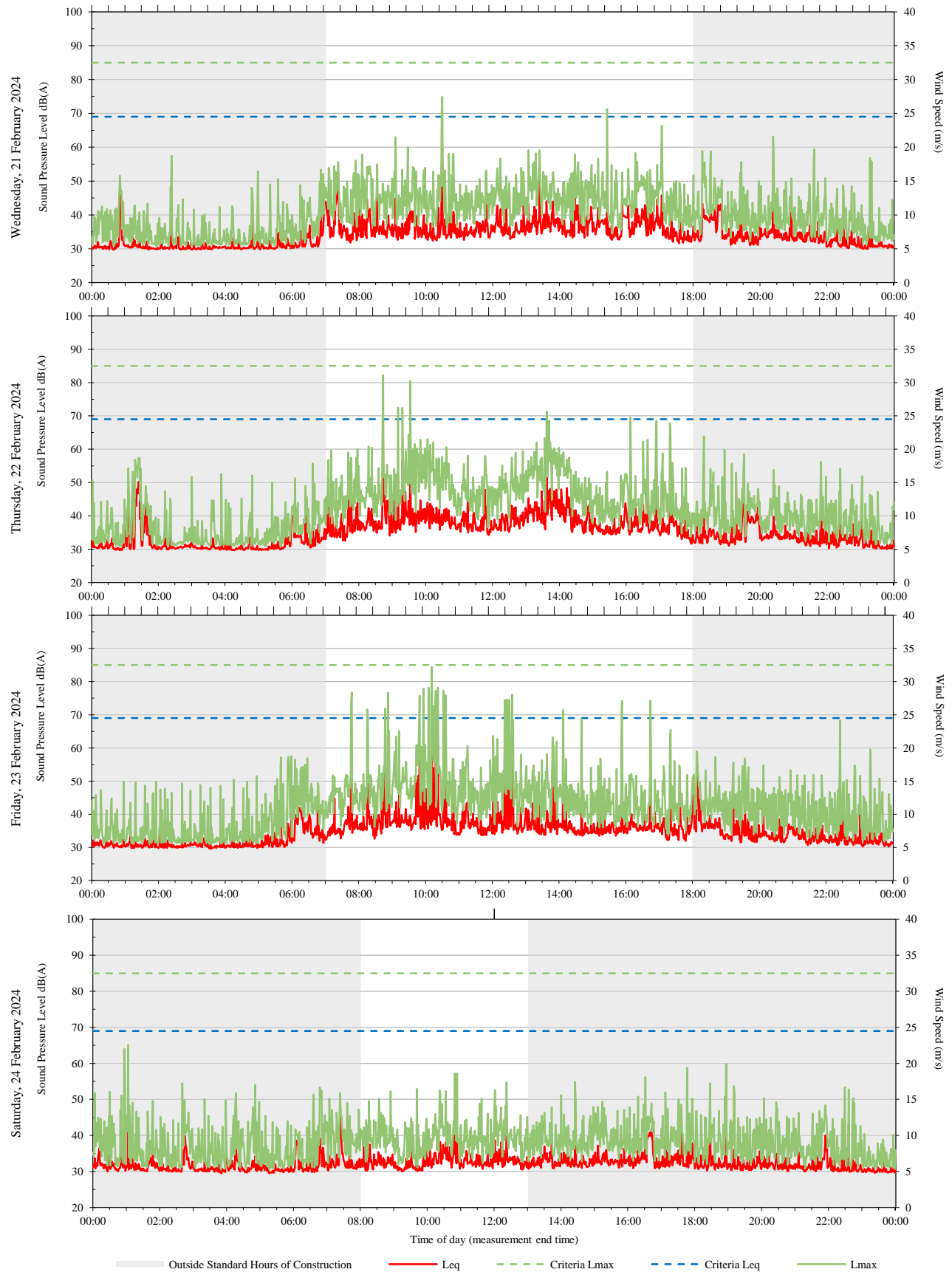
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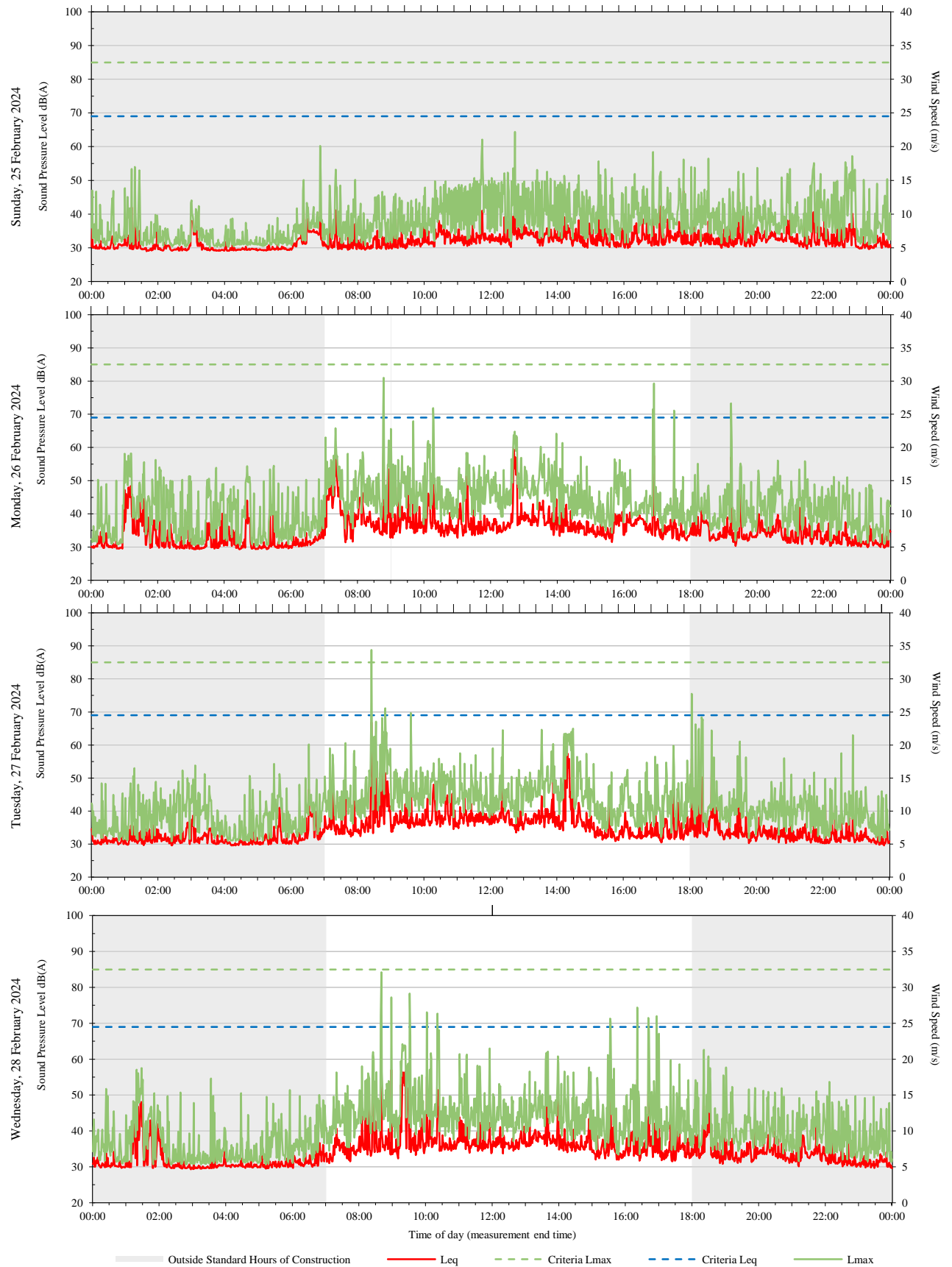
Unattended monitoring: WIMR Level 1 Bike Parking room (C.1.06) (Internal)



