

Health Infrastructure NSW
Westmead PSB and MSCP
Construction Noise Monitoring

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

AC14

v1 | 6 February 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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Appendix A

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 January 2023 to 31 January 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.

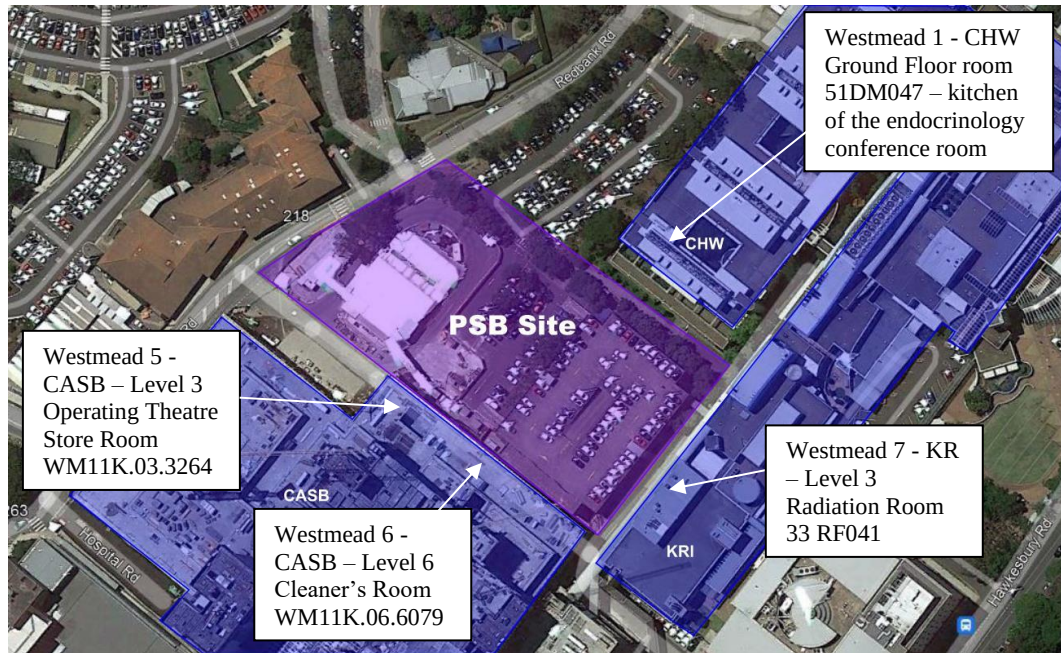


Figure 1: PSB noise monitoring locations.



Figure 2: MSCP noise monitoring locations.

2.1 Noise Logger relocation

The following table provides a record of the noise loggers which have been relocated during the project.

Table 1: Noise logger relocation records

Logger ID	Original location	Current location	
	Location	Date moved	Location
Westmead 2	CHW Level 2 Consult Room 92BW025	14/04/22	CHW Level 2 Parent Kitchen 92BW028

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 7	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

The following provides a progressive record of 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)	06/01/23-27/01/23
Westmead 5	CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (facing PSB site)	03/01/23-31/01/23
Westmead 6	CASB Level 6 Cleaner's Room WM11K.06.6079 (facing PSB site)	02/01/23-07/01/23 09/01/23-31/01/23
Westmead 7	KR Level 3 Radiation Room 33 RF041(facing PSB site)	06/01/23-31/01/23
Westmead 2	CHW Level 2 Parent Kitchen 92BW025 (facing MSCP site)	02/01/23-12/01/23 14/01/23-27/01/23
Westmead 3	RMH Level 1 Store Room 101 (facing MSCP site)	04/01/23-31/01/23

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)	4
Westmead 5	CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (facing PSB site)	1
Westmead 6	CASB Level 6 Cleaner's Room WM11K.06.6079 (facing PSB site)	-
Westmead 7	KR Level 3 Radiation Room 33 RF041(facing PSB site)	1
Westmead 2	CHW Level 2 Parent Kitchen 92BW025 (facing MSCP site)	2
Westmead 3	RMH Level 1 Store Room 101 (facing MSCP site)	-

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.

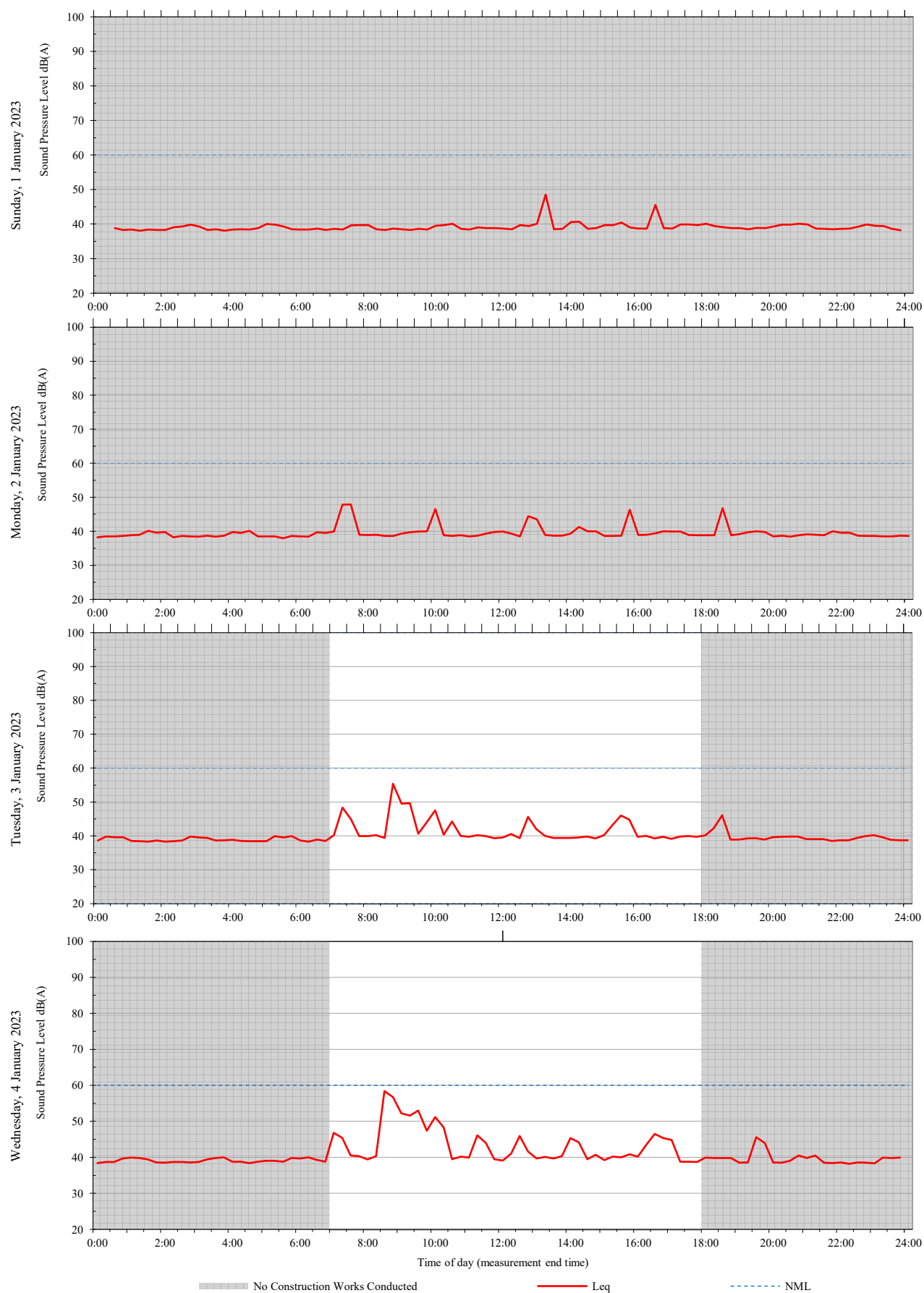
Appendix A

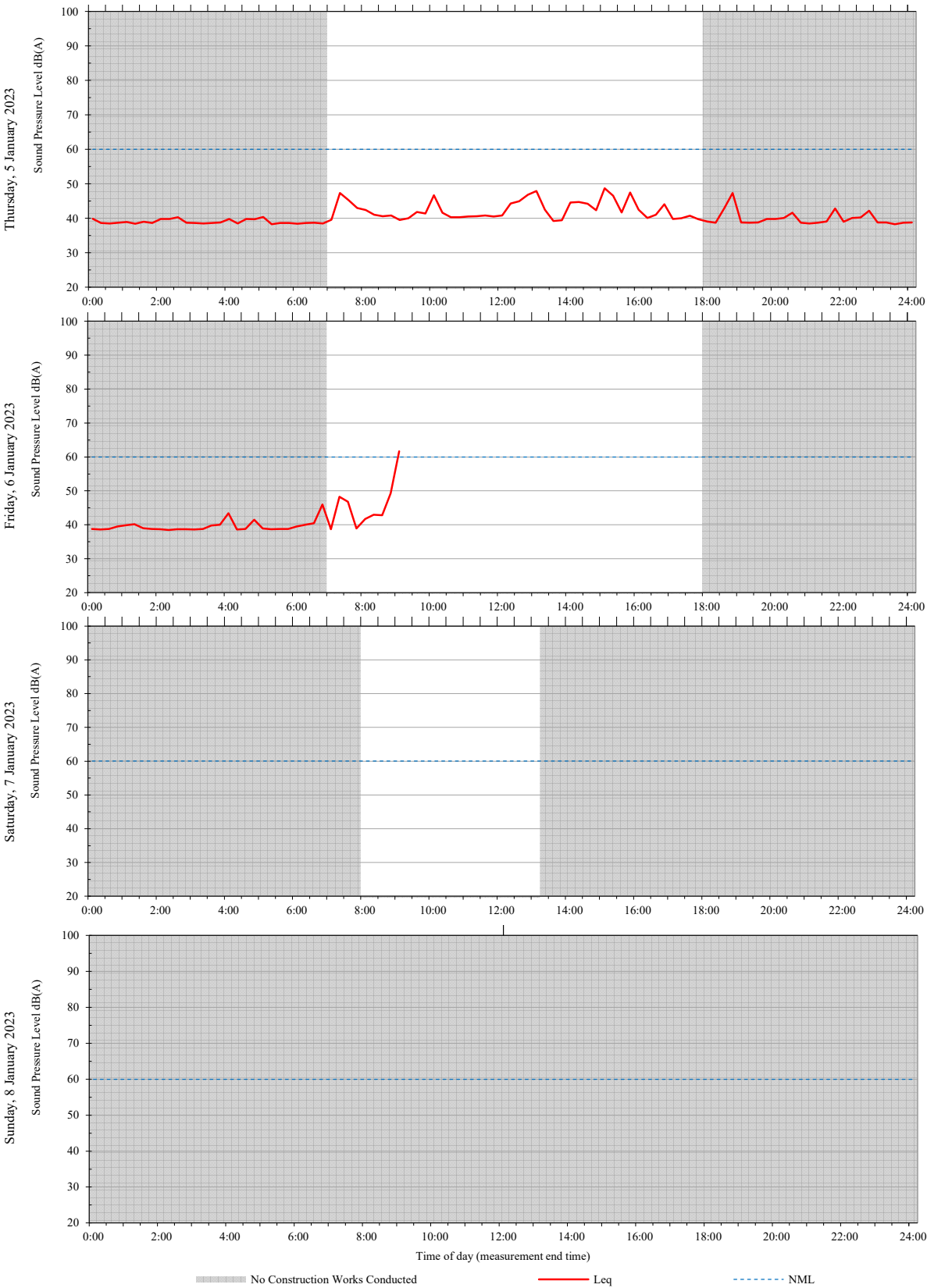
Noise Monitoring Daily Results

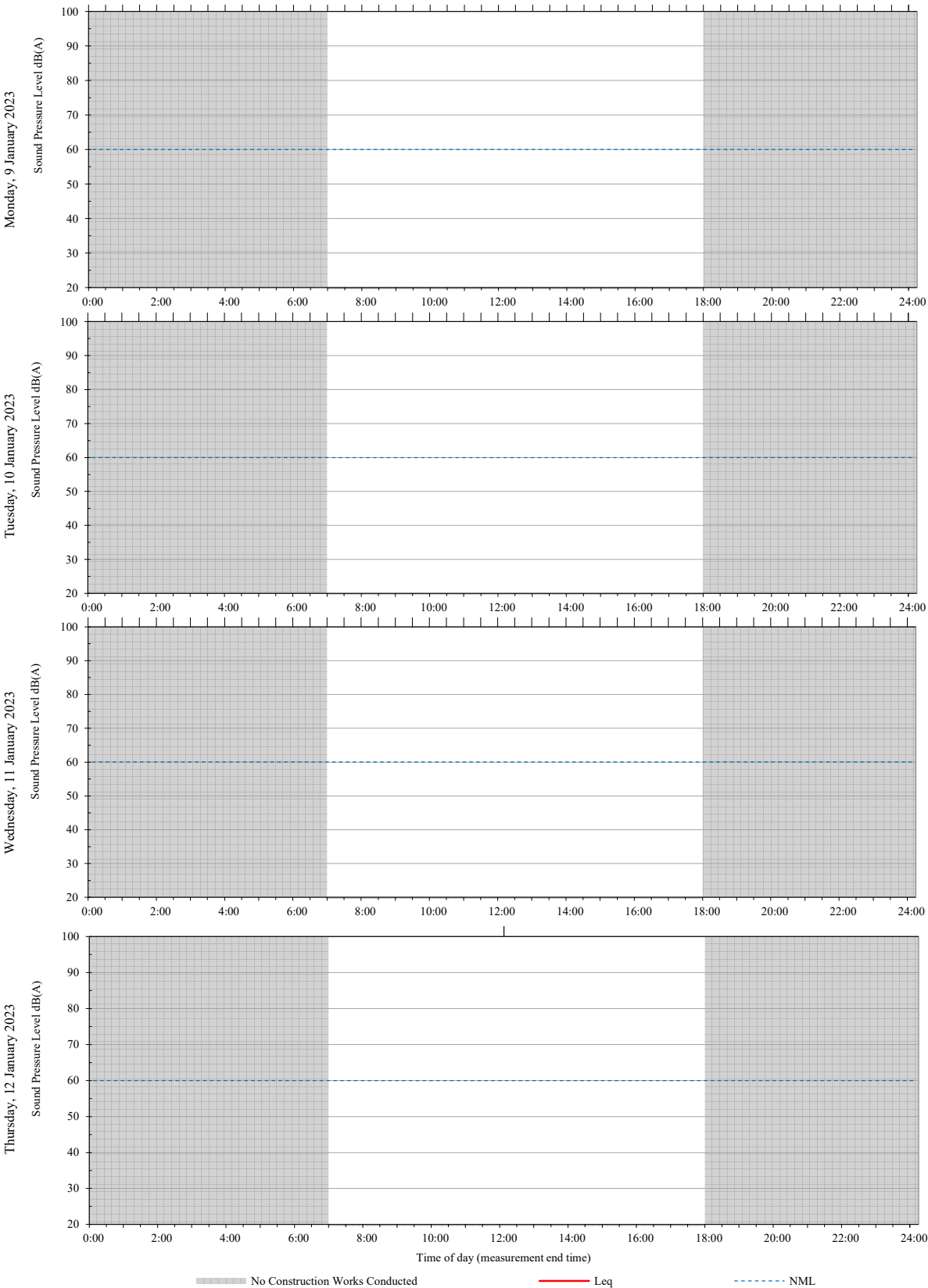
A1 CHW Ground Floor room 51DM047 (Westmead 1)

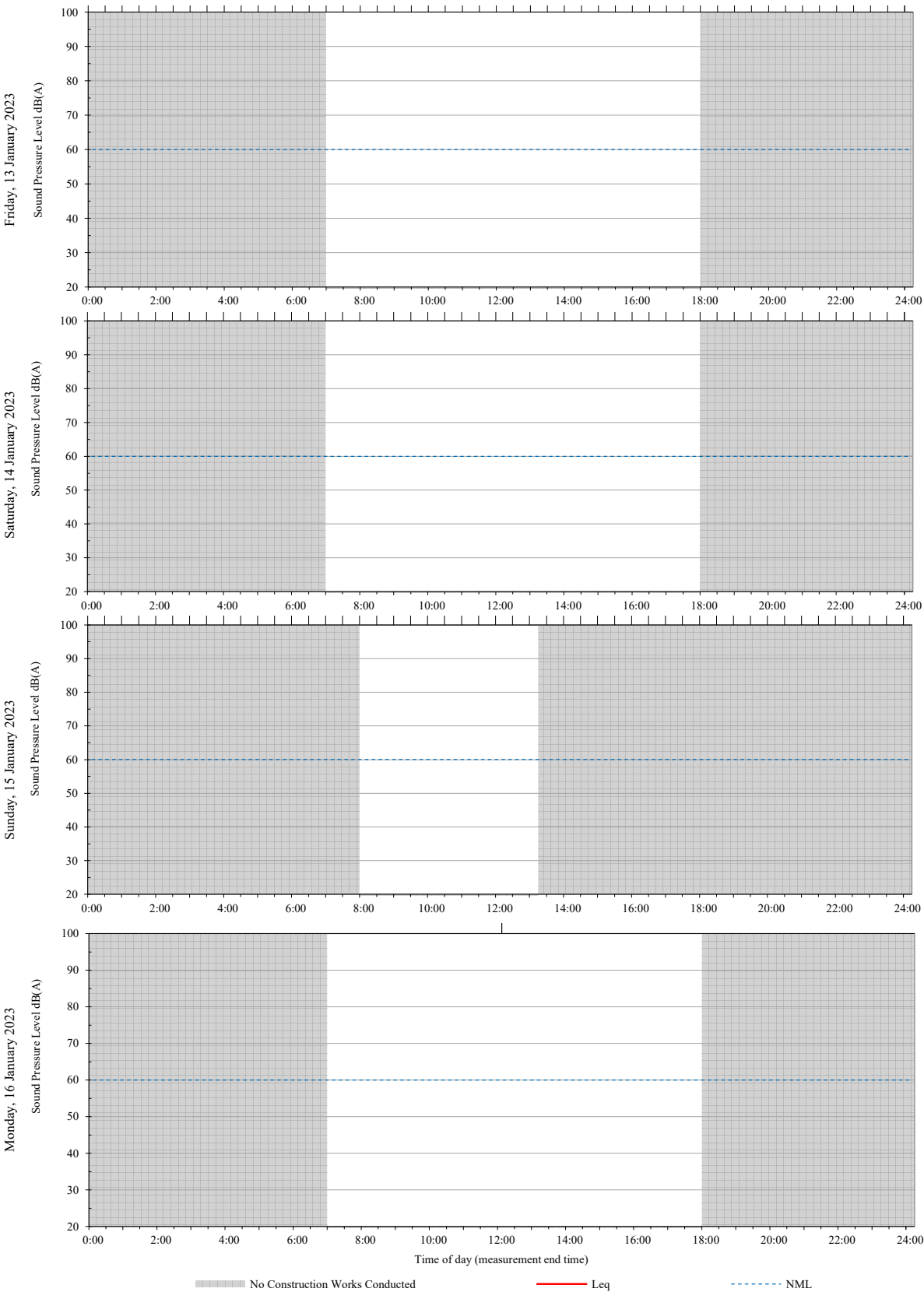
Unattended monitoring: CHW Ground Floor room 51DM047 (Internal)

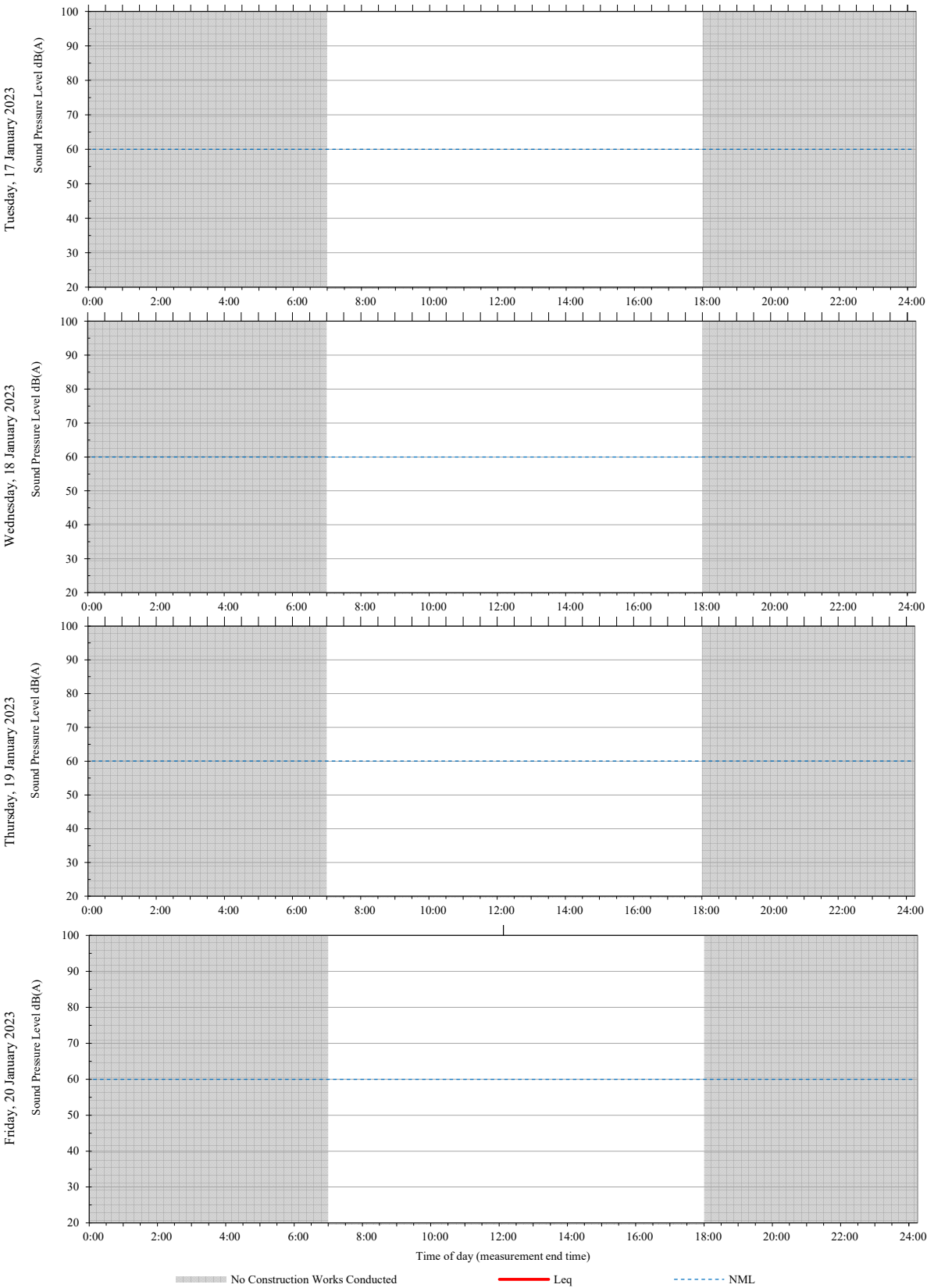
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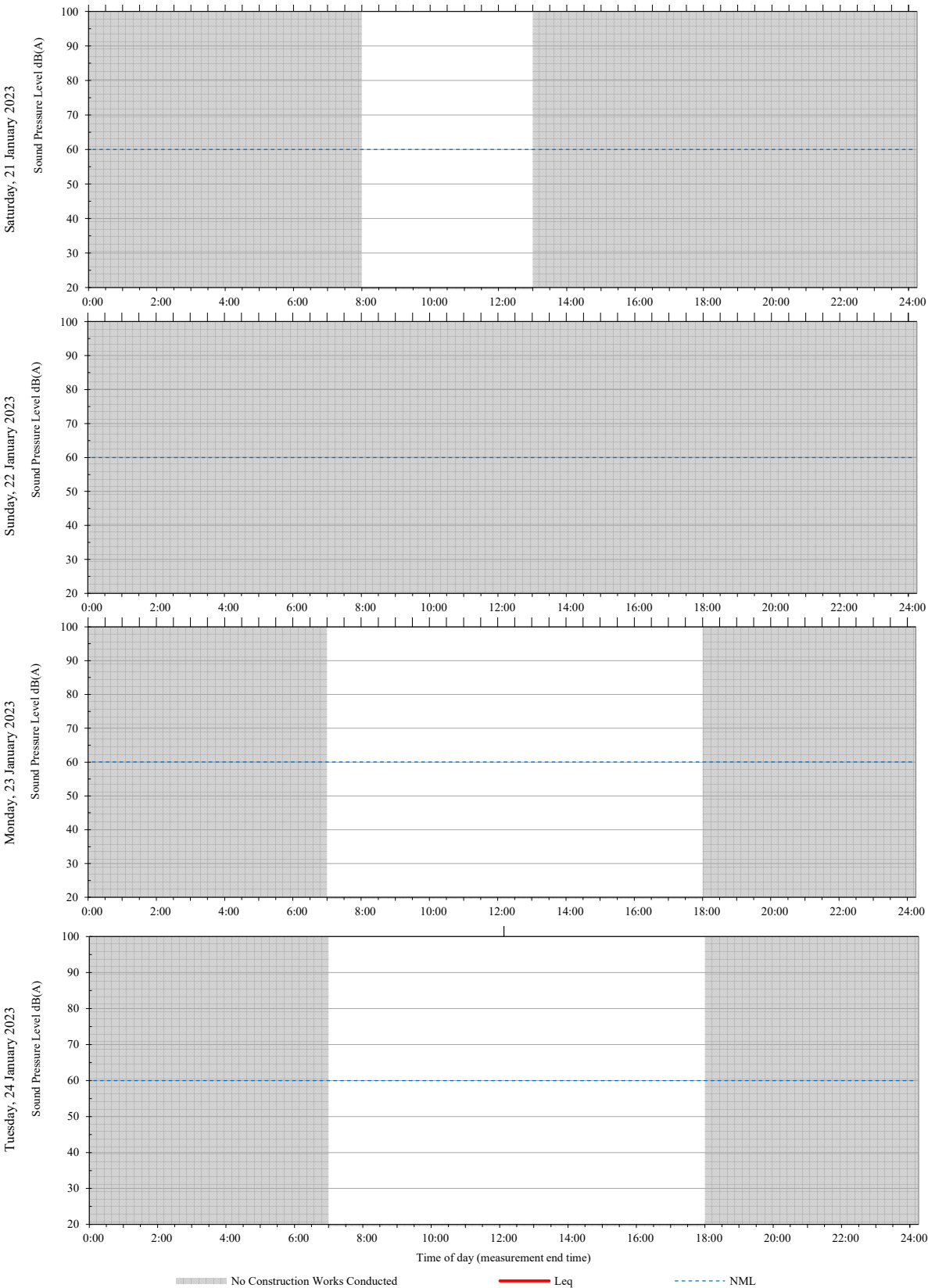


