

Health Infrastructure NSW
Westmead PSB and MSCP
Construction Noise Monitoring

Noise monitoring report
2023-05-01 to 2023-05-31

AC18

v1 | 20 June 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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Appendices

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 May 2023 to 31 May 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.

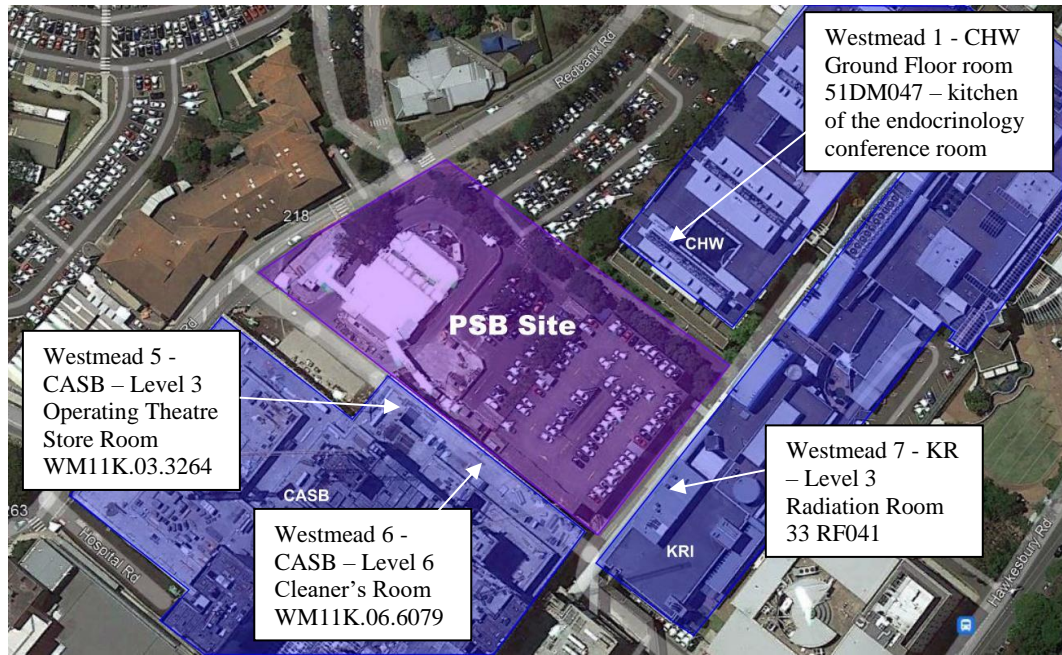


Figure 1: PSB noise monitoring locations.



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)	-
Westmead 5	CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (facing PSB site)	4/5/23-31/5/23 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)	-
Westmead 2	CHW Level 2 Parent Kitchen 92BW025 (facing MSCP site)	-
Westmead 3	RMH Level 1 Store Room 101 (facing MSCP site)	-

Note:

1_ Westmead 5 was experiencing signs of malfunction, this issue has since been repaired.

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)	19
Westmead 5	CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (facing PSB site)	23
Westmead 6	CASB Level 6 Cleaner's Room WM11K.06.6079 (facing PSB site)	62
Westmead 7	KR Level 3 Radiation Room 33 RF041(facing PSB site)	-
Westmead 2	CHW Level 2 Parent Kitchen 92BW025 (facing MSCP site)	7
Westmead 3	RMH Level 1 Store Room 101 (facing MSCP site)	24

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

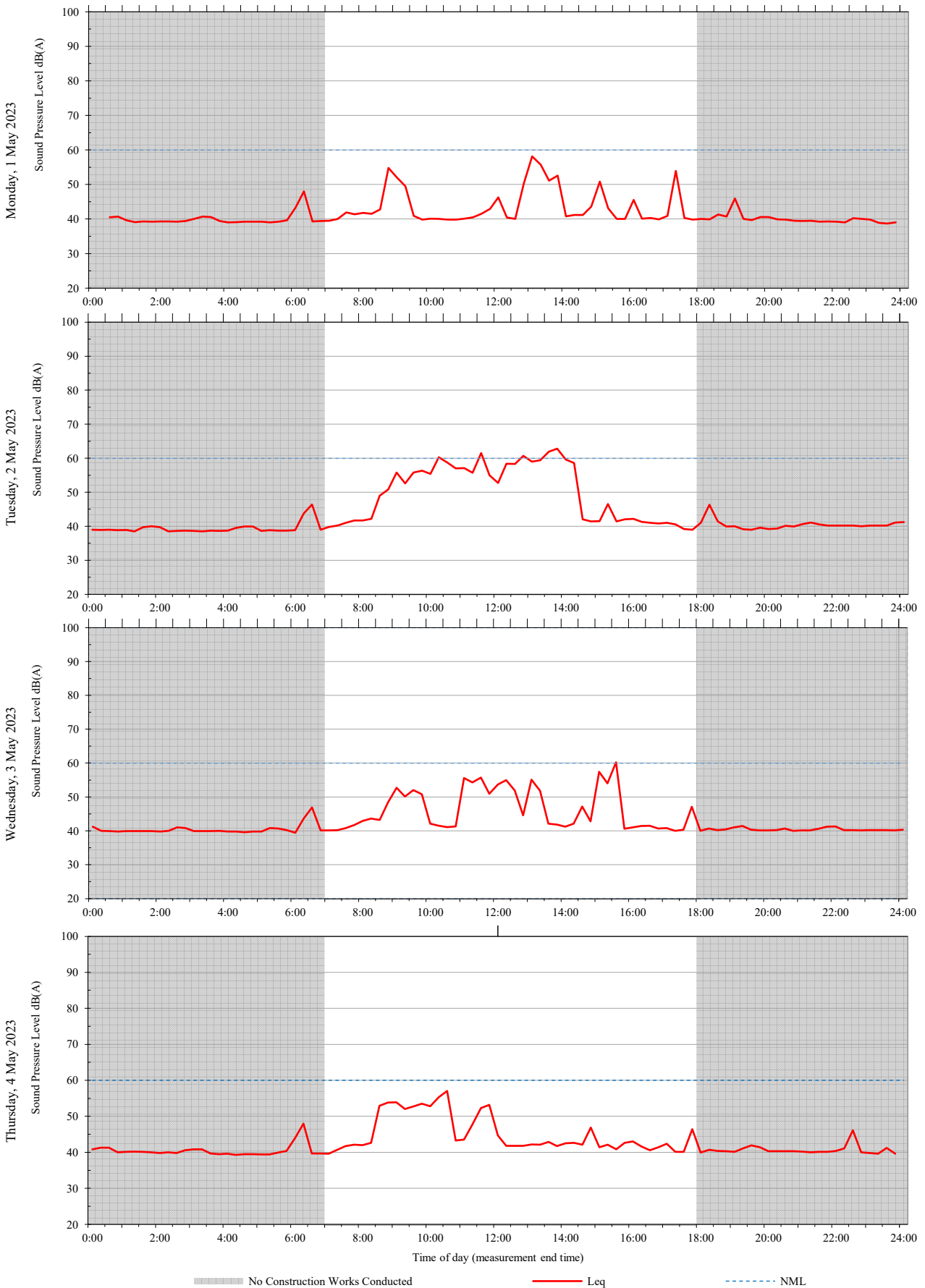
Daily noise monitoring results are showing for each location in Appendix A.

Appendix A

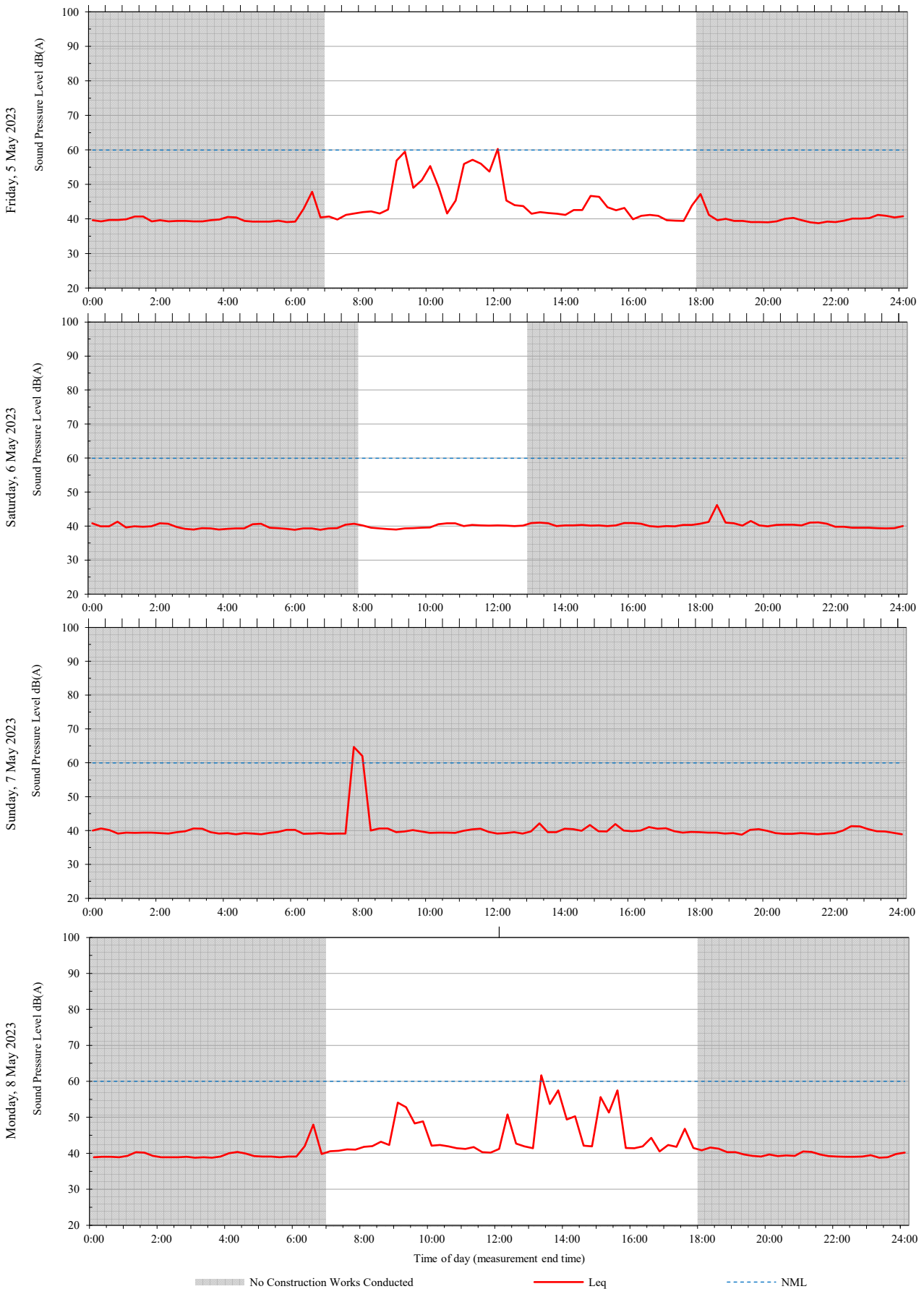
Noise Monitoring Daily Results

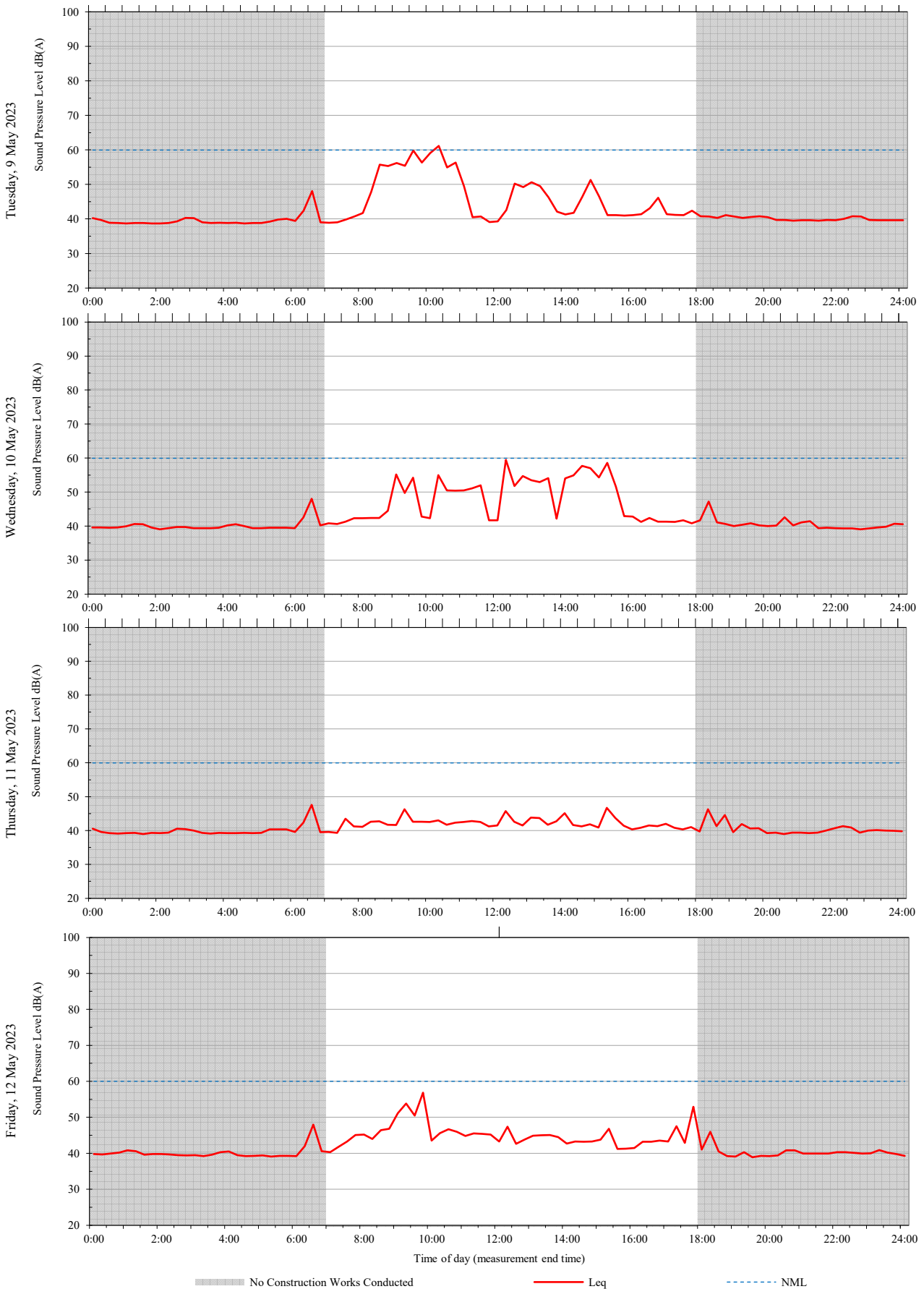
A1 CHW Ground Floor room 51DM047 (Westmead 1)

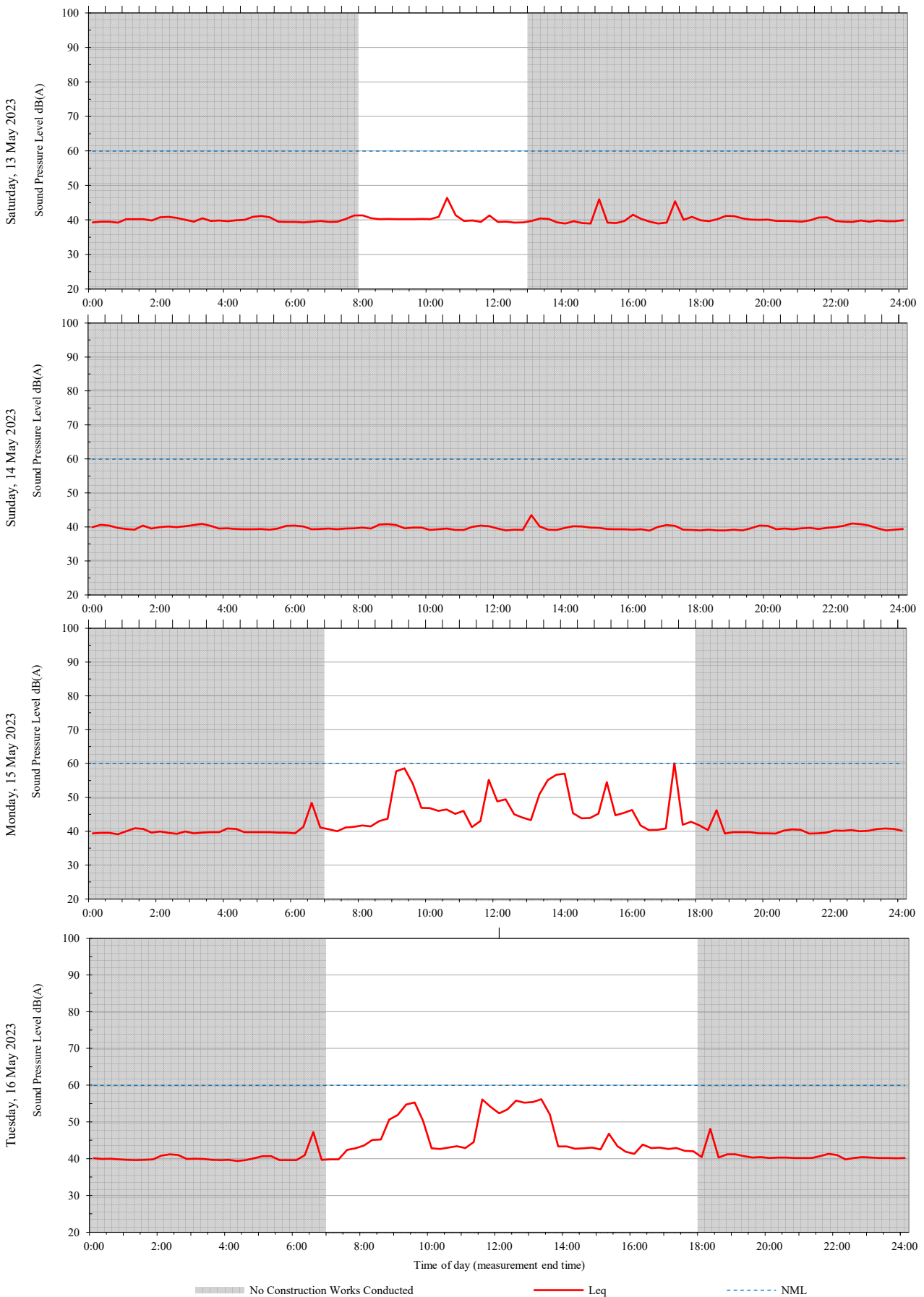
Unattended monitoring: CHW Ground Floor room 51DM047 (Internal)