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

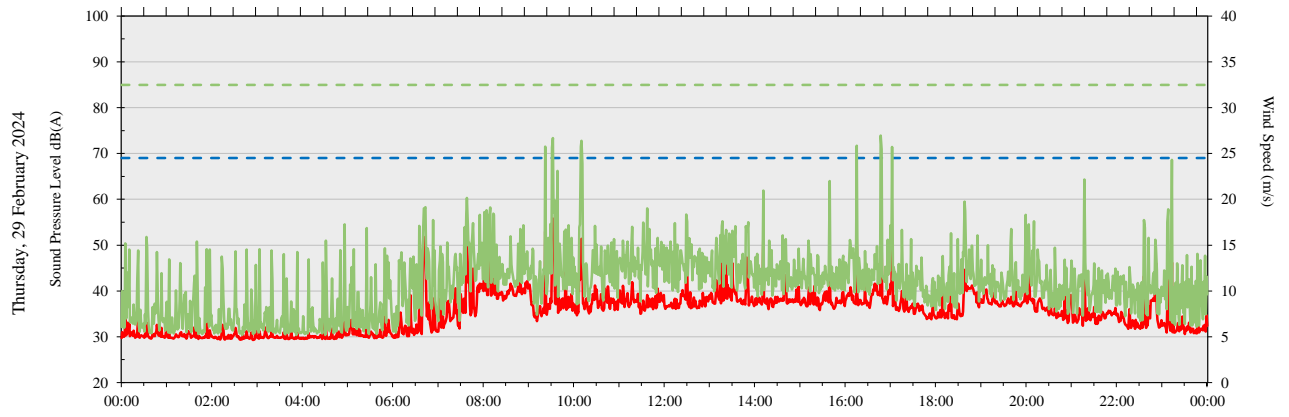


Unattended monitoring: WIMR Level 1 Bike Parking room (C.1.06) (Internal)



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

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Health Infrastructure

Children's Hospital Westmead

Vibration Monitoring - SCHN L1
Endocrinology Lab - February 2024

CVM/ SCHN/202402

Issue 1 | 06/03/2024

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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Revision	Date	Filename
		Westmead Hospital – 103157 SCHN L1 Endocrinology Lab - Summary of Recent Vibration Measurements (01-02 to 29-02).docx

Issue	Date	Description
Issue 1	06/03/2024	Issue

	Prepared by	Checked by	Approved by
Name	PR	MJW	MJW
Signature			

Filename

Description	Prepared by	Checked by	Approved by

Name

Signature

Filename

Description	Prepared by	Checked by	Approved by

Name

Signature

Issue Document Verification with Document



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Executive Summary

This report summarises the vibration monitoring data recorded at SCHN L1 Endocrinology Lab, over one month – from 01/02/2024 to 29/02/2024. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

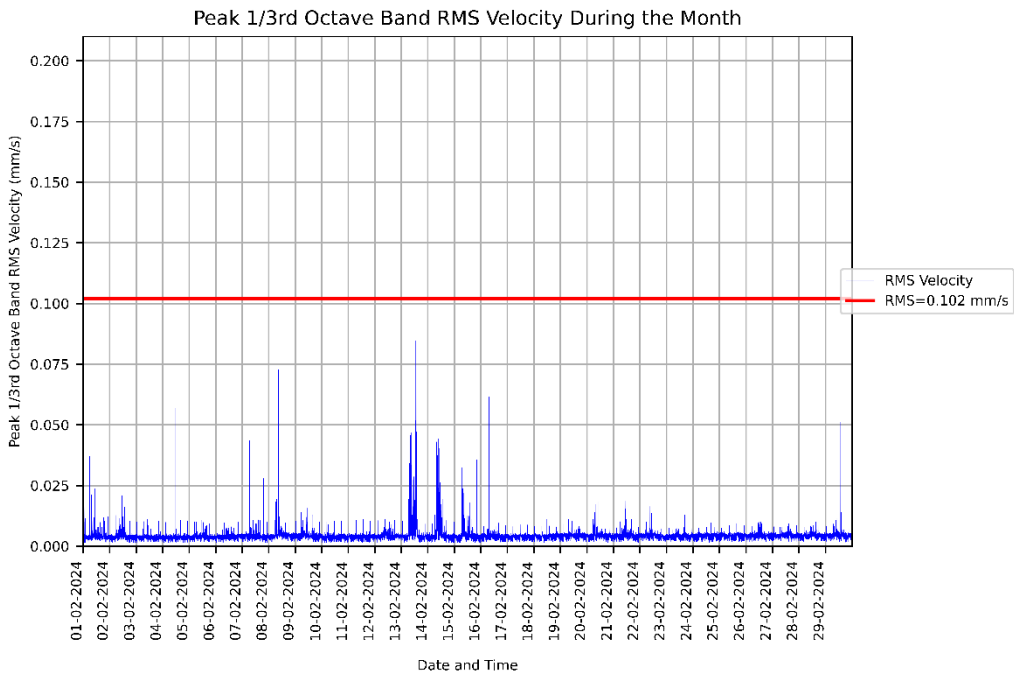


Figure 1: Measured RMSV vibration levels for 01/02/2024 to 29/02/2024 at the SCHN L1 Endocrinology Lab.

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
0	0

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 SCHN L1 Endocrinology Lab during the period of the 01/02/2024 to 29/02/2024.

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.

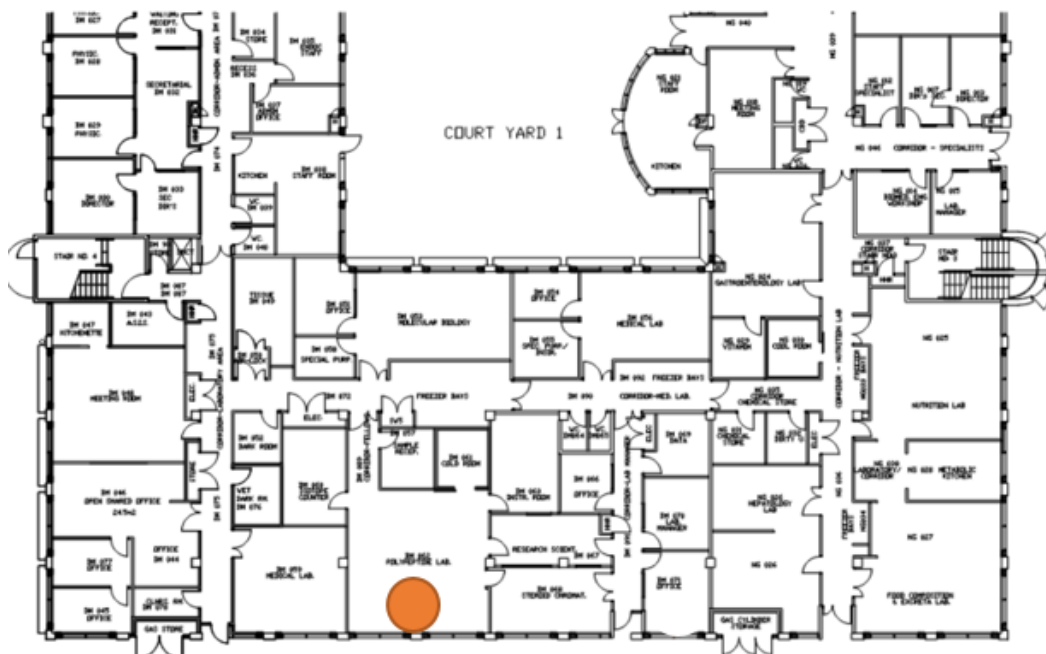


Figure 3: SCHN L1 Endocrinology Lab vibration monitor location shown in orange

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 01/02/2024 and 29/02/2024. The recorded data is shown in blue, while the limit of 0.102mm/s (V_{RMS}) is shown in red.

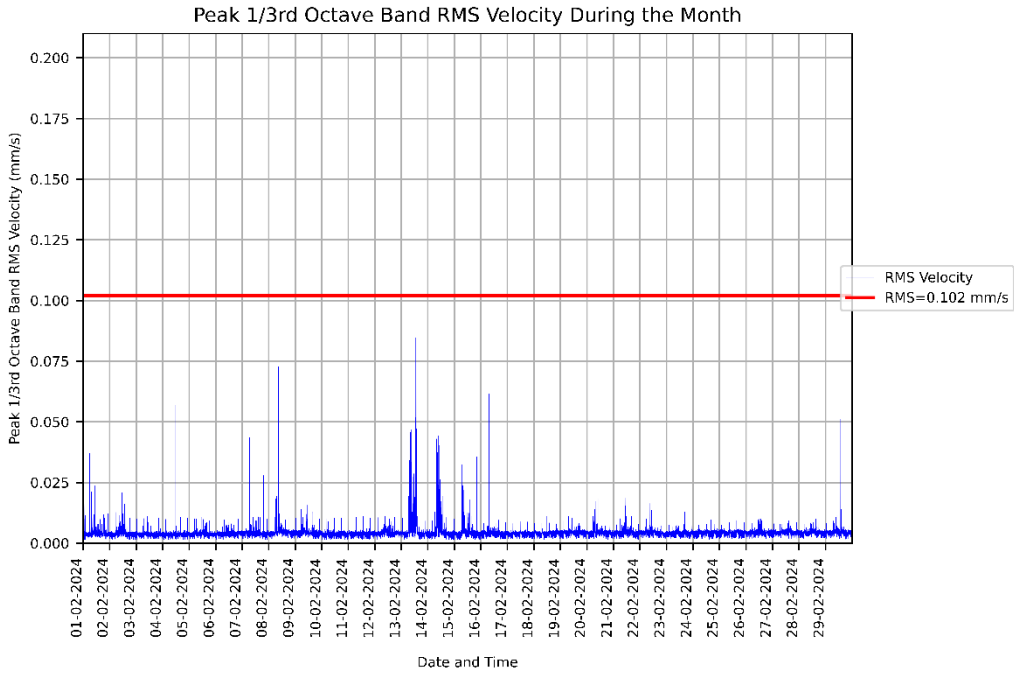


Figure 4: Measured RMSV vibration levels for 01/02/2024 to 29/02/2024 at the SCHN L1 Endocrinology Lab.