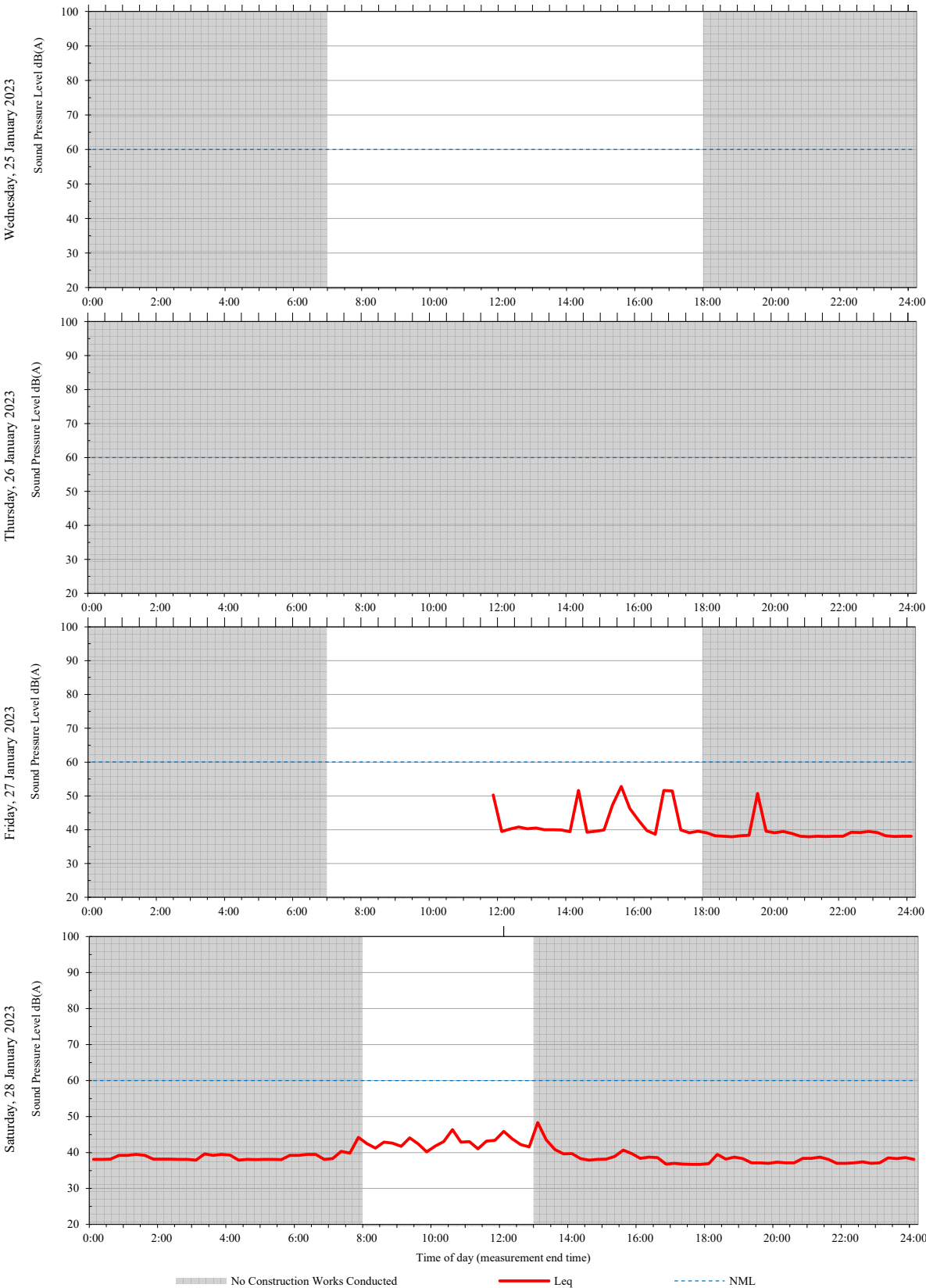




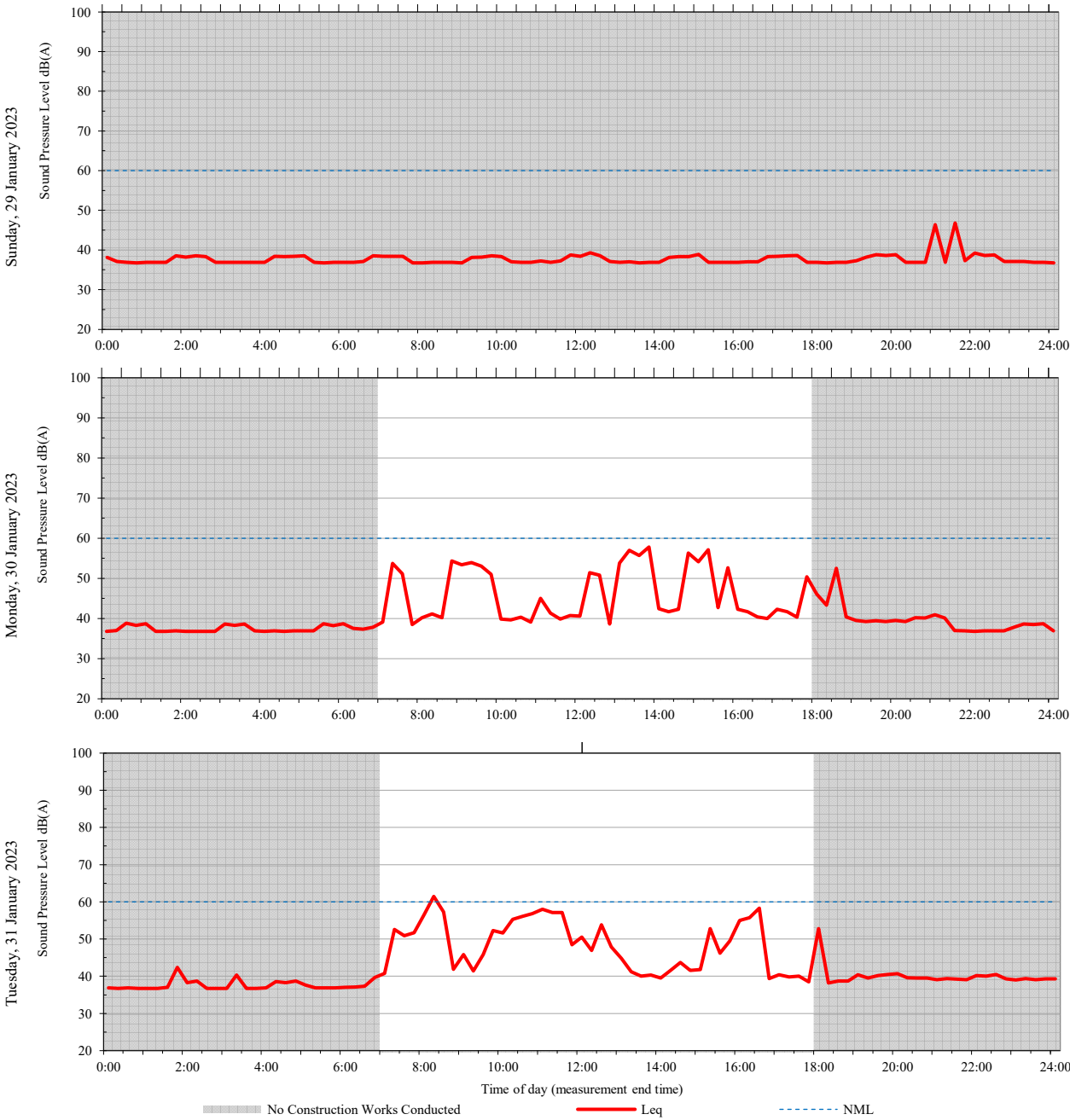








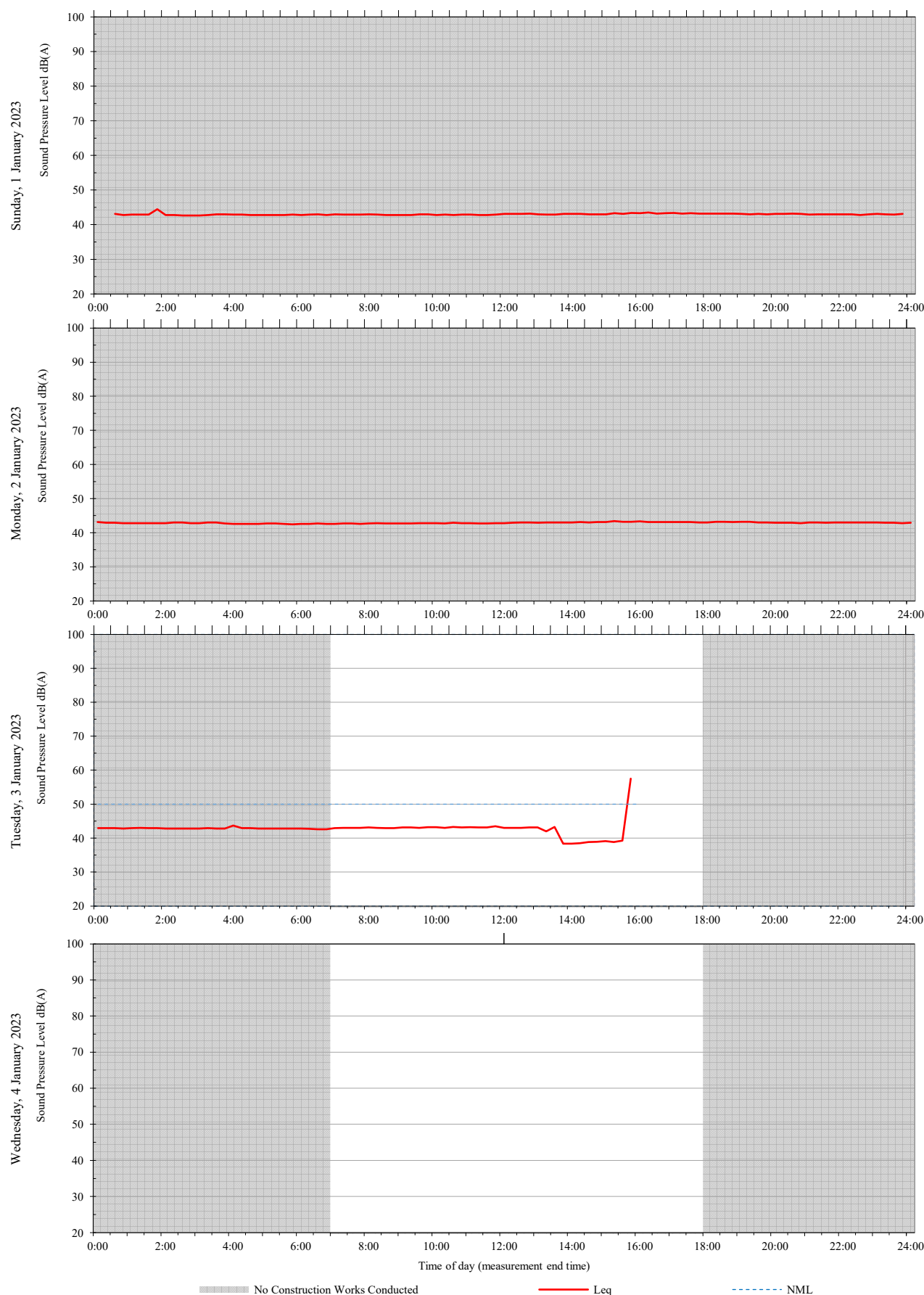
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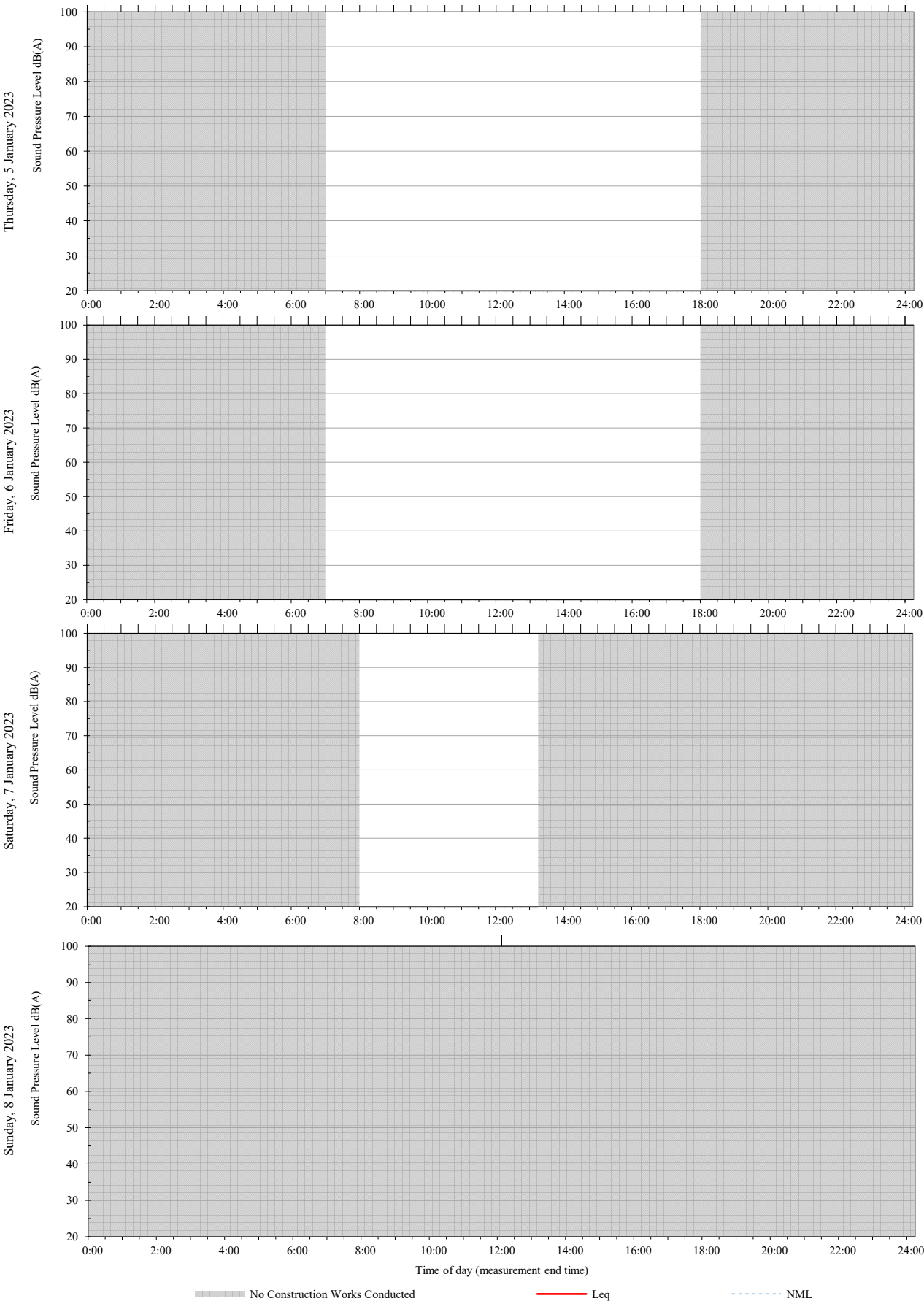


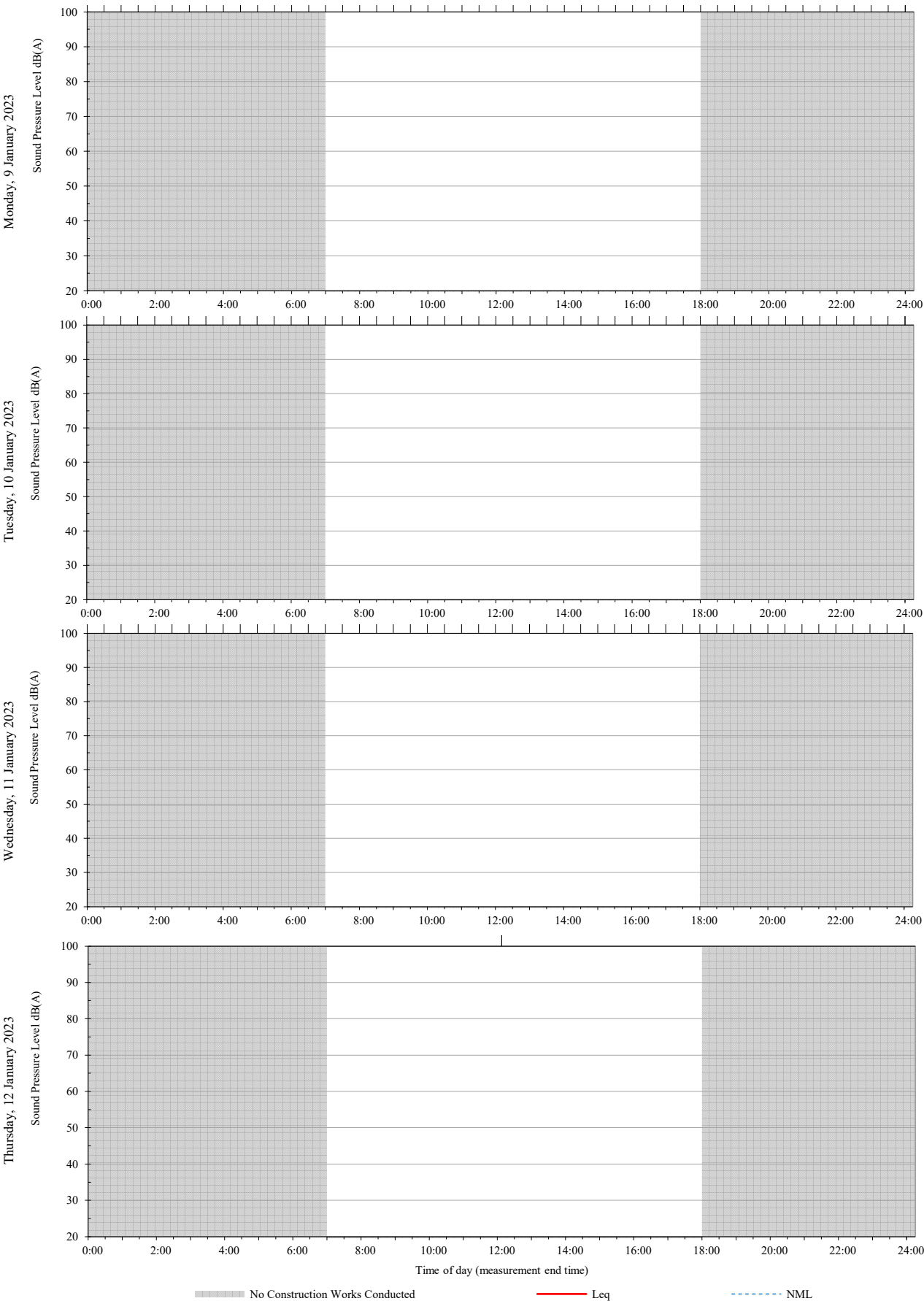
A2 CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (Westmead 5)

Unattended monitoring: CASB Level 3 Operating Theatre Store Room (Westmead 5) (Internal)

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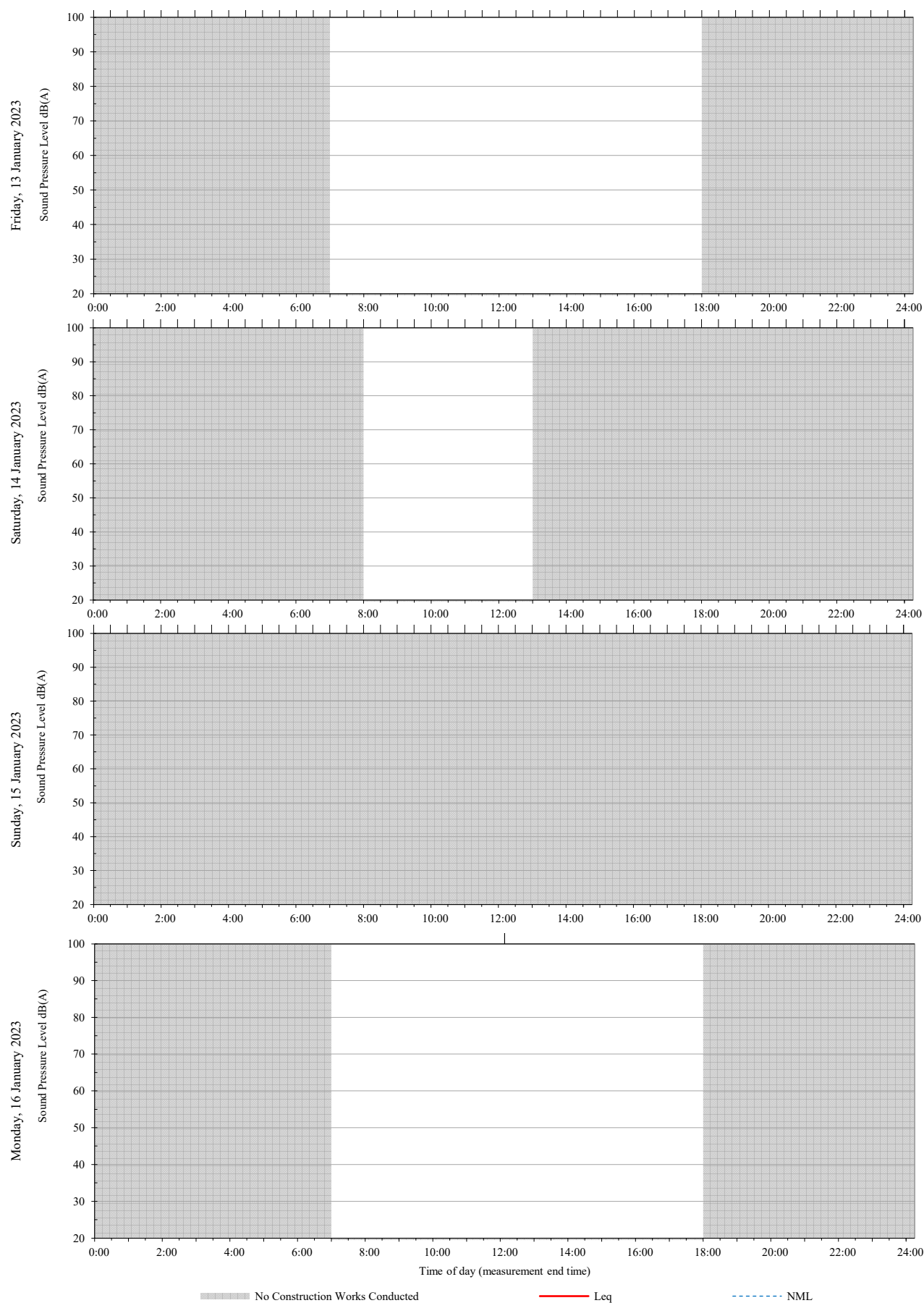


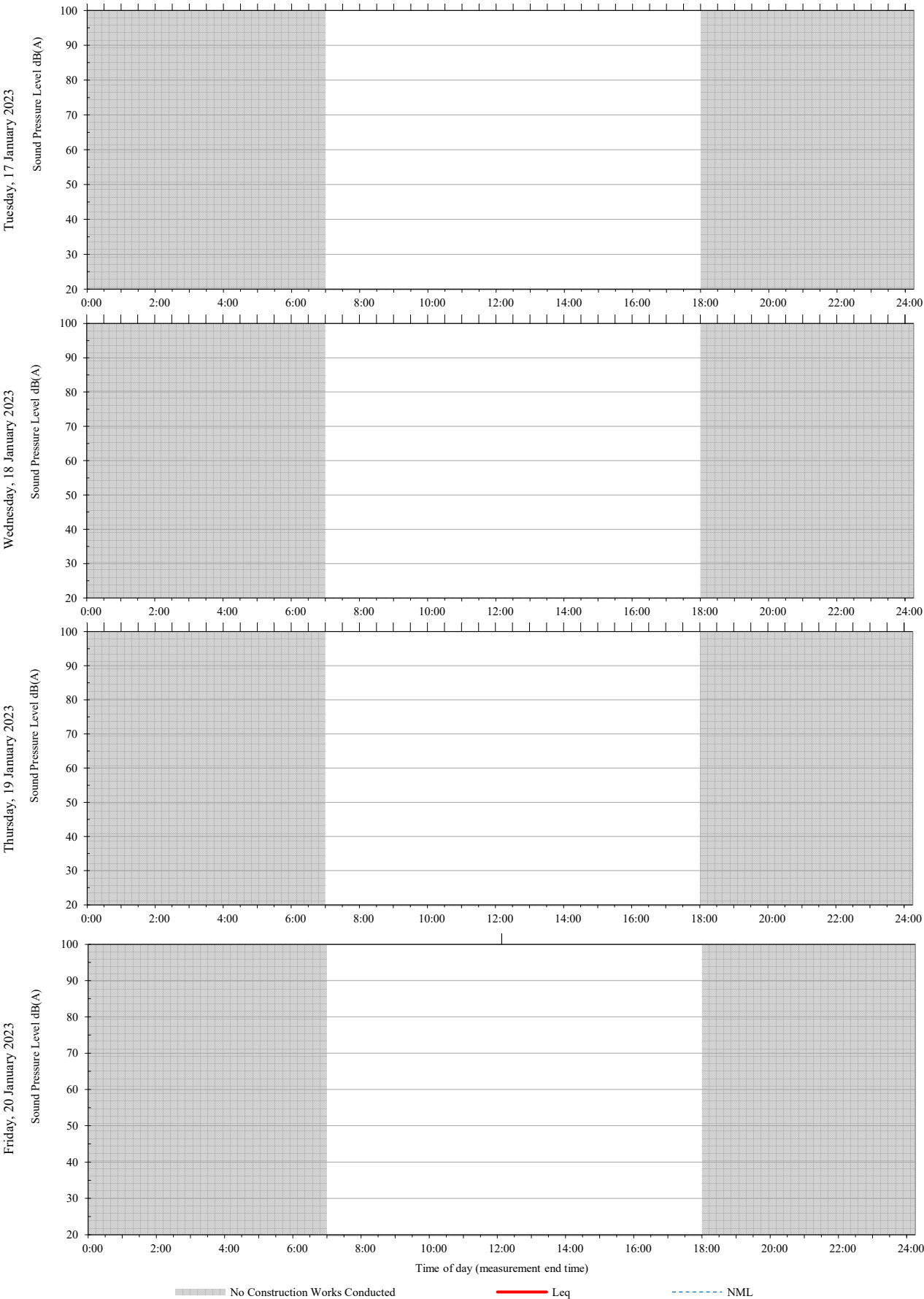




Unattended monitoring: CASB Level 3 Operating Theatre Store Room (Westmead 5) (Internal)