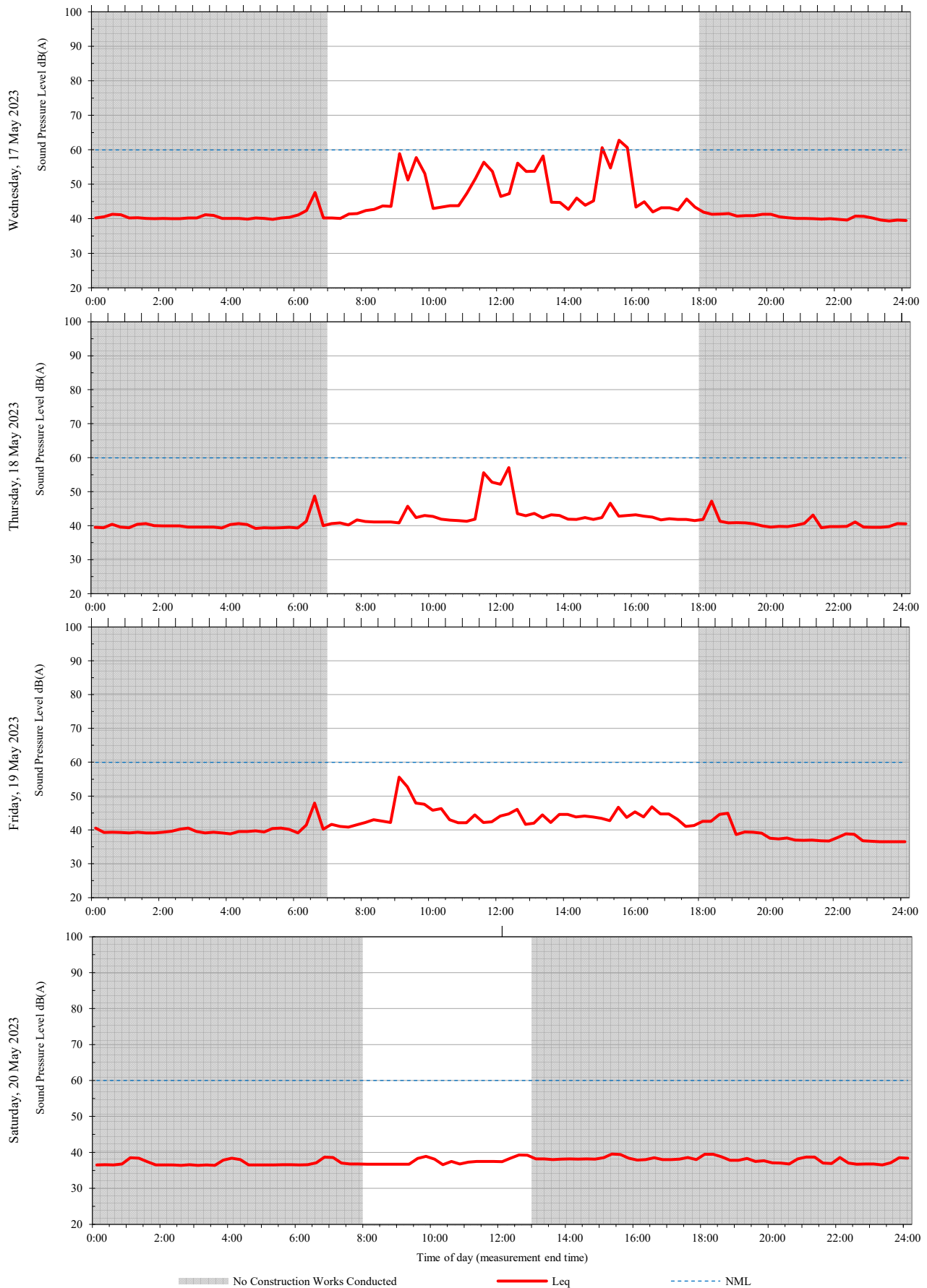
Unattended monitoring: CHW Ground Floor room 51DM047 (Internal)

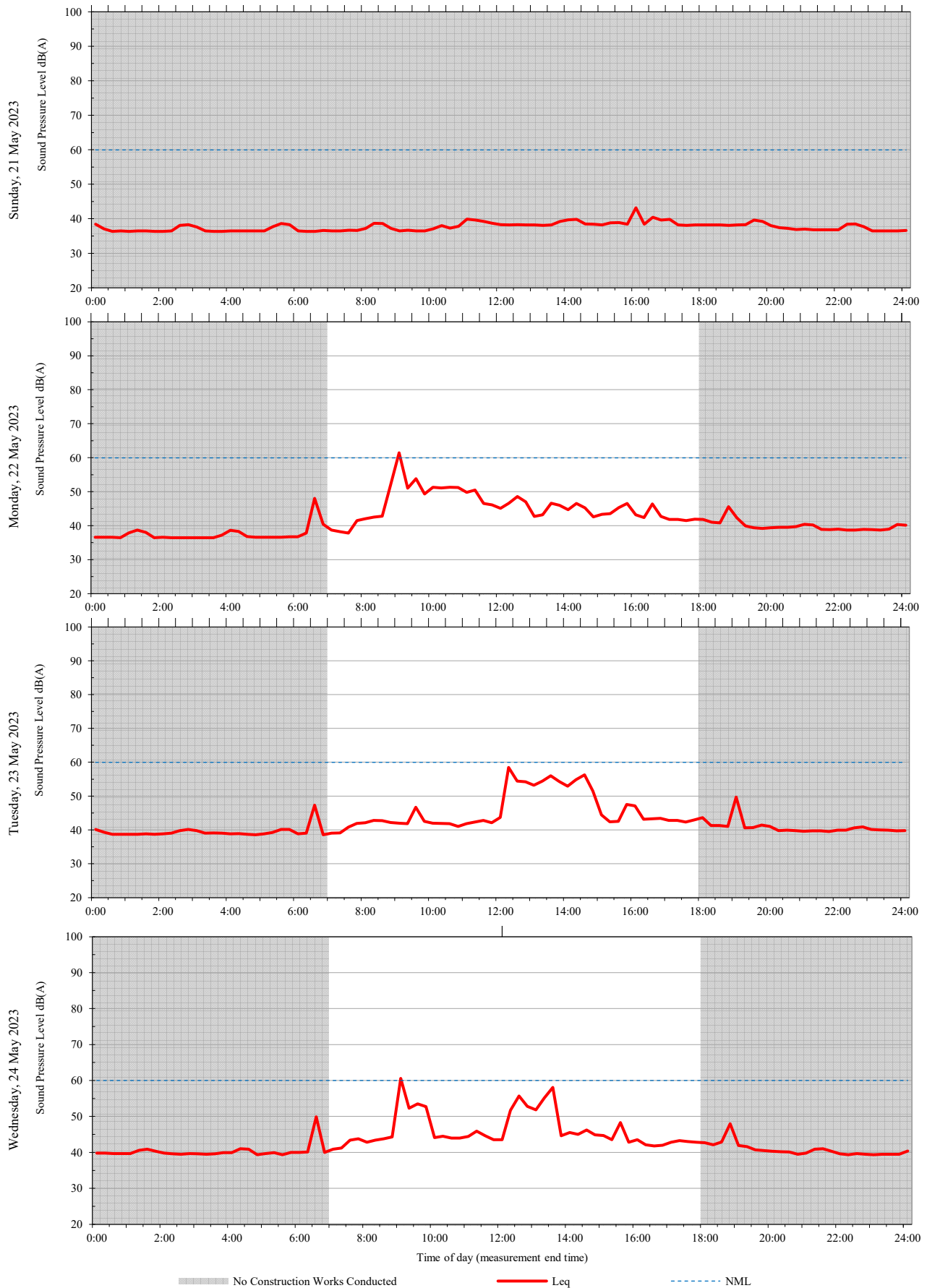




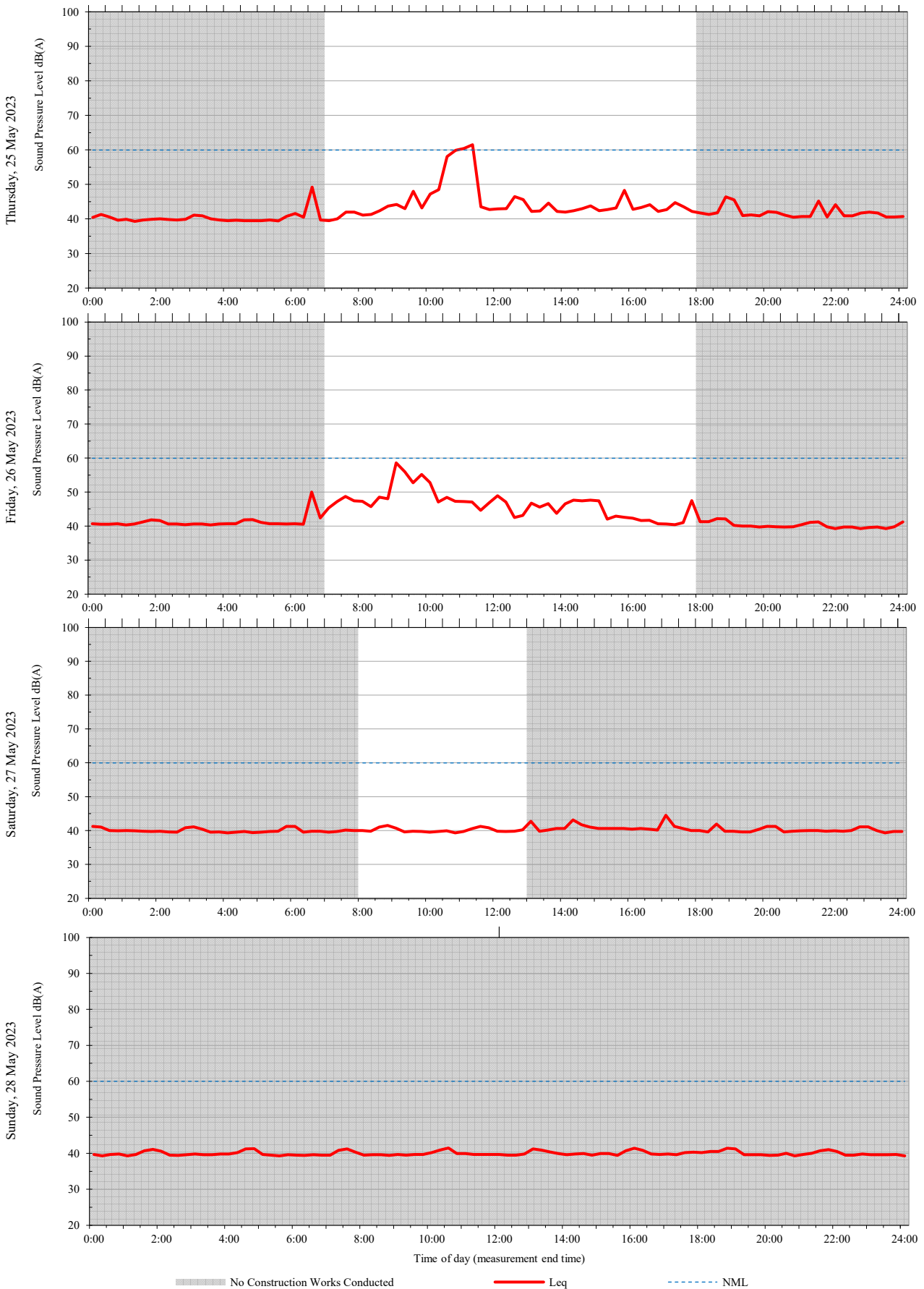


Unattended monitoring: CHW Ground Floor room 51DM047 (Internal)

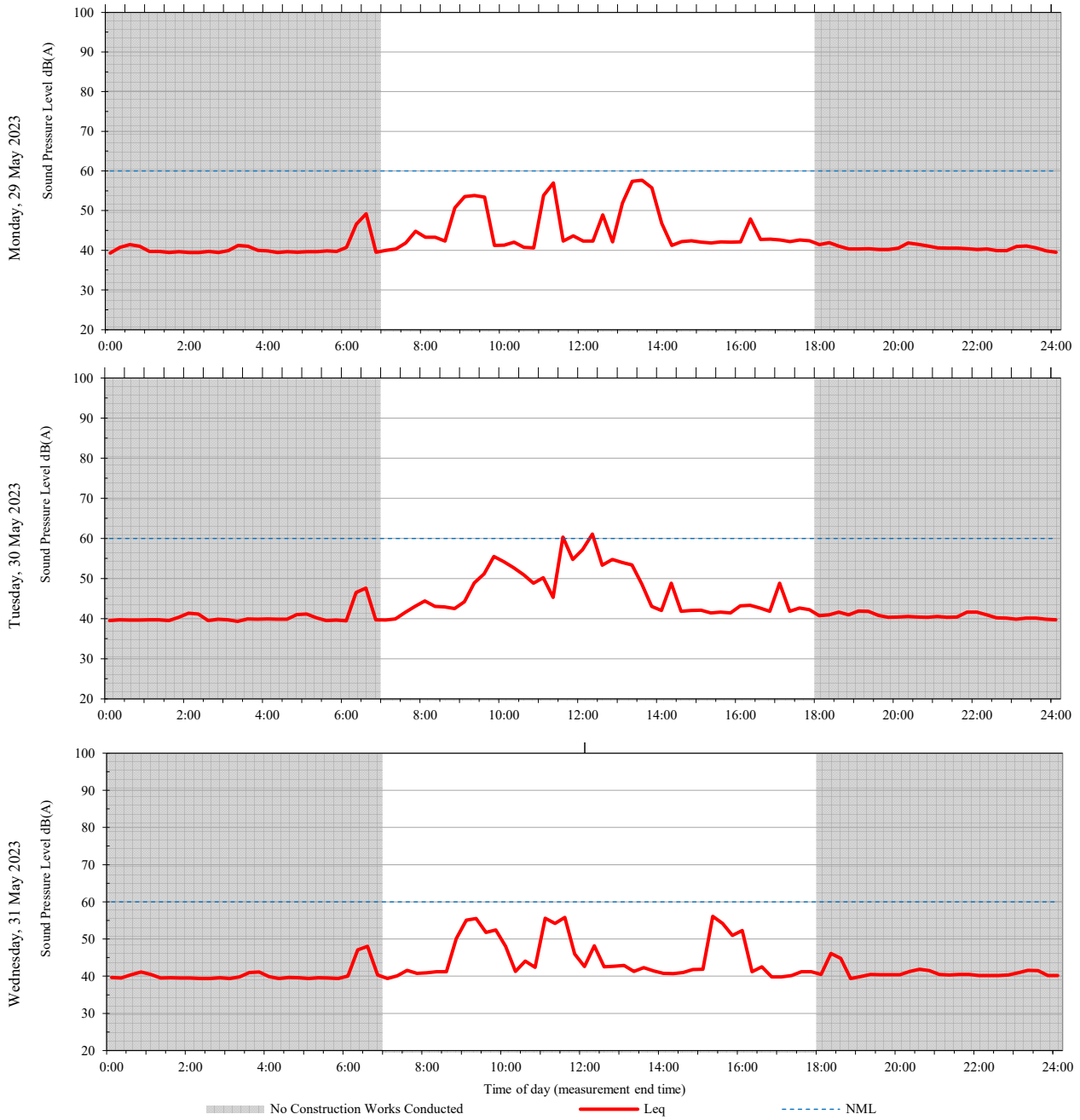




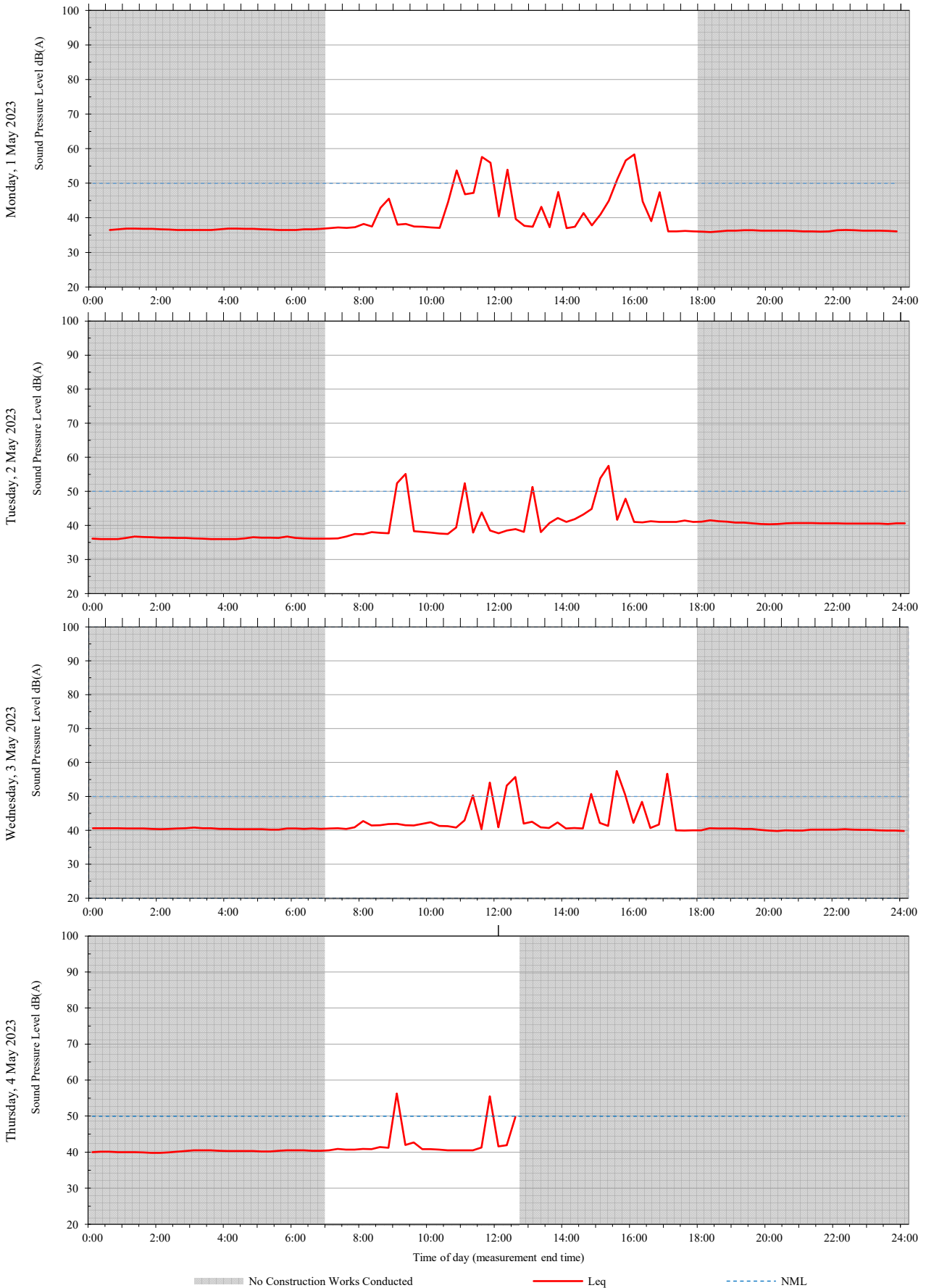
Unattended monitoring: CHW Ground Floor room 51DM047 (Internal)