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
0	0

Frequency response and linearity characteristics for
GeoSIG Velocity Geophone **VE-11** Serial No. **55910**
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	109.76	1.00%
4.00	25.13	10.0	111.50	0.90%
6.00	37.70	10.0	108.98	0.90%
10.00	62.83	10.0	103.80	0.90%
15.00	94.25	10.0	101.12	0.90%
15.92	94.25	1.0	N/A	0.90%
15.92	94.25	5.0	95.09	0.90%
15.92	94.25	10.0	94.96	0.90%
15.92	94.25	50.0	94.83	0.90%
15.92	94.25	100	N/A	0.50%
30.00	188.50	10.0	99.03	0.50%
60.00	376.99	10.0	100.56	0.50%
120.00	753.98	10.0	113.91	0.50%
150.00	942.48	10.0	119.09	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 - February
2024**

CVM/ WIMR/202402

Issue 1 | 06/03/2024

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

Project title Children's Hospital Westmead
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Revision	Date	Filename
		Westmead Hospital – 103158 WIMR - BSF Mice Holding Room - Floor - Summary of Recent Vibration Measurements (01-02 to 29-02).docx

Issue 1 06/03/2024 **Description** Issue

	Prepared by	Checked by	Approved by
Name	PR	MJW	MJW
Signature			

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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 01/02/2024 to 29/02/2024. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

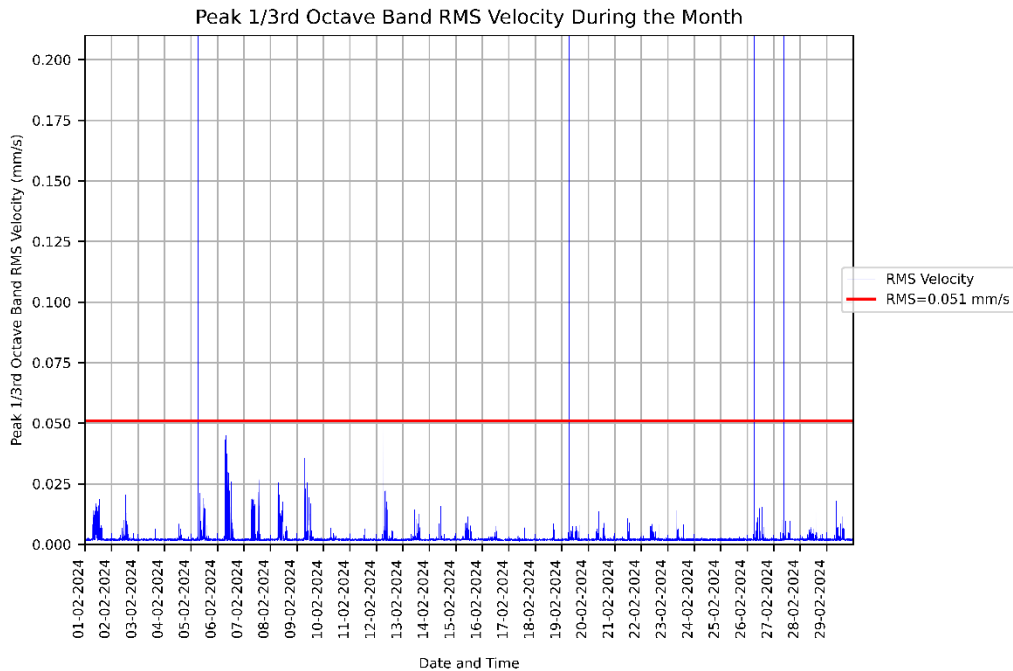


Figure 1: Measured RMSV vibration levels for 01/02/2024 to 29/02/2024 at the WIMR - BSF Mice Holding Room - Floor.

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
1	5

PPV Vibration Levels

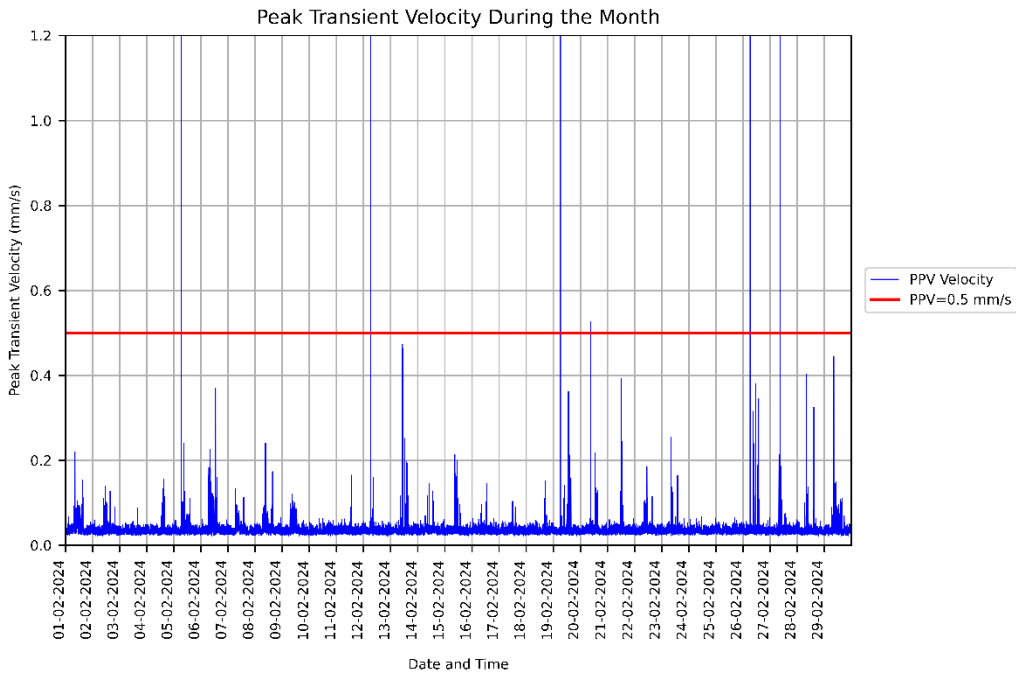


Figure 2: Measured vibration levels for 01/02/2024 to 29/02/2024 at the WIMR - BSF Mice Holding Room - Floor.

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
2	5

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 01/02/2024 to 29/02/2024.

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.