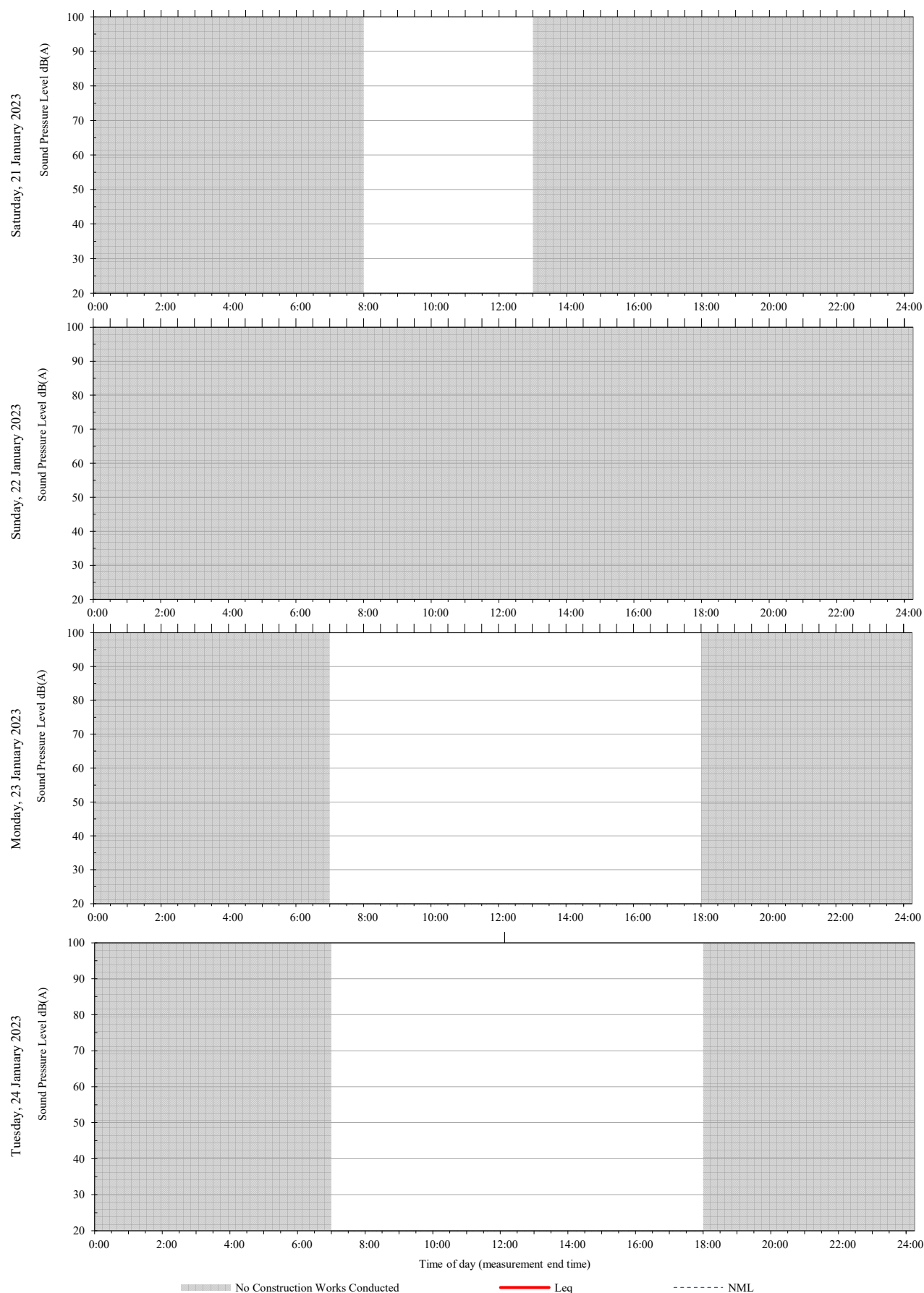
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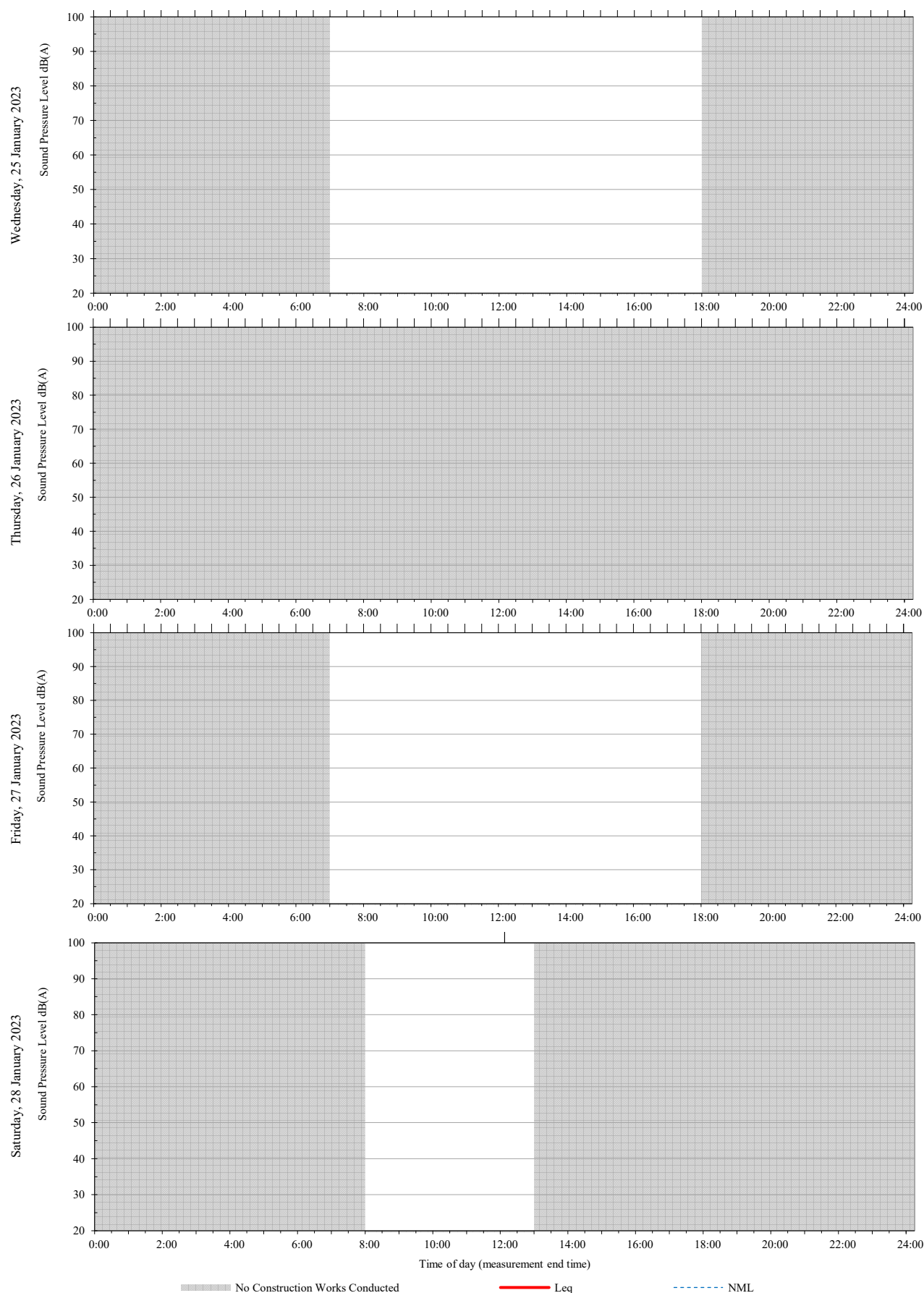
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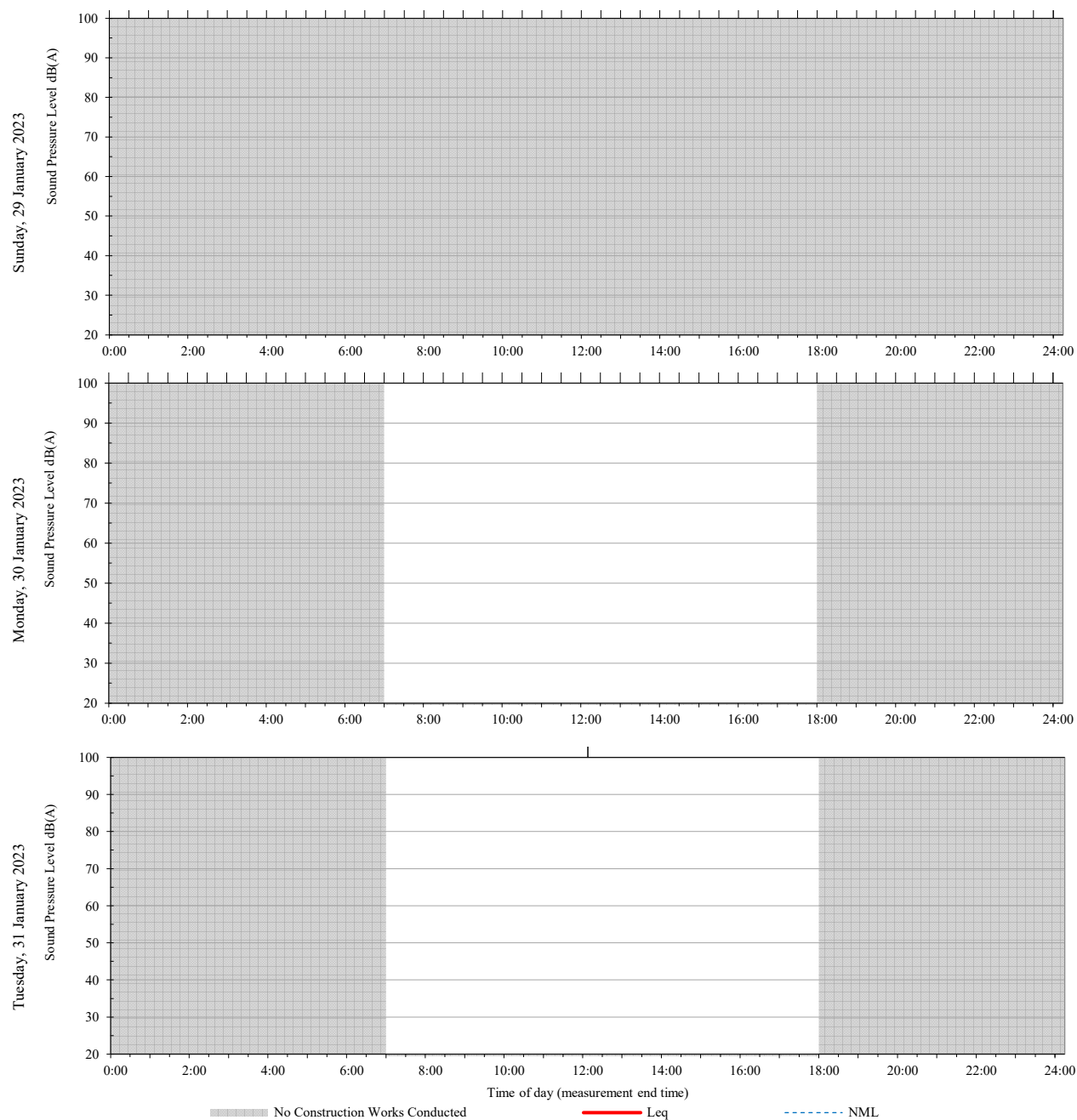
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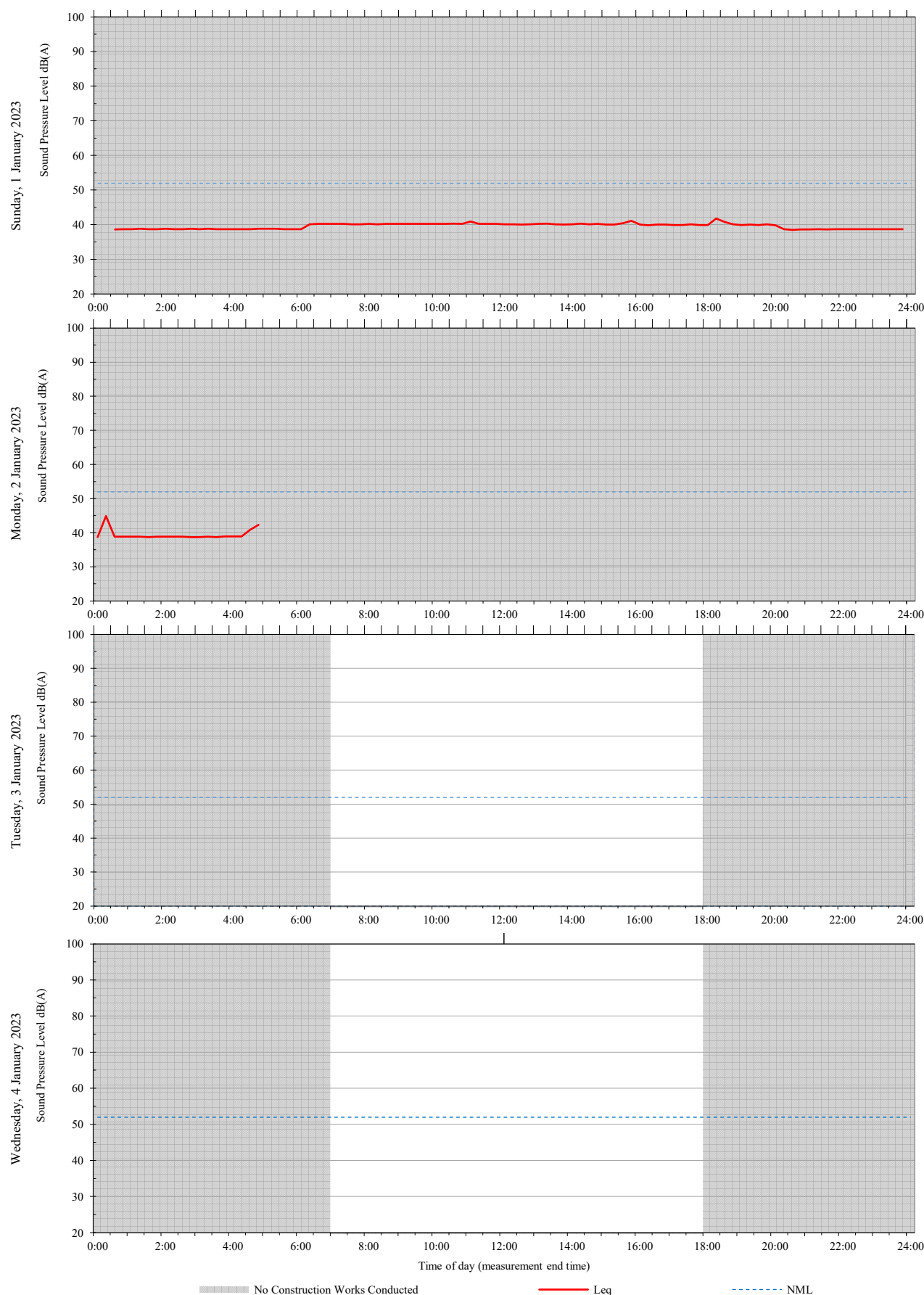


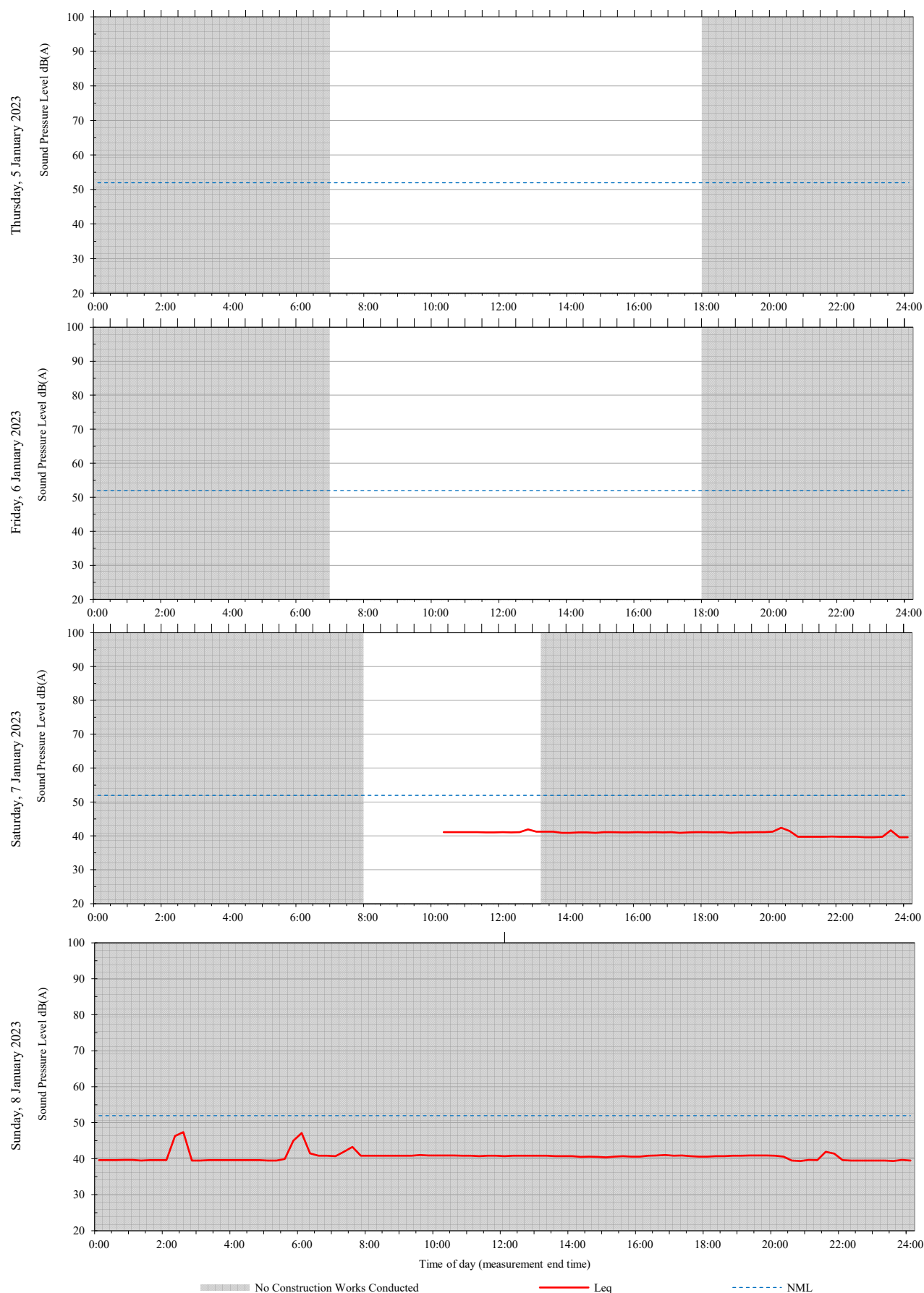
Unattended monitoring: CASB Level 3 Operating Theatre Store Room (Westmead 5) (Internal)

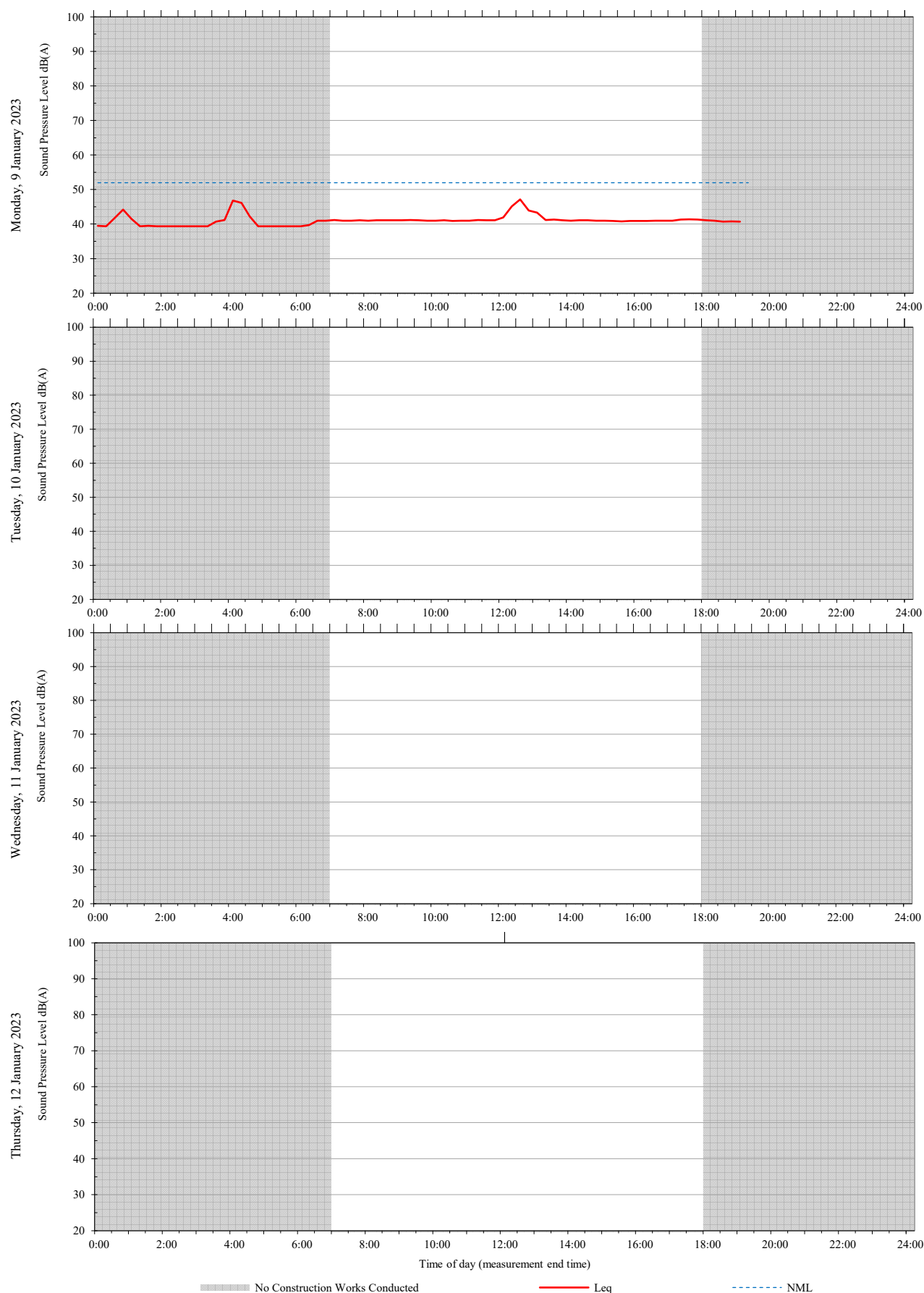
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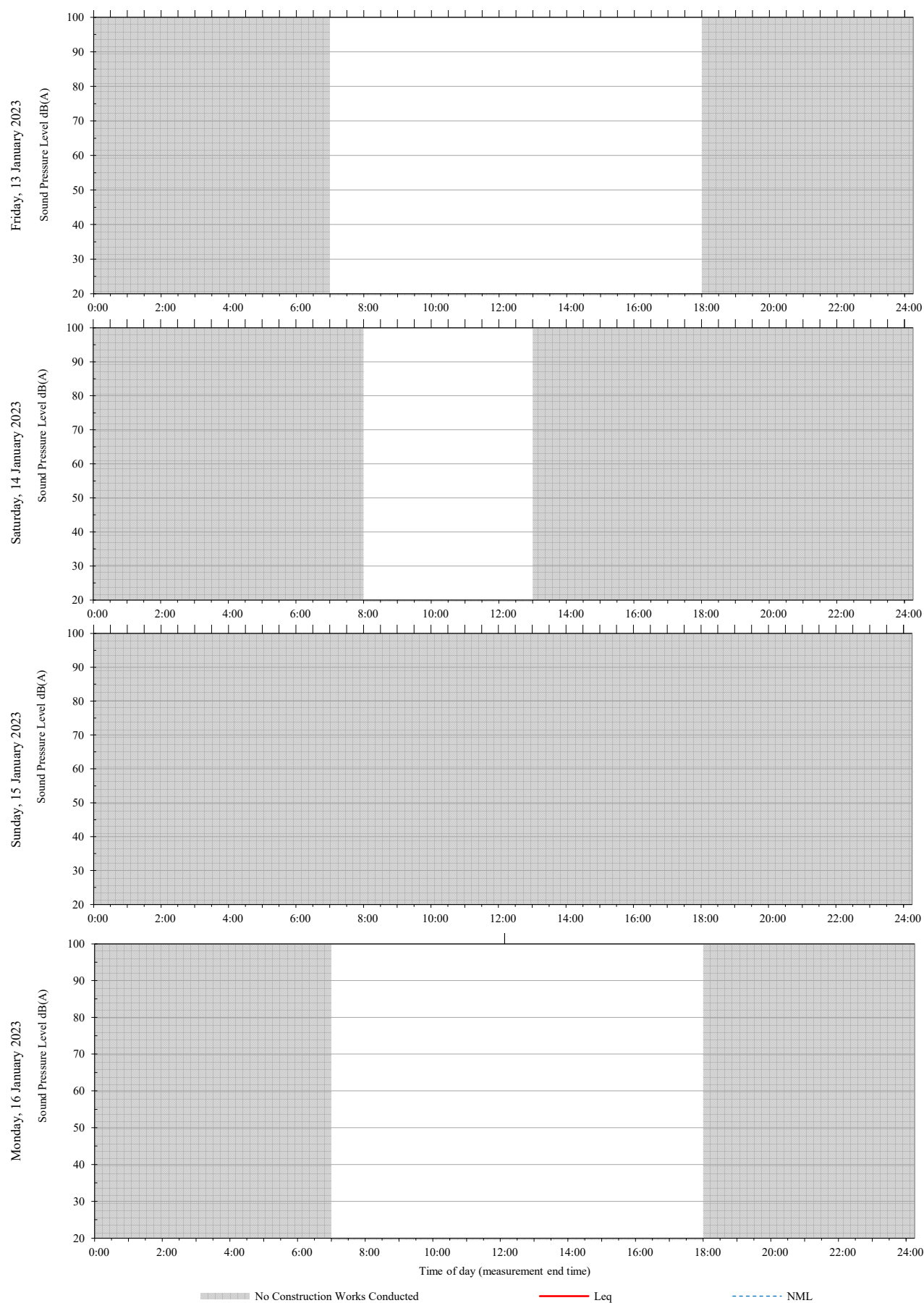


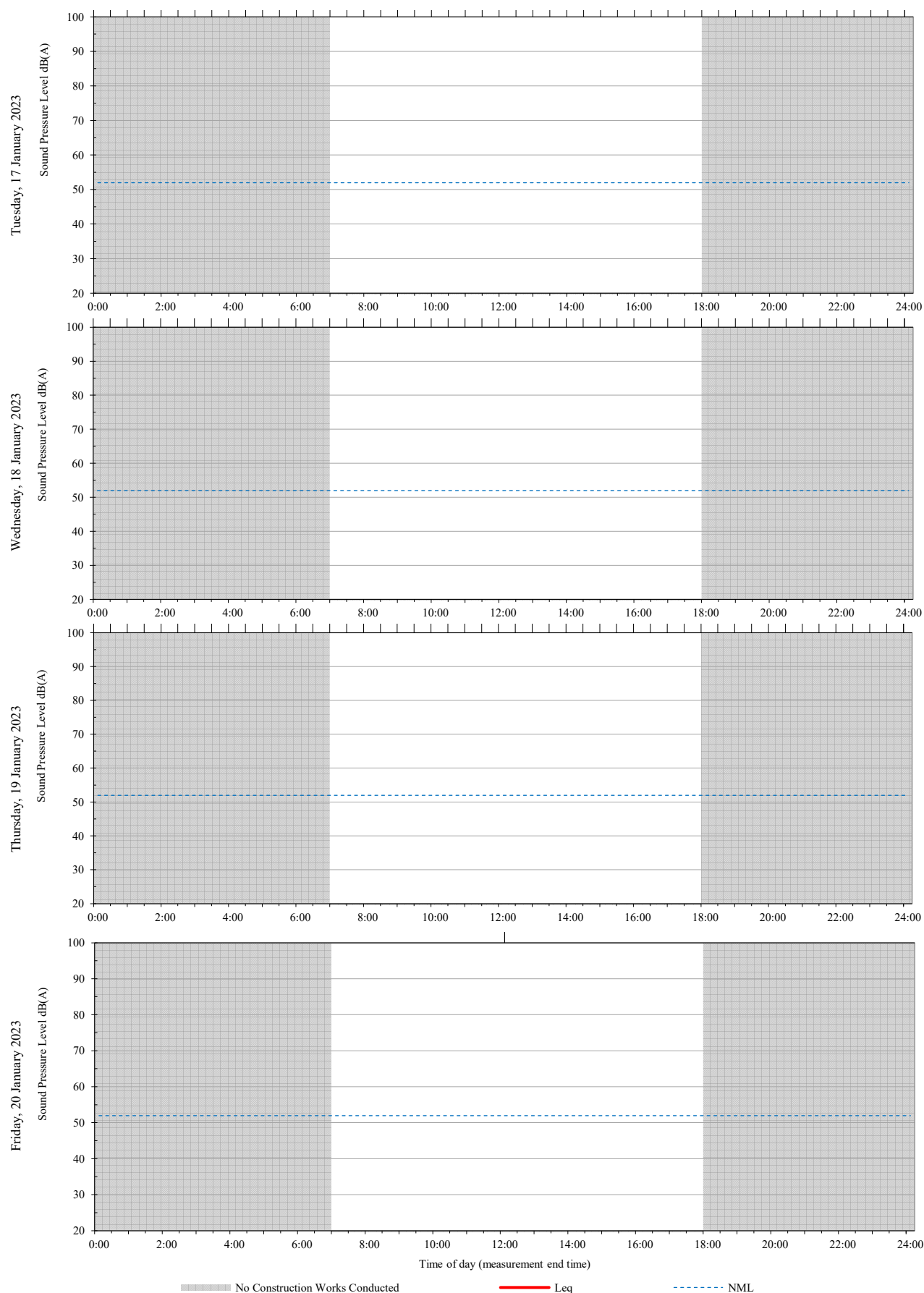
A3 CASB Level 6 Cleaner's Room WM11K.06.6079 (Westmead 6)