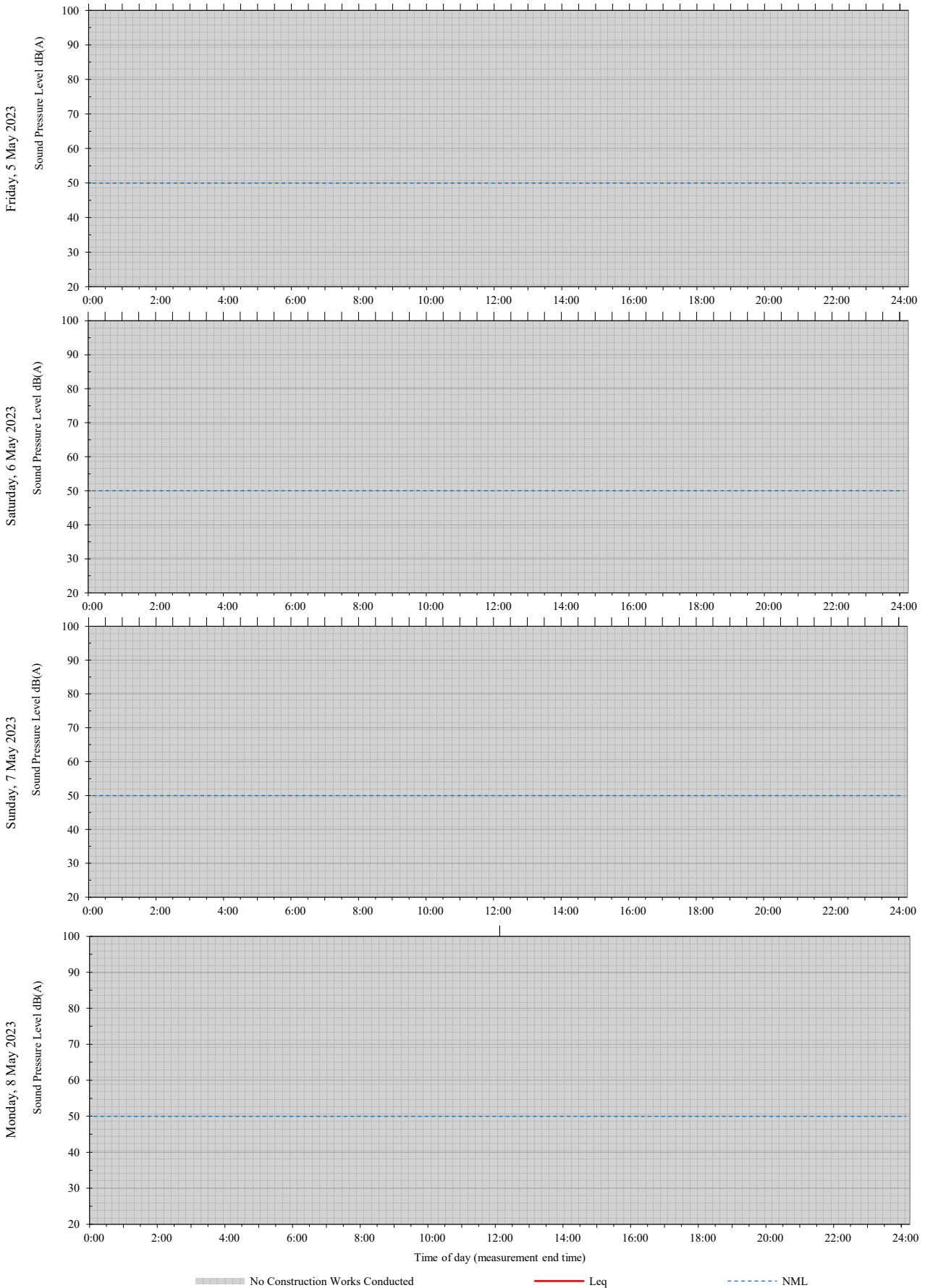


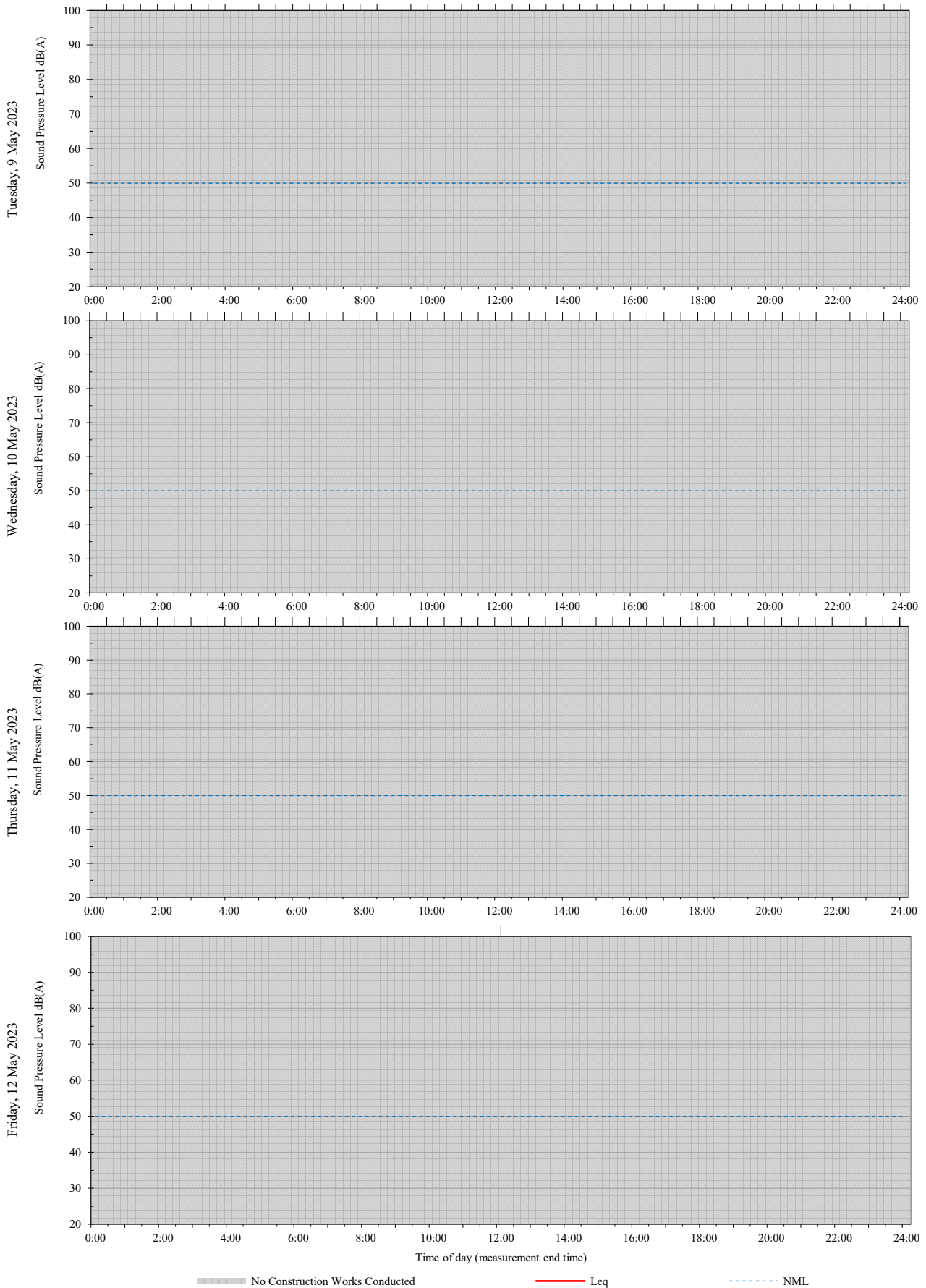
Unattended monitoring: CHW Ground Floor room 51DM047 (Internal)

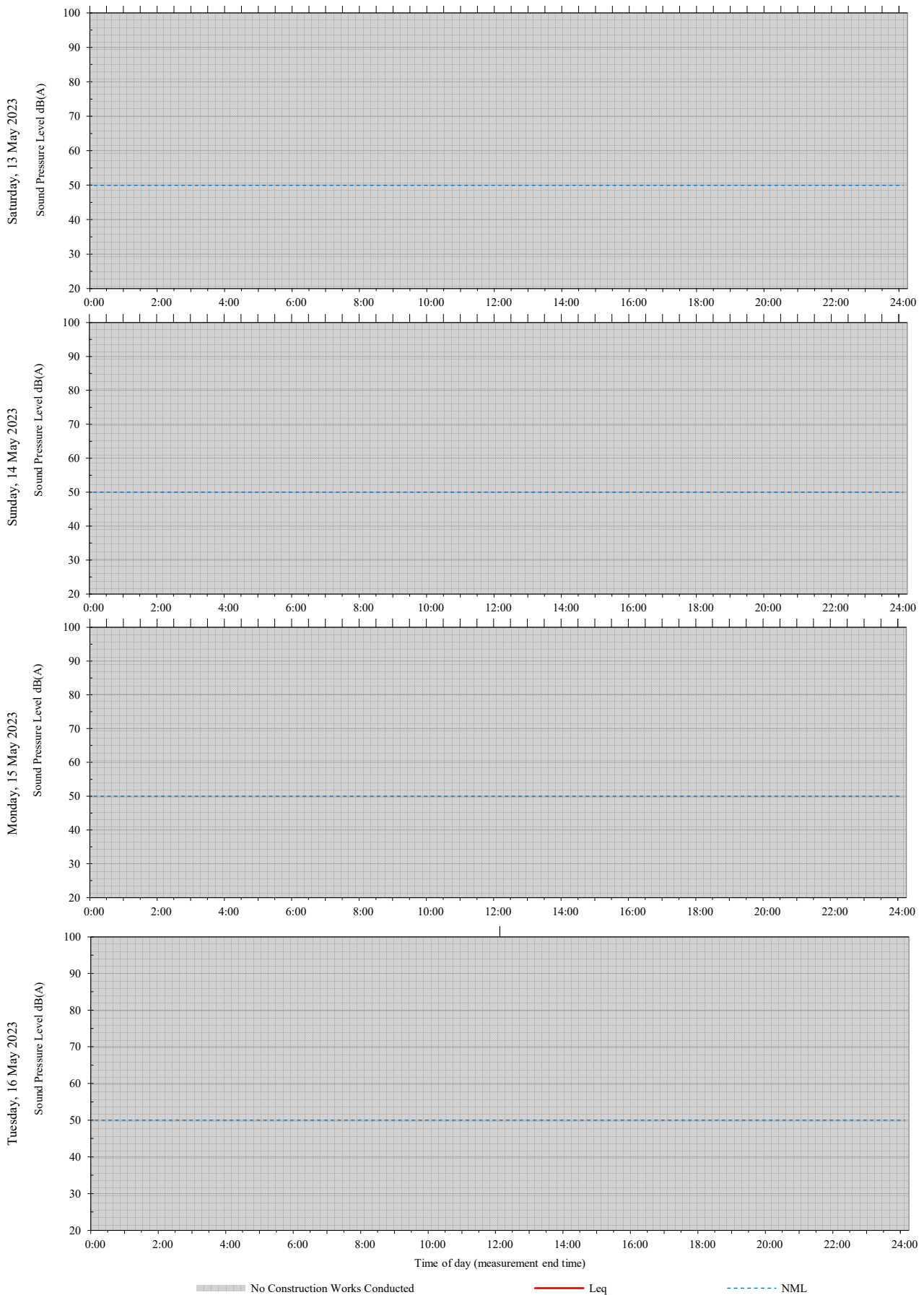


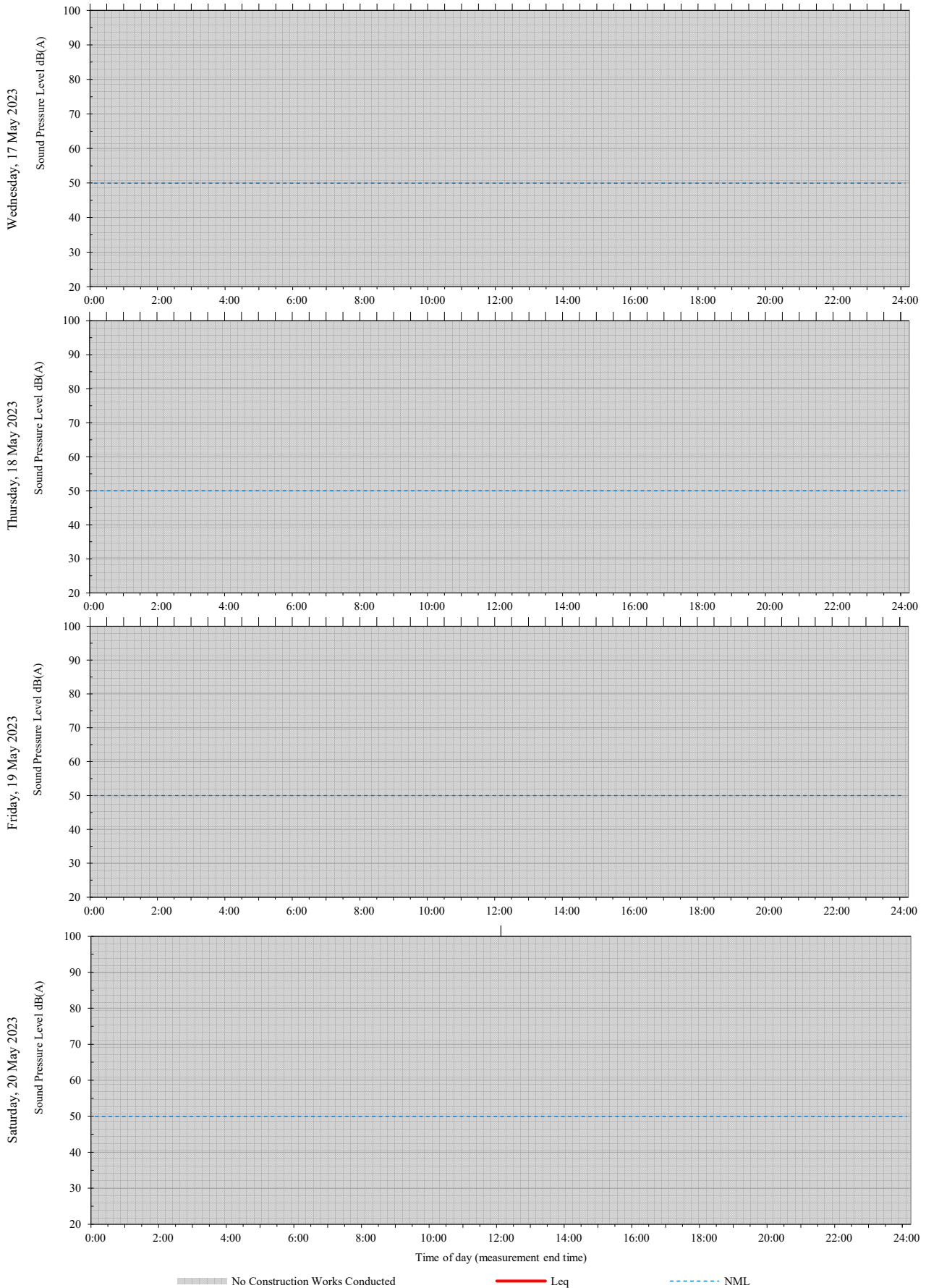
A2 CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (Westmead 5)