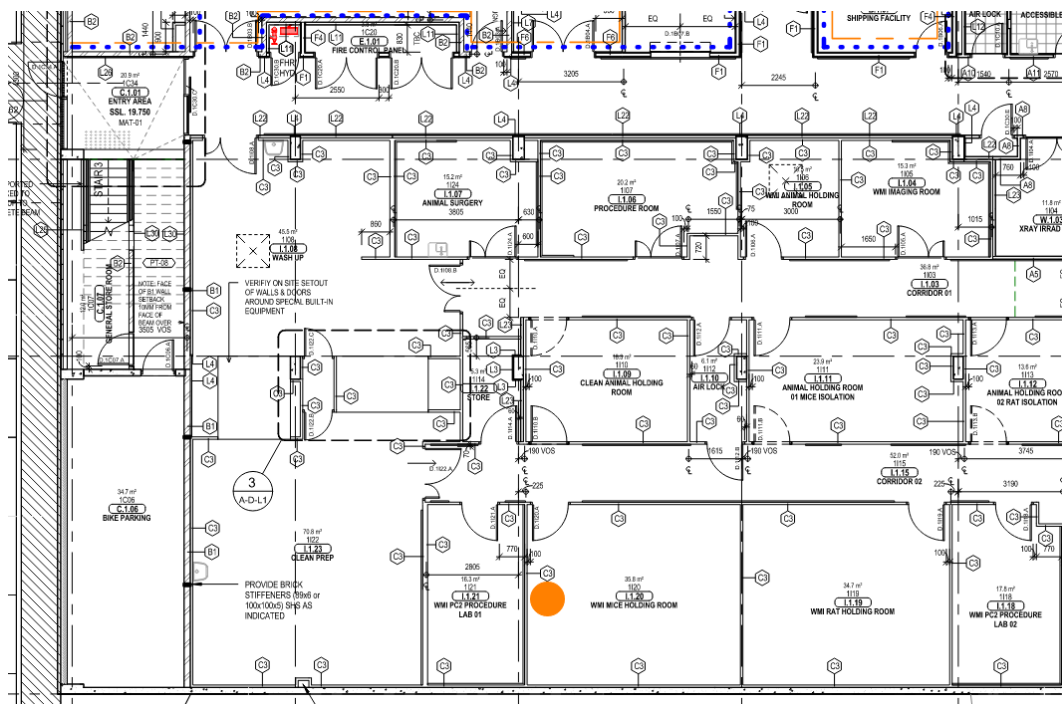


Figure 3: WIMR - BSF Mice Holding Room - Floor vibration monitor location

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 01/02/2024 and 29/02/2024. The recorded data is shown in blue, while the limit of 0.051mm/s (V_{RMS}) is shown in red.

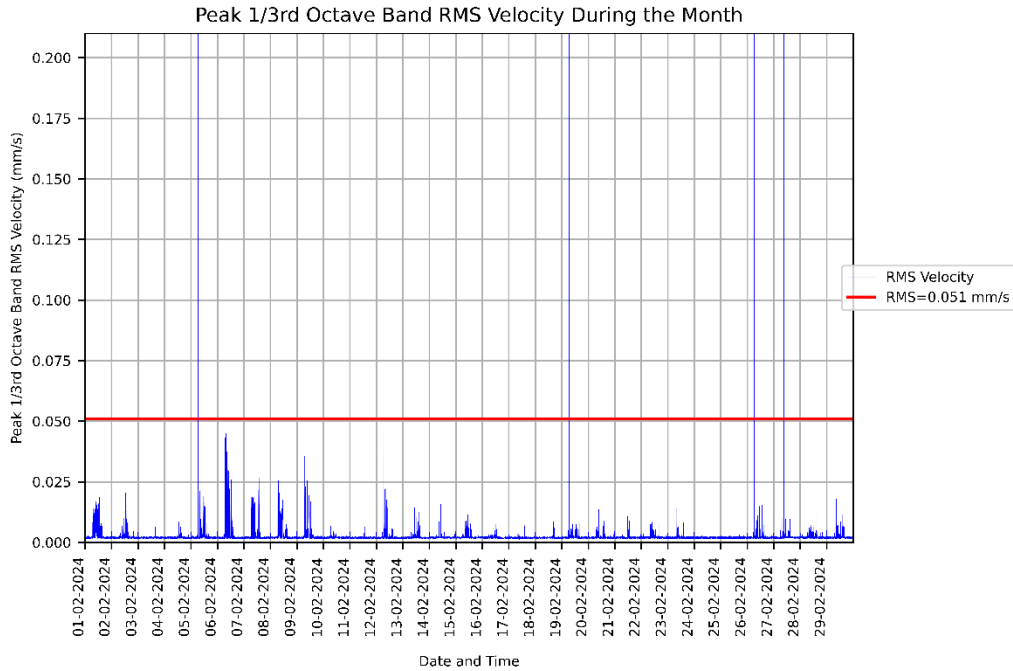


Figure 4: Measured RMSV vibration levels for 01/02/2024 to 29/02/2024 at the WIMR - BSF Mice Holding Room - Floor.

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
1	5

Figure 5 below shows the peak particle vibration levels (PPV velocity) recorded between 01/02/2024 and 29/02/2024. The recorded data is shown in blue, while the limit of 0.5mm/s (V_{PPV}) is shown in red.

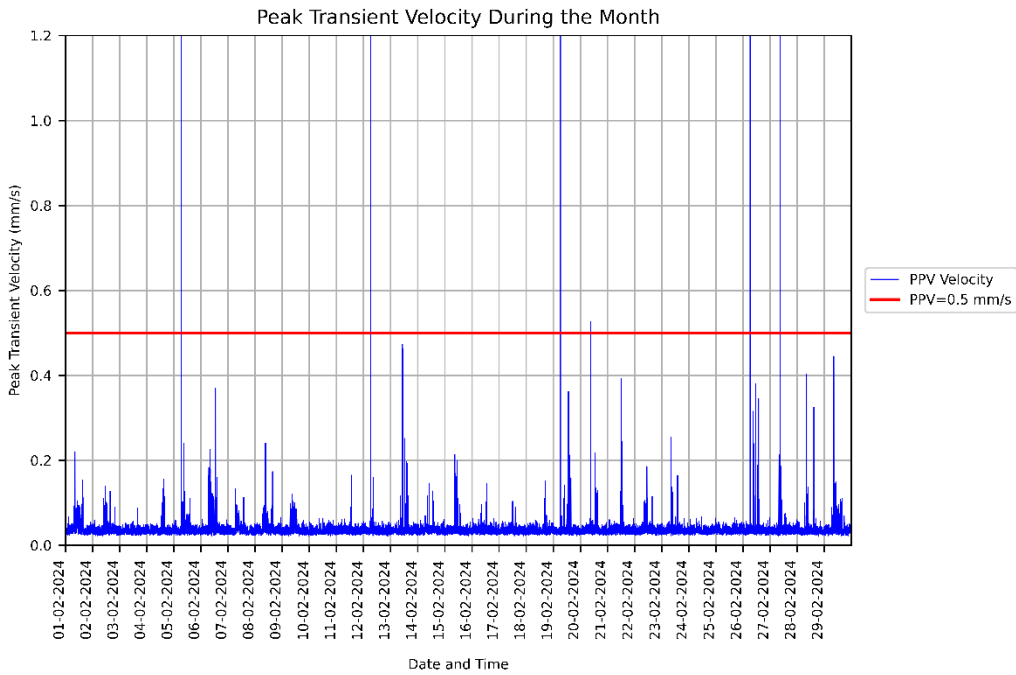


Figure 5: Measured PPV vibration levels for 01/02/2024 to 29/02/2024 at the WIMR - BSF Mice Holding Room - Floor.

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

During Construction Hours	Outside of Construction Hours
2	5

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			
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 - February 2024**

CVM/ CASB/202402

Issue 1 | 06/03/2024

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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Project title Children's Hospital Westmead
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		Westmead Hospital – 103160 CASB level 3 Surgical Suite - Summary of Recent Vibration Measurements (01-02 to 29-02).docx

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Name	PR	MJW	MJW
Signature			

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Signature			

Filename

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Name			
Signature			

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Executive Summary

This report summarises the vibration monitoring data recorded at CASB level 3 Surgical Suite, over one month – from 01/02/2024 to 29/02/2024. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

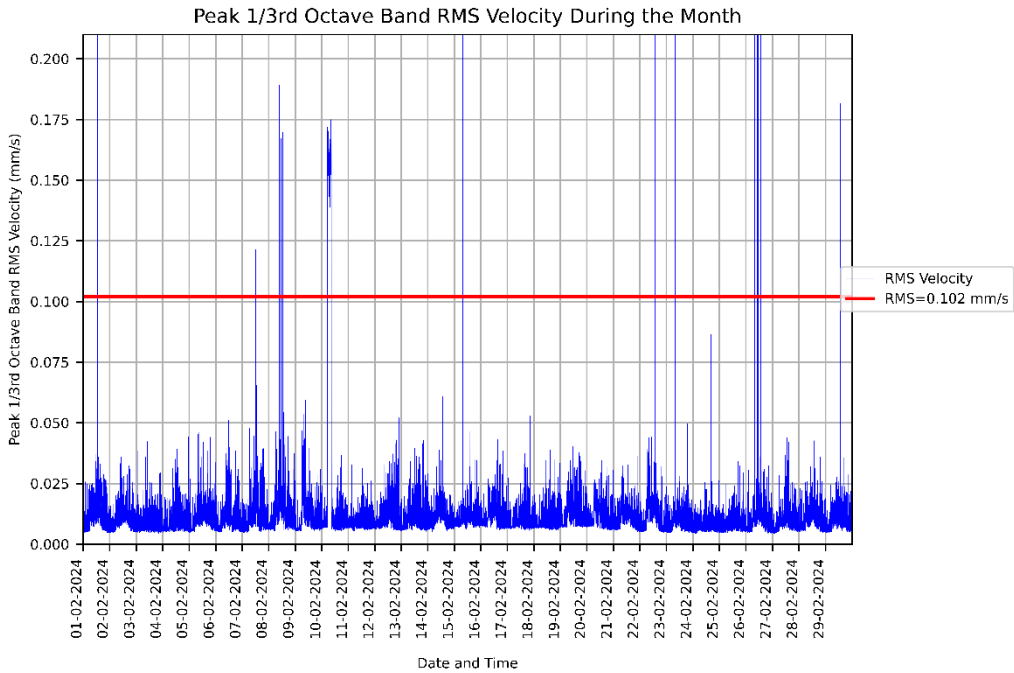


Figure 1: Measured RMSV vibration levels for 01/02/2024 to 29/02/2024 at the CASB level 3 Surgical Suite.