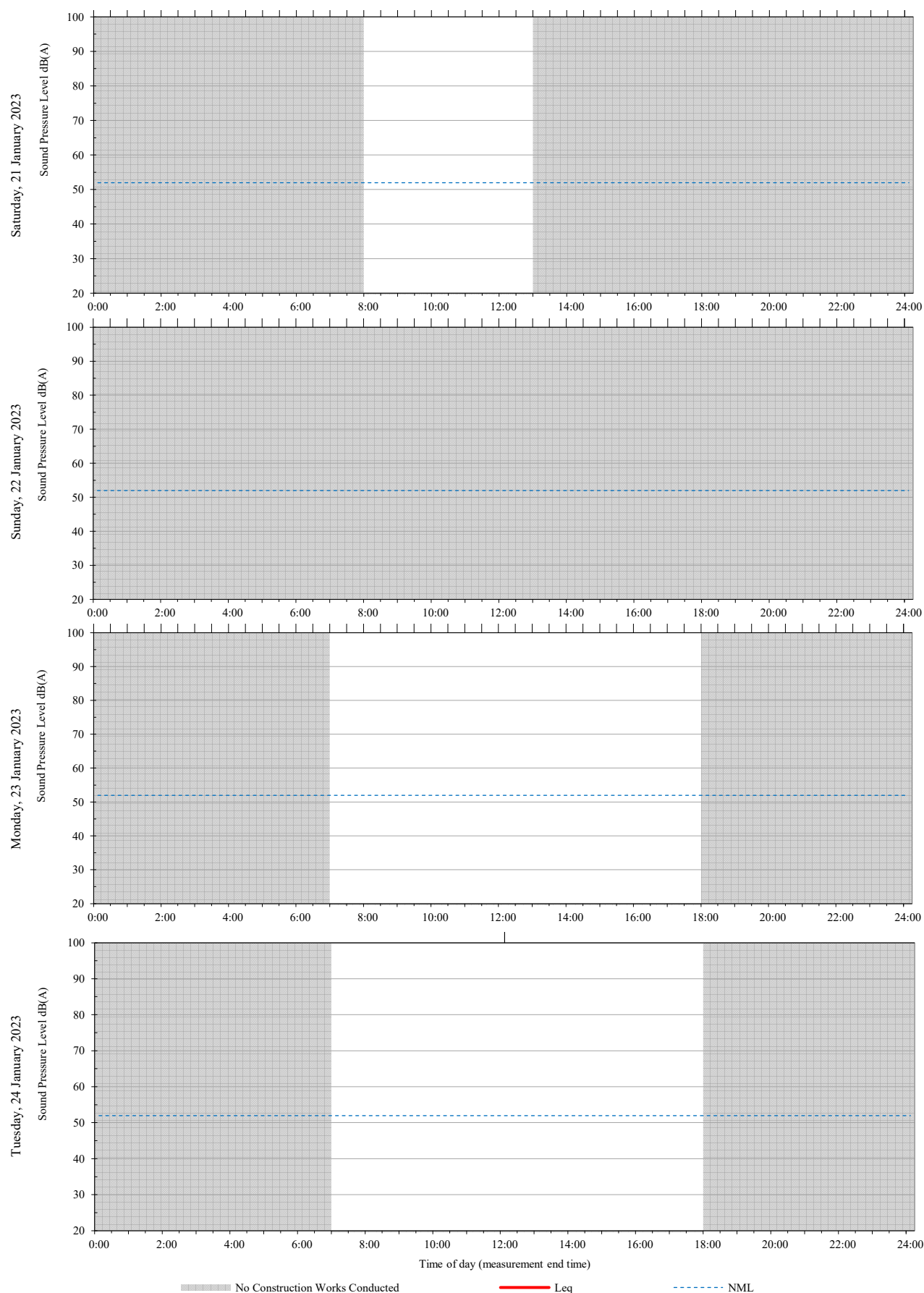


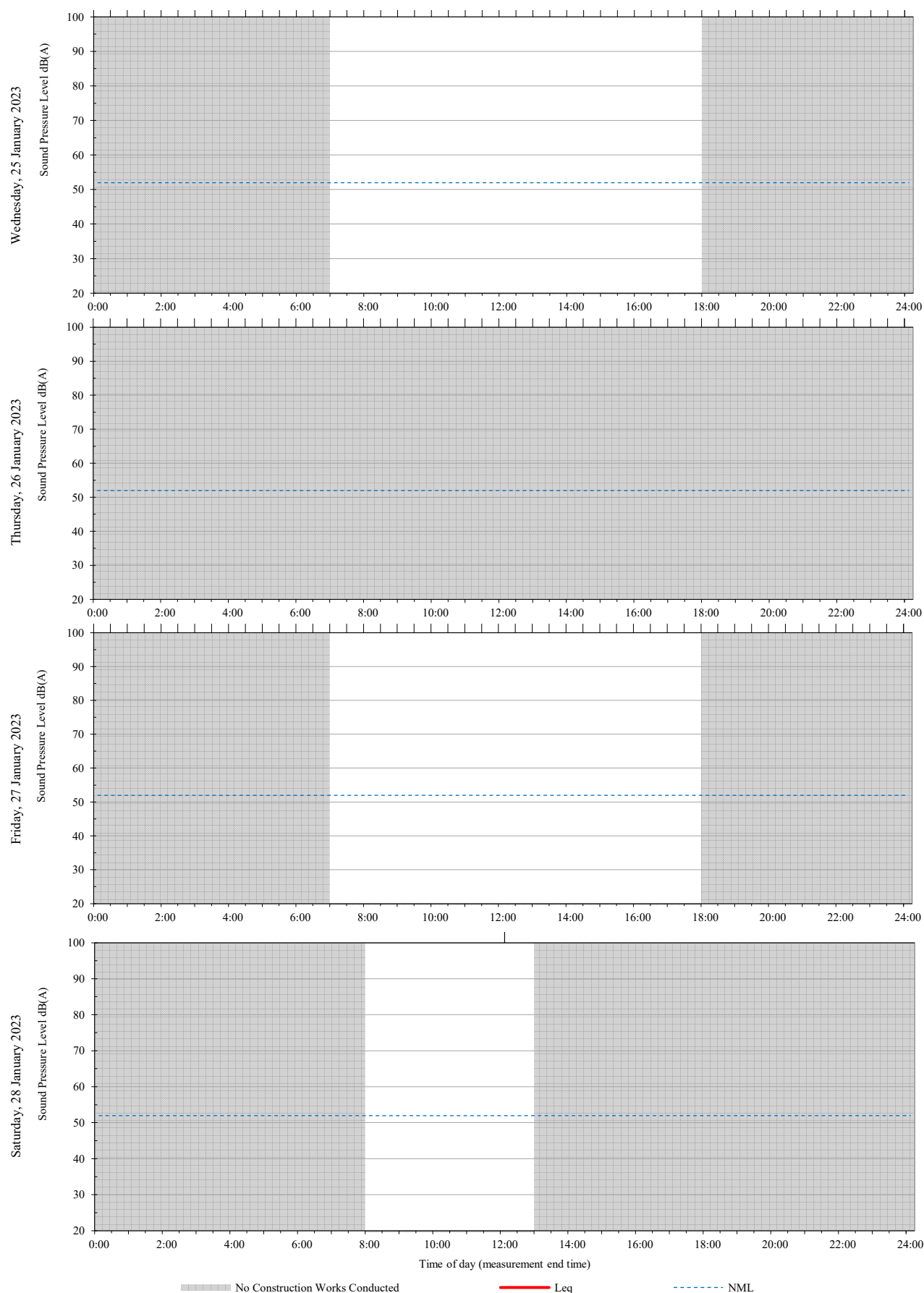






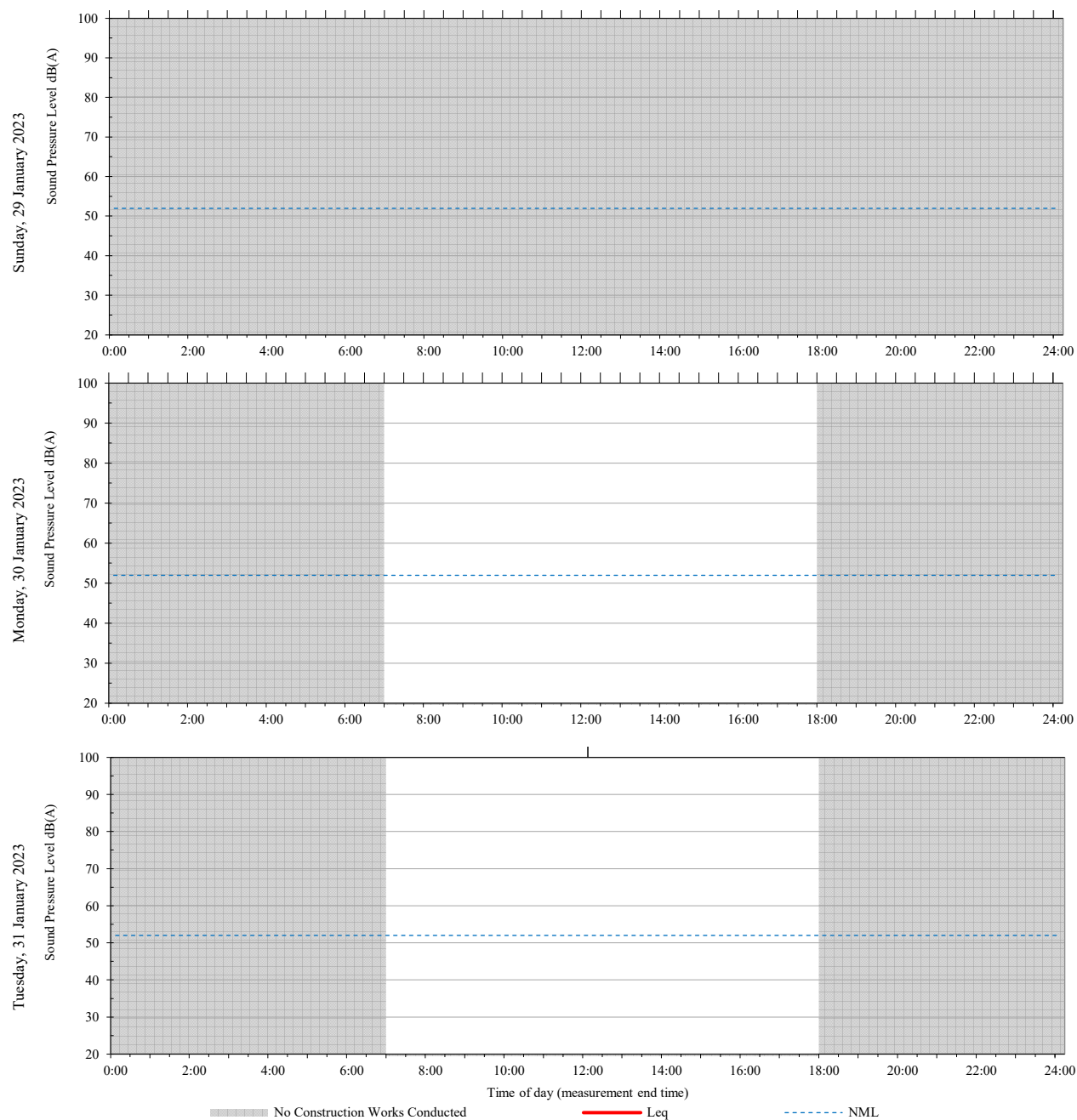






Unattended monitoring: CASB Level 6 Cleaner's Room WM11K.06.6079 (Westmead 6) (Internal)

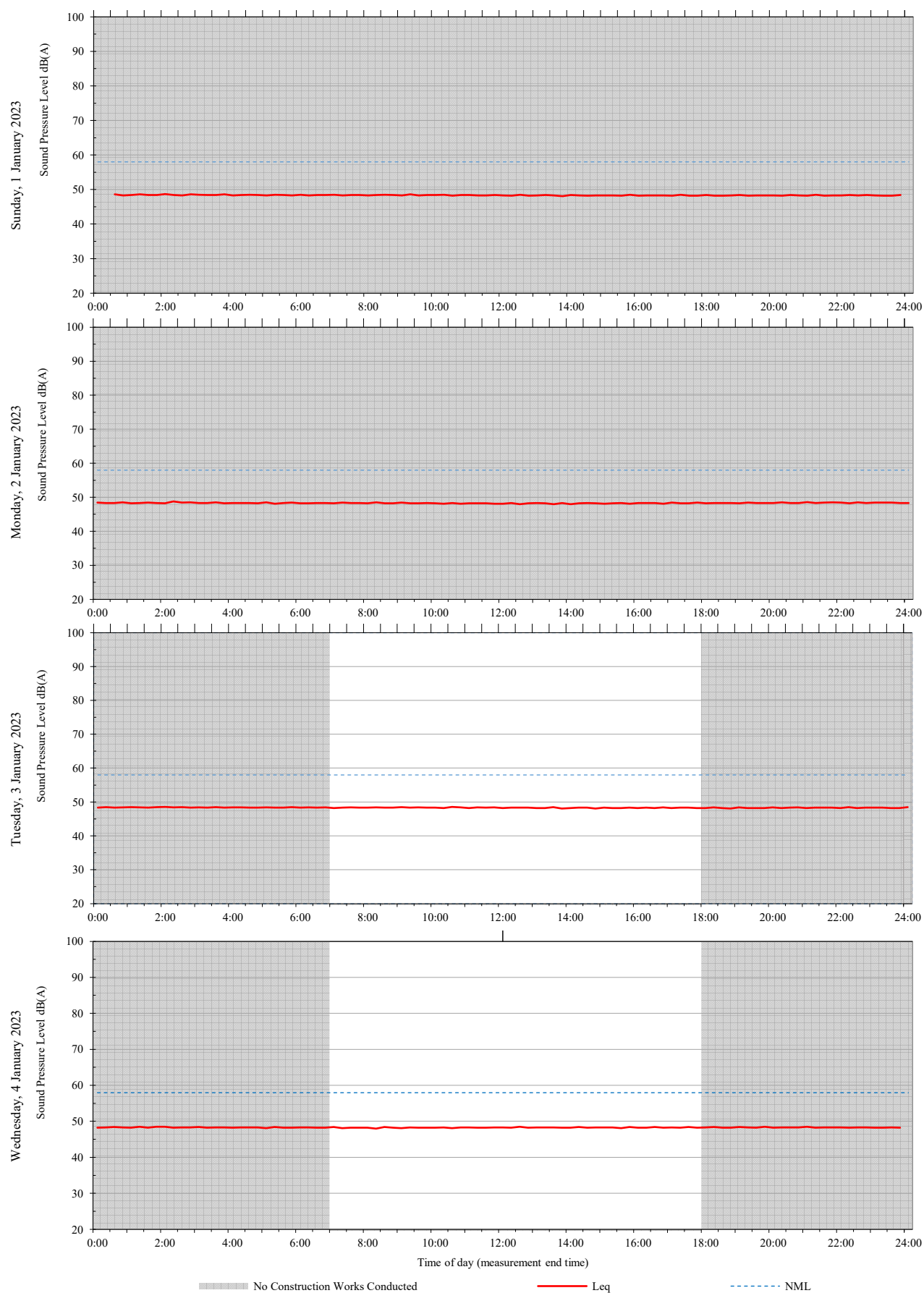
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A4 KR Level 3 Radiation Room 33 RF041 (Westmead 7)

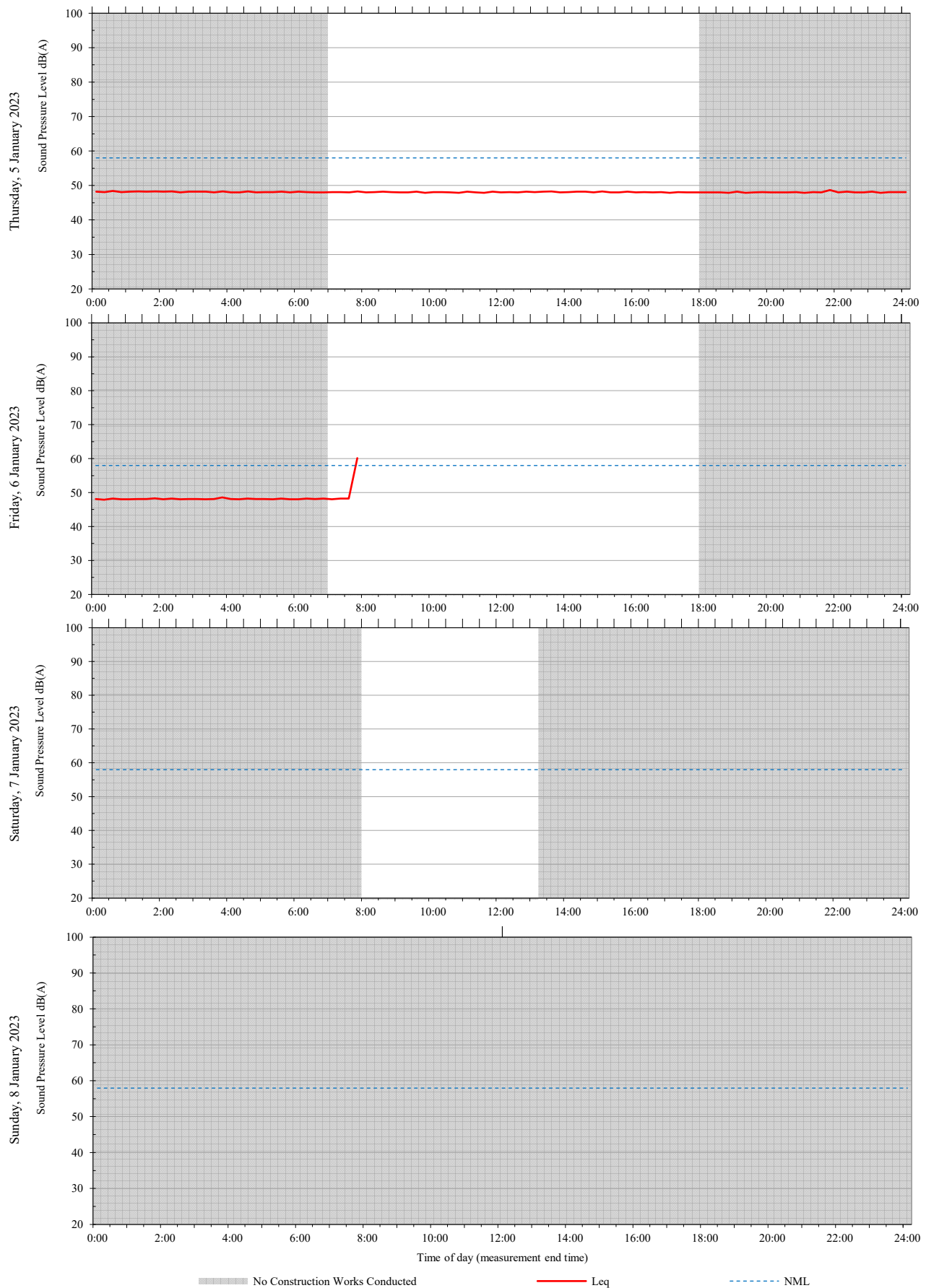
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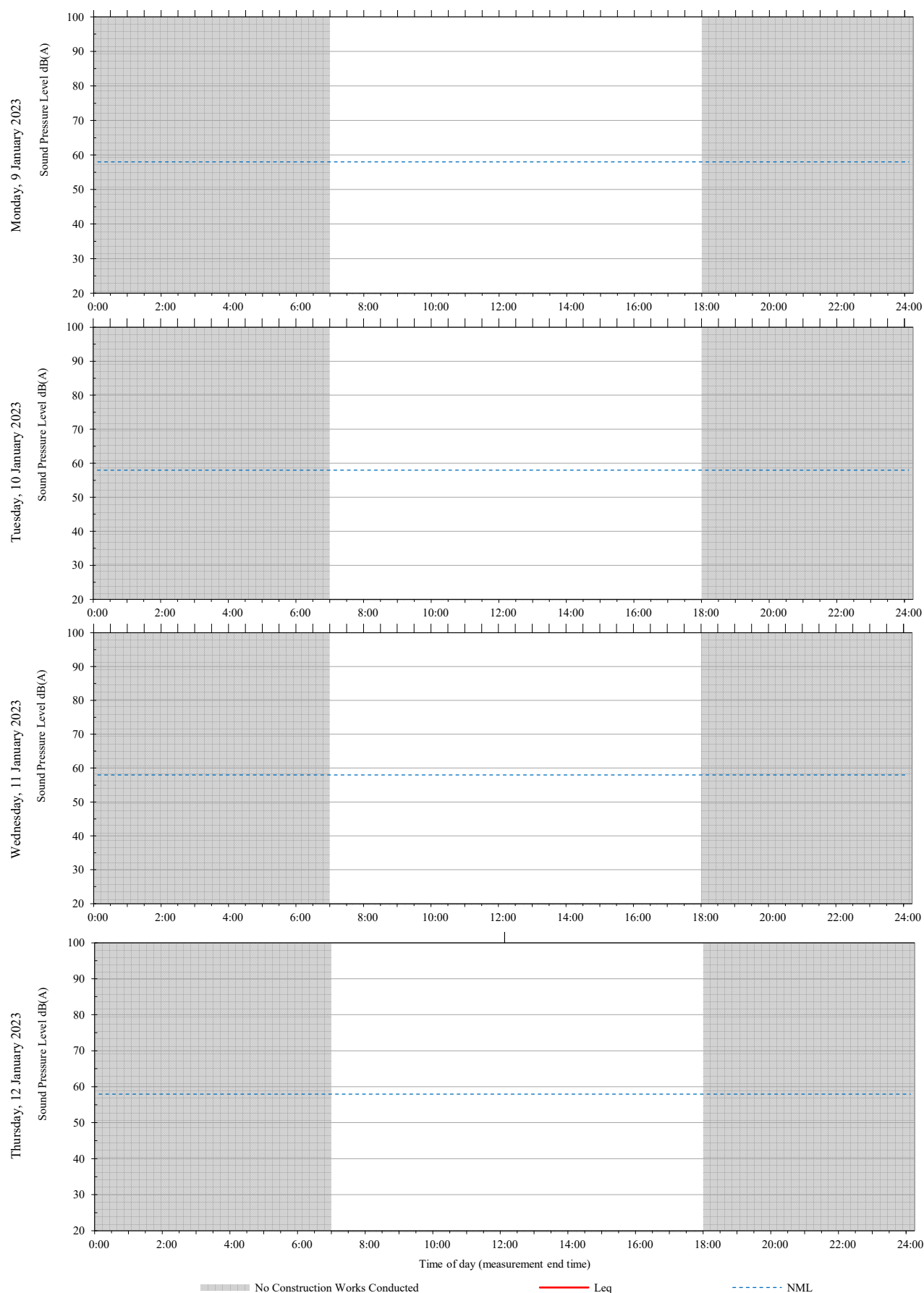
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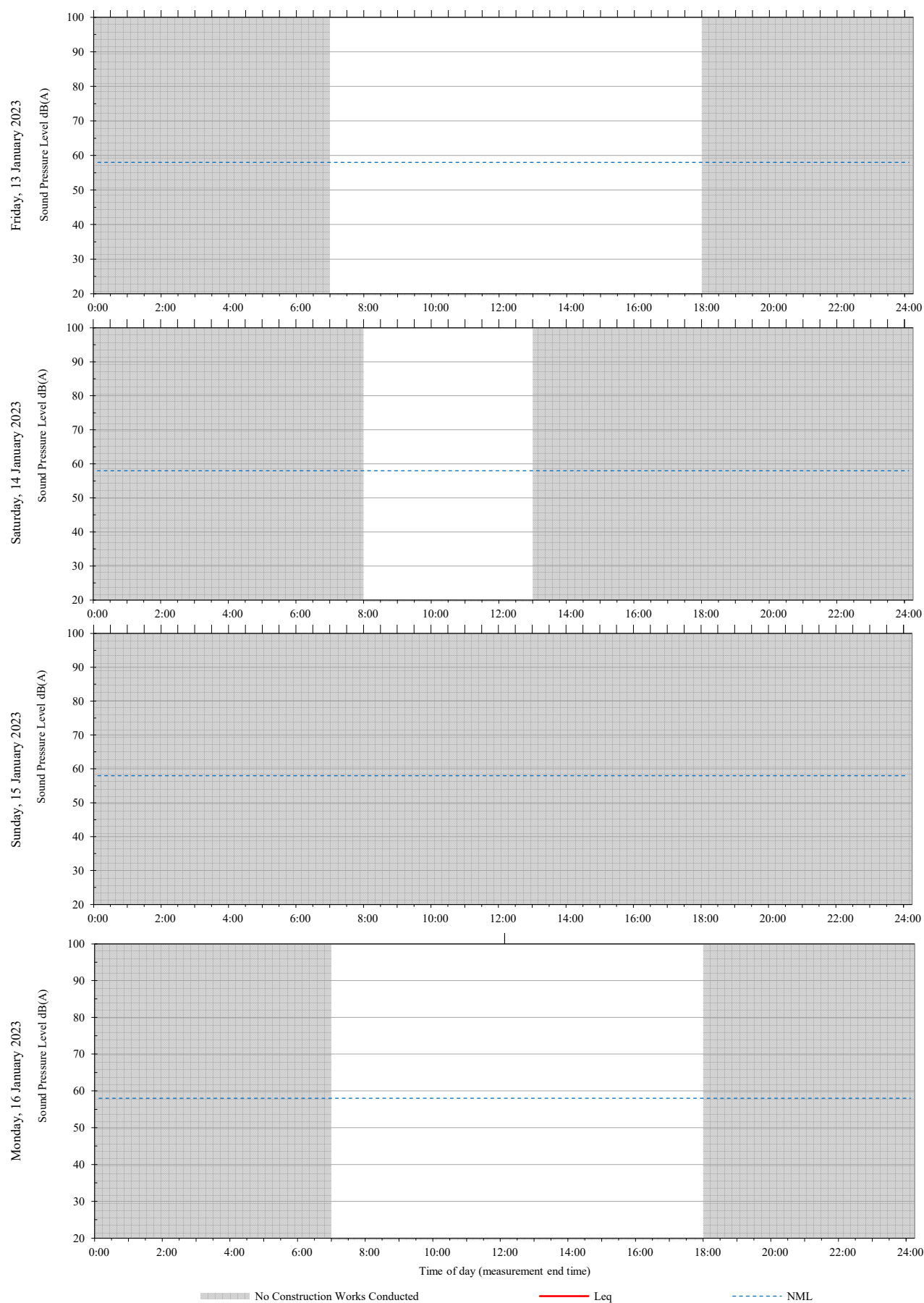
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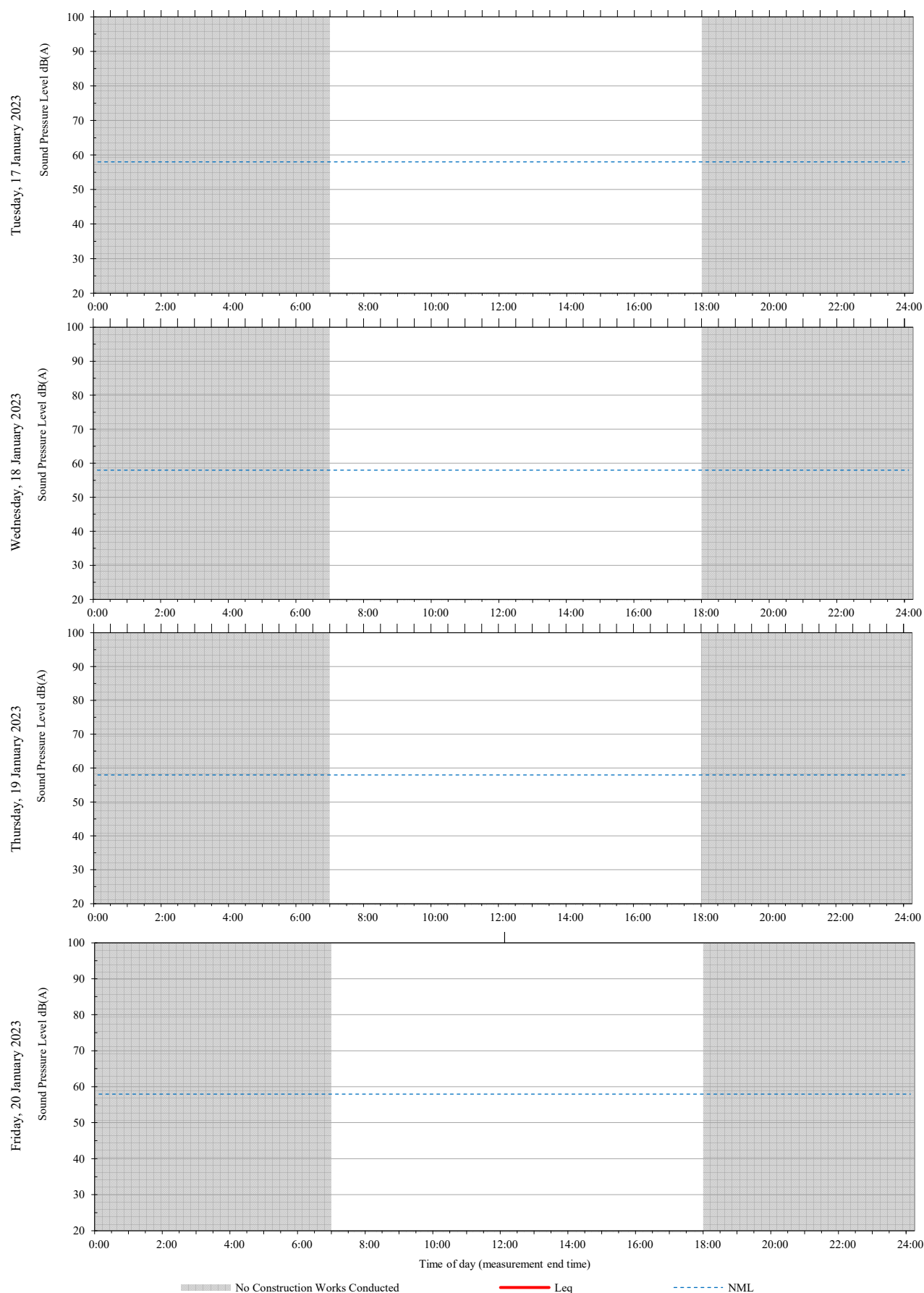
Unattended monitoring: KR Level 3 Radiation Room 33 RF041(Westmead 7) (Internal)