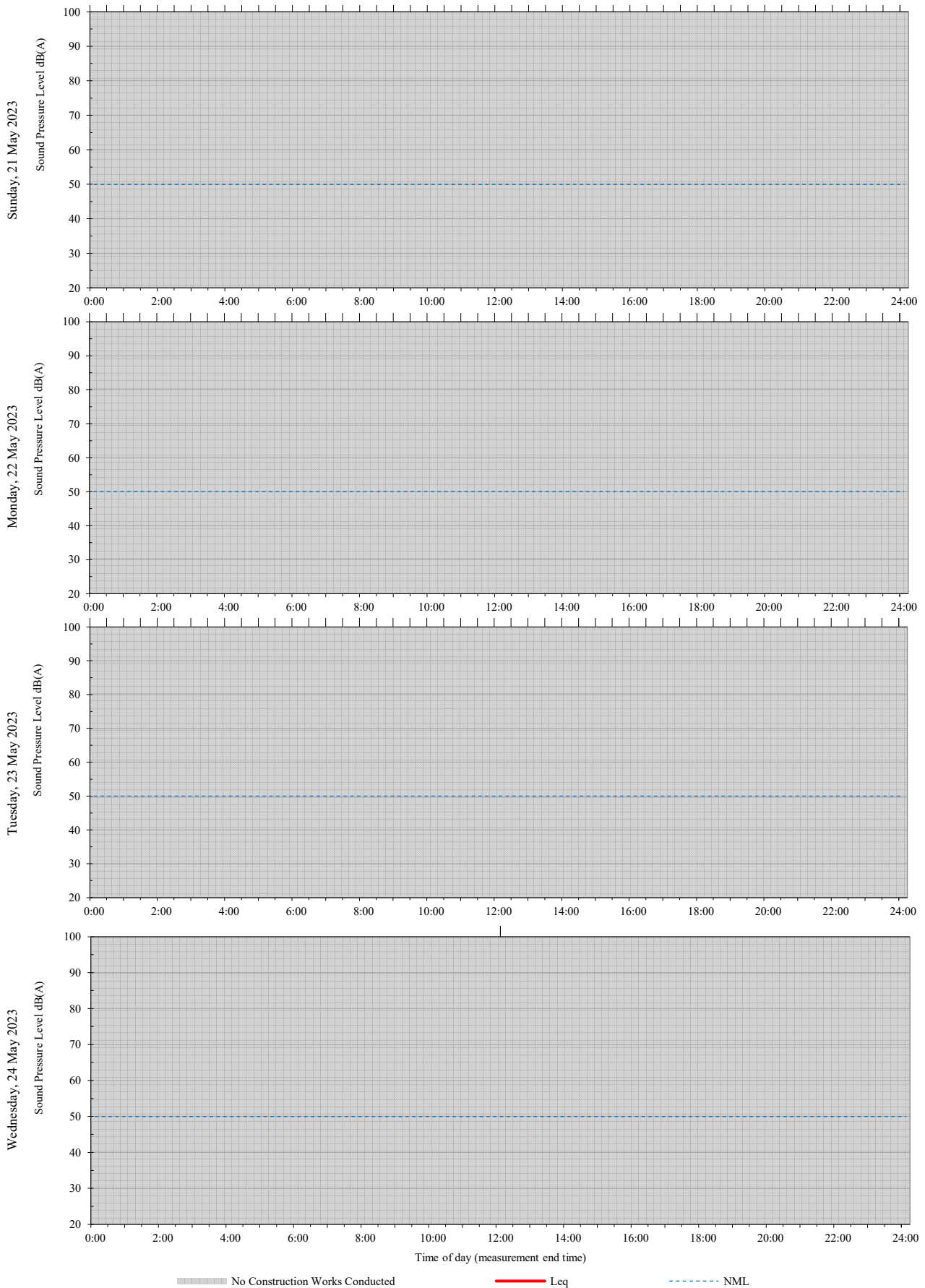


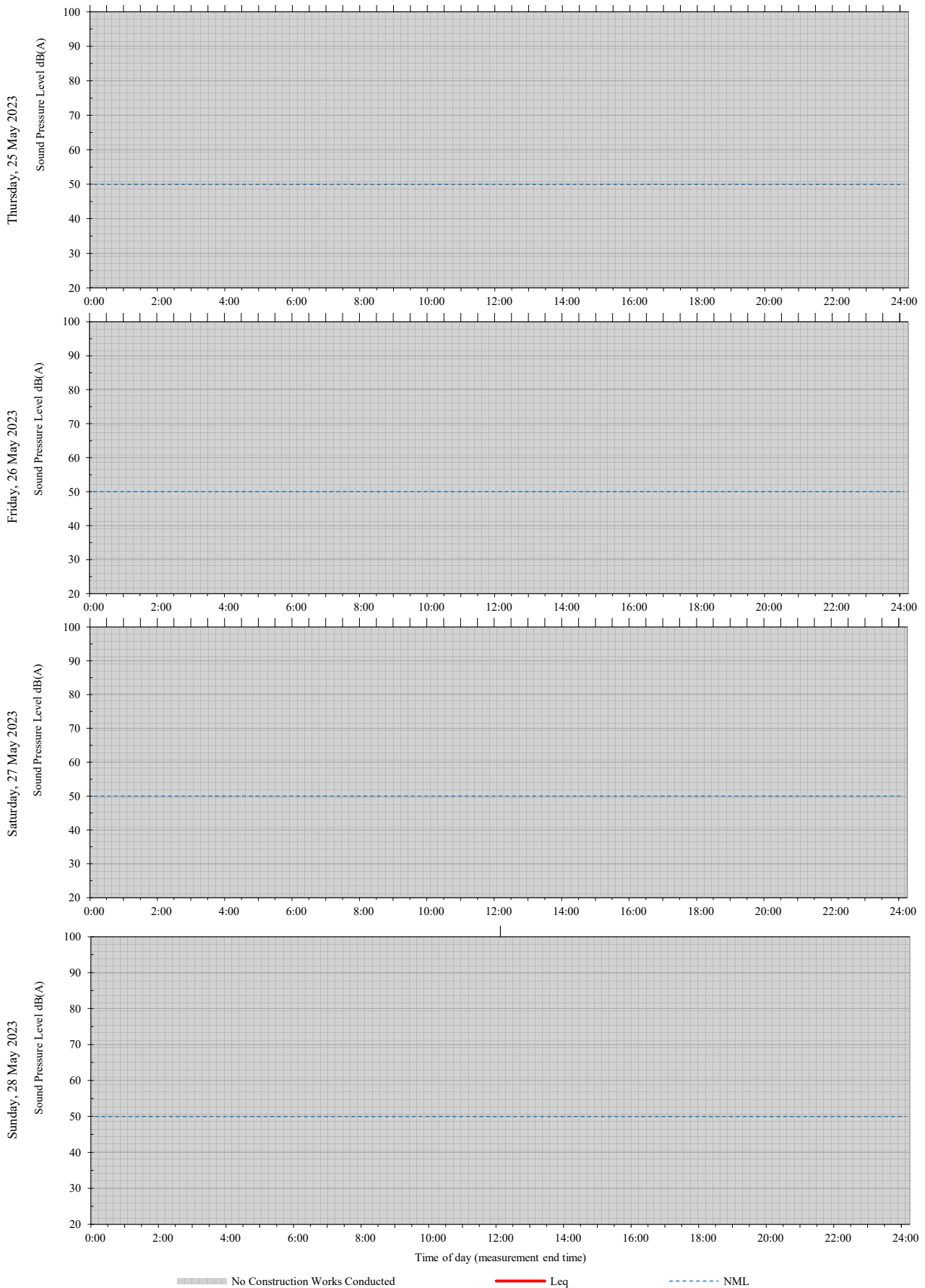




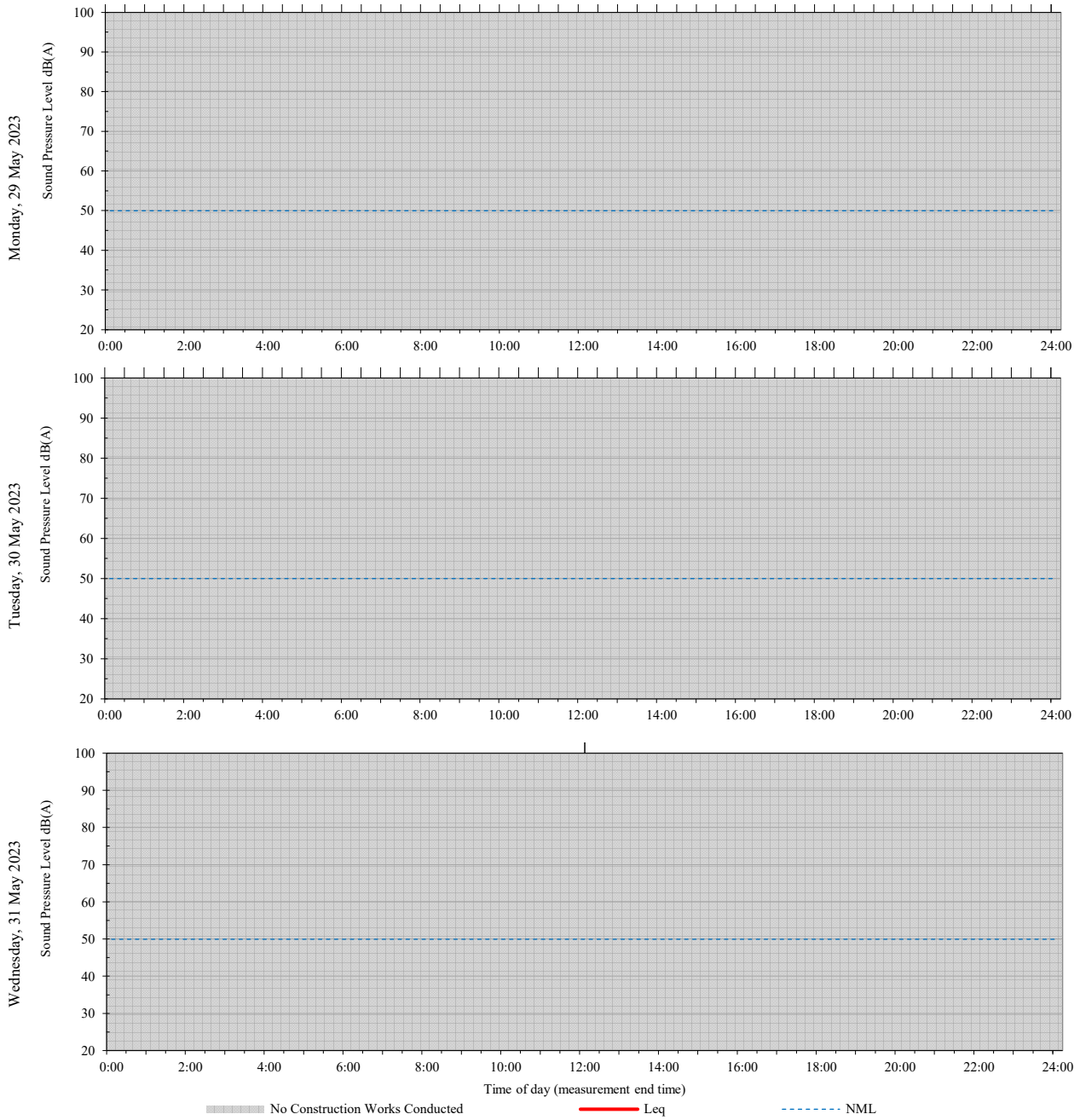






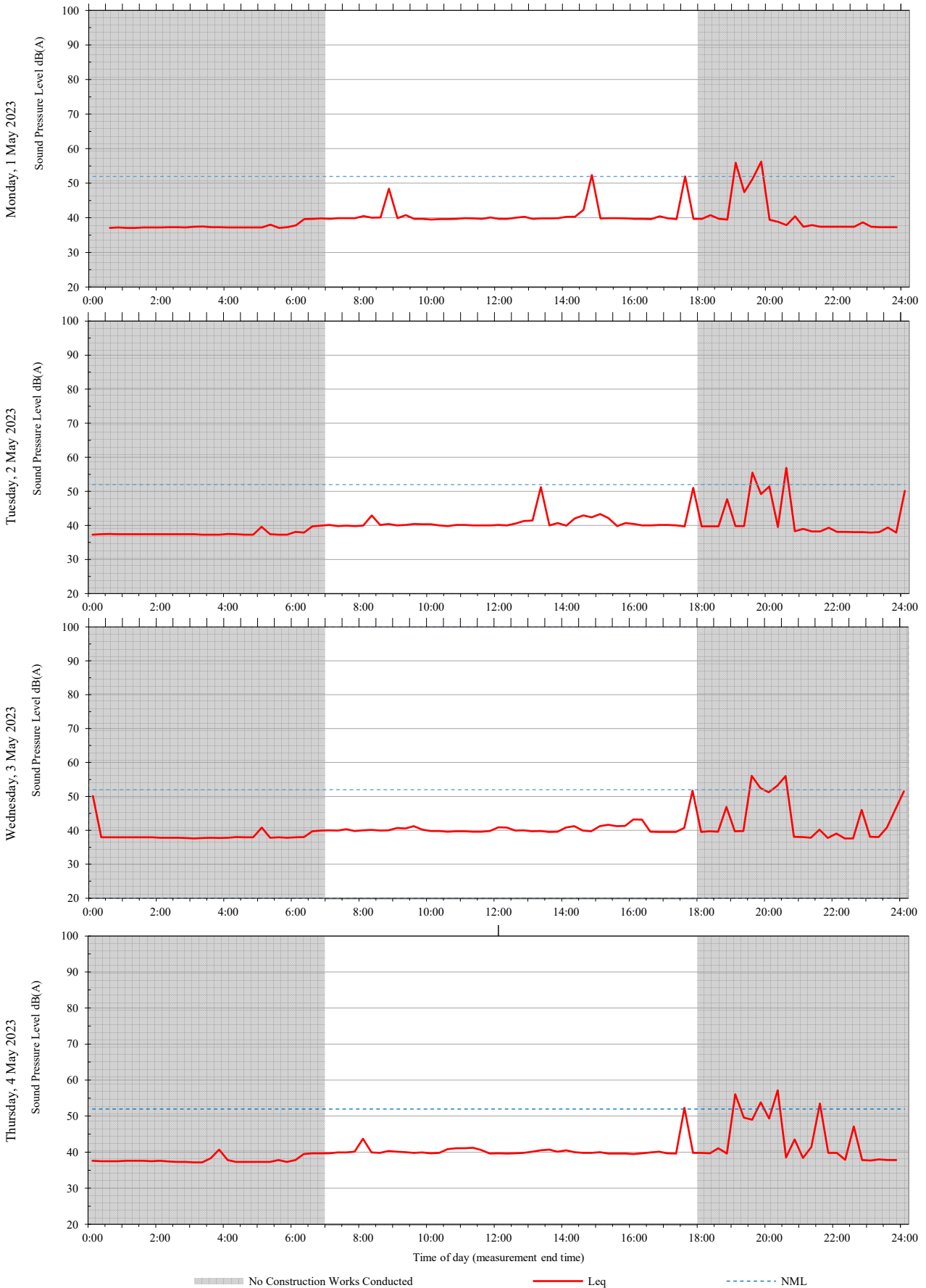


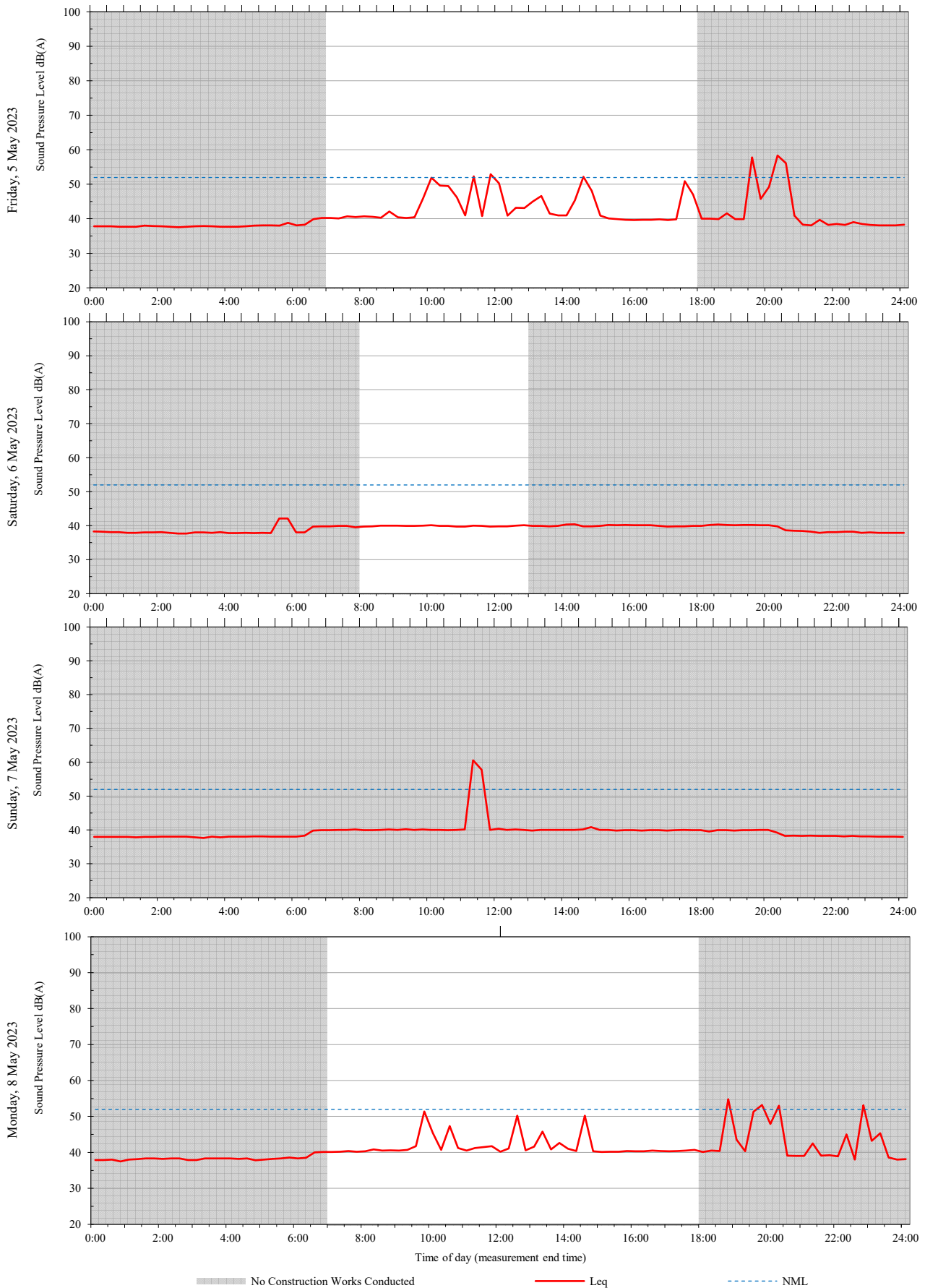
Unattended monitoring: CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (Internal)



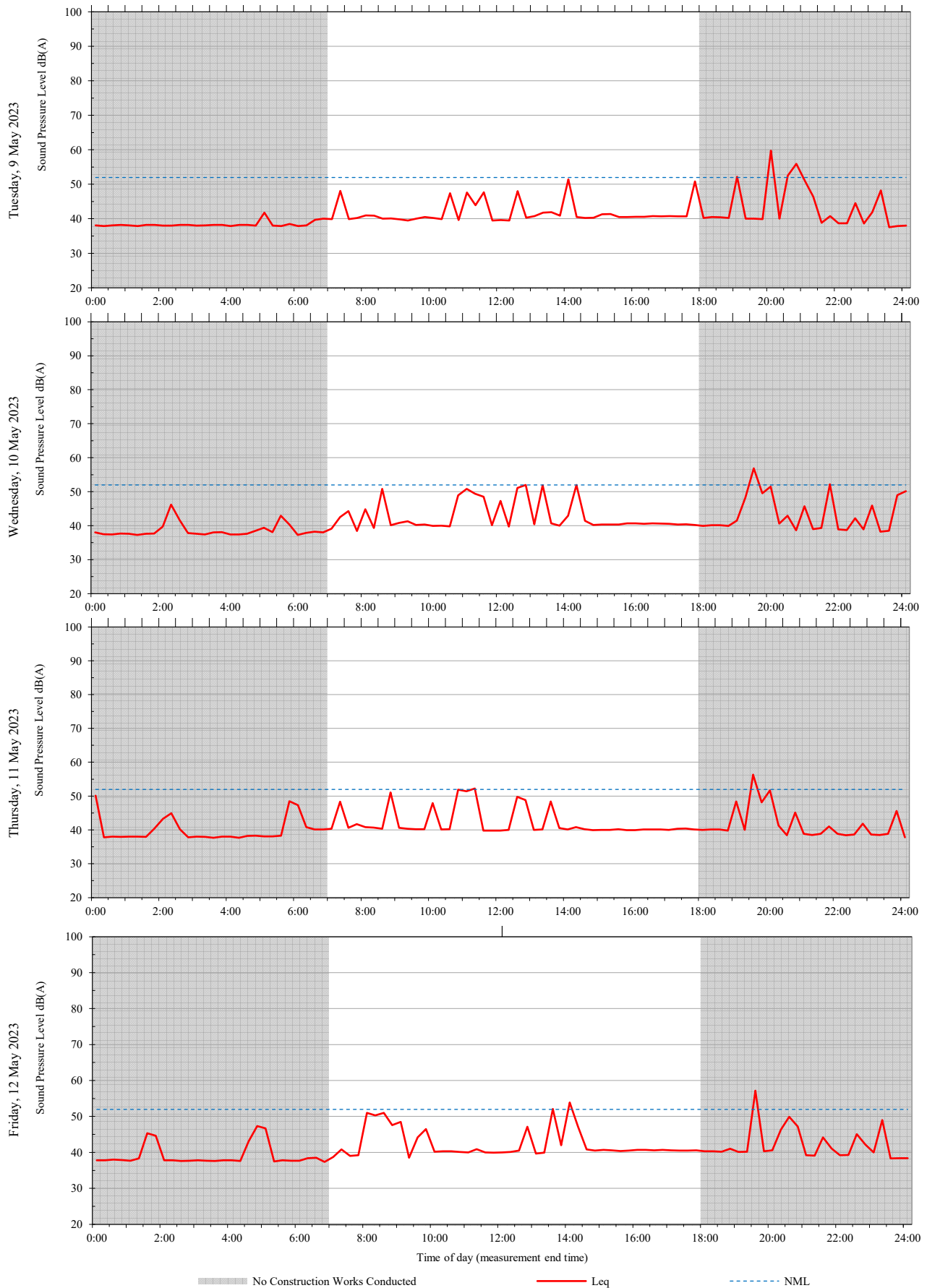
A3 CASB Level 6 Cleaner's Room WM11K.06.6079 (Westmead 6)