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
44	89

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 01/02/2024 to 29/02/2024.

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.

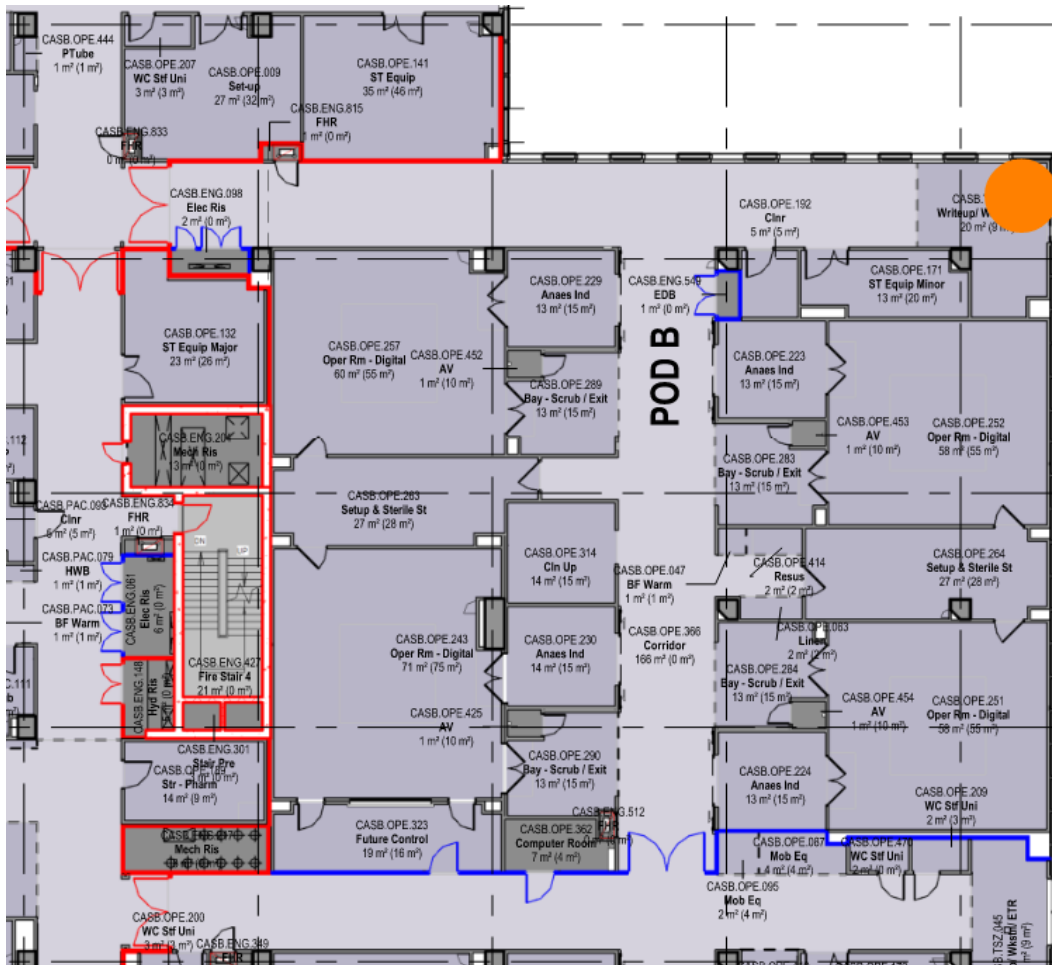


Figure 3: CASB level 3 Surgical Suite vibration monitor location

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 01/02/2024 and 29/02/2024. The recorded data is shown in blue, while the limit of 0.102mm/s (V_{RMS}) is shown in red.

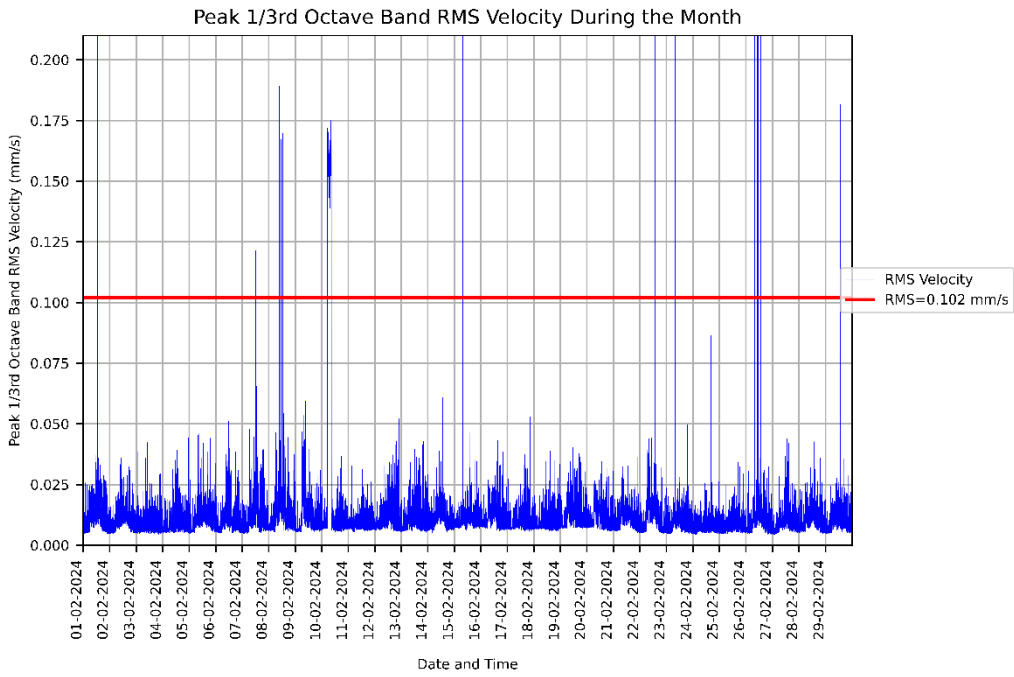
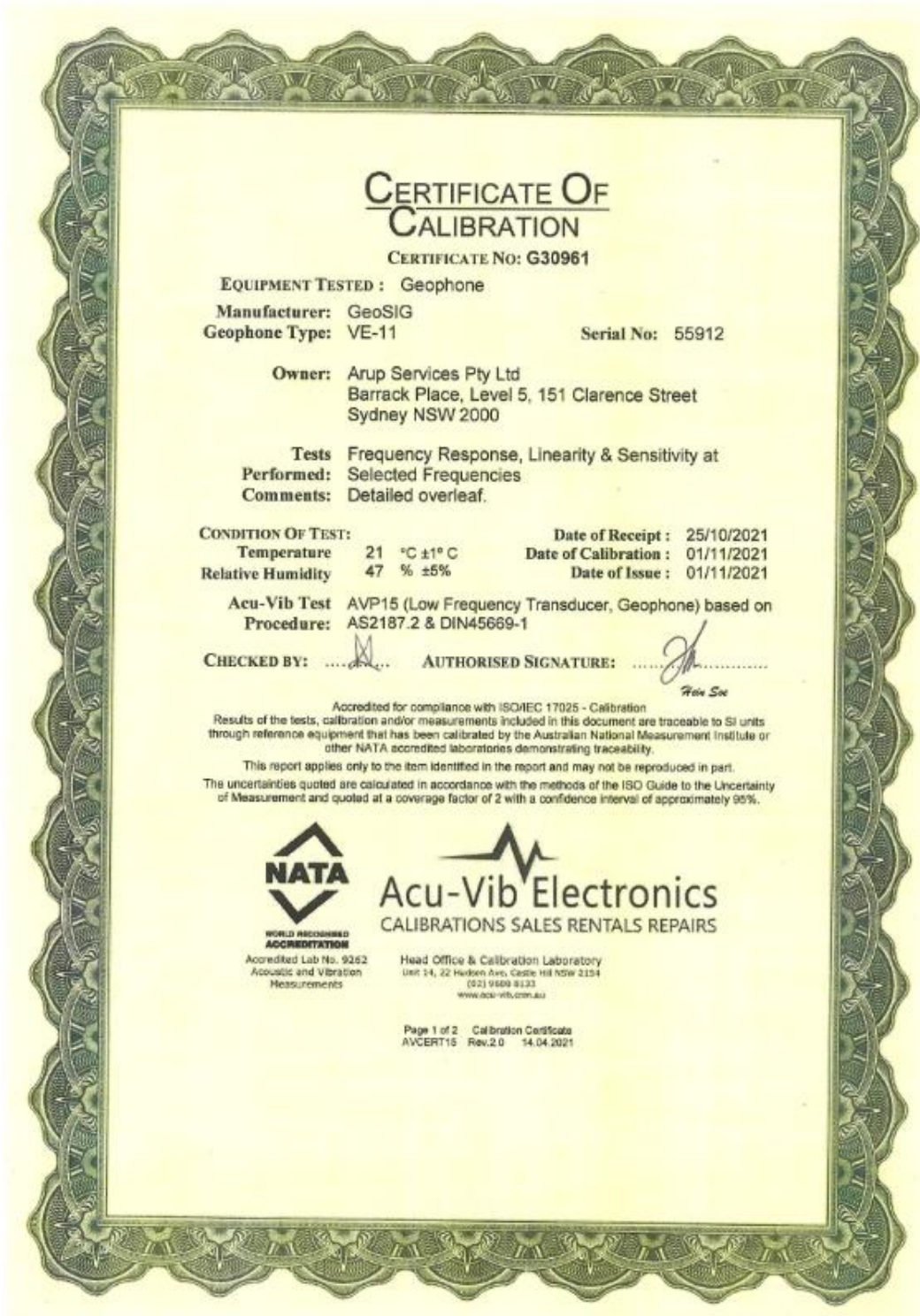