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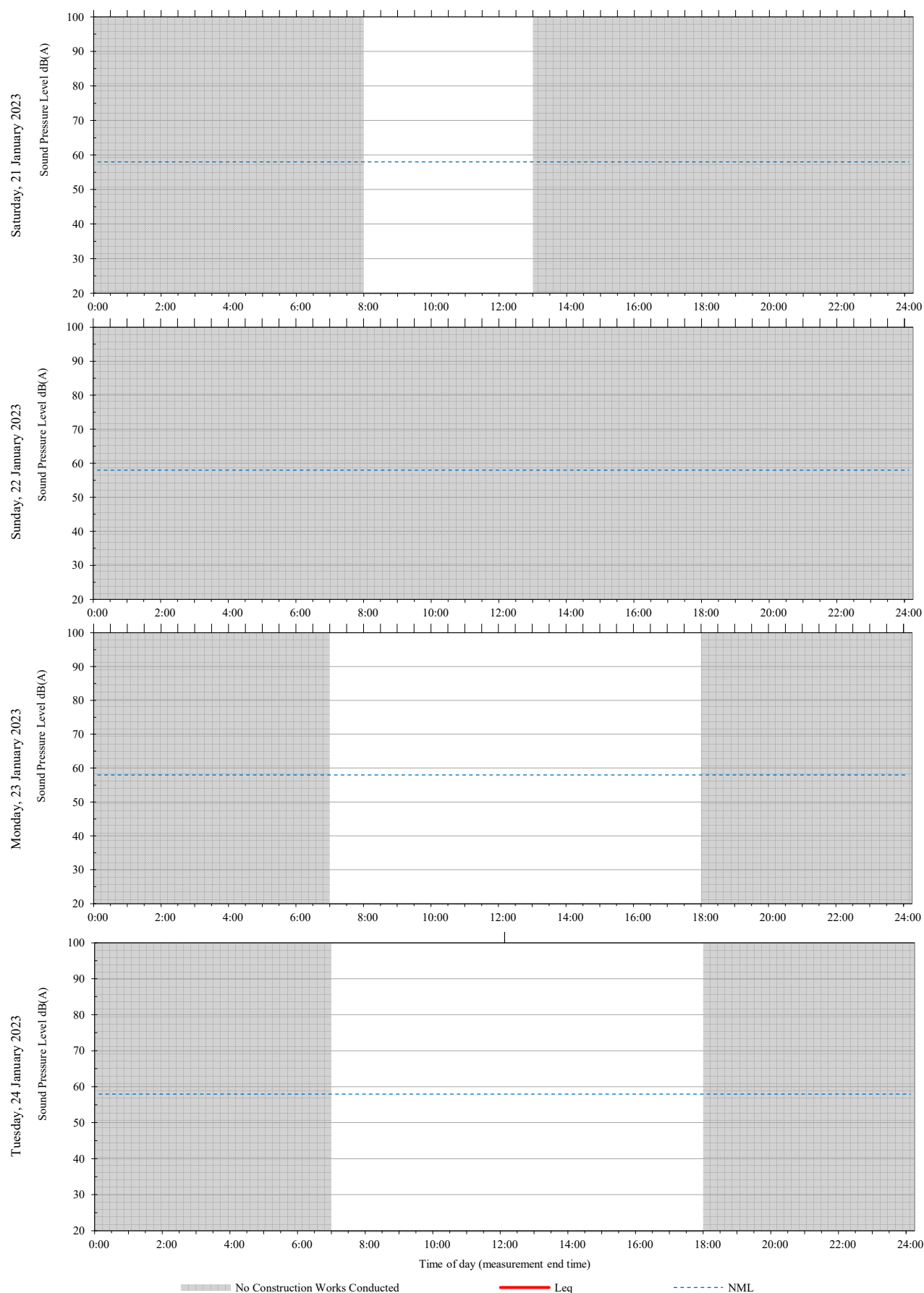
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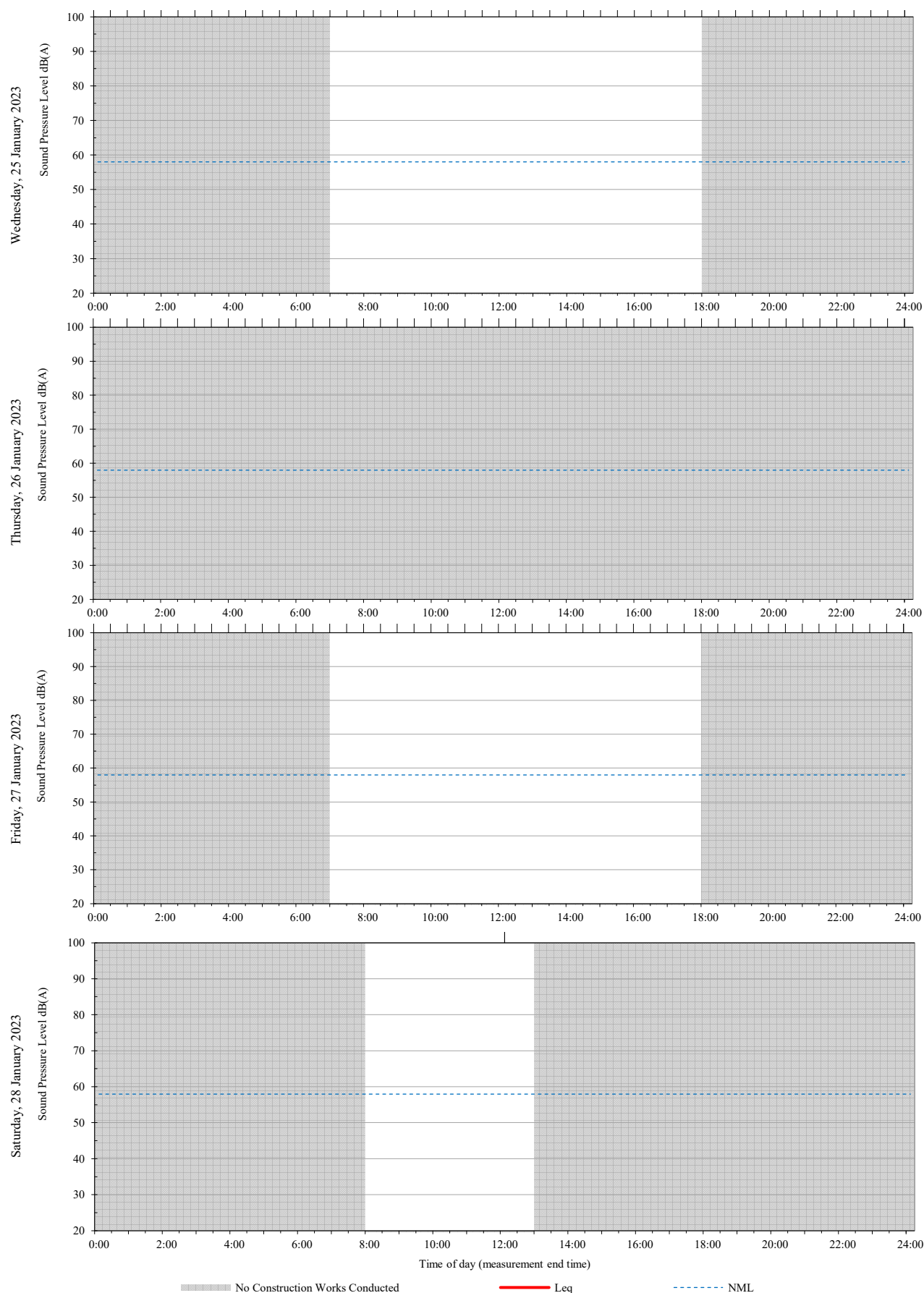
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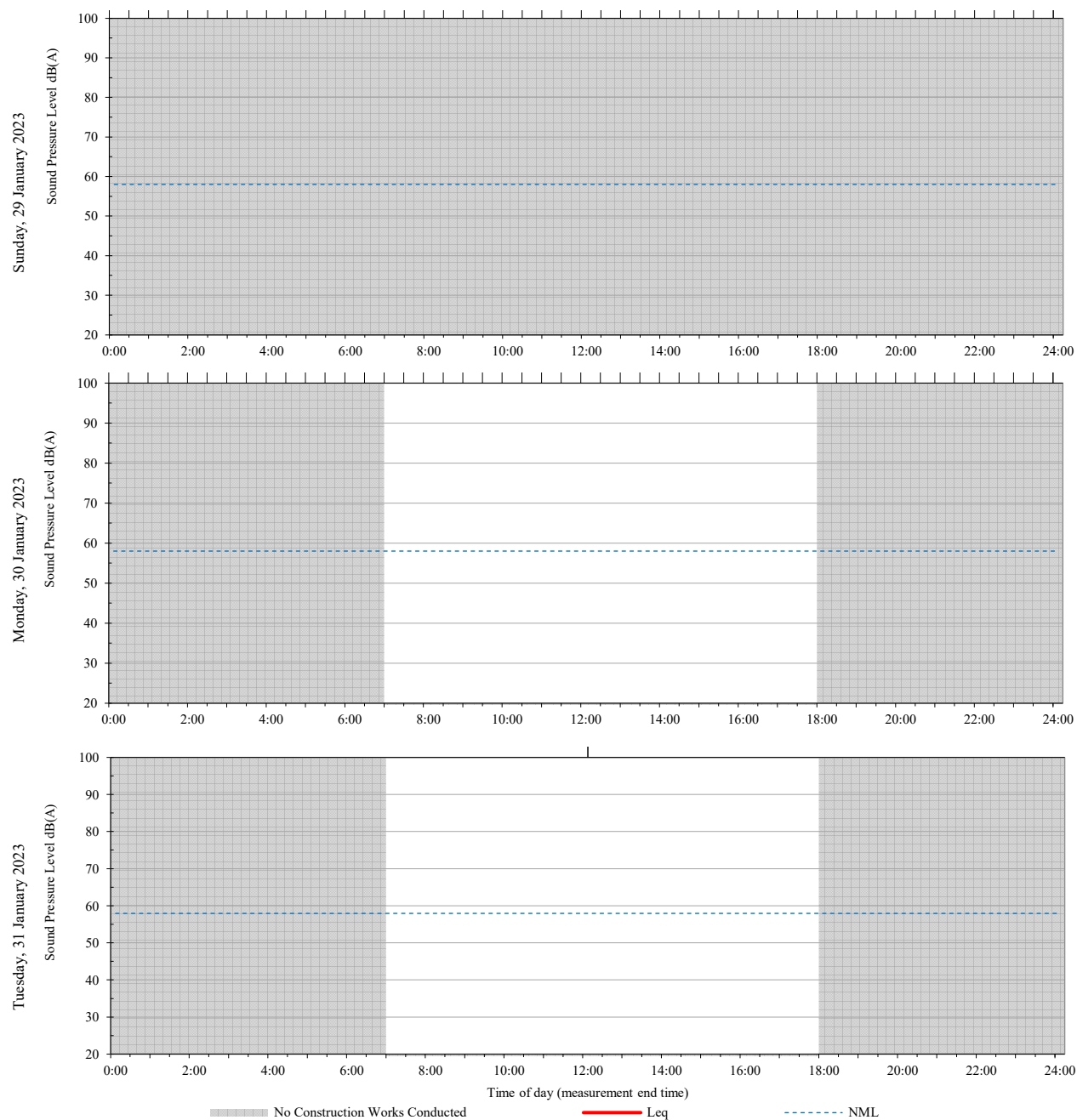
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Unattended monitoring: KR Level 3 Radiation Room 33 RF041(Westmead 7) (Internal)

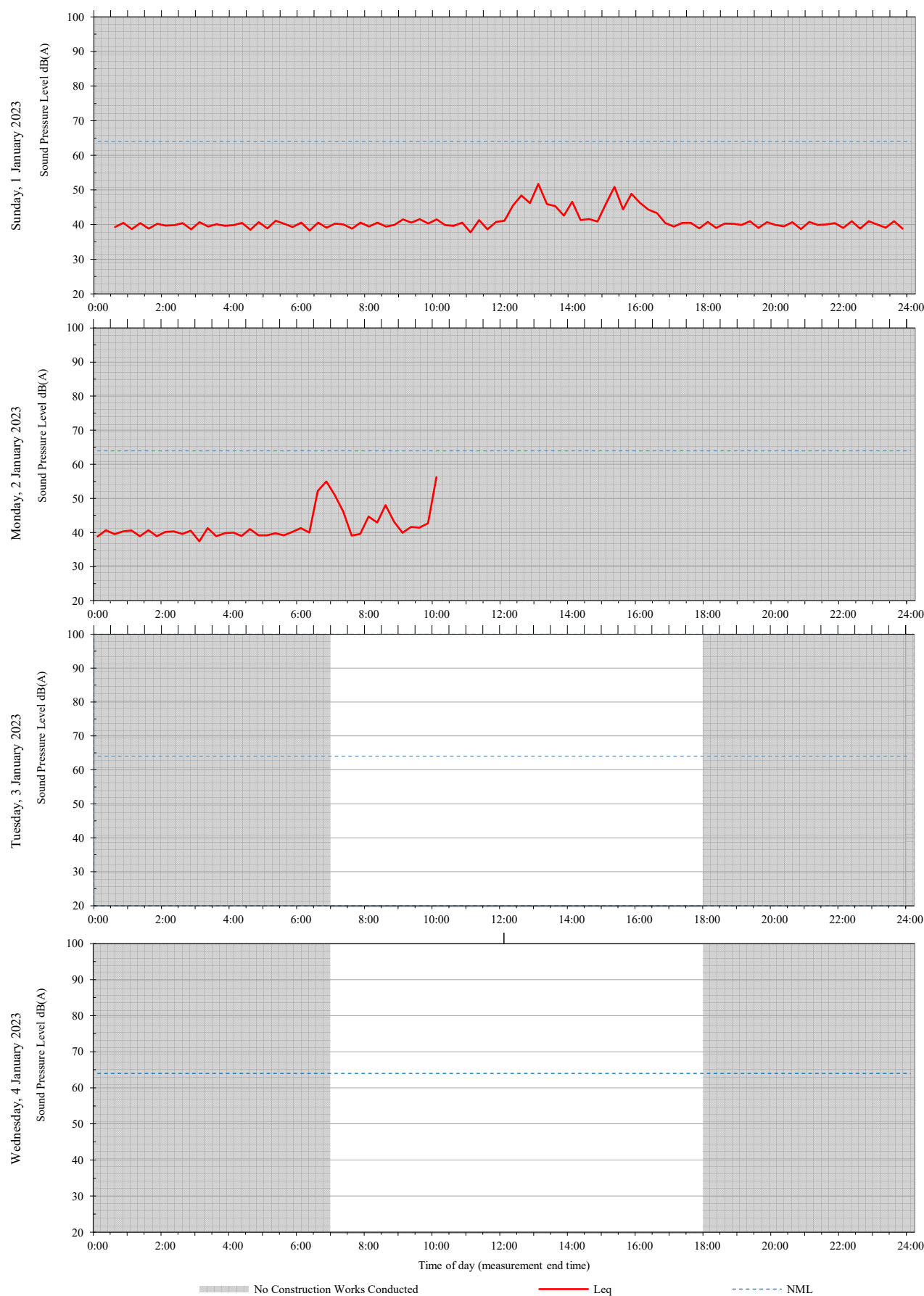
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A5 CHW Level 2 Parent Kitchen 92BW025 (facing MSCP site) (Westmead 2)

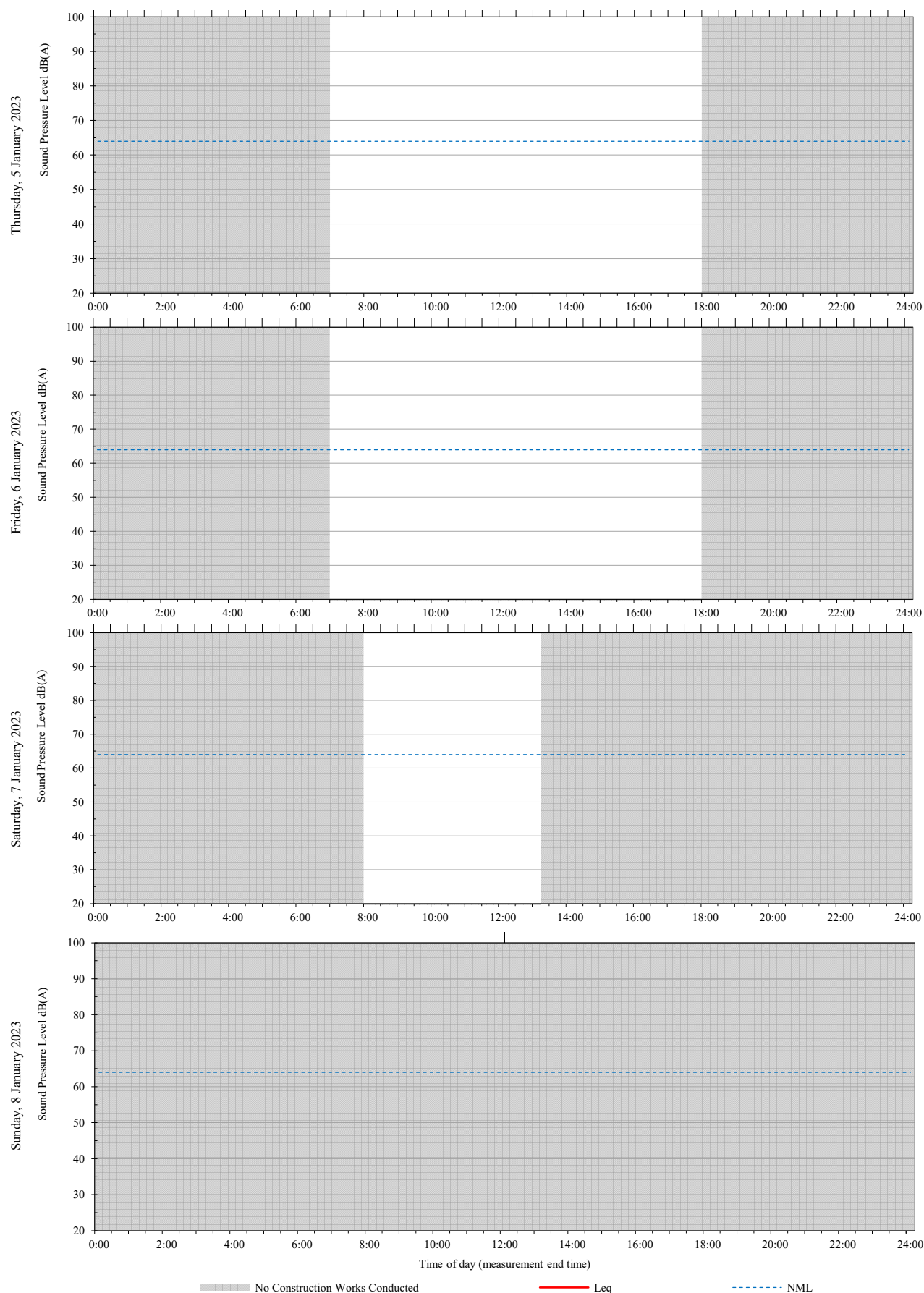
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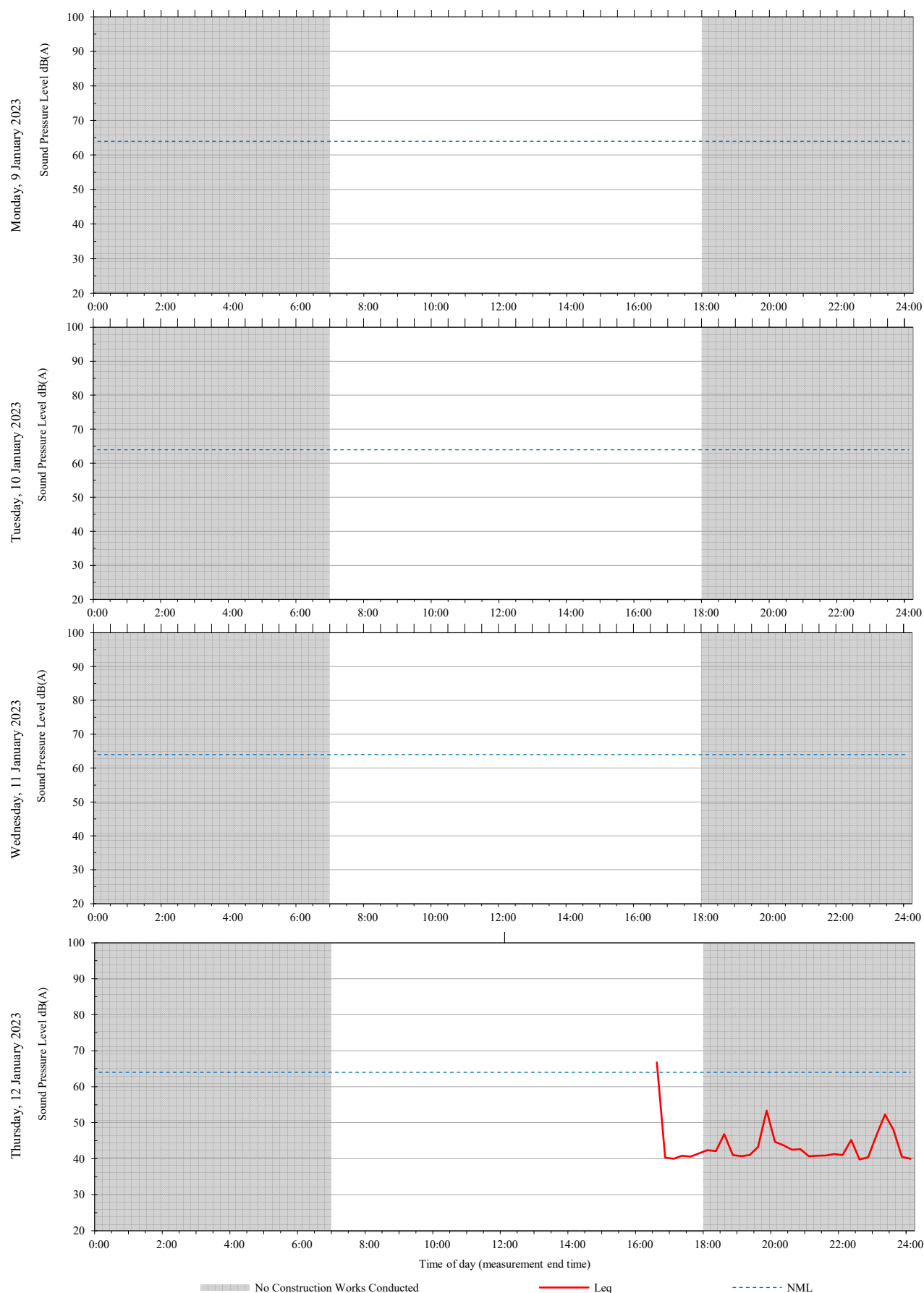
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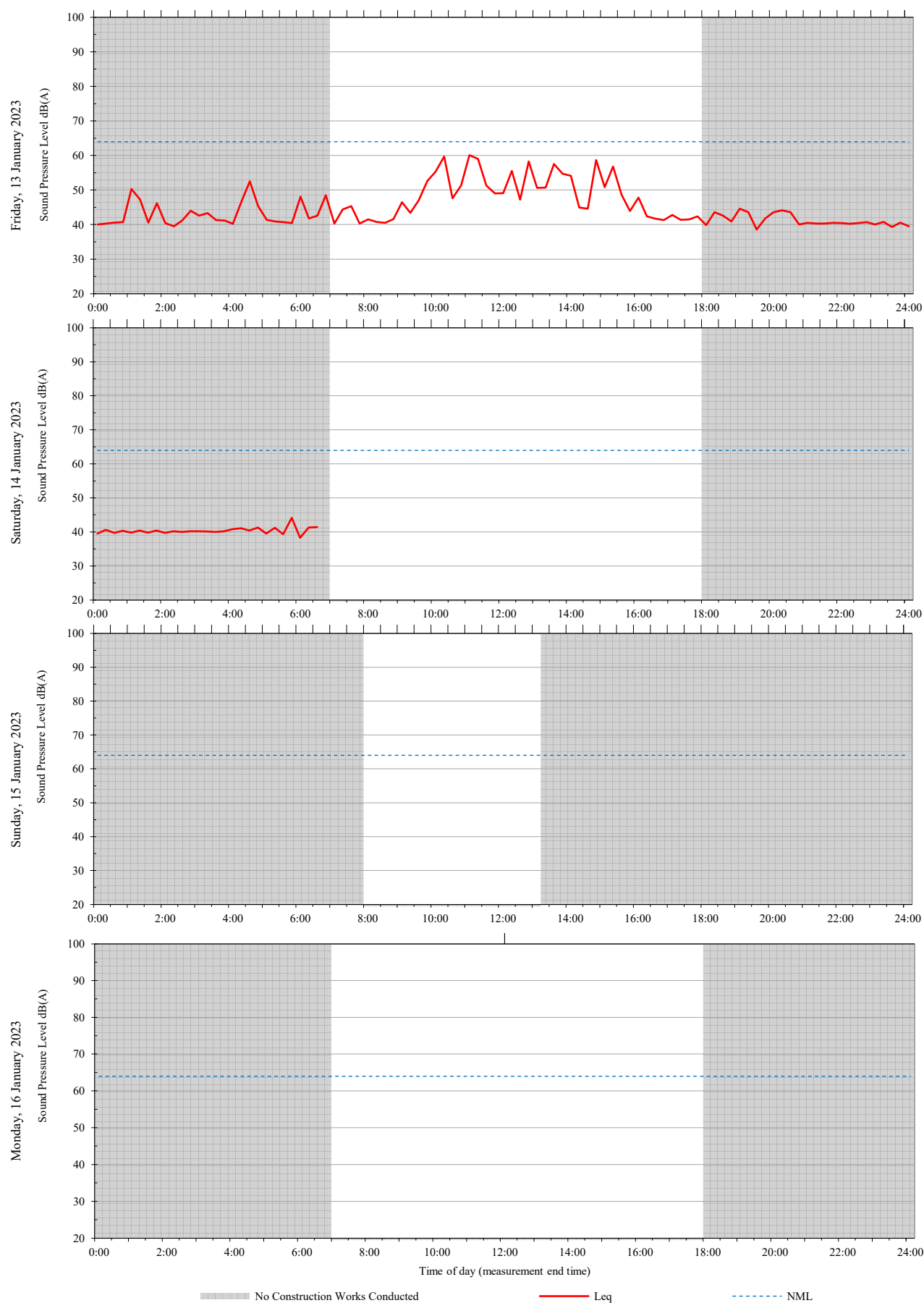
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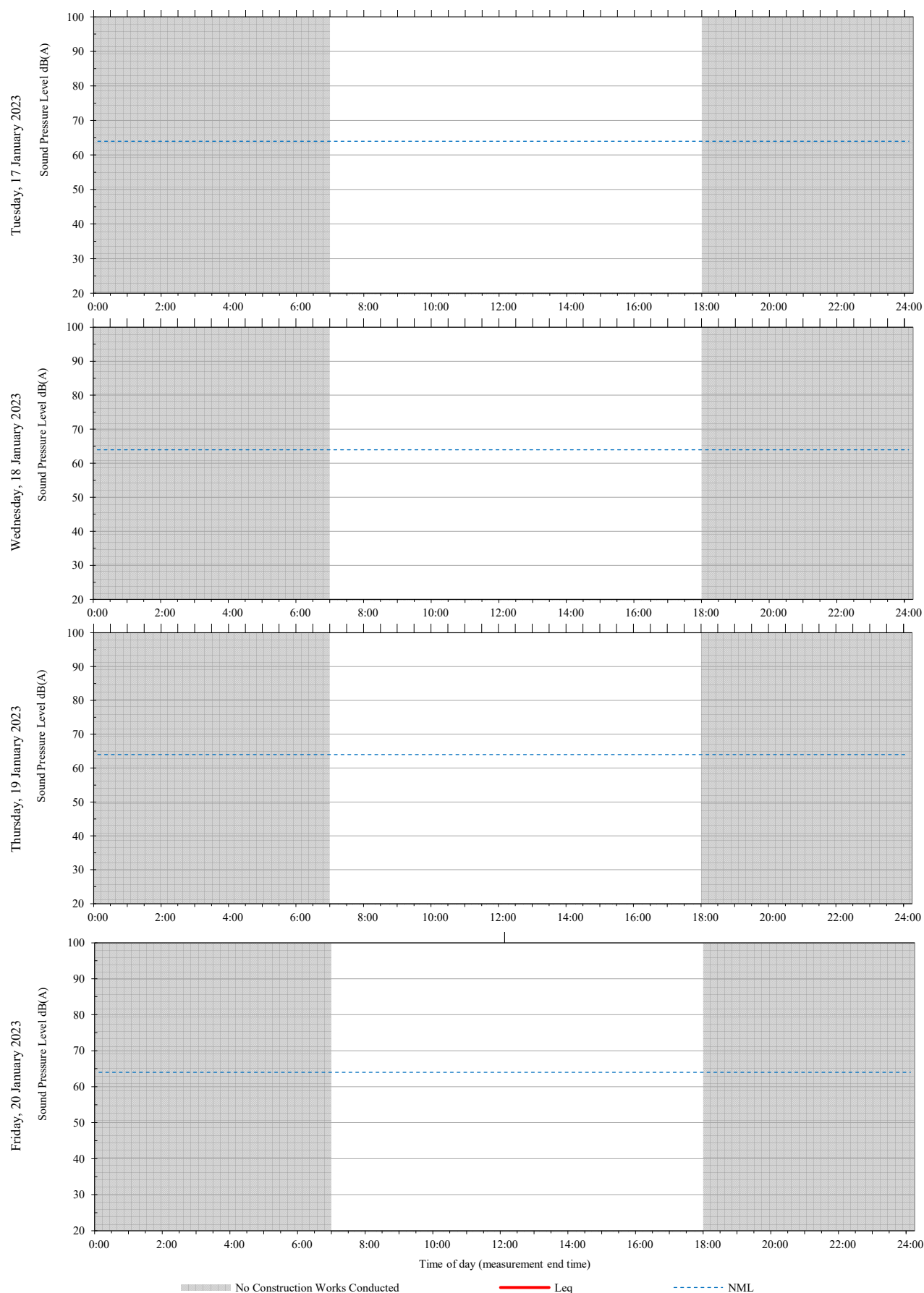
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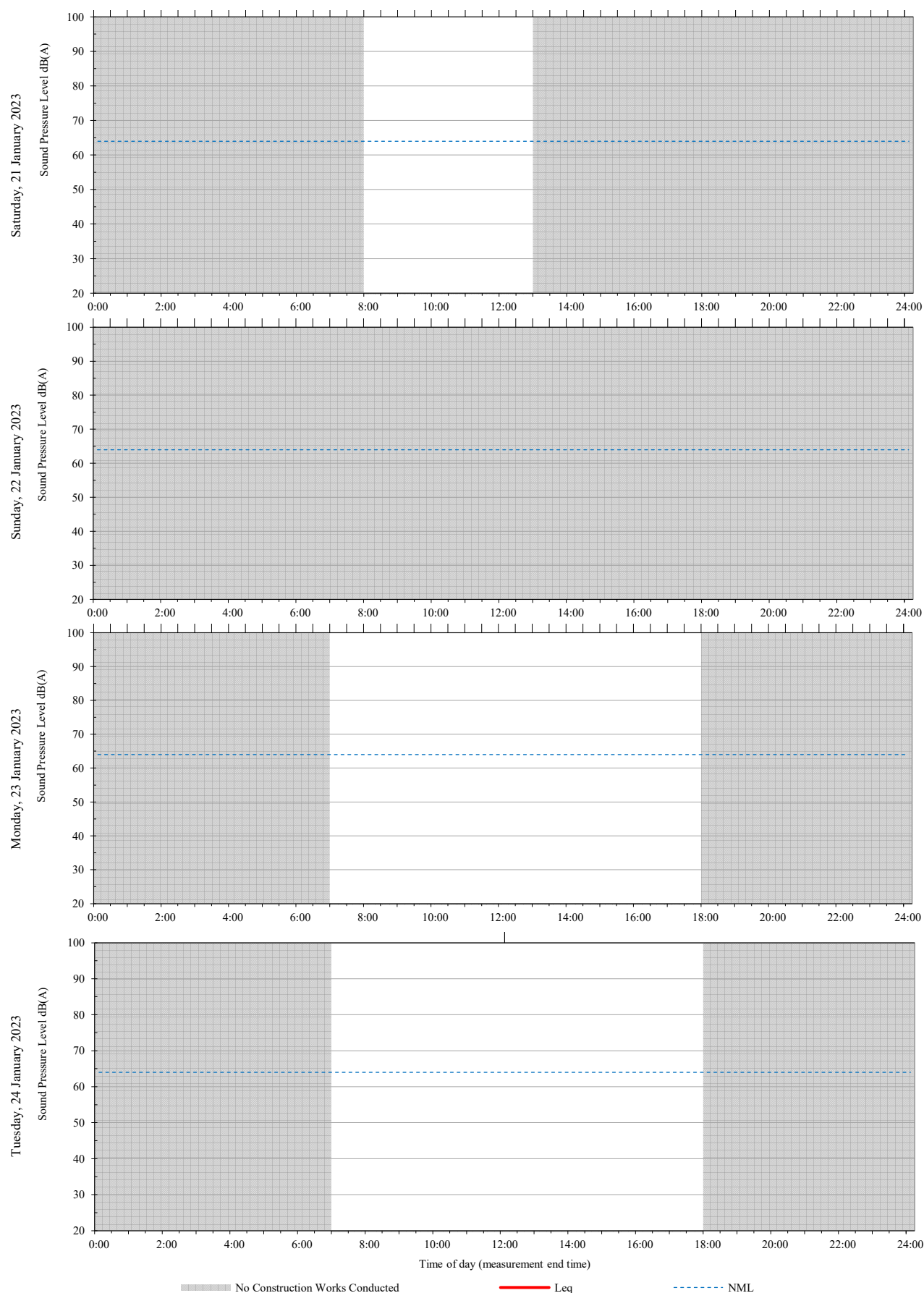
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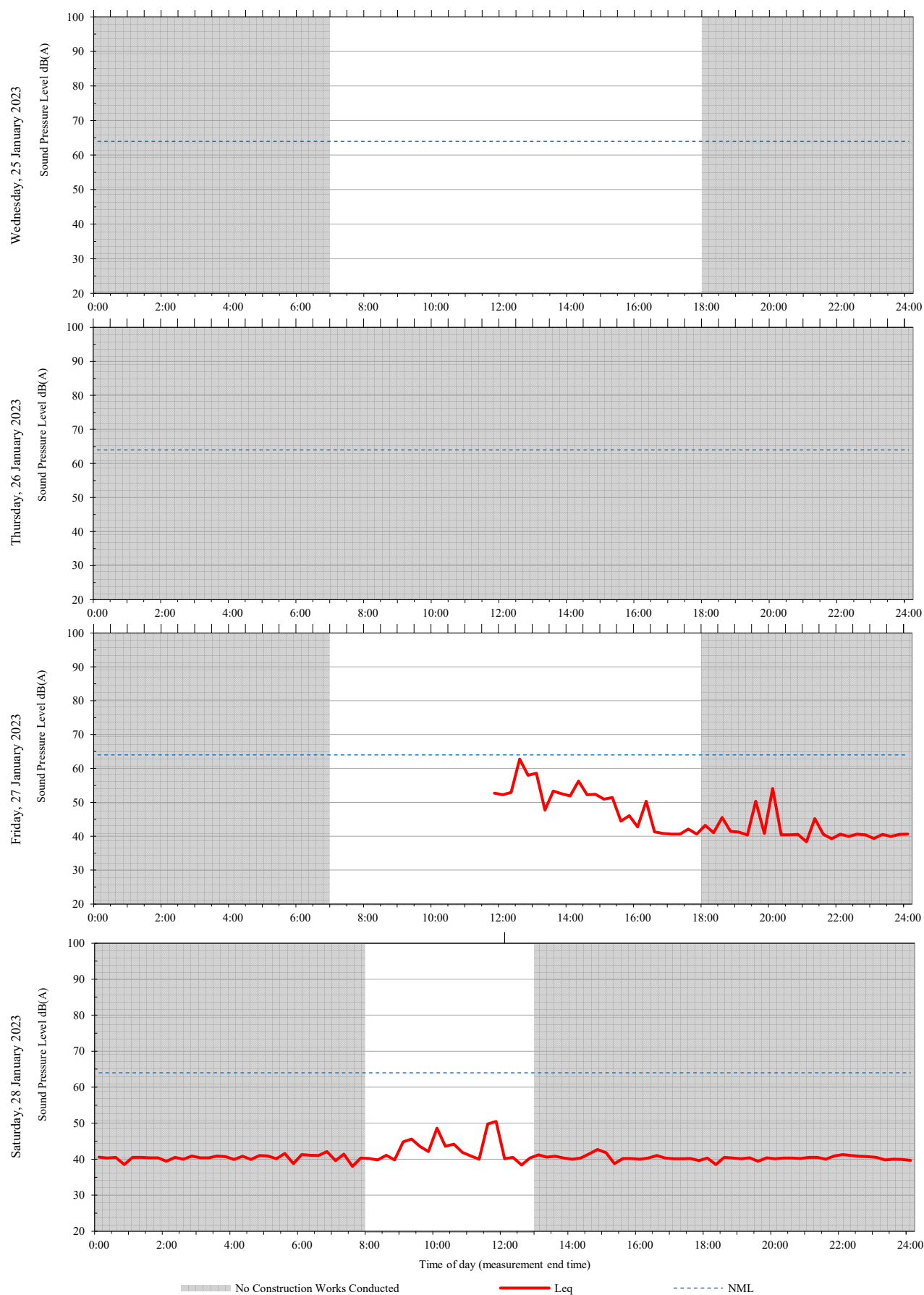
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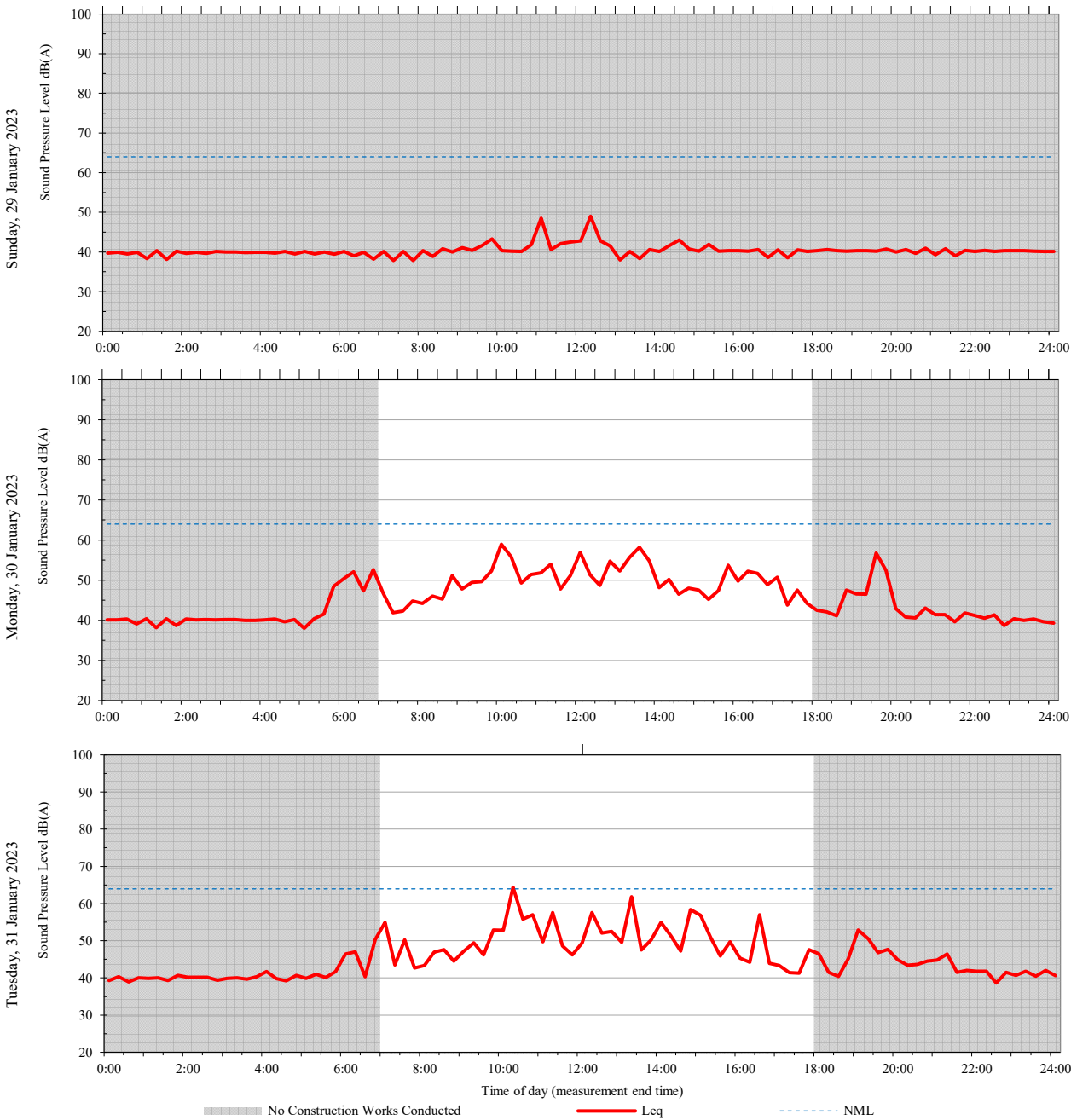
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Unattended monitoring: CHW Level 2 Parent Kitchen 92BW025 (Internal)