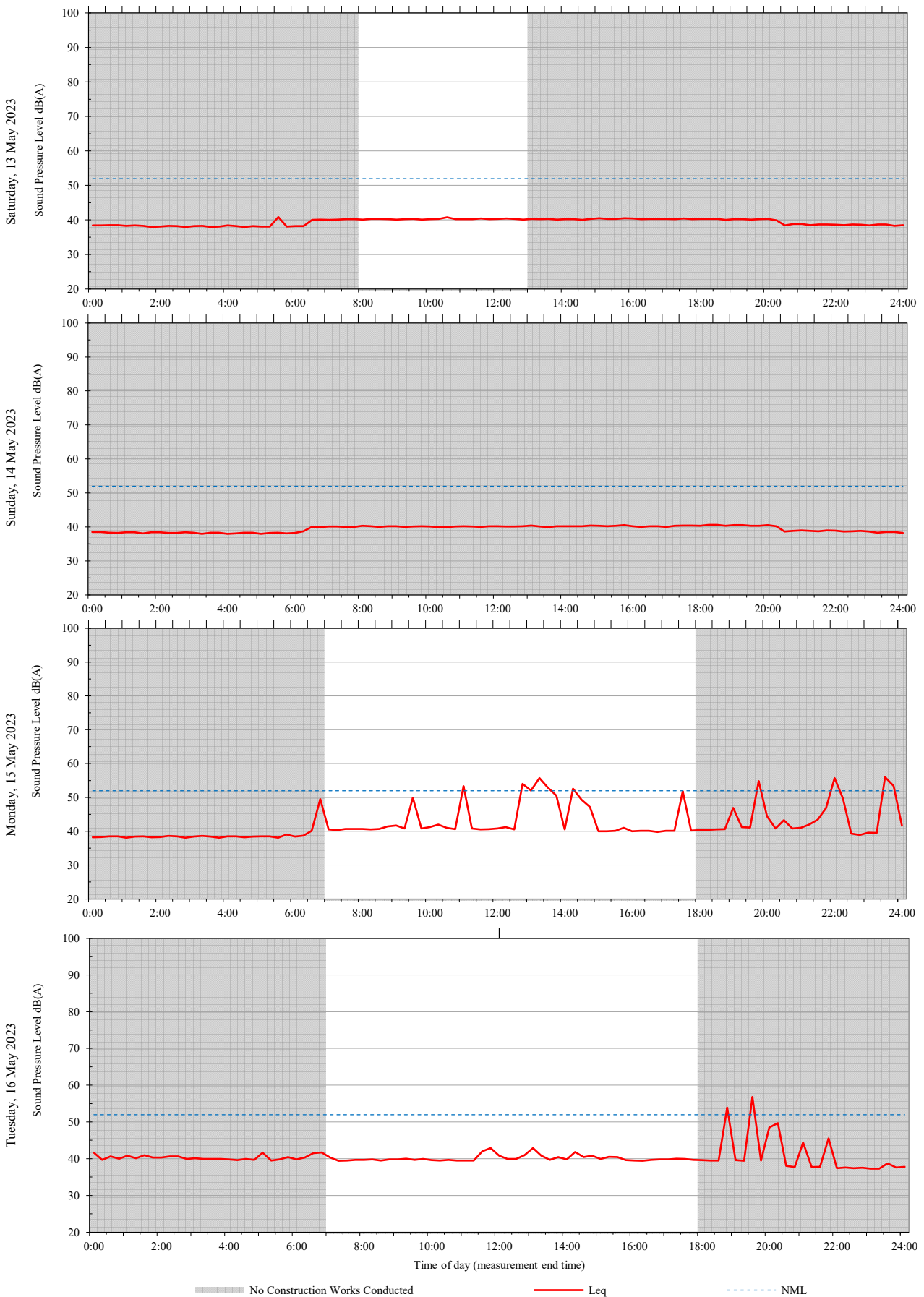
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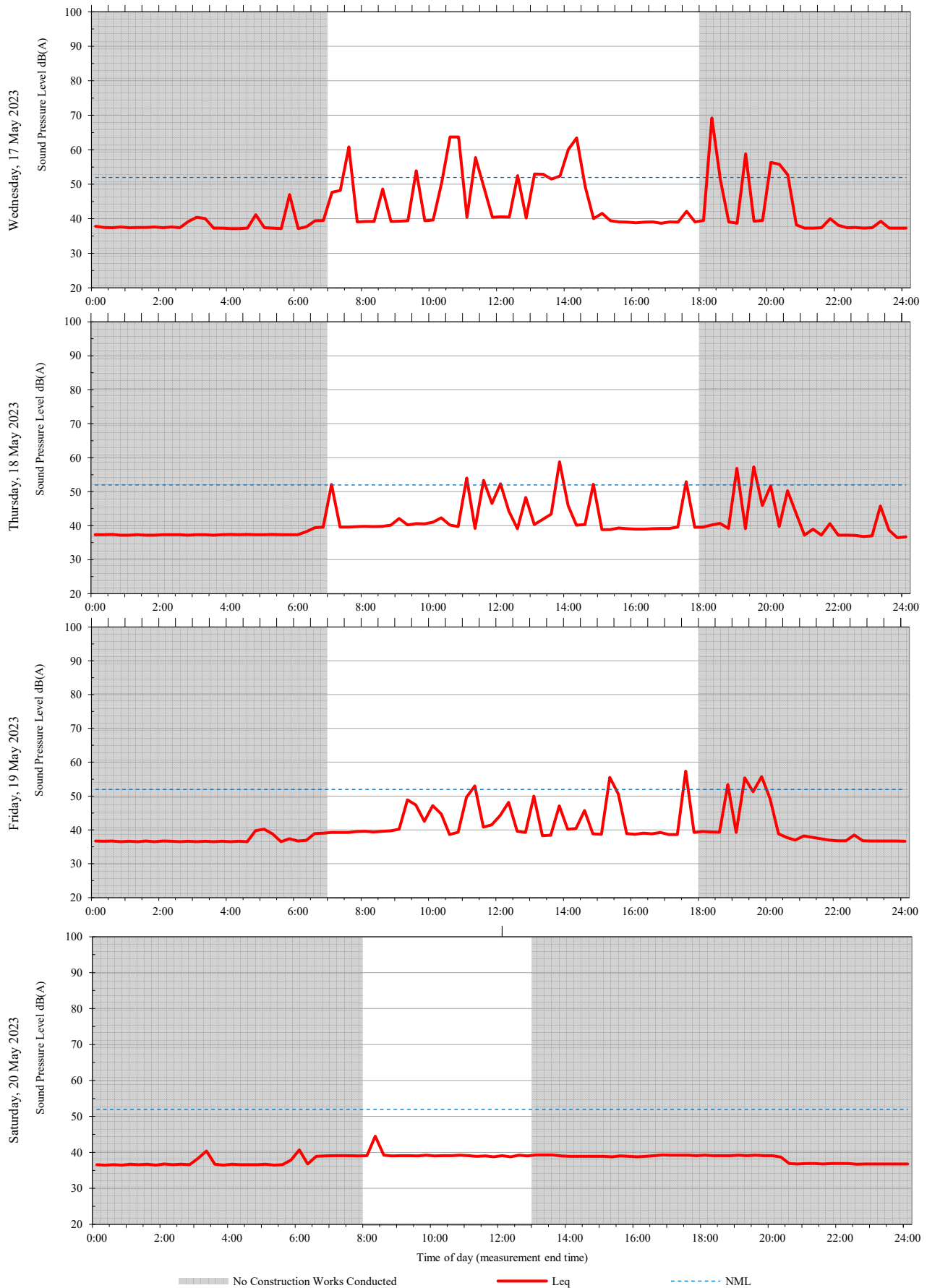


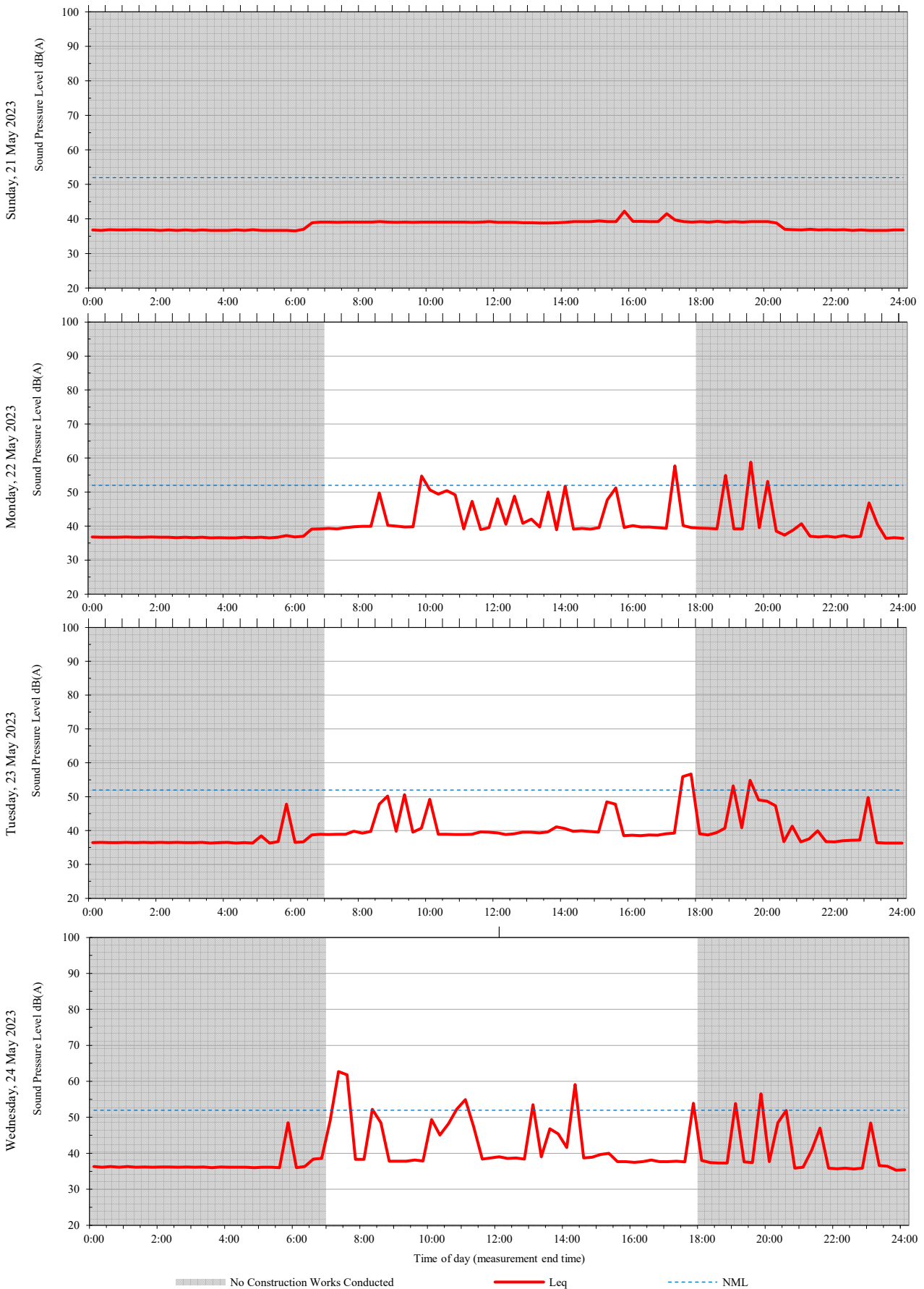
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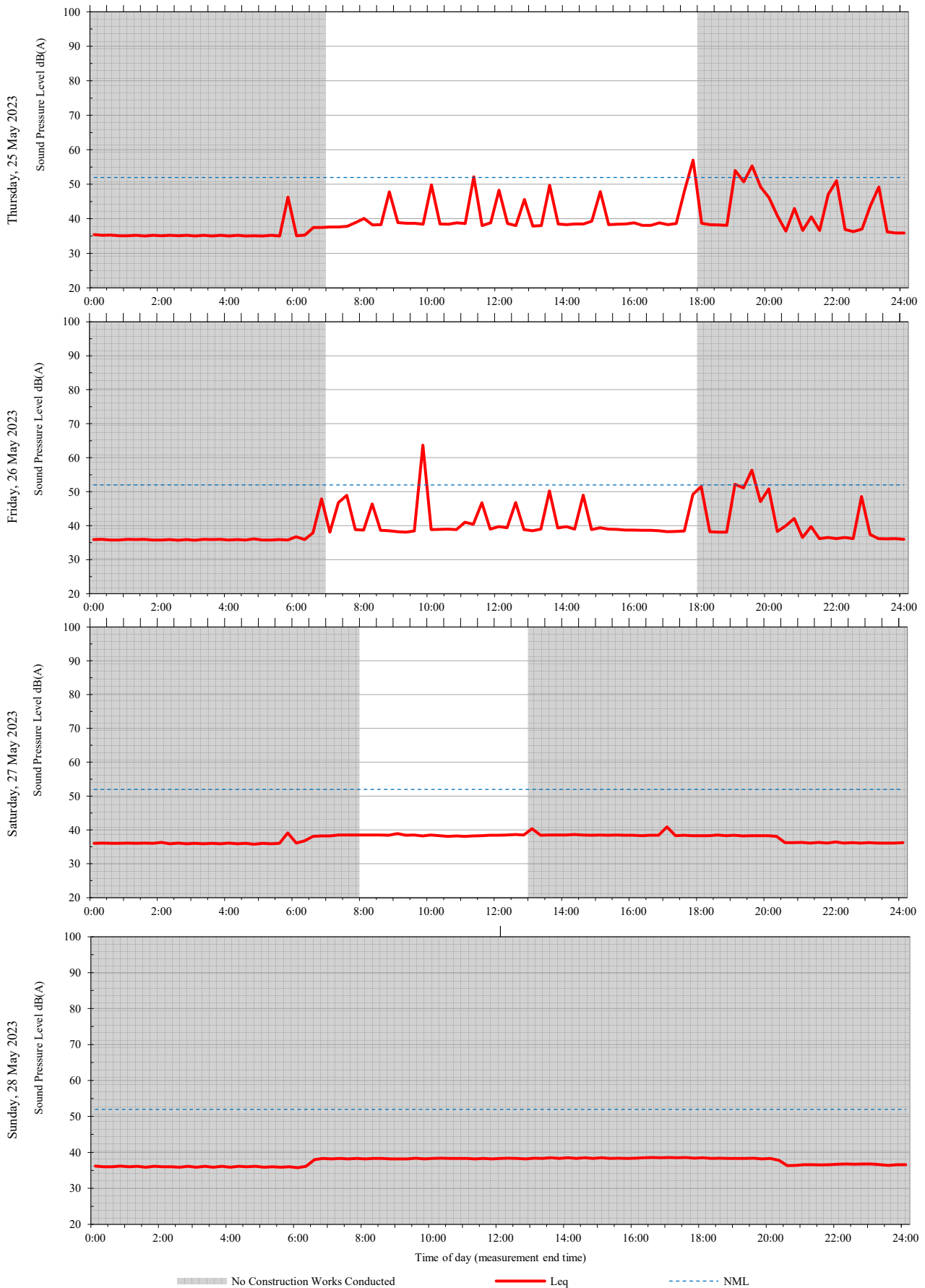




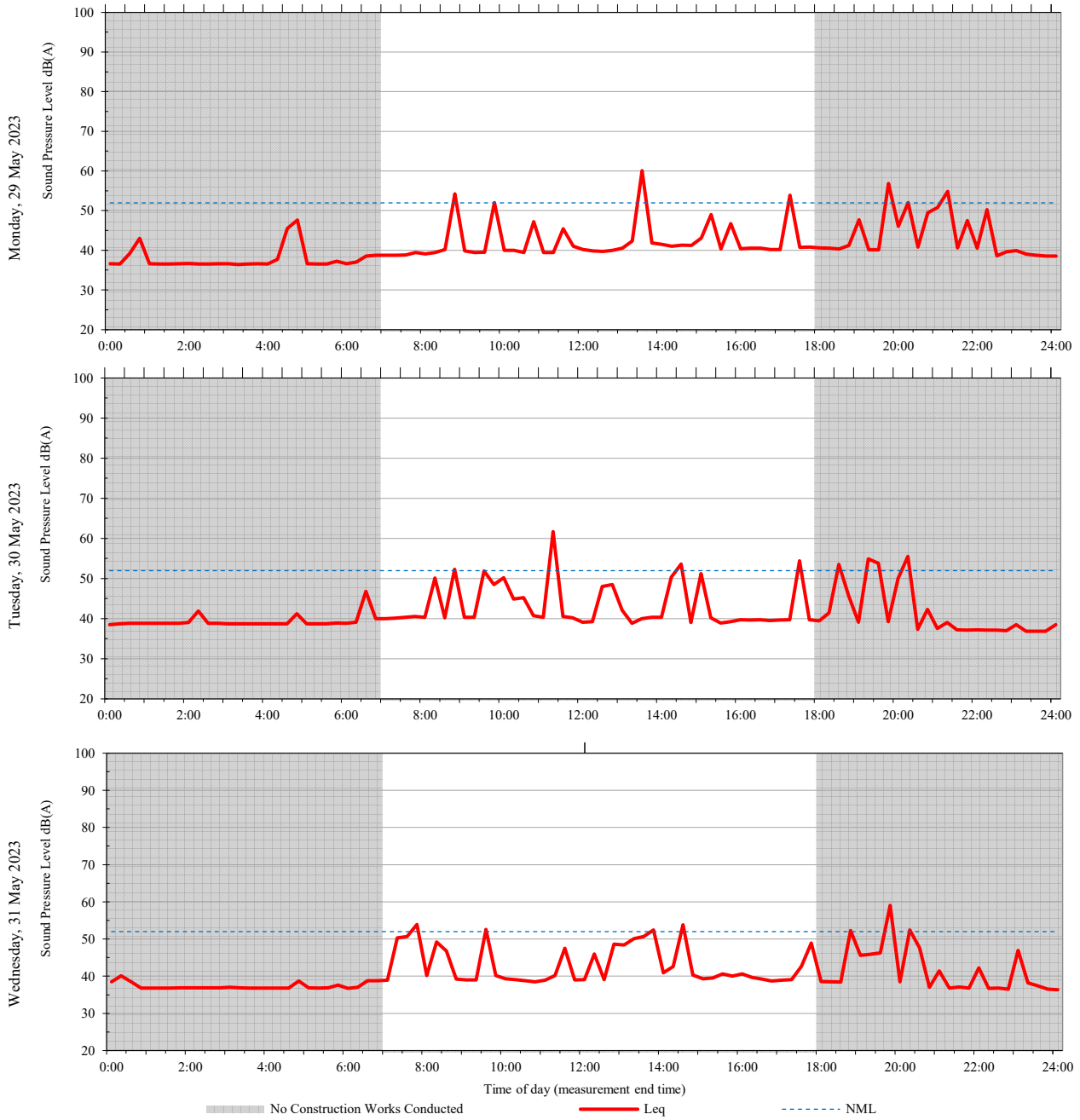
Unattended monitoring: CASB Level 6 Cleaner's Room WM11K.06.6079 (Internal)





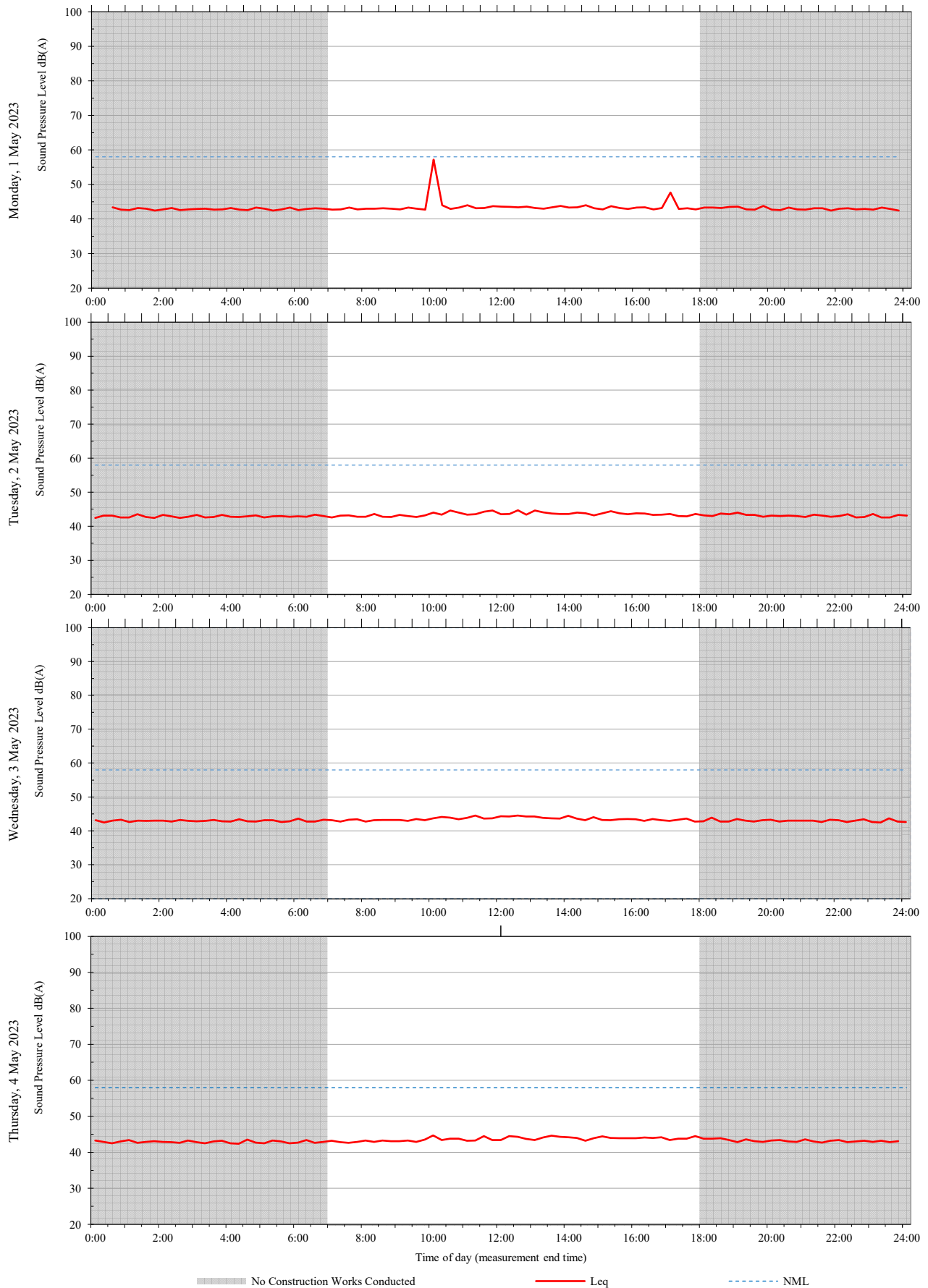


Unattended monitoring: CASB Level 6 Cleaner's Room WM11K.06.6079 (Internal)