Figure 4: Measured RMSV vibration levels for 01/02/2024 to 29/02/2024 at the CASB level 3 Surgical Suite.

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
44	89

Appendix A: Calibration Certificates



CERTIFICATE OF CALIBRATION

CERTIFICATE NO: G30961

EQUIPMENT TESTED : Geophone

Manufacturer: GeoSIG
Geophone Type: VE-11 **Serial No:** 55912

Owner: Arup Services Pty Ltd
 Barrack Place, Level 5, 151 Clarence Street
 Sydney NSW 2000

Tests Performed: Frequency Response, Linearity & Sensitivity at Selected Frequencies
Comments: Detailed overleaf.

CONDITION OF TEST: **Date of Receipt :** 25/10/2021
Temperature 21 °C ±1° C **Date of Calibration :** 01/11/2021
Relative Humidity 47 % ±5% **Date of Issue :** 01/11/2021

Acu-Vib Test Procedure: AVP15 (Low Frequency Transducer, Geophone) based on AS2187.2 & DIN45669-1

CHECKED BY: *[Signature]* **AUTHORISED SIGNATURE:** *[Signature]*
For Use

Accredited for compliance with ISO/IEC 17025 - Calibration
 Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.
 This report applies only to the item identified in the report and may not be reproduced in part.
 The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.



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Page 1 of 2 Calibration Certificate
 AVCERT15 Rev.2.0 14.04.2021

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 mV/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 - WIMR - BSF
Mice Holding Room - Rack - February
2024**

CVM/ WIMR/202402

Issue 1 | 06/03/2024

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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Document Verification

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Signature			

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Signature			
Filename			
Description			
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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 01/02/2024 to 29/02/2024. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

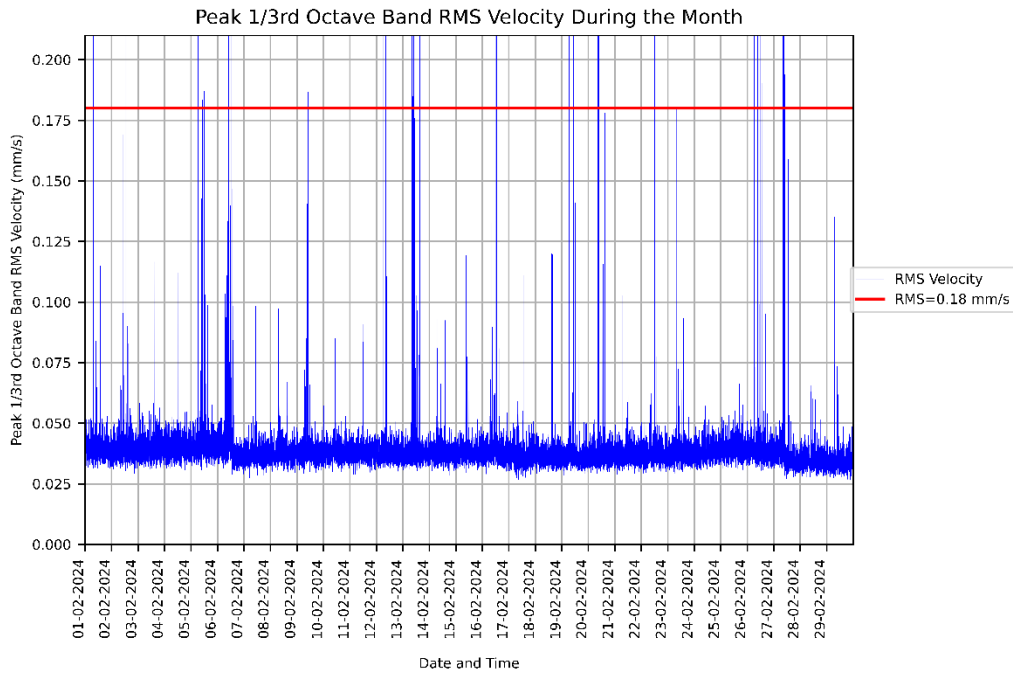


Figure 1: Measured RMSV vibration levels for 01/02/2024 to 29/02/2024 at the WIMR - BSF Mice Holding Room - Rack.

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
28	4

PPV Vibration Levels

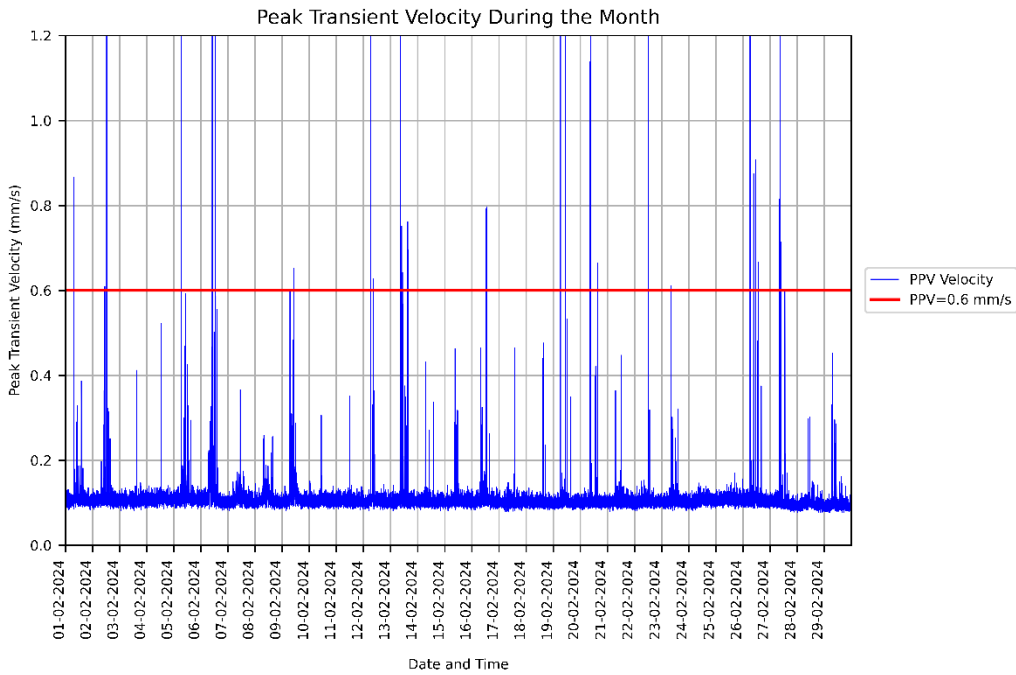


Figure 2: Measured vibration levels for 01/02/2024 to 29/02/2024 at the WIMR - BSF Mice Holding Room - Rack.