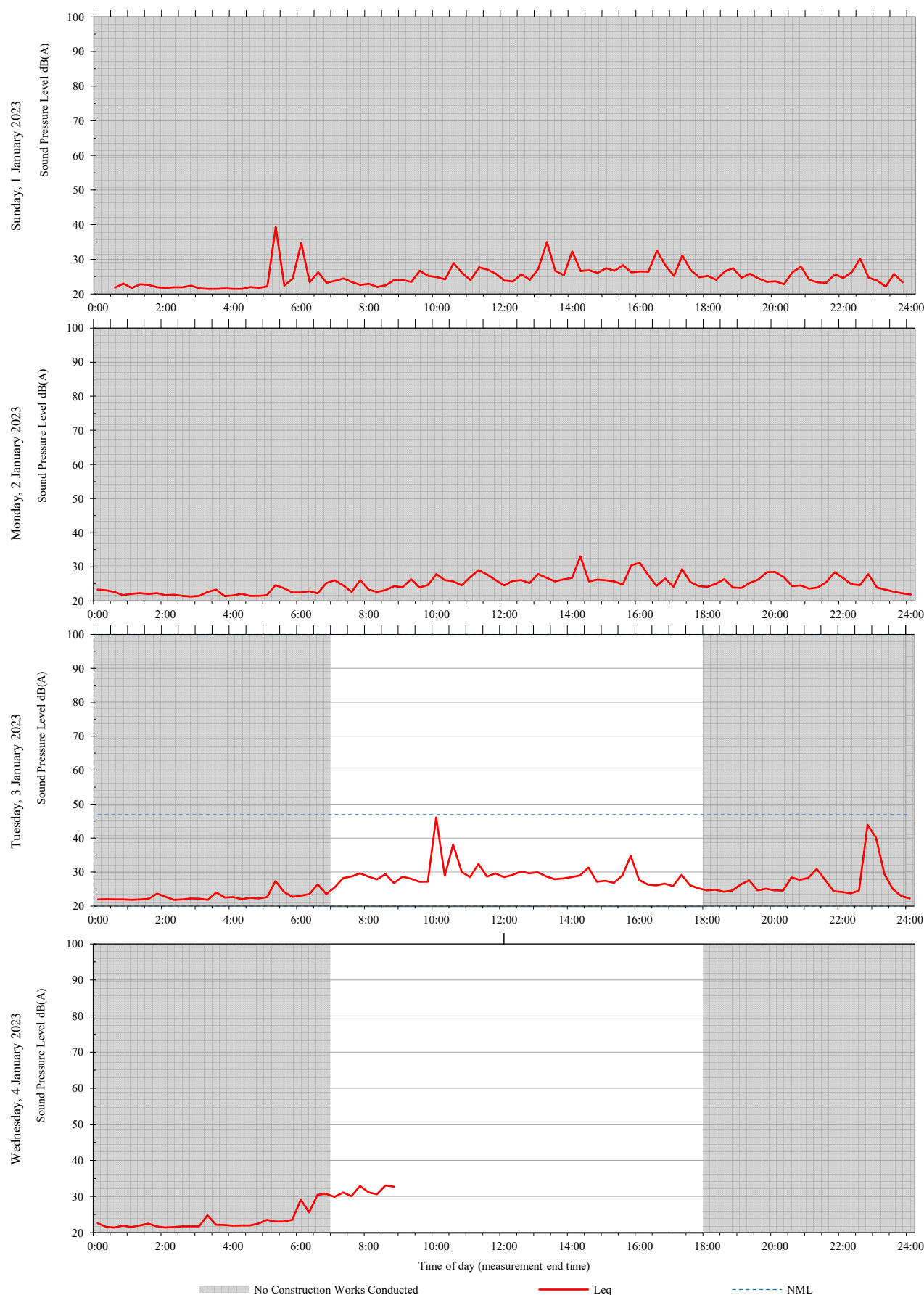
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A6 RMH Level 1 Store Room 101 (Westmead 3)

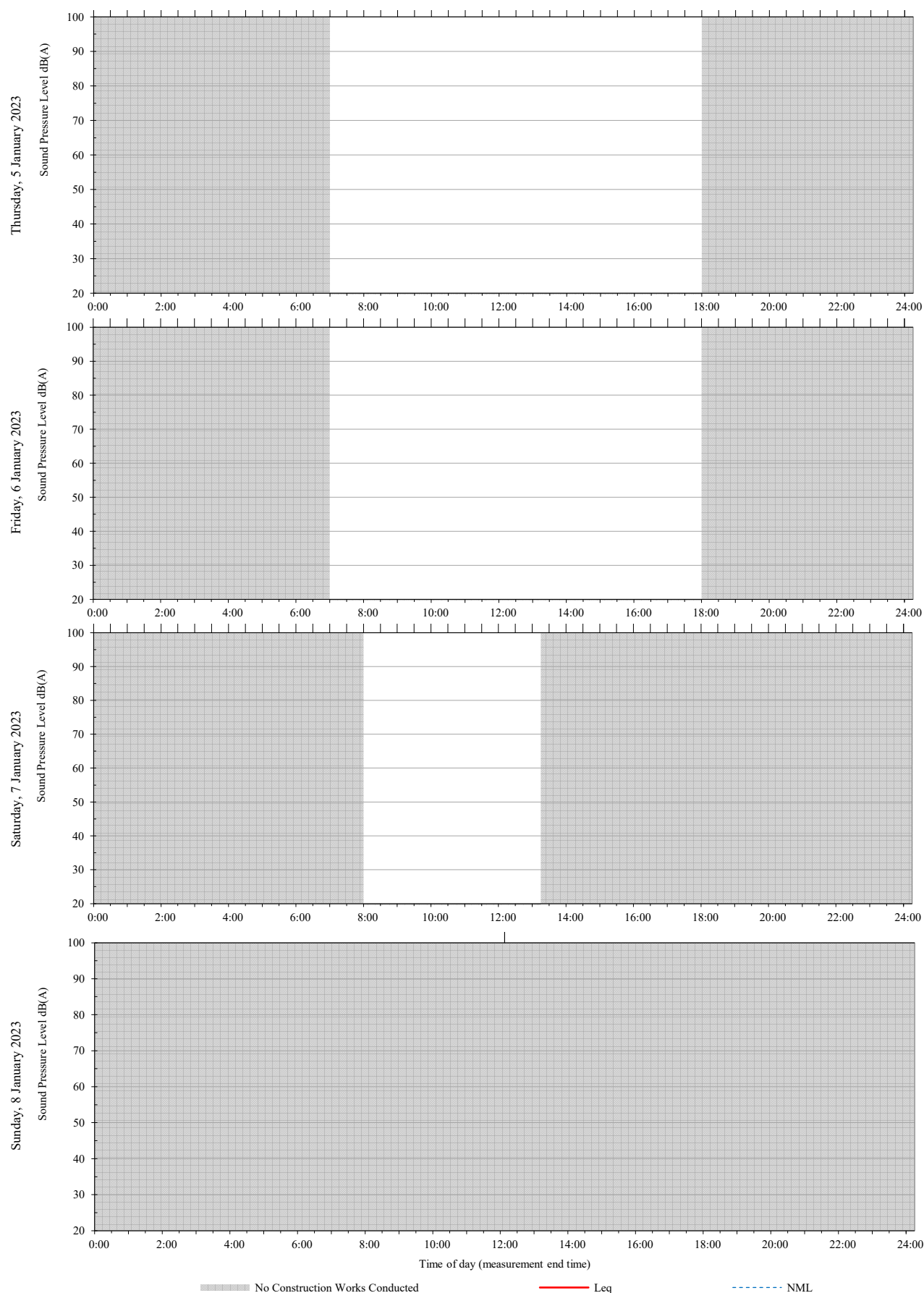
Unattended monitoring: RMH Level 1 Store Room 101 (facing MSCP site)- Westmead 3 (Internal)

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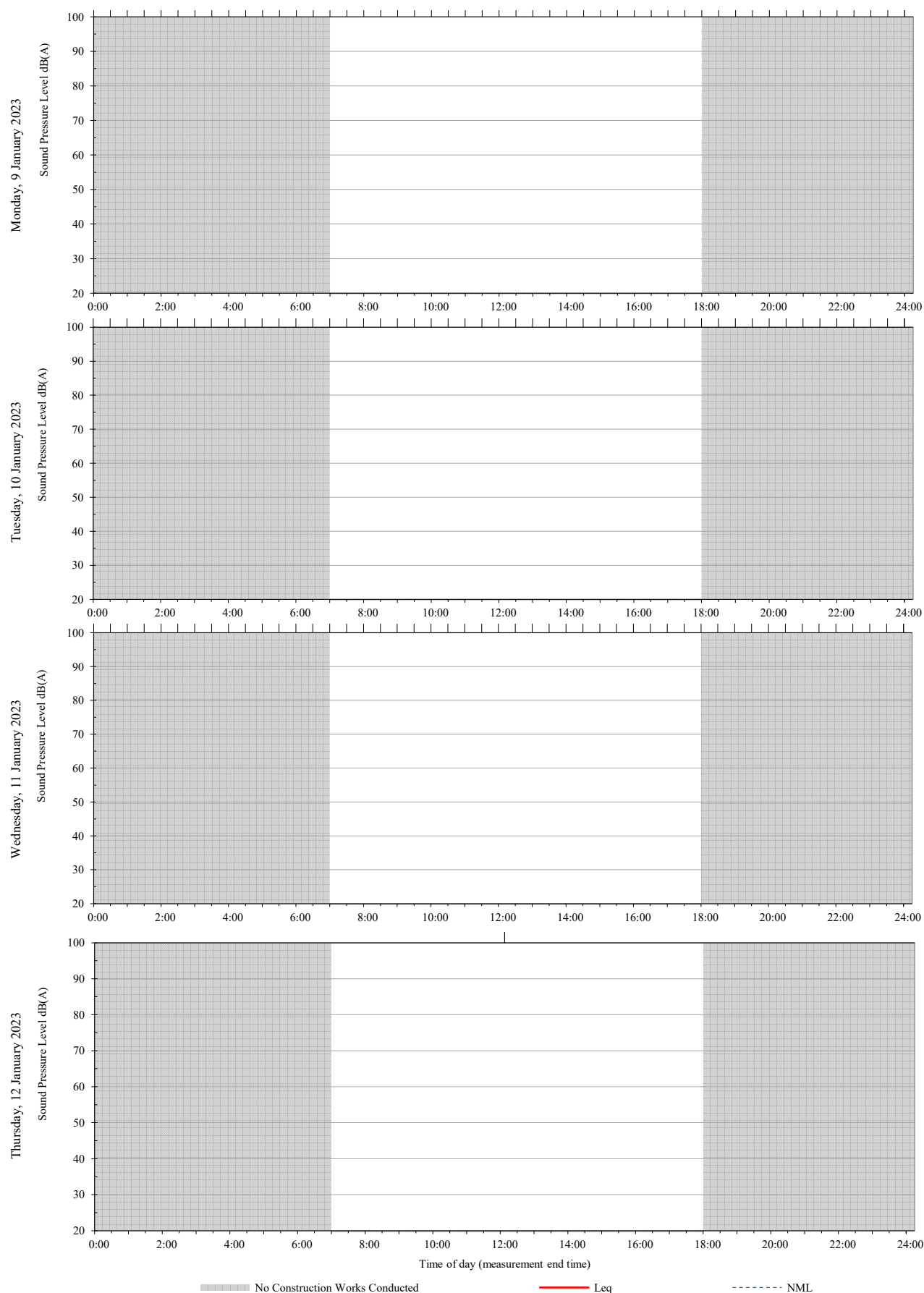
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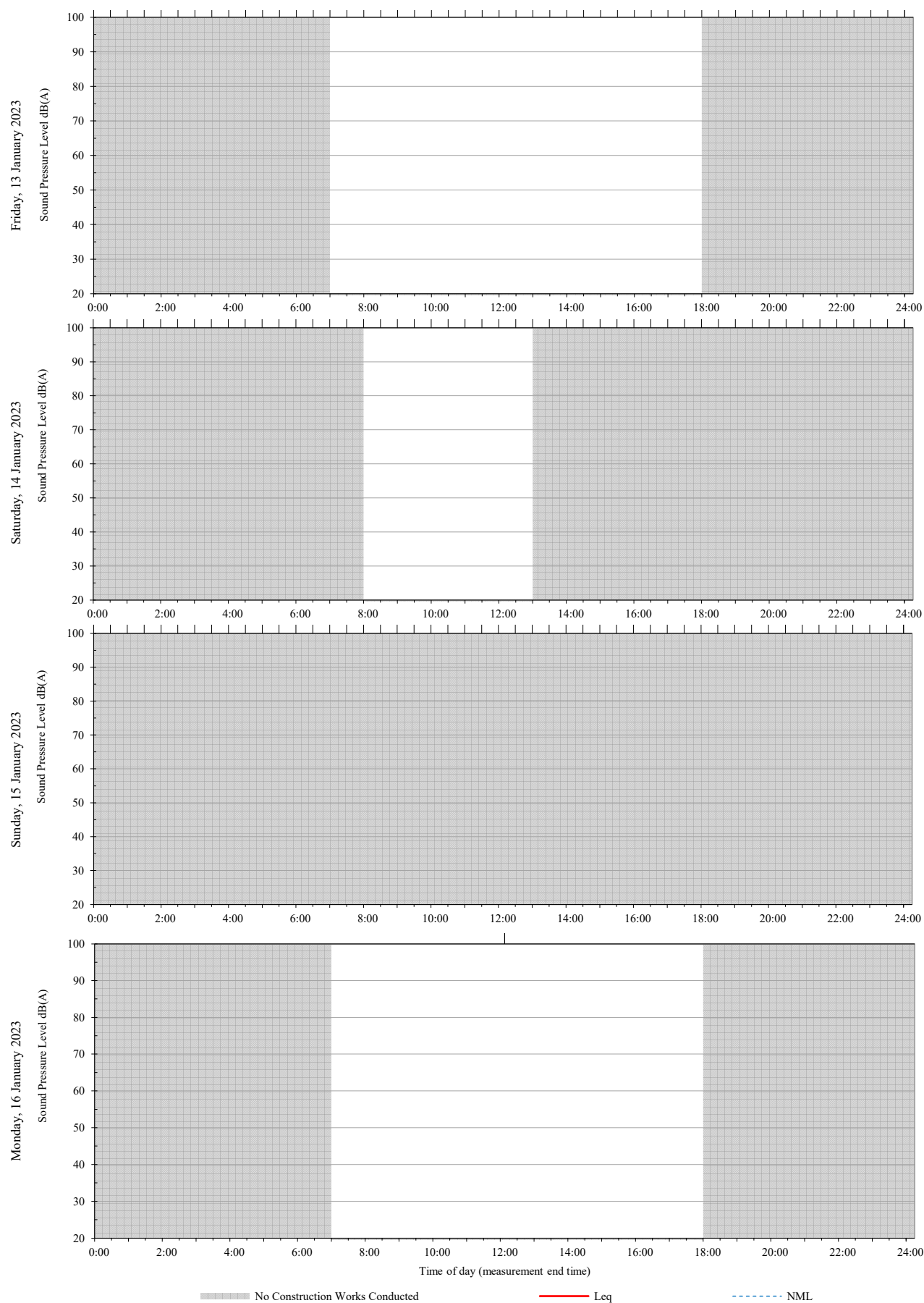
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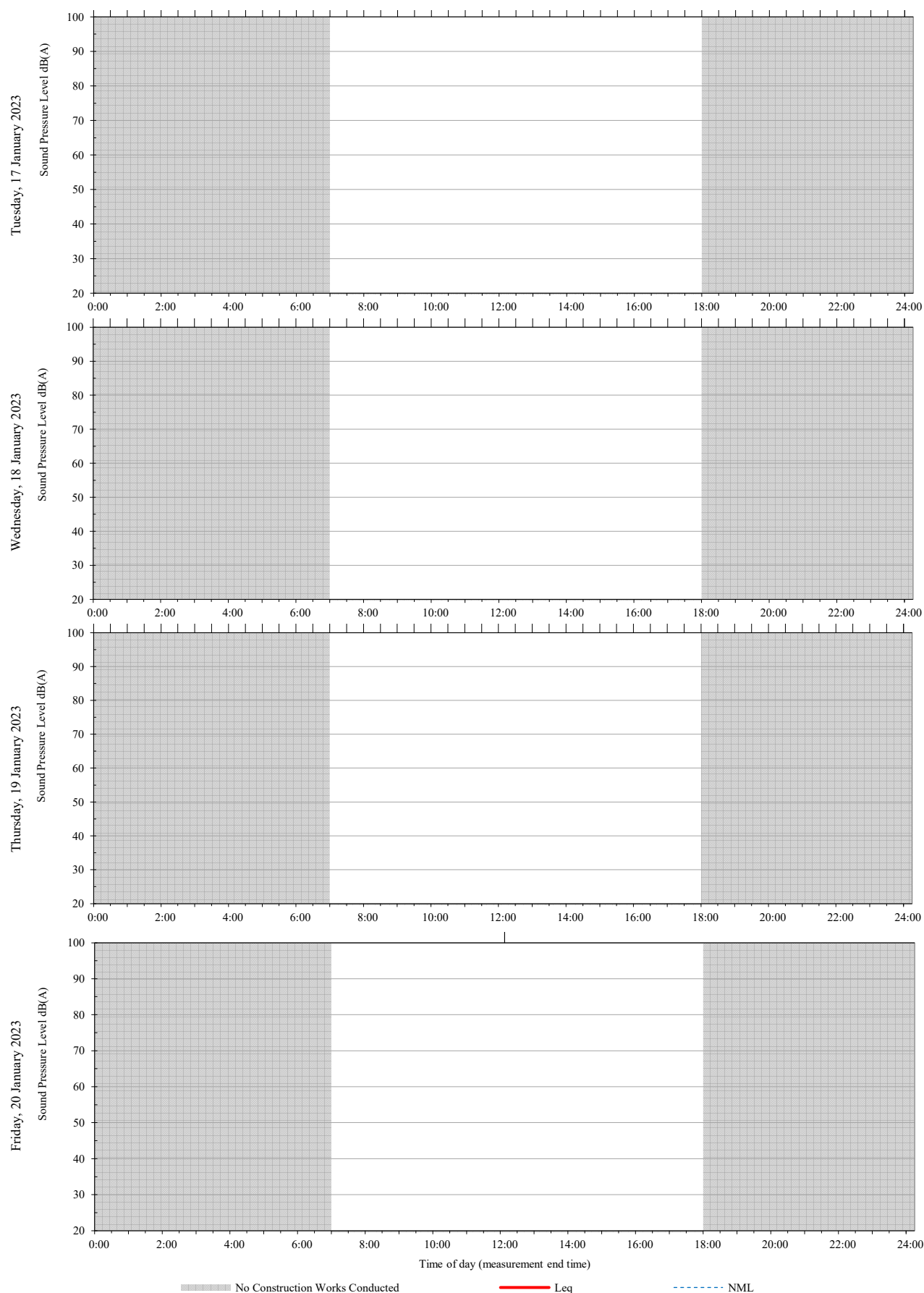
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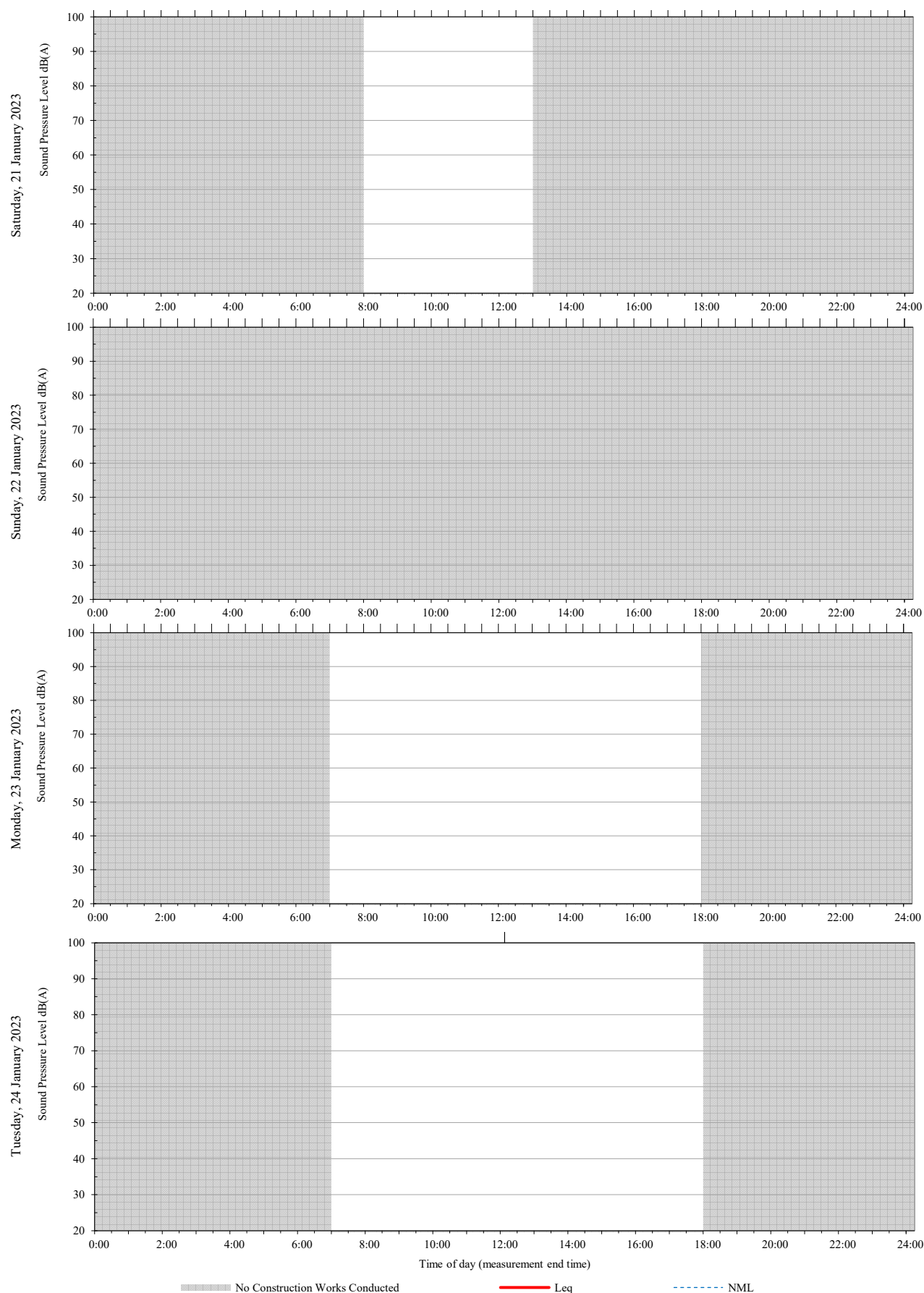
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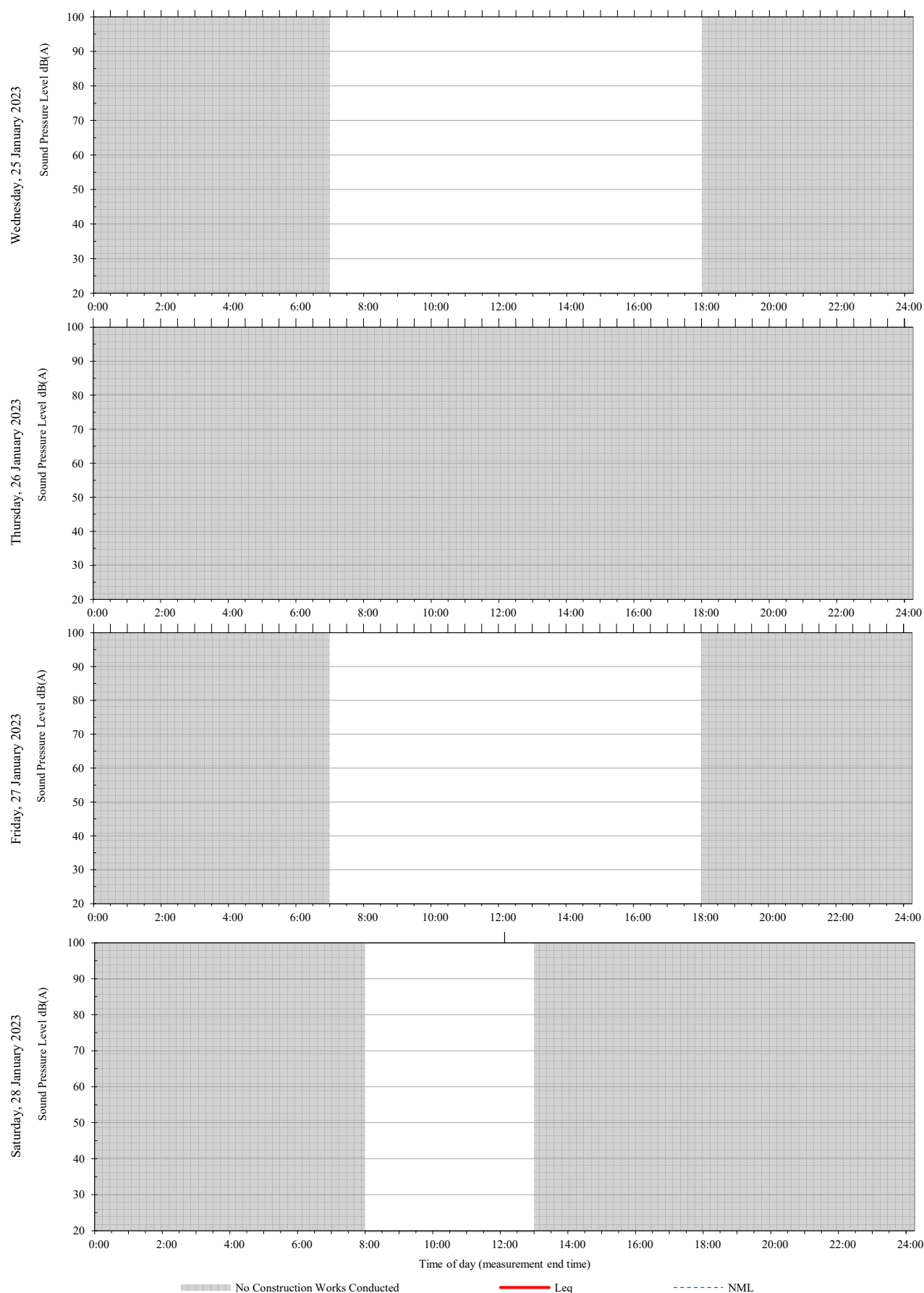
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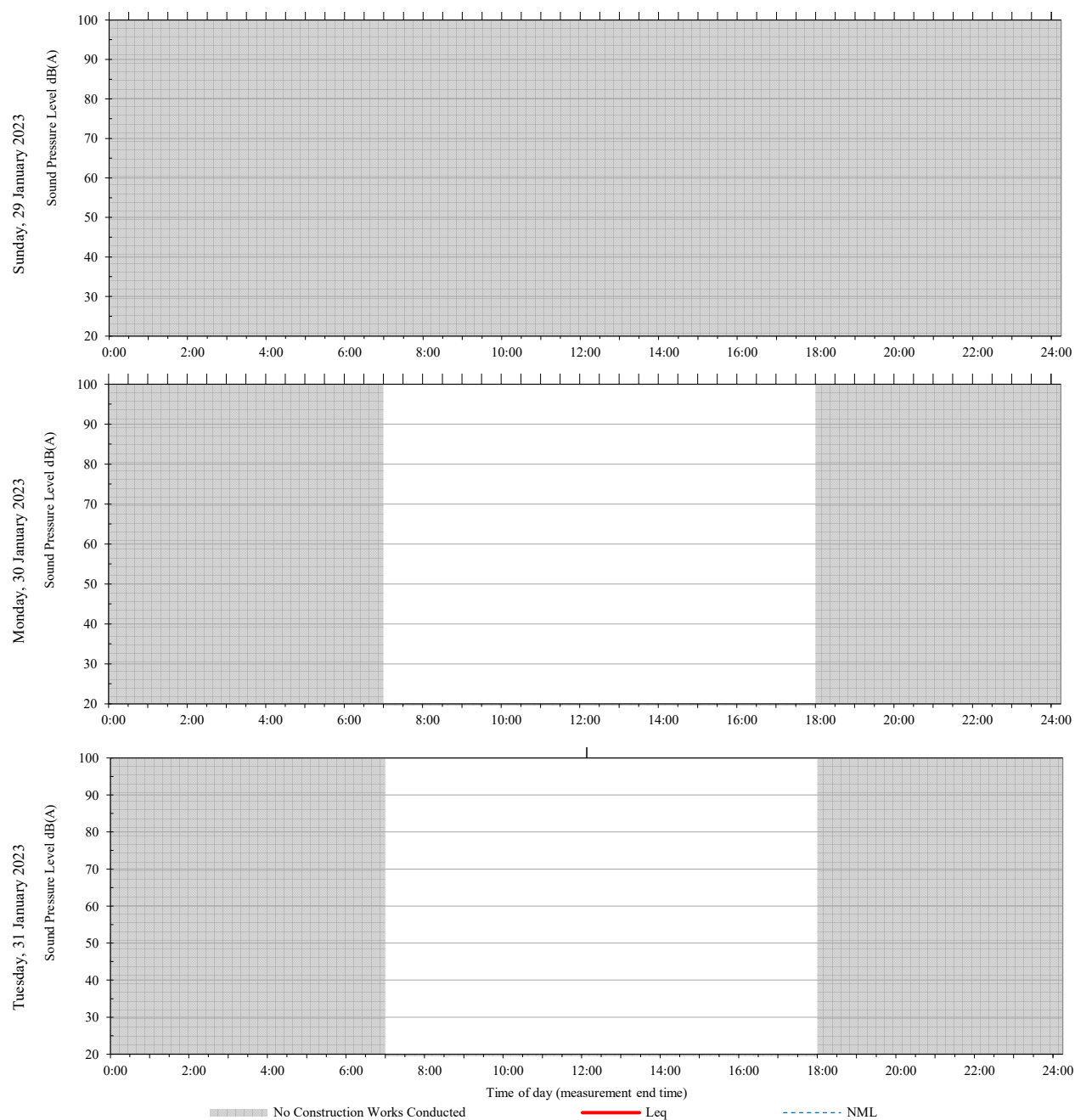
Unattended monitoring: RMH Level 1 Store Room 101 (facing MSCP site)- Westmead 3 (Internal)