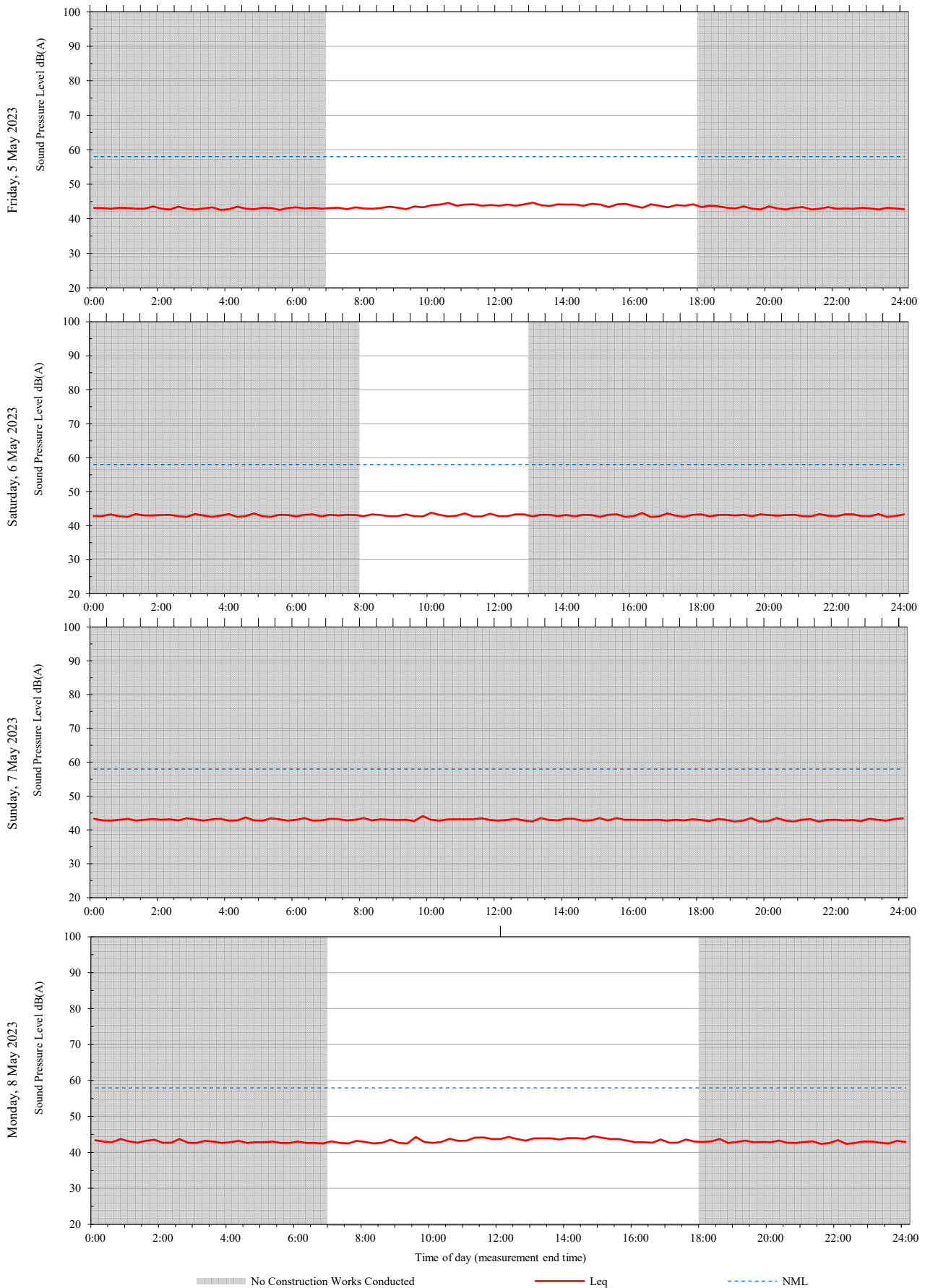


A4 KR Level 3 Radiation Room 33 RF041 (Westmead 7)

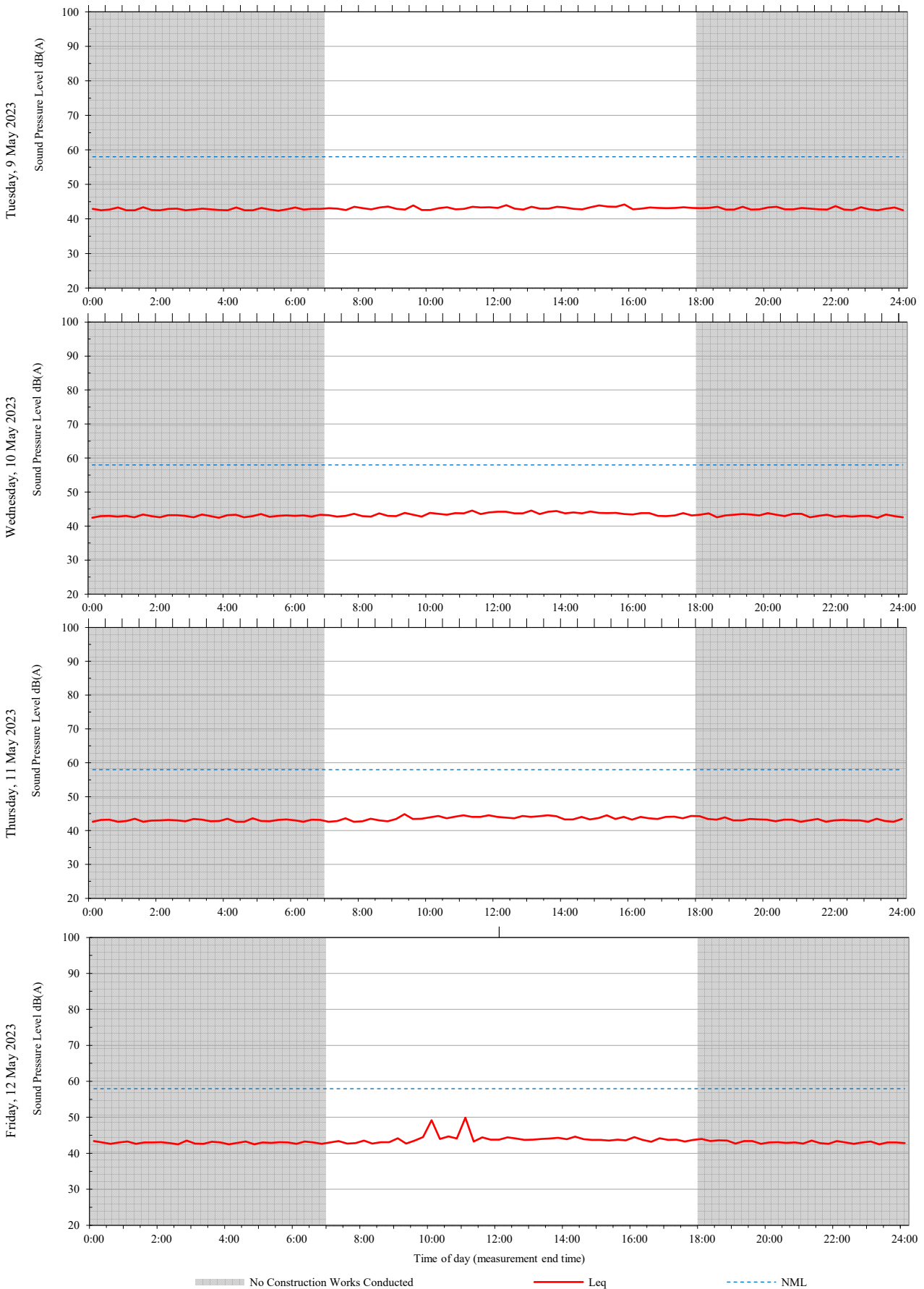
Unattended monitoring: KR Level 3 Radiation Room 33 RF041 (Internal)



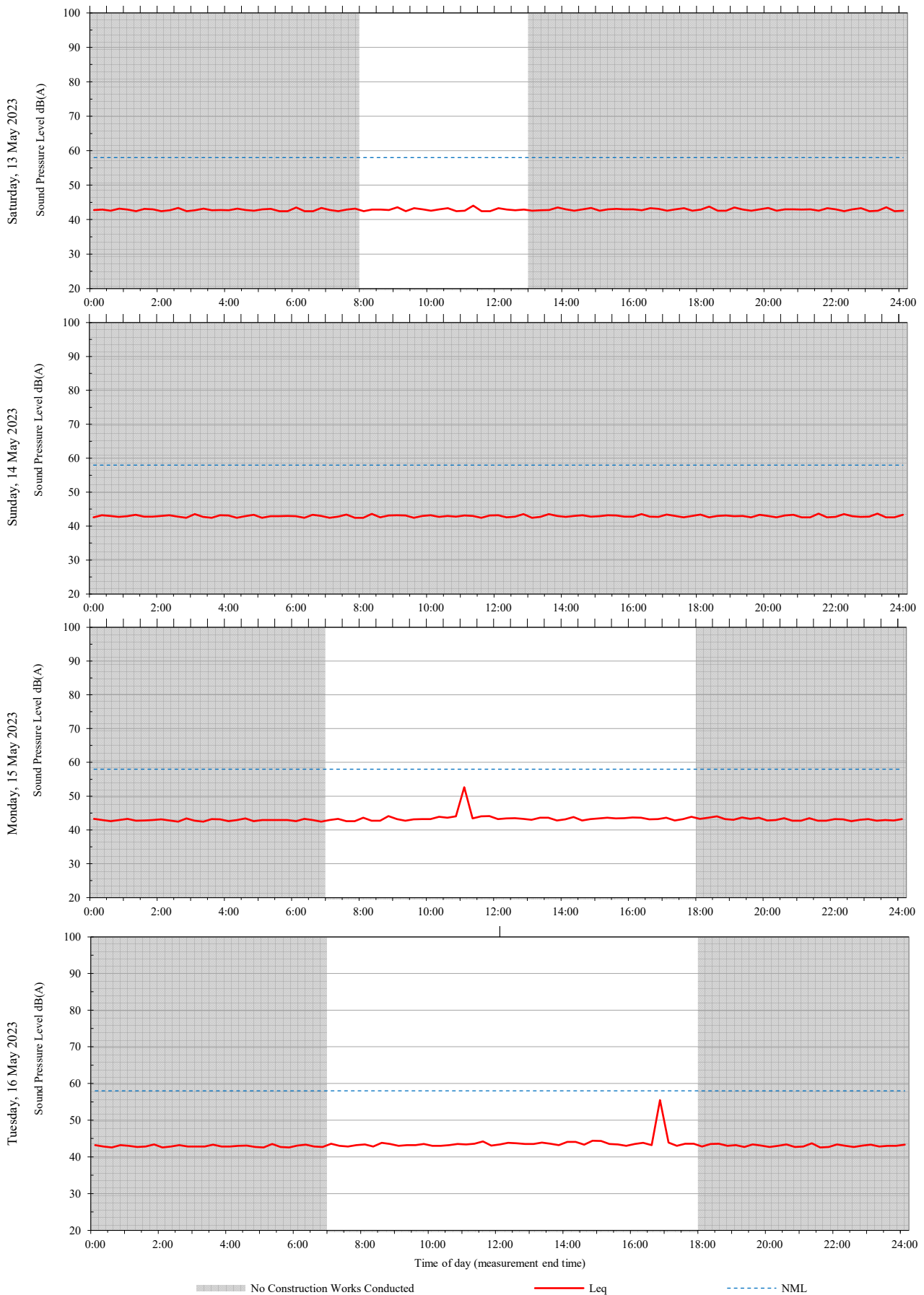
Unattended monitoring: KR Level 3 Radiation Room 33 RF041 (Internal)



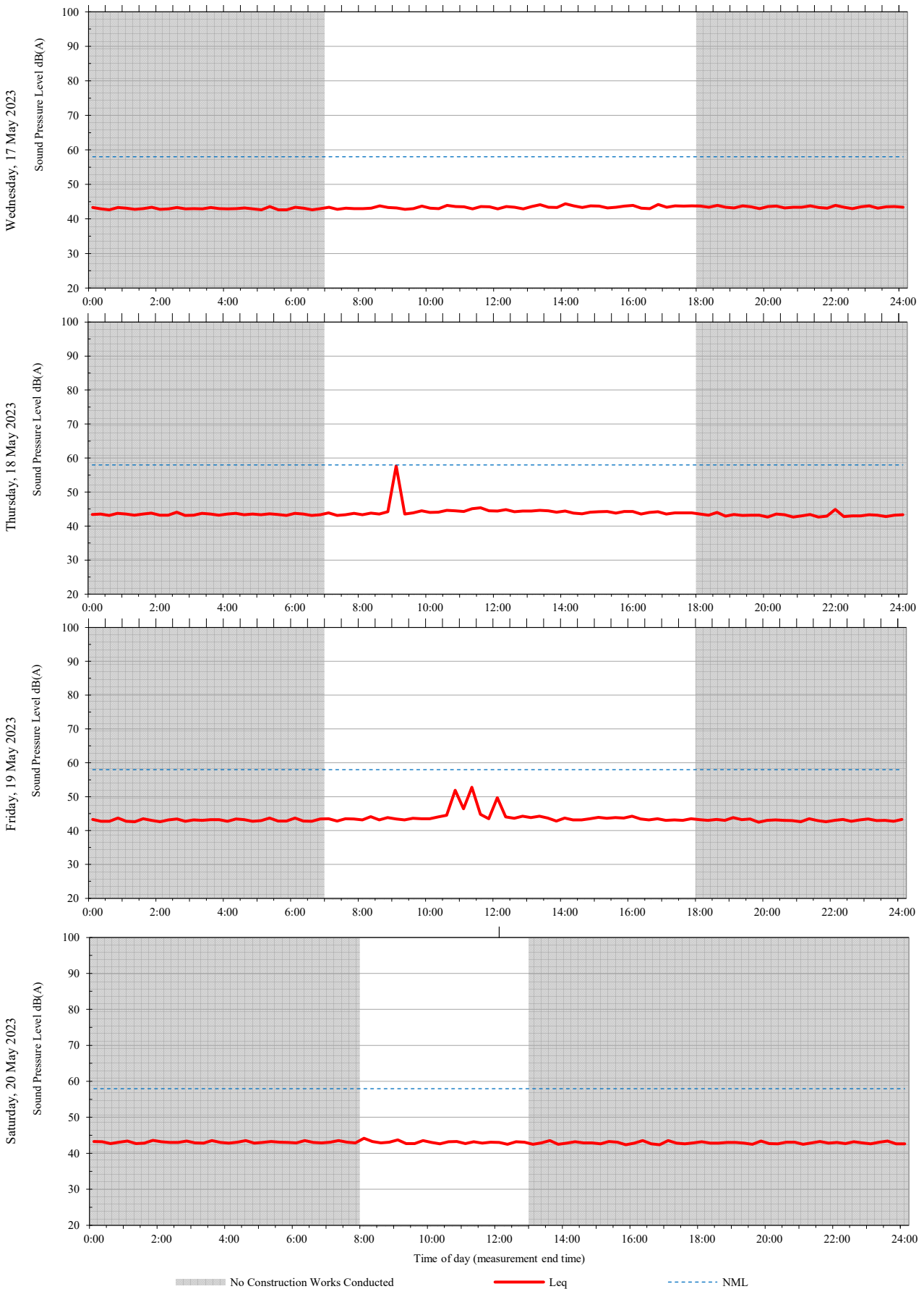
Unattended monitoring: KR Level 3 Radiation Room 33 RF041 (Internal)