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
24	11

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 01/02/2024 to 29/02/2024.

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.

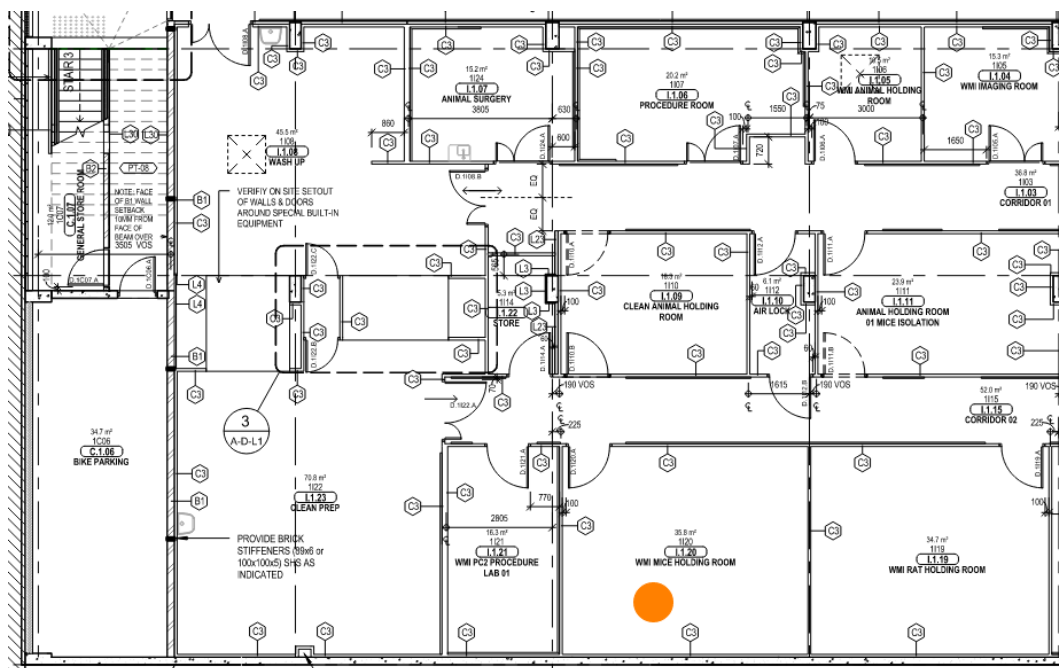


Figure 3: WIMR - BSF Mice Holding Room - Rack vibration monitor location

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 01/02/2024 and 29/02/2024. The recorded data is shown in blue, while the limit of 0.18mm/s (V_{RMS}) is shown in red.

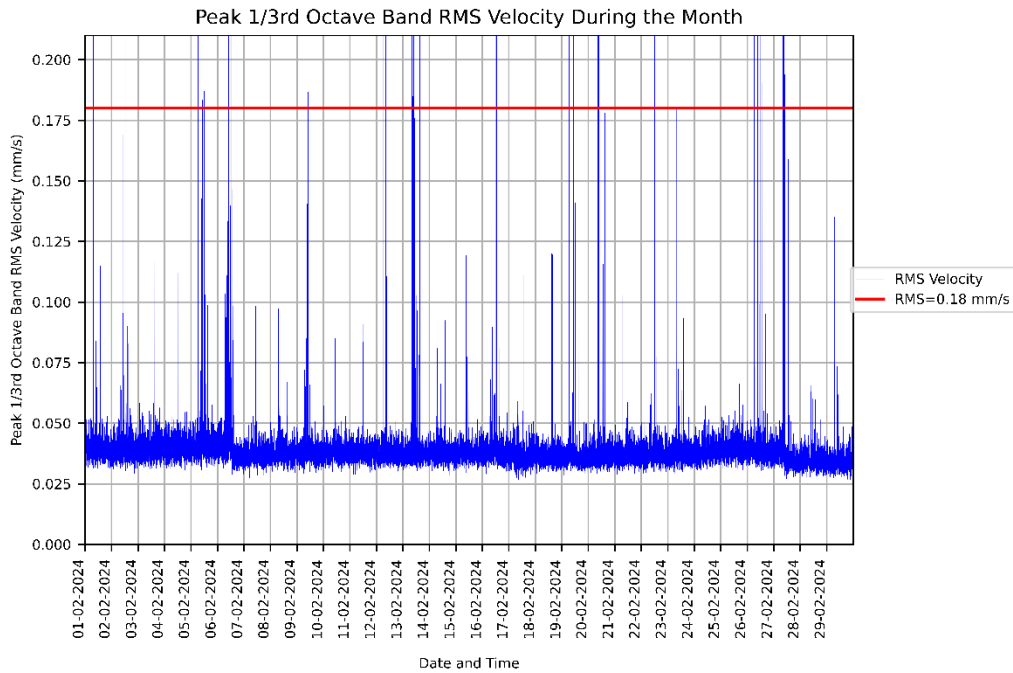


Figure 4: Measured RMSV vibration levels for 01/02/2024 to 29/02/2024 at the WIMR - BSF Mice Holding Room - Rack.

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
28	4

Figure 5 below shows the peak particle vibration levels (PPV velocity) recorded between 01/02/2024 and 29/02/2024. The recorded data is shown in blue, while the limit of 0.6mm/s (V_{PPV}) is shown in red.

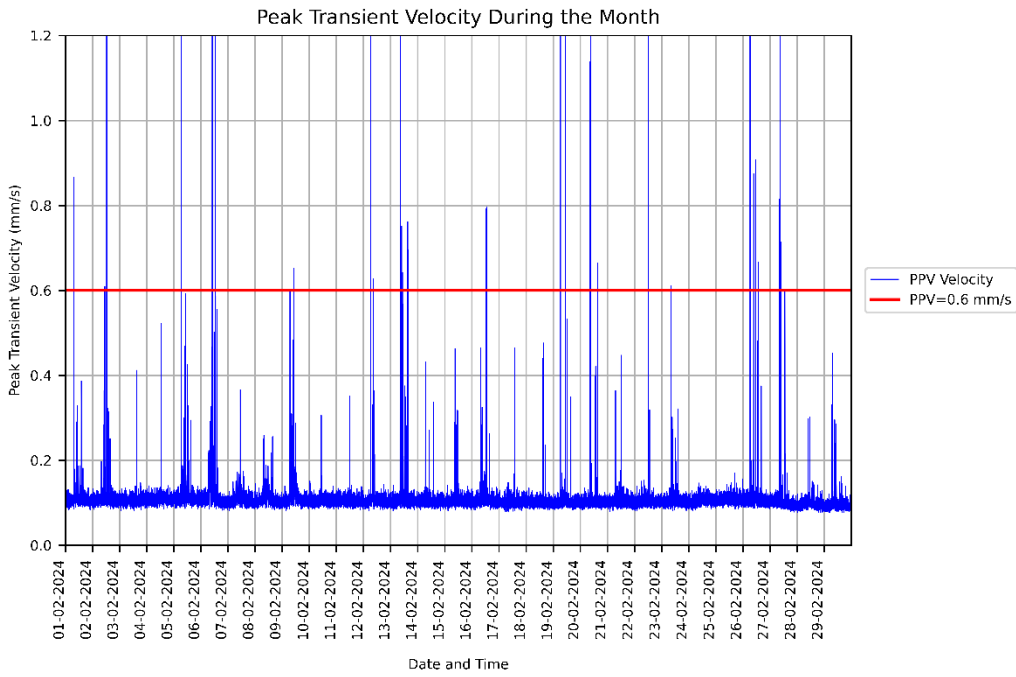


Figure 5: Measured PPV vibration levels for 01/02/2024 to 29/02/2024 at the WIMR - BSF Mice Holding Room - Rack.