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Unattended monitoring: RMH Level 1 Store Room 101 (facing MSCP site)- Westmead 3 (Internal)

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Health Infrastructure

Children's Hospital Westmead

**Vibration Monitoring - KR - Animal
House - January 2023**

CVM/ KR/202301

Issue 1 | 07/02/2023

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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File reference -

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		Name			
		Signature			

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Executive Summary

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

RMSV Vibration Levels

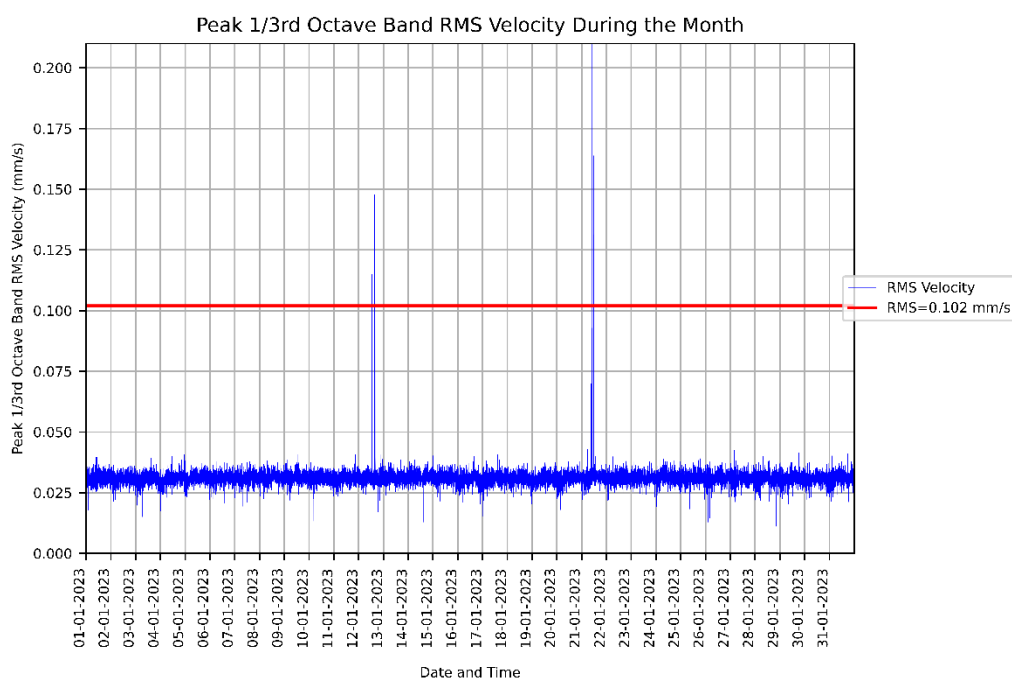


Figure 1: Measured RMSV vibration levels for 01/01/2023 to 31/01/2023 at the KR - Animal House.

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
14	0

PPV Vibration Levels

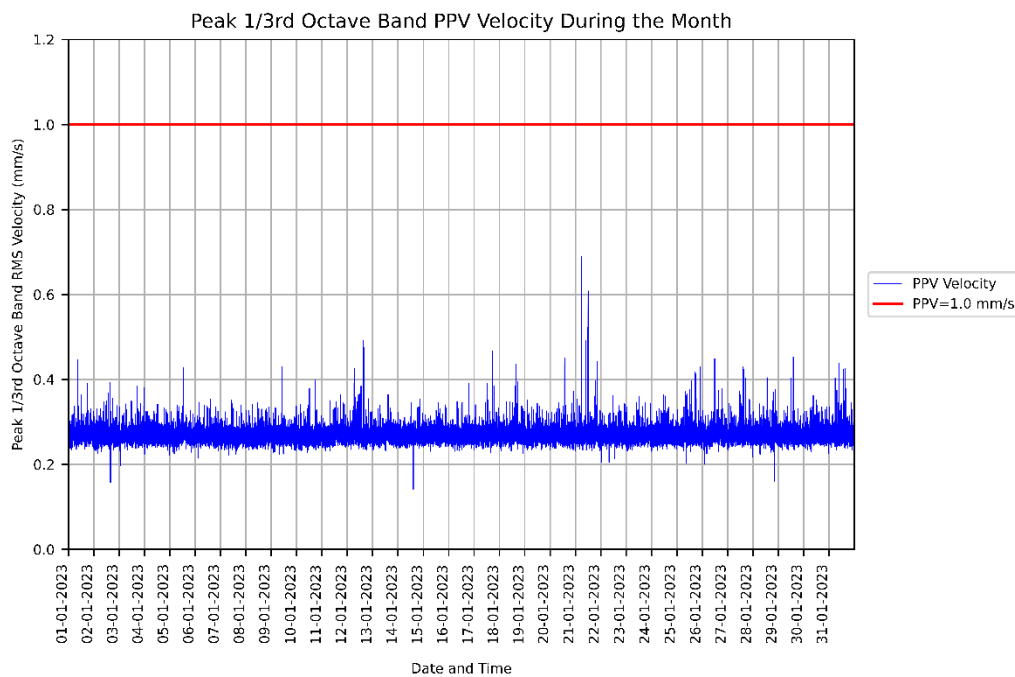


Figure 2: Measured vibration levels for 01/01/2023 to 31/01/2023 at the KR - Animal House.

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	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 KR - Animal House during the period of the 01/01/2023 to 31/01/2023.

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 .

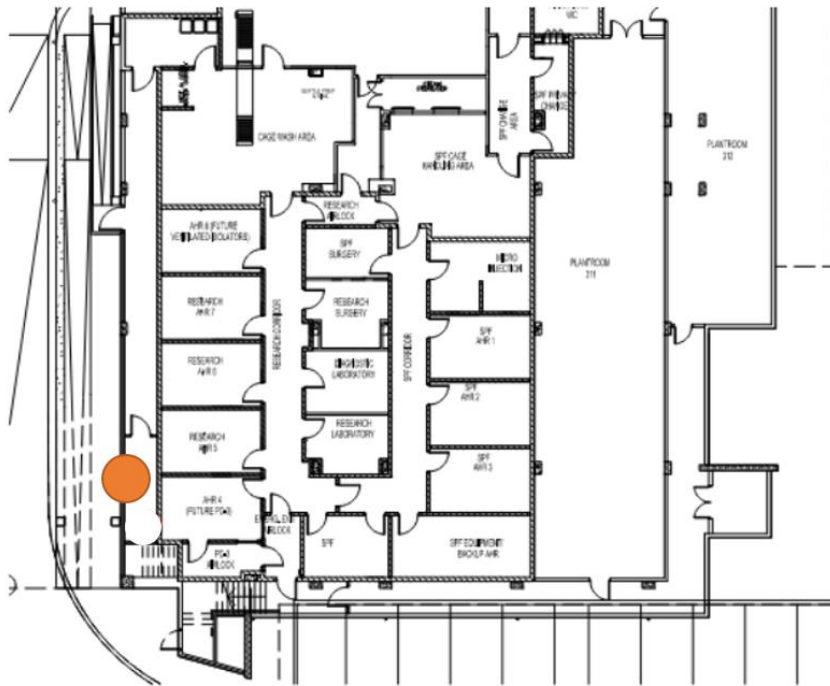


Figure 3: KR - Animal House vibration monitor location shown in orange

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 01/01/2023 and 31/01/2023. The recorded data is shown in blue, while the limit of 0.102mm/s (V_{RMS}) is shown in red.

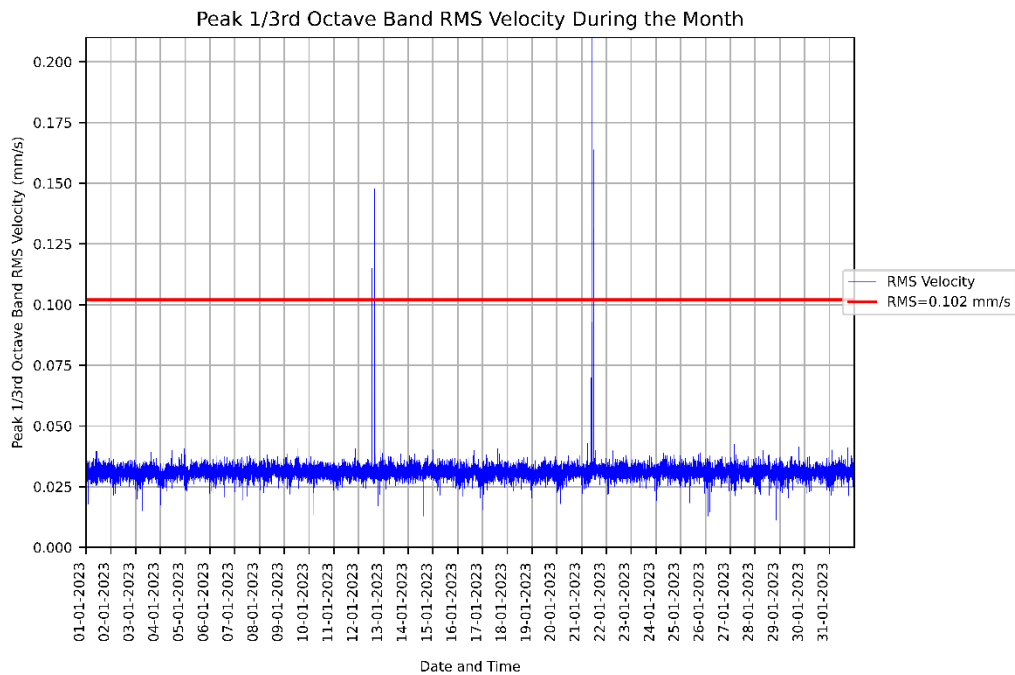


Figure 4: Measured RMSV vibration levels for 01/01/2023 to 31/01/2023 at the KR - Animal House.

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
14	0

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

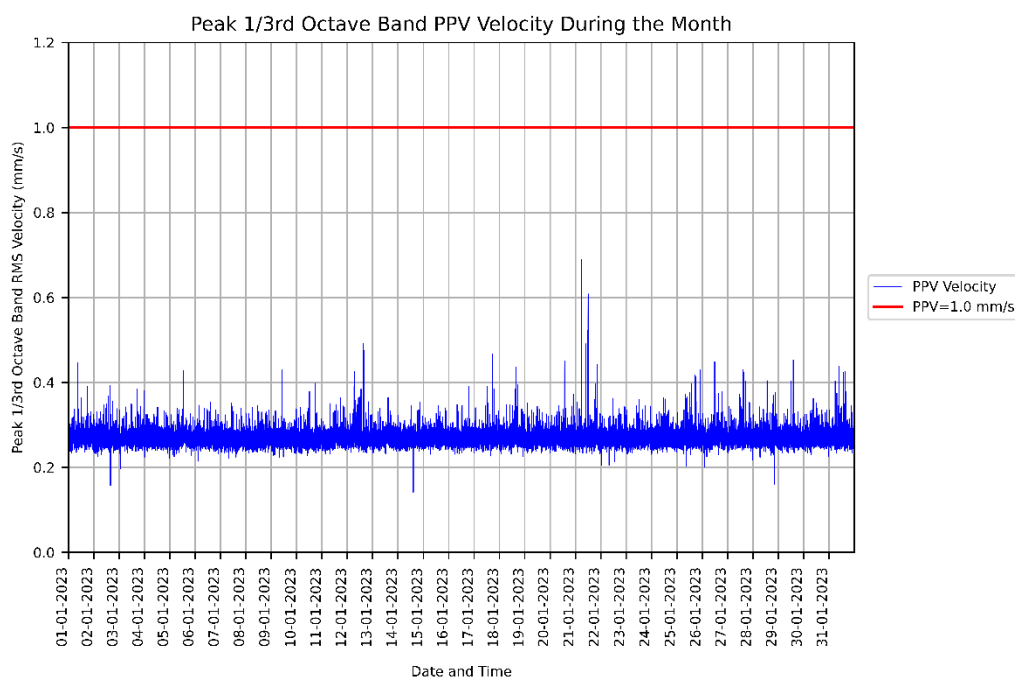
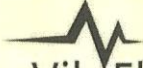


Figure 5: Measured PPV vibration levels for 01/01/2023 to 31/01/2023 at the KR - Animal House.

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	0

Appendix A: Calibration Certificates

CERTIFICATE OF CALIBRATION	
CERTIFICATE No: G30982	
EQUIPMENT TESTED : Geophone	
Manufacturer: GeoSIG	Serial No: 55908
Geophone Type: VE-11	
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:	
Temperature	23 °C ±1° C
Relative Humidity	44 % ±5%
Date of Receipt : 25/10/2021	
Date of Calibration : 01/11/2021	
Date of Issue : 01/11/2021	
Acu-Vib Test Procedure:	AVP15 (Low Frequency Transducer, Geophone) based on AS2187.2 & DIN45669-1
CHECKED BY:	AUTHORISED SIGNATURE: <i>Hein Soc</i>
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%.	
 WORLD RECOGNISED ACCREDITATION Accredited Lab No. 9262 Acoustic and Vibration Measurements	 Acu-Vib Electronics CALIBRATIONS SALES RENTALS REPAIRS Head Office & Calibration Laboratory Unit 14, 22 Hudson Ave. Castle Hill NSW 2154 (02) 9680 8133 www.acu-vib.com.au
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. **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 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 - CHW - L1 Lab -
January 2023**

CVM/ CHW/202301

Issue 1 | 07/02/2023

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

Level 5

151 Clarence Street

Sydney NSW 2000

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Document Verification

Project title Children's Hospital Westmead
Document title Monthly Vibration Monitoring Report
Job number 271985
Document ref CVM/CHW/202301
File reference -

Revision	Date	Filename	Westmead Hospital – 103157 CHW - L1 Lab - Summary of Recent Vibration Measurments (01-01 to 31-01).docx		
Issue 1	07/02/2023	Description	Issue		
			Prepared by	Checked by	Approved by
		Name	PR	KF	KF
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			

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Executive Summary

This report summarises the vibration monitoring data recorded at CHW - L1 Lab, over one month – from 01/01/2023 to 31/01/2023. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

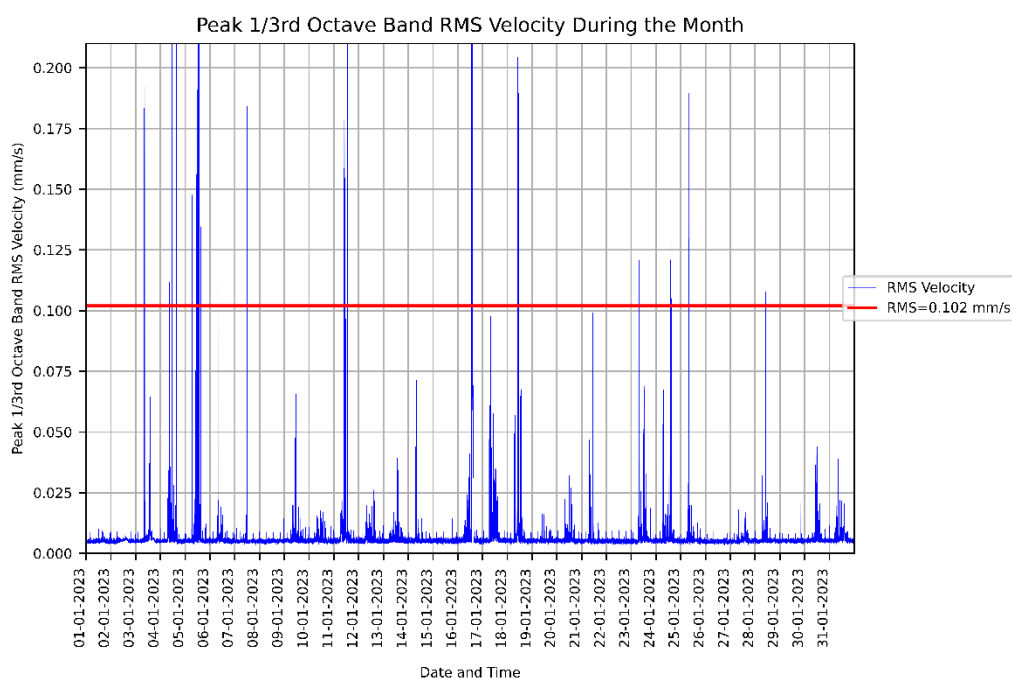


Figure 1: Measured RMSV vibration levels for 01/01/2023 to 31/01/2023 at the CHW - L1 Lab.

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
147	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 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 CHW - L1 Lab during the period of the 01/01/2023 to 31/01/2023.

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 2.