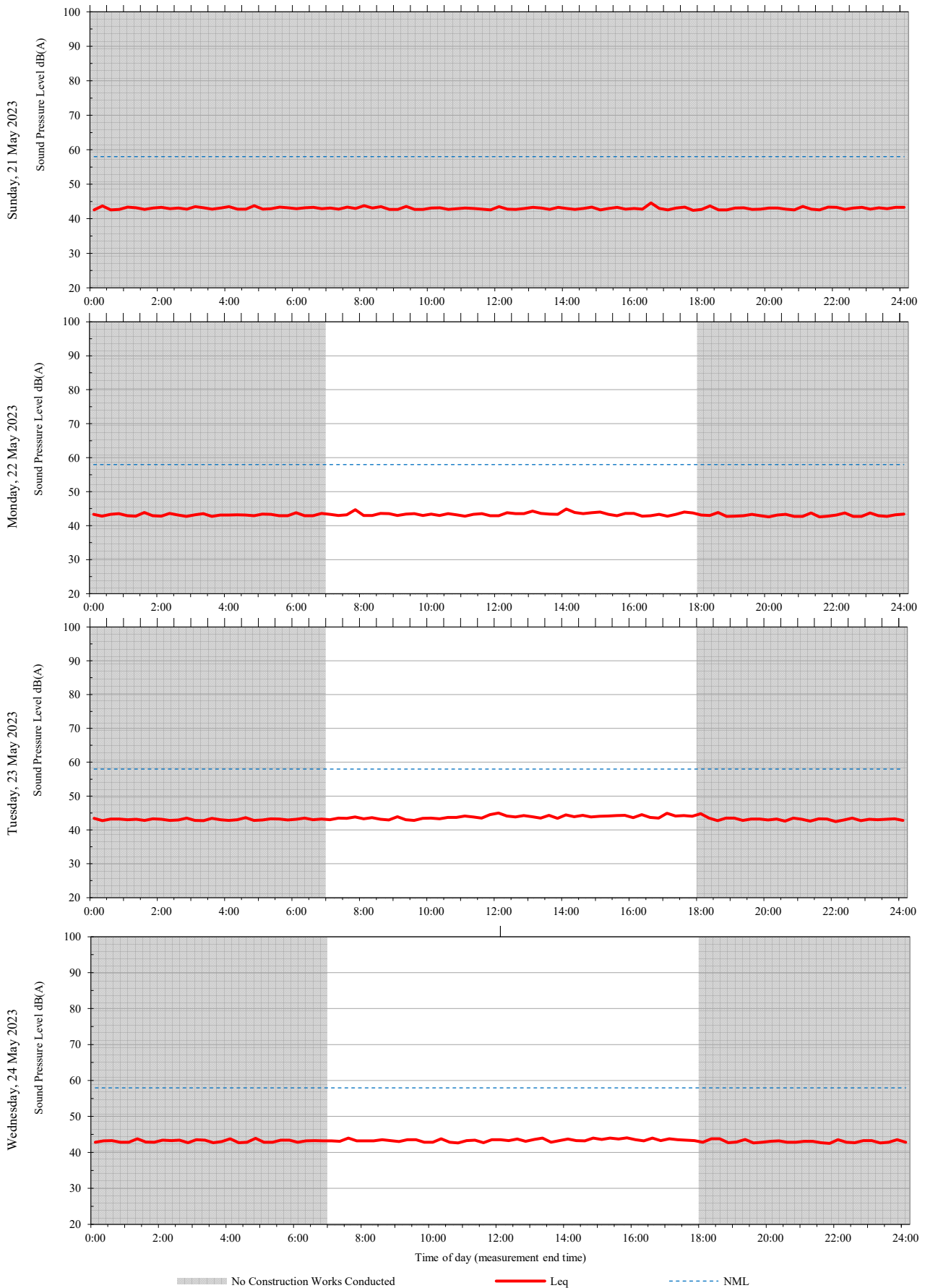
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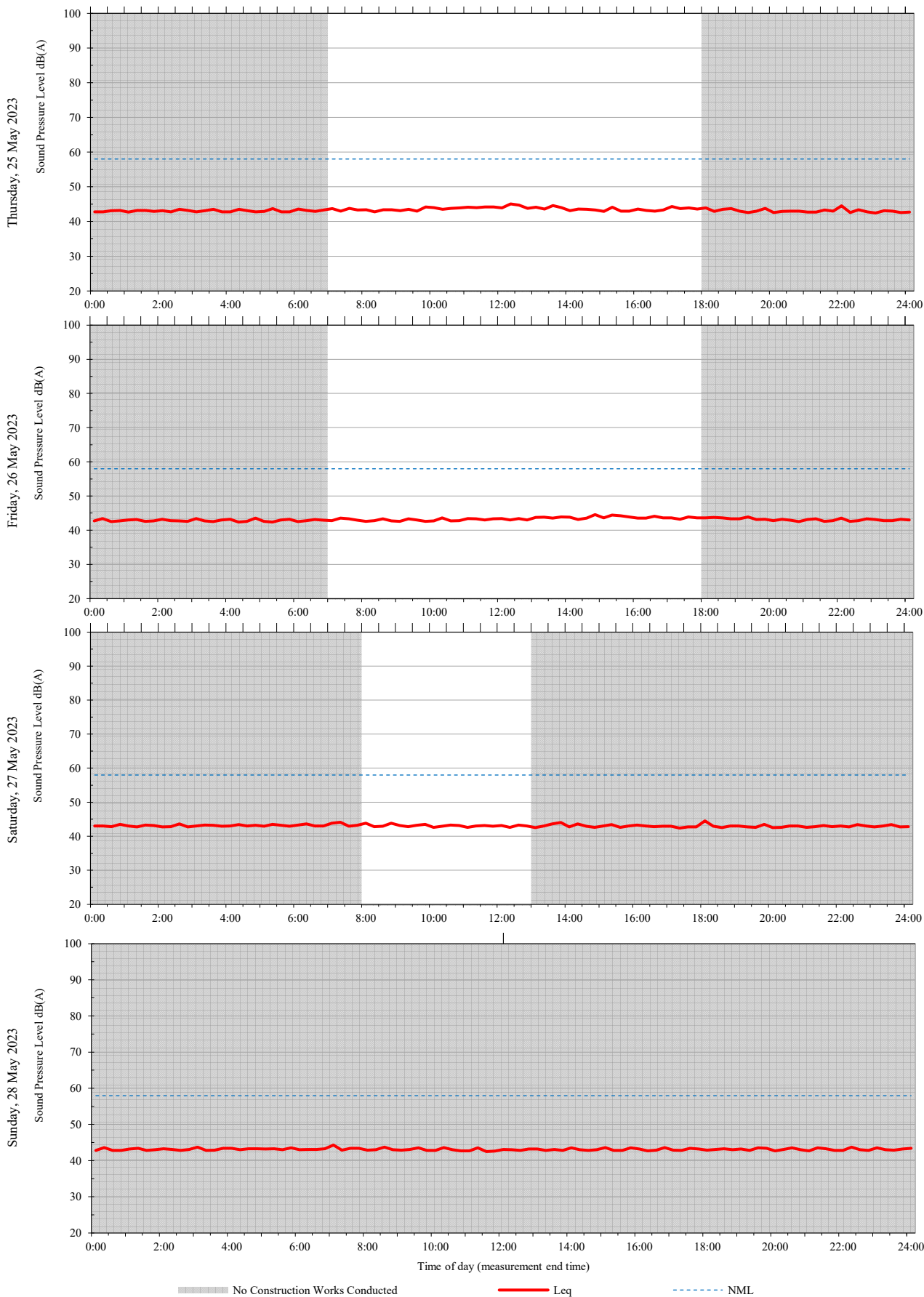
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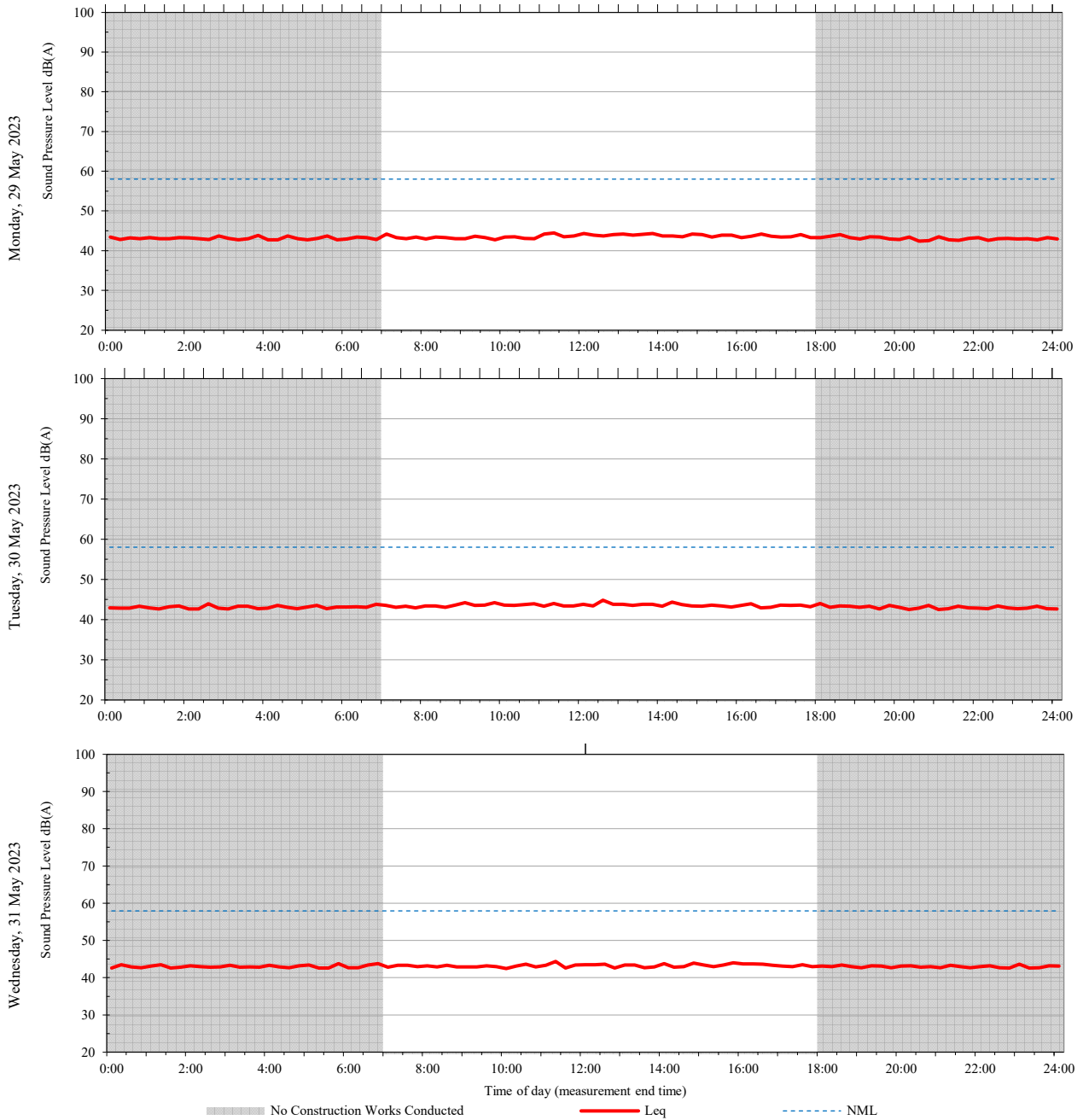
Unattended monitoring: KR Level 3 Radiation Room 33 RF041 (Internal)



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

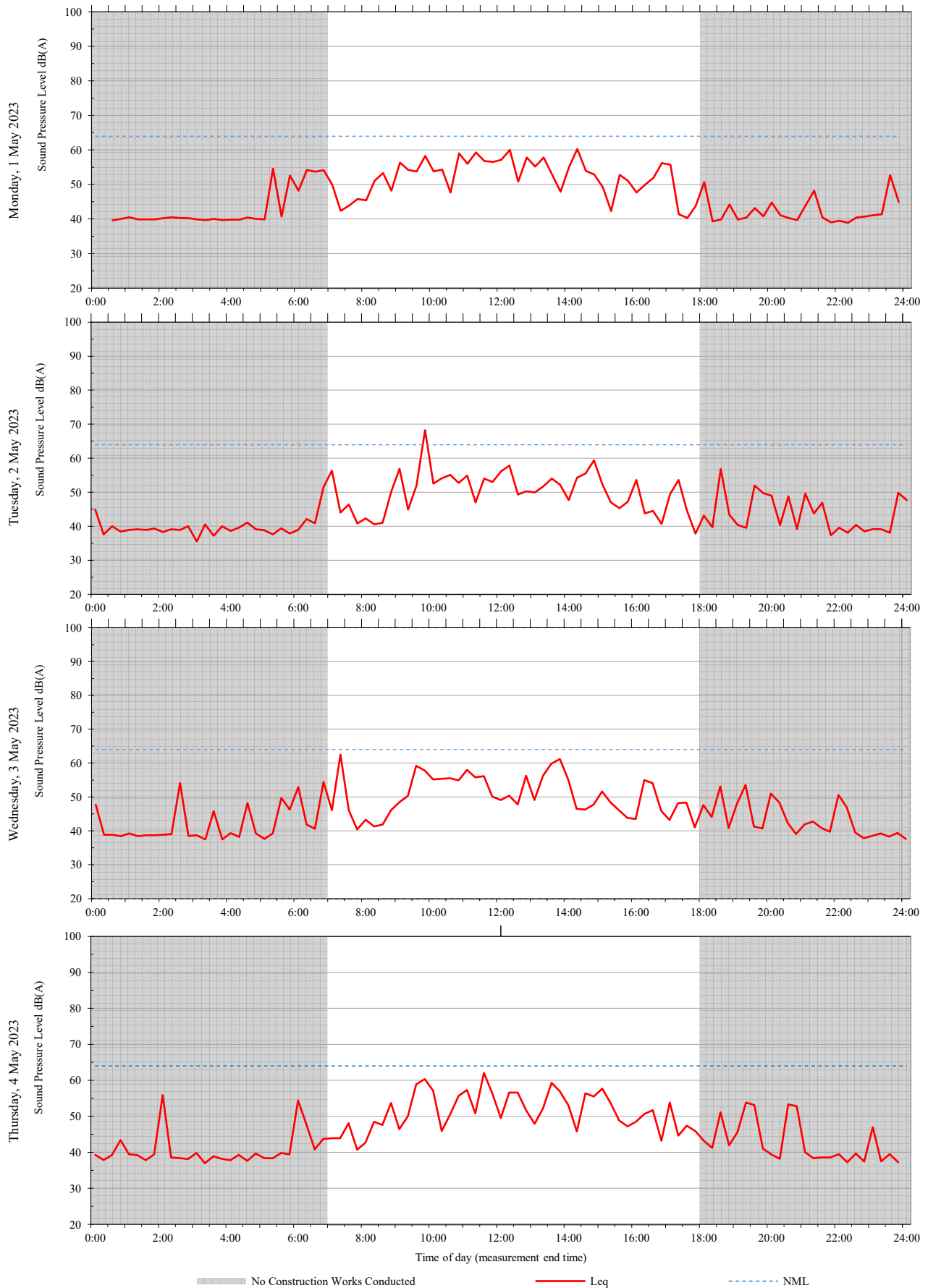


Unattended monitoring: KR Level 3 Radiation Room 33 RF041 (Internal)

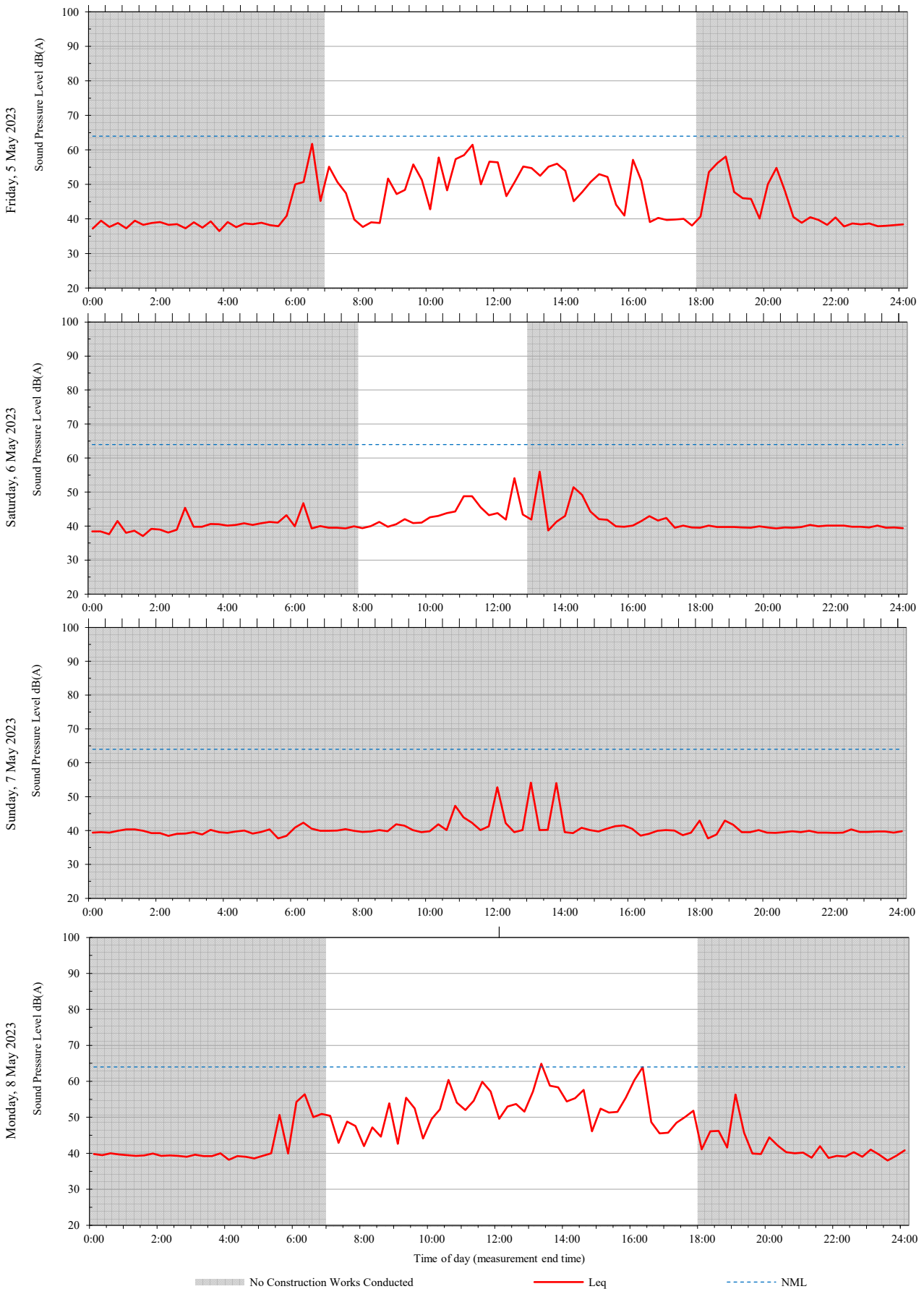


A5 CHW Level 2 Parent Kitchen 92BW025 (facing MSCP site) (Westmead 2)

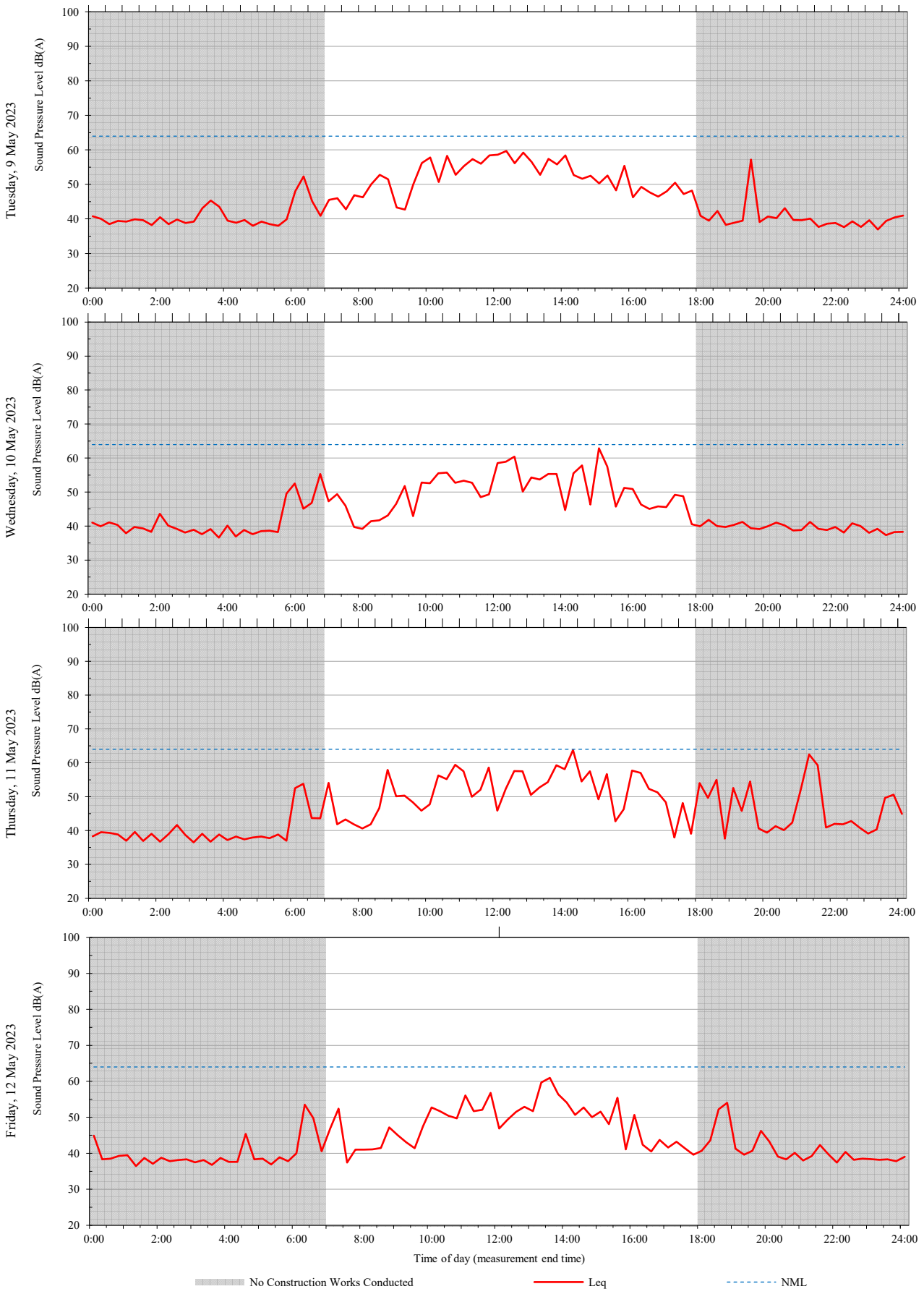
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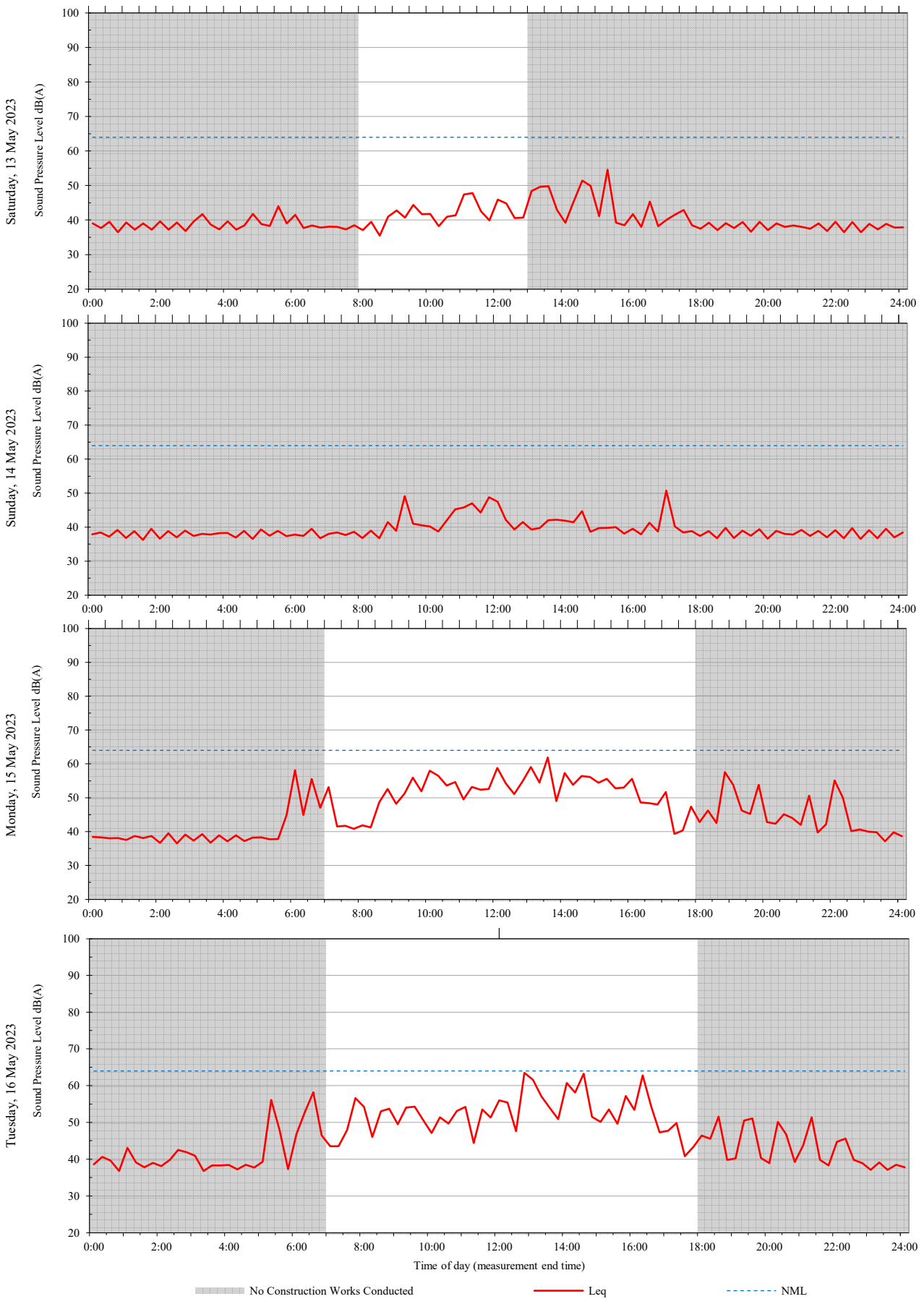
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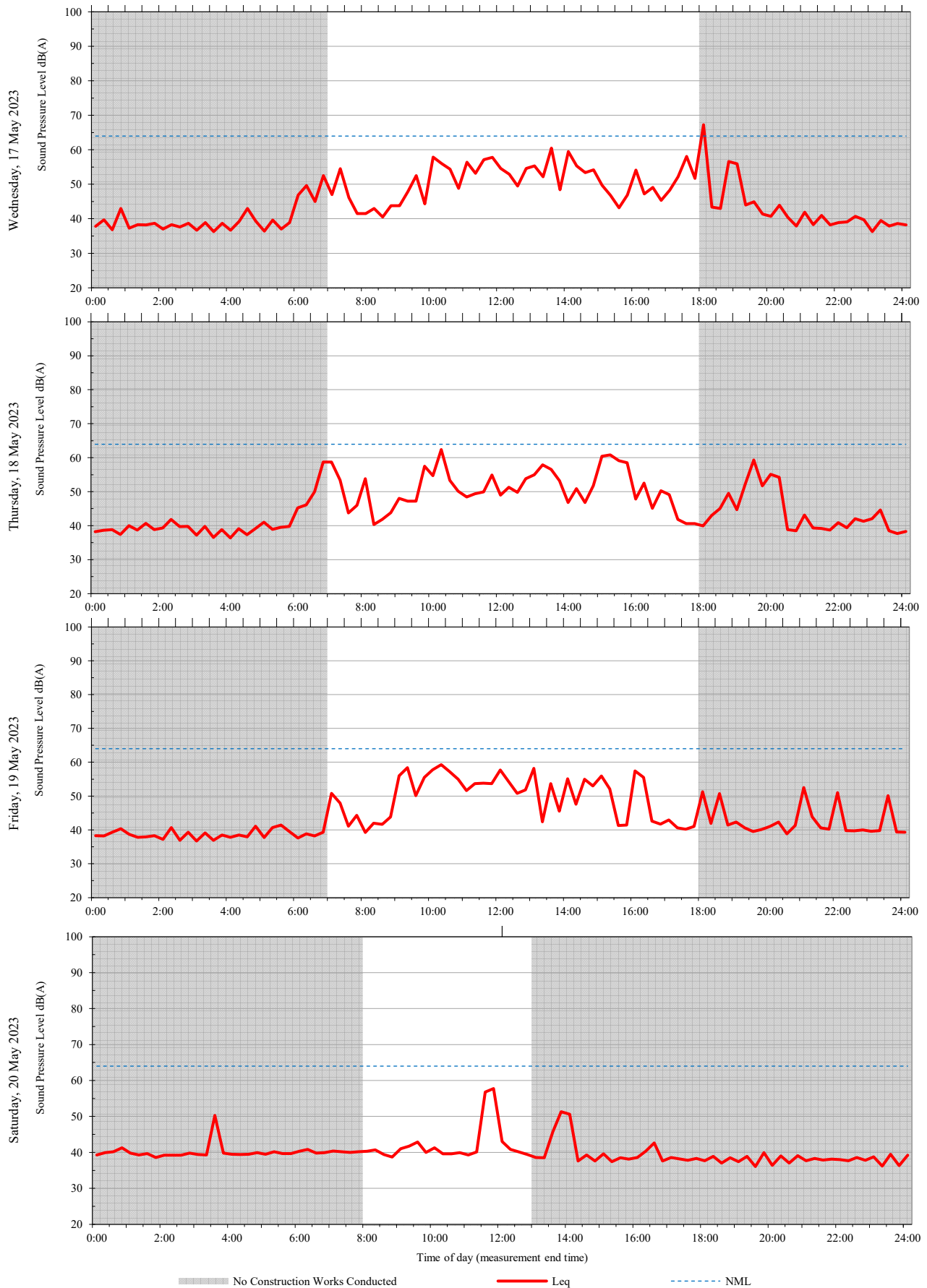
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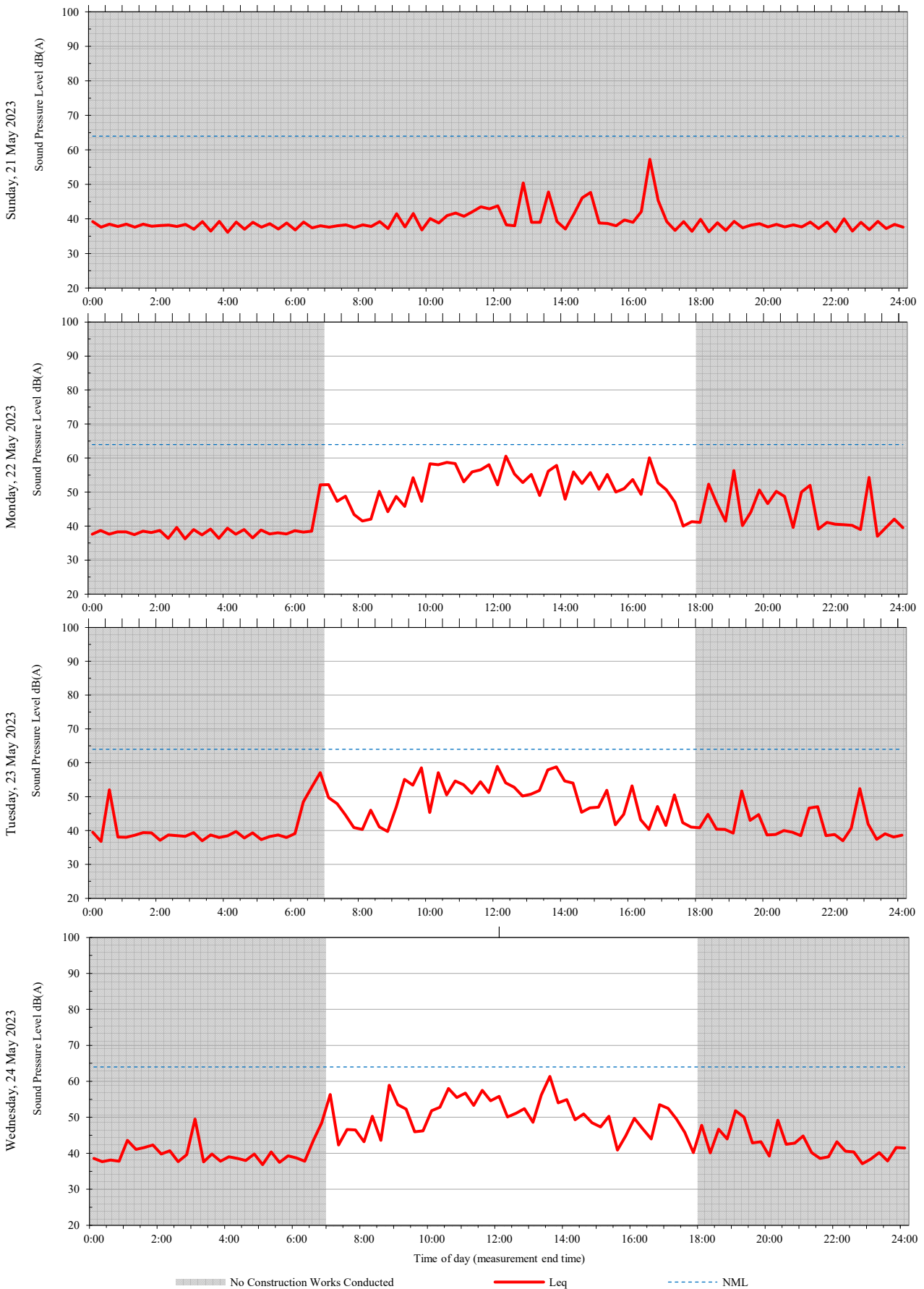
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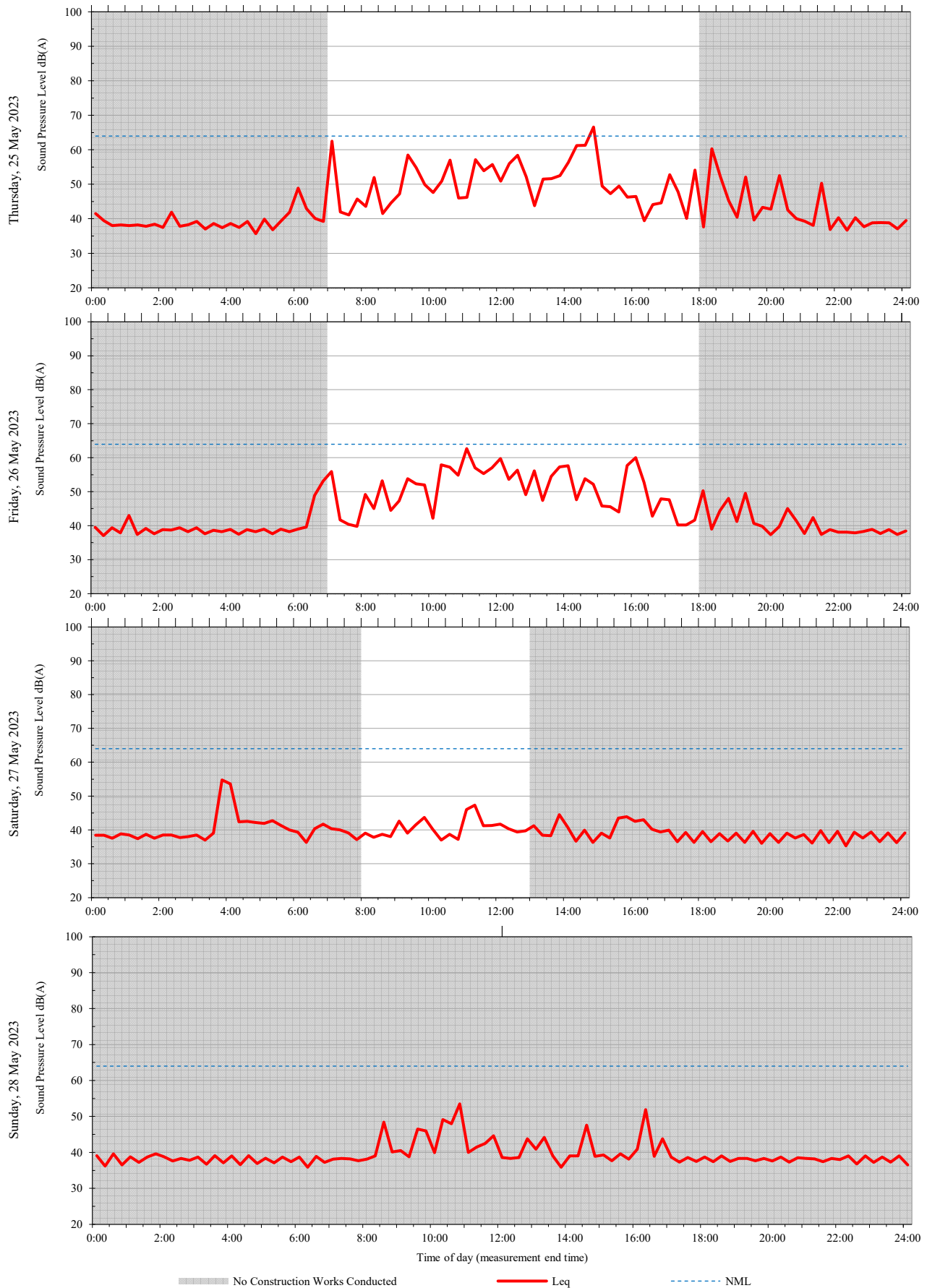
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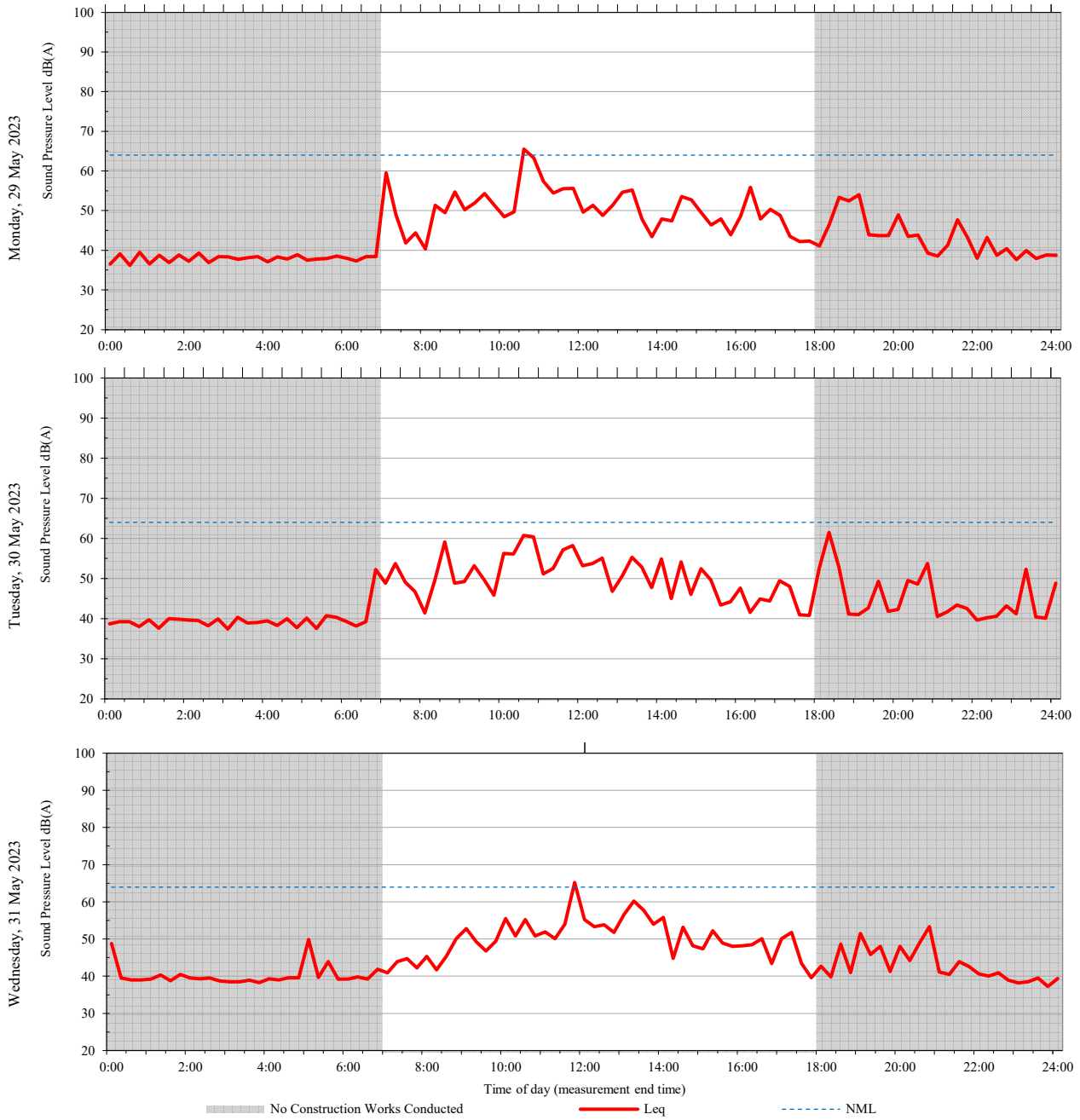
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