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

During Construction Hours	Outside of Construction Hours
24	11

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
--	--

2. Visual Check

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

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



Health Infrastructure

Children's Hospital Westmead

**Vibration Monitoring - KR L4 44-4873 -
Jan 2024**

CVM/ KRL4/202401

Issue 1 | 15/02/2024

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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Document Verification

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Document ref CVM/KRL4/202401
File reference -

Revision	Date	Filename
		Westmead Hospital – SVAN958 KR – L4 Rm 44-4873 - Summary of Recent Vibration Measurements (01-01 to 31-01).docx
Issue 1	15/02/2024	Description Issue

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Name	PR	MJW	MJW
Signature			

Filename
Description

	Prepared by	Checked by	Approved by
Name			
Signature			

Filename
Description

	Prepared by	Checked by	Approved by
Name			
Signature			

Issue Document Verification with Document

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Executive Summary

This report summarises the vibration monitoring data recorded at KR Level 4 in Room 44-4873, over one month – from 01/01/2024 to 31/01/2024. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMS Acceleration Levels

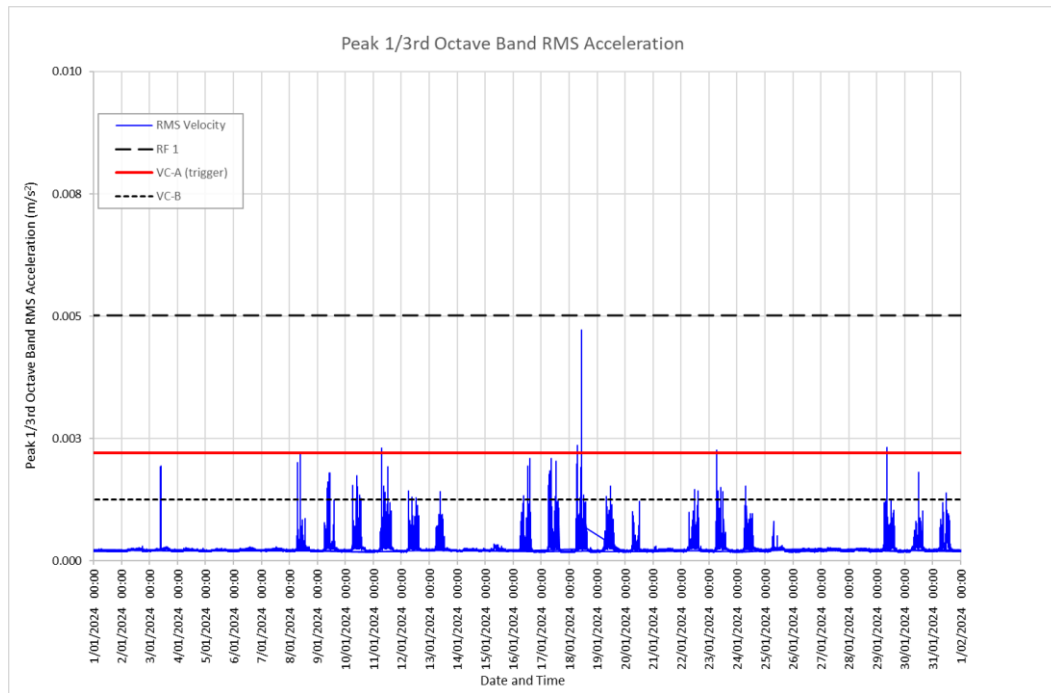


Figure 1: Measured RMS acceleration vibration levels at the KR L4.

The table below summarises the number of Root-Mean-Square Acceleration limit exceedances recorded during and outside of construction hours at KR L4 Lab.

During Construction Hours	Outside of Construction Hours
2	3

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 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 – L4 Room 44-4873 during the period of the 01/01/2024 to 31/01/2024.

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 2.

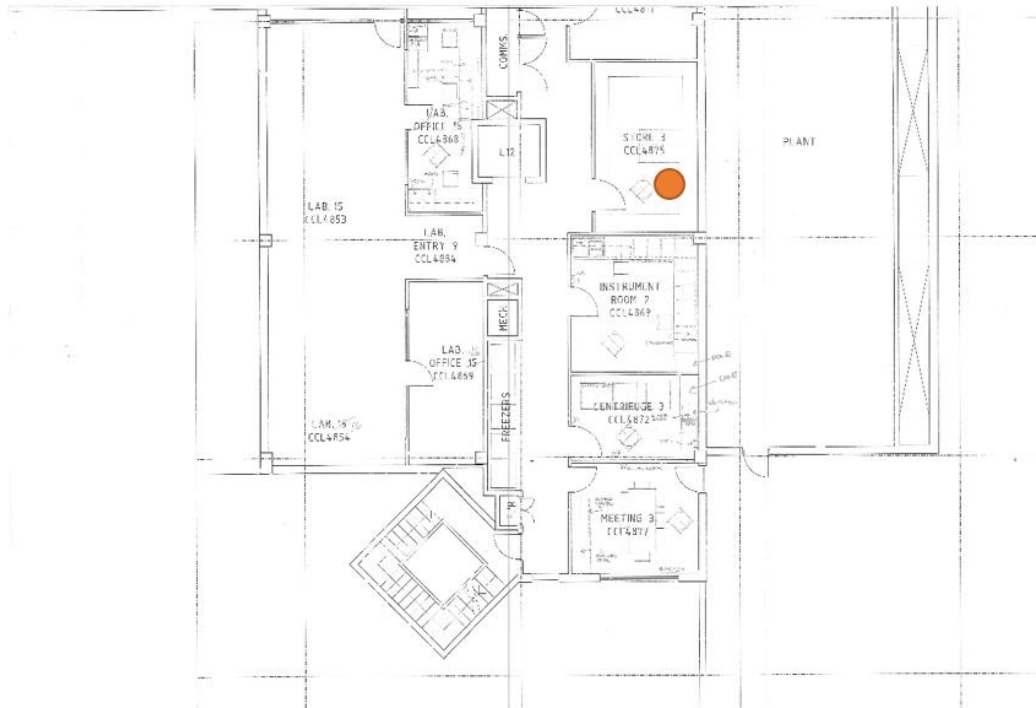


Figure 2: KR – L4 vibration monitor location

Monitoring at this location utilises a SVAN 958AG (SN 59827) with a triaxial accelerometer (SA207B).

3. Recorded Data

Figure 3 below shows the vibration levels (RMS acceleration) recorded between 01/01/2024 and 31/01/2024. The recorded data is shown in blue, while the limit of 0.0025 m/s^2 (VC-A) is shown in red.

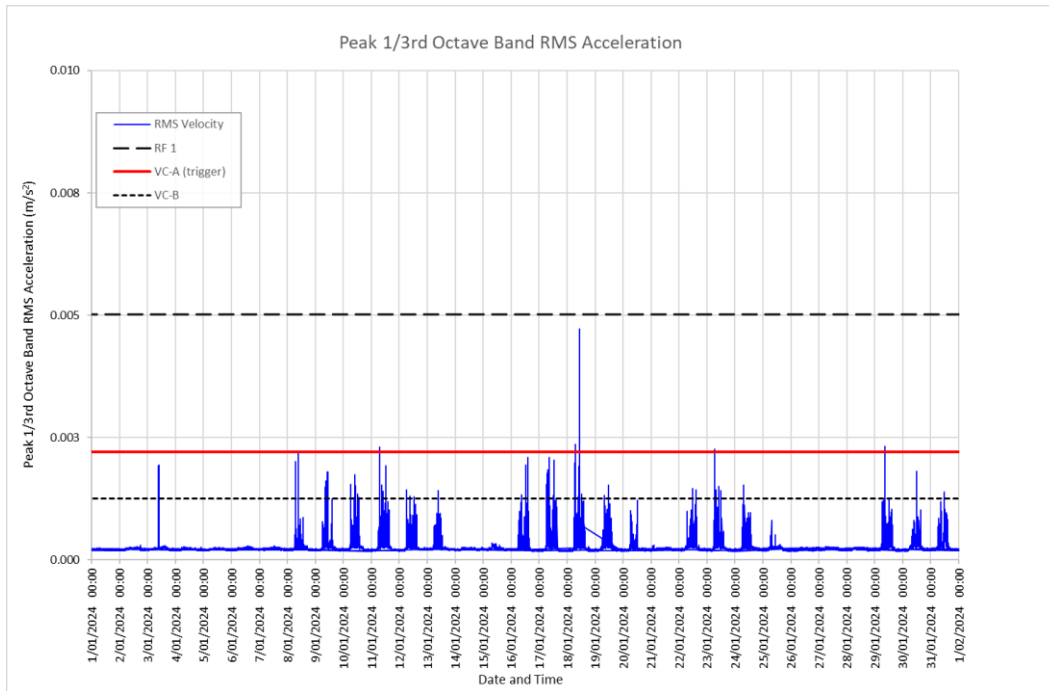


Figure 3: Measured RMS acceleration vibration levels for 01/01/2024 to 31/01/2024 at KR – L4.

The table below summarises the number of Root-Mean-Square Acceleration limit exceedances recorded during and outside of construction hours at KR L4 Lab.

During Construction Hours	Outside of Construction Hours
2	3