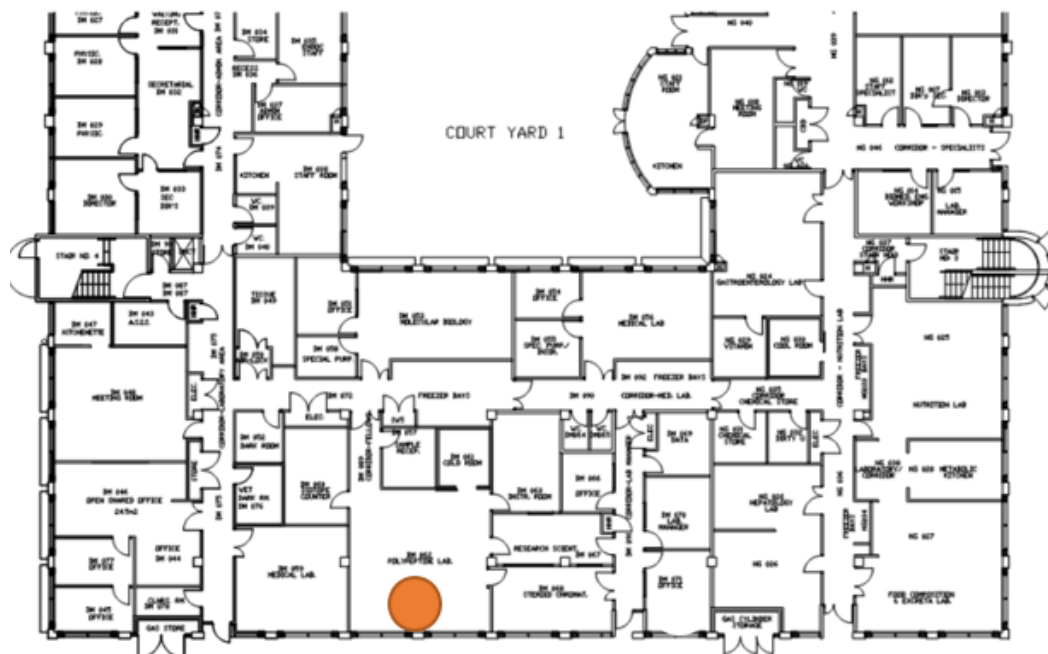


Figure 2: CHW - L1 Lab vibration monitor location shown in orange

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

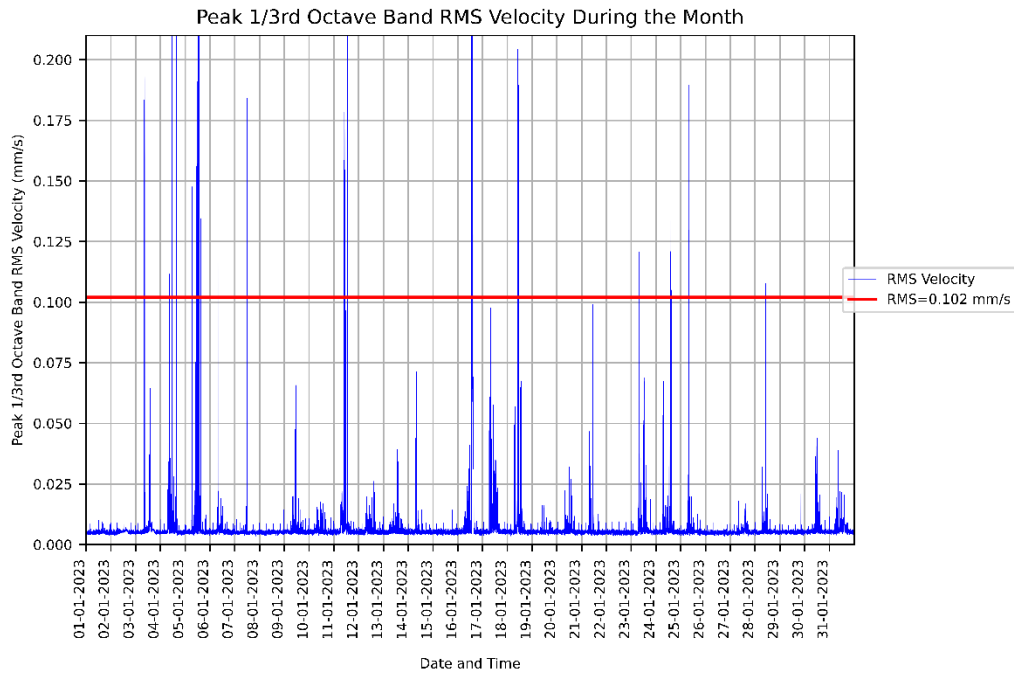


Figure 3: Measured RMSV vibration levels for 01/01/2023 to 31/01/2023 at the CHW - L1 Lab.

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
147	2

Appendix A: Calibration Certificates

**CERTIFICATE OF
CALIBRATION**

CERTIFICATE NO: **G30985**

EQUIPMENT TESTED : Geophone

Manufacturer: GeoSIG
Geophone Type: VE-11
Serial No: 55910

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:
Temperature 23 °C ±1° C
Relative Humidity 44 % ±5%

Date of Receipt : 25/10/2021
Date of Calibration : 01/11/2021
Date of Issue : 01/11/2021

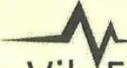
Acu-Vib Test Procedure: AVP15 (Low Frequency Transducer, Geophone) based on
AS2187.2 & DIN45669-1

CHECKED BY: **AUTHORISED SIGNATURE:**
Hein See

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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Unit 14, 22 Hudson Ave. Castle Hill NSW 2134
(02) 9680 8133
www.acu-vib.com.au

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. **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 mV/mm s^{-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 - CASB Level 2
MRI - January 2023**

CVM/ CASB/202301

Issue 1 | 07/02/2023

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

Level 5

151 Clarence Street

Sydney NSW 2000

Australia

www.arup.com



Document Verification

Project title Children's Hospital Westmead
Document title Monthly Vibration Monitoring Report
Job number 271985
Document ref CVM/CASB/202301
File reference -

Revision	Date	Filename	Westmead Hospital – 103158 CASB Level 2 MRI - Summary of Recent Vibration Measurments (01-01 to 31-01).docx		
Issue 1	07/02/2023	Description	Issue		
			Prepared by	Checked by	Approved by
		Name	PR	KF	KF
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			

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Executive Summary

This report summarises the vibration monitoring data recorded at CASB Level 2 MRI, over one month – from 01/01/2023 to 31/01/2023. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

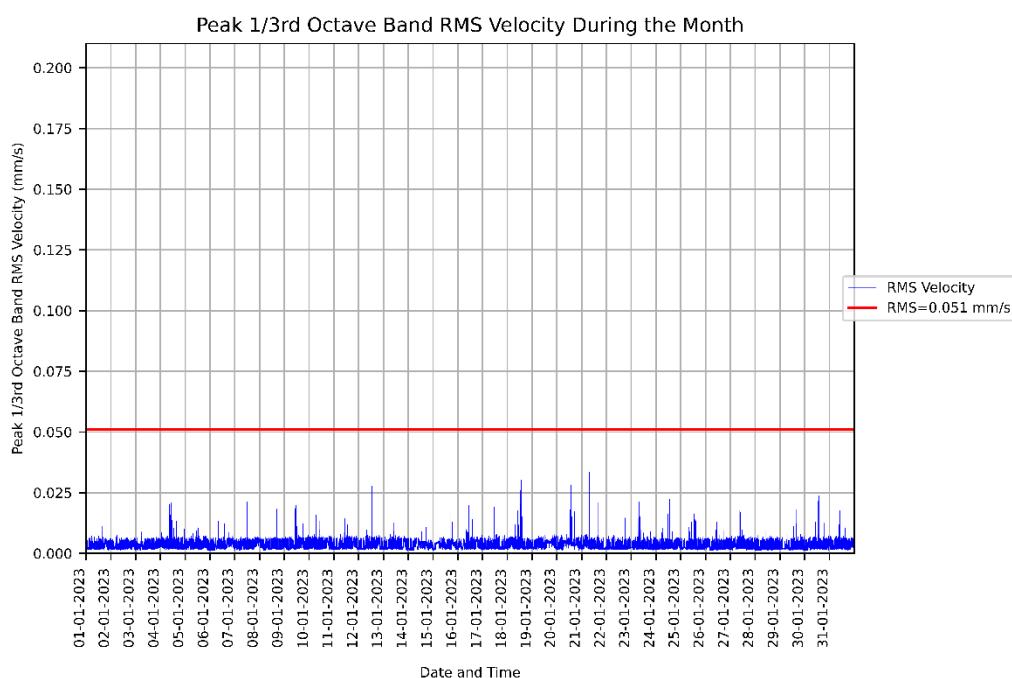


Figure 1: Measured RMSV vibration levels for 01/01/2023 to 31/01/2023 at the CASB Level 2 MRI.

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 CASB Level 2 MRI during the period of the 01/01/2023 to 31/01/2023.

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 2.

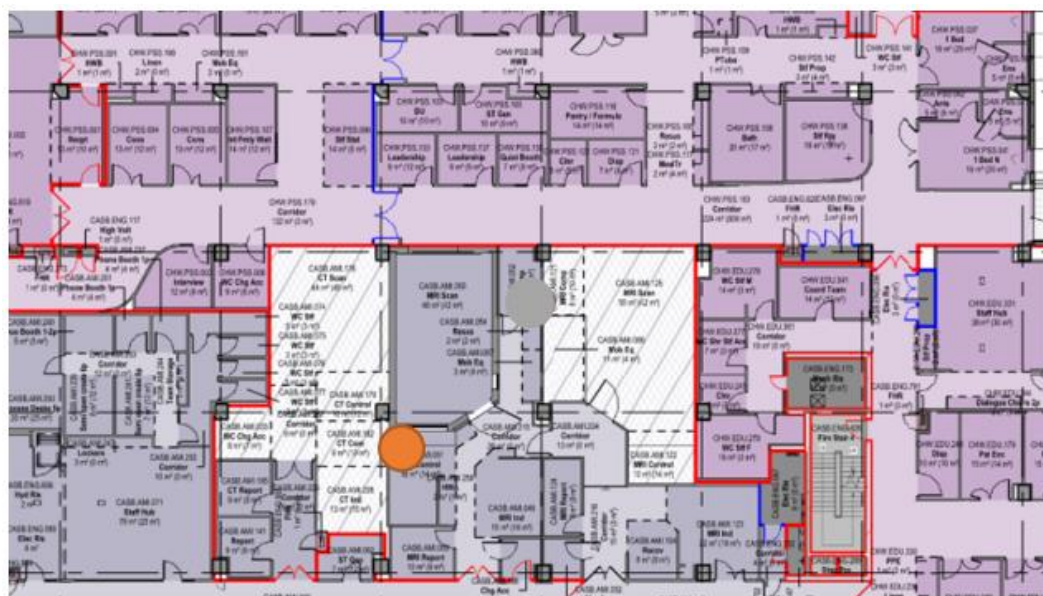


Figure 2: CASB Level 2 MRI vibration monitor location shown in orange

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

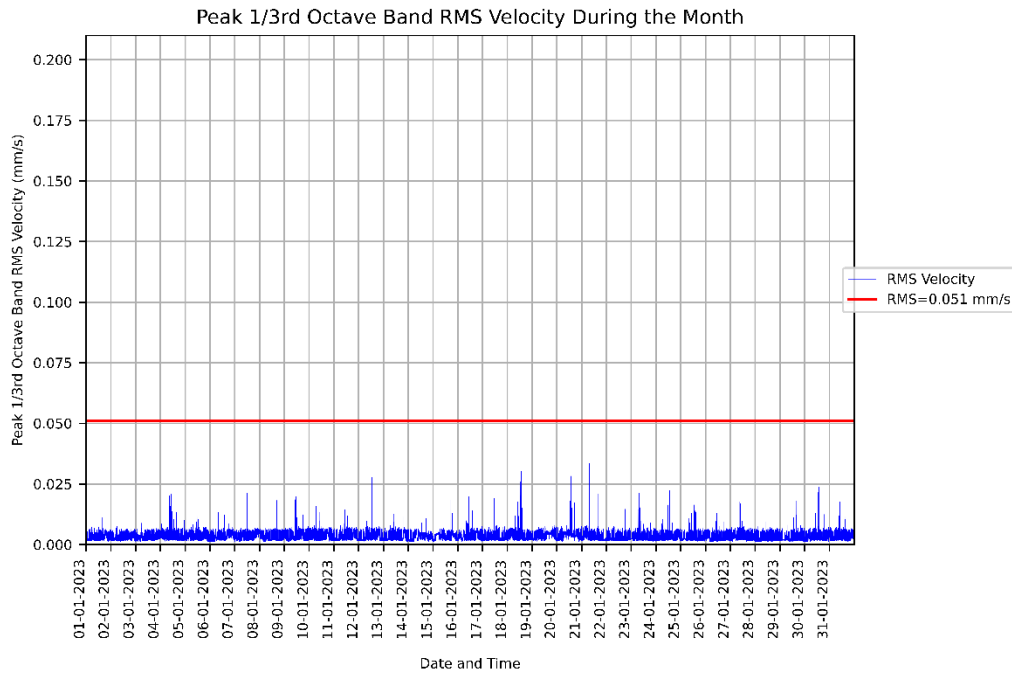


Figure 3: Measured RMSV vibration levels for 01/01/2023 to 31/01/2023 at the CASB Level 2 MRI.

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

Appendix A: Calibration Certificates

**CERTIFICATE OF
CALIBRATION**

CERTIFICATE No: **G30979**

EQUIPMENT TESTED : Geophone

Manufacturer: GeoSIG
Geophone Type: VE-11
Serial No: 55911

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:
Temperature 21 °C $\pm 1^{\circ}$ C
Relative Humidity 47 % $\pm 5\%$

Date of Receipt : 25/10/2021
Date of Calibration : 01/11/2021
Date of Issue : 01/11/2021

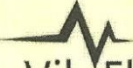
Acu-Vib Test Procedure: AVP15 (Low Frequency Transducer, Geophone) based on
AS2187.2 & DIN45669-1

CHECKED BY: **AUTHORISED SIGNATURE:**
Wen See

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. **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 mV/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 - January 2023**

CVM/ CASB/202301

Issue 1 | 07/02/2023

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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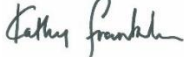


Document Verification

Project title Children's Hospital Westmead
Document title Monthly Vibration Monitoring Report
Job number 271985
Document ref CVM/CASB/202301
File reference -

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

Issue 1	07/02/2023	Description	Issue
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	Prepared by	Checked by	Approved by
Name	PR	KF	KF
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 CASB level 3 Surgical Suite, over one month – from 01/01/2023 to 31/01/2023. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

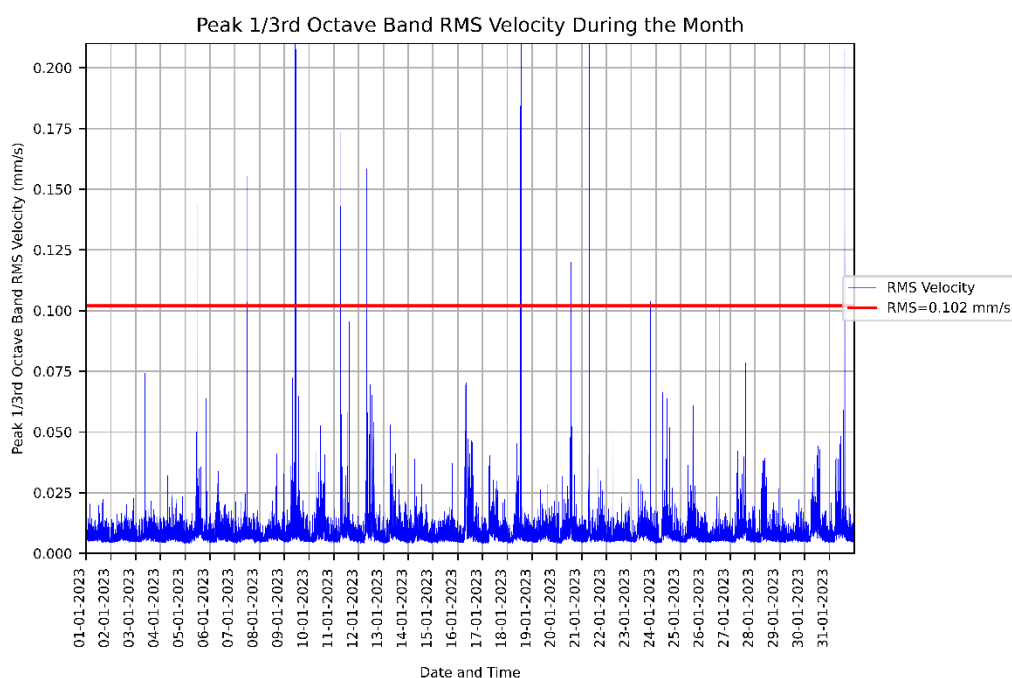


Figure 1: Measured RMSV vibration levels for 01/01/2023 to 31/01/2023 at the CASB level 3 Surgical Suite.

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	9

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 01/01/2023 to 31/01/2023.

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 2.

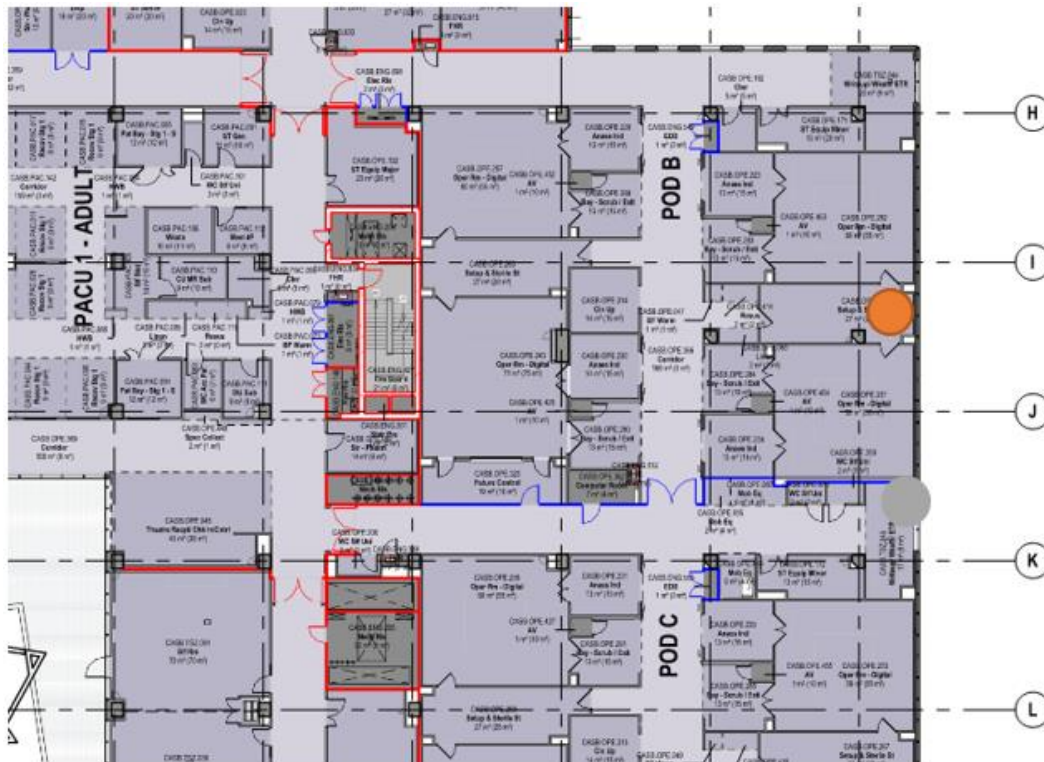


Figure 2: CASB level 3 Surgical Suite vibration monitor location shown in orange

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

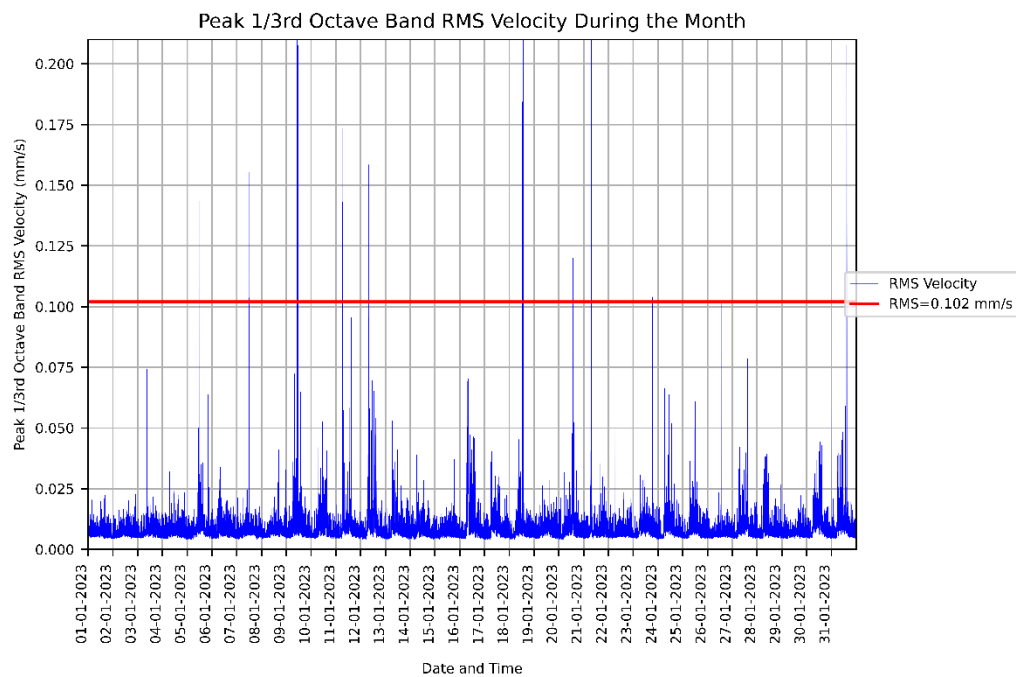


Figure 3: Measured RMSV vibration levels for 01/01/2023 to 31/01/2023 at the CASB level 3 Surgical Suite.

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	9

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 mV/mm ^s ⁻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.

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 mV/mm s^{-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 - KR - L4 Lab 9 -
January 2023**

CVM/ KR/202301

Issue 1 | 07/02/2023

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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Document Verification

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Revision	Date	Filename	Westmead Hospital – 103161 KR - L4 Lab 9 - Summary of Recent Vibration Measurments (01-01 to 31-01).docx		
Issue 1	07/02/2023	Description	Issue		
			Prepared by	Checked by	Approved by
		Name	PR	KF	KF
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		Name			
		Signature			

Issue Document Verification with Document ☒

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Executive Summary

This report summarises the vibration monitoring data recorded at KR - L4 Lab 9, over one month – from 01/01/2023 to 31/01/2023. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

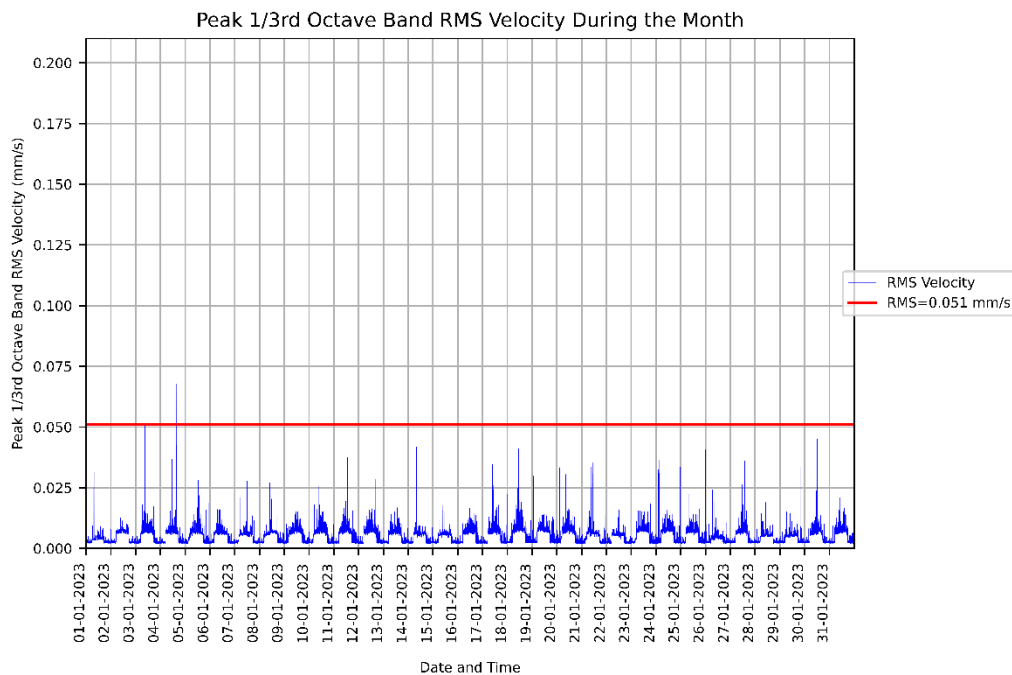


Figure 1: Measured RMSV vibration levels for 01/01/2023 to 31/01/2023 at the KR - L4 Lab 9.

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	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 KR - L4 Lab 9 during the period of the 01/01/2023 to 31/01/2023.

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 2.

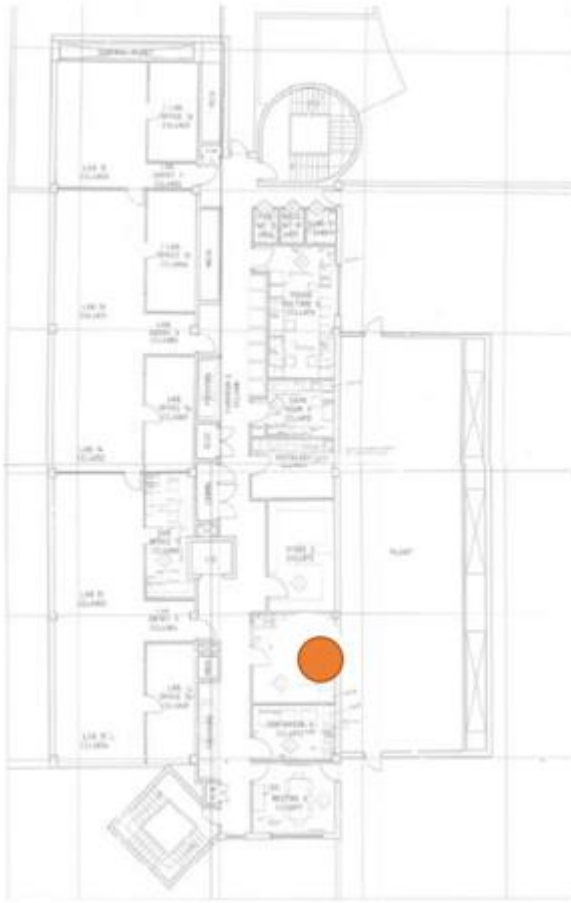


Figure 2: KR - L4 Lab 9 vibration monitor location shown in orange

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

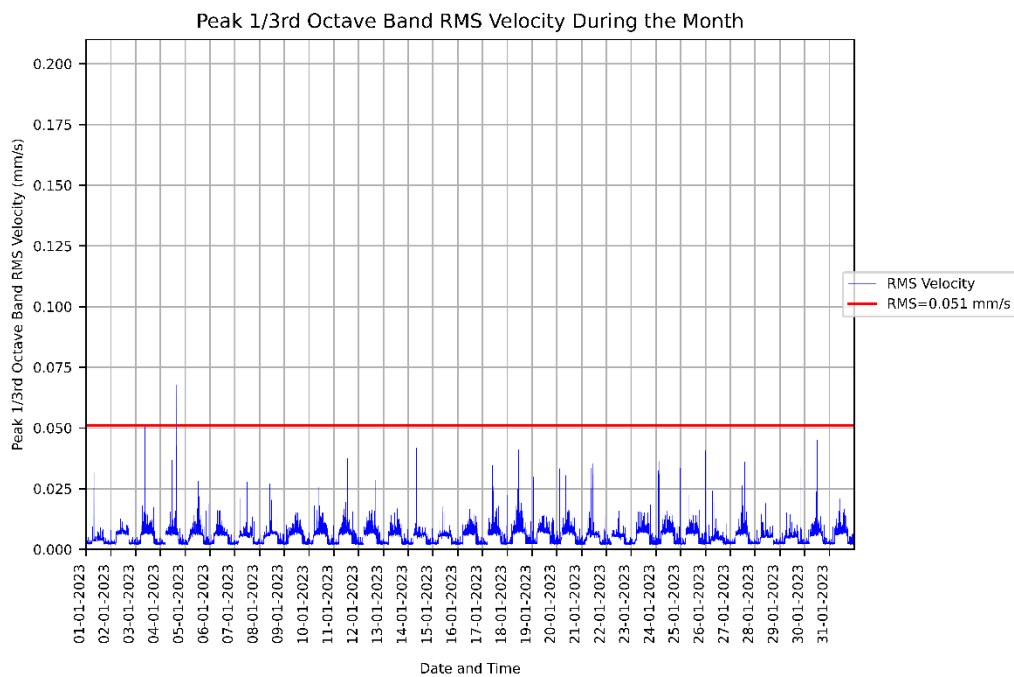
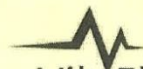


Figure 3: Measured RMSV vibration levels for 01/01/2023 to 31/01/2023 at the KR - L4 Lab 9.

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	0

Appendix A: Calibration Certificates

CERTIFICATE OF CALIBRATION	
CERTIFICATE NO: G30976	
EQUIPMENT TESTED : Geophone	
Manufacturer: GeoSIG	Serial No: 55913
Geophone Type: VE-11	
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:	
Temperature	21 °C ±1° C
Relative Humidity	47 % ±5%
Date of Receipt :	25/10/2021
Date of Calibration :	01/11/2021
Date of Issue :	01/11/2021
Acu-Vib Test Procedure:	AVP15 (Low Frequency Transducer, Geophone) based on AS2187.2 & DIN45669-1
CHECKED BY: 	AUTHORISED SIGNATURE:  Helen See
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%.	
 WORLD RECOGNISED ACCREDITATION Accredited Lab No. 9262 Acoustic and Vibration Measurements	 Acu-Vib Electronics CALIBRATIONS SALES RENTALS REPAIRS Head Office & Calibration Laboratory Unit 14, 22 Hudson Ave, Castle Hill NSW 2134 (02) 9580 8133 www.acu-vib.com.au
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. **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)
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12VDC Power Supply

Geophone Orientation.: Vertical

Frequency		Velocity mm/sec Peak	Indicated Sensitivity mV/mm s^{-1}	Expanded uncertainty
Hz	Radians/sec		Vertical Sensitivity	$U_{95} \%$
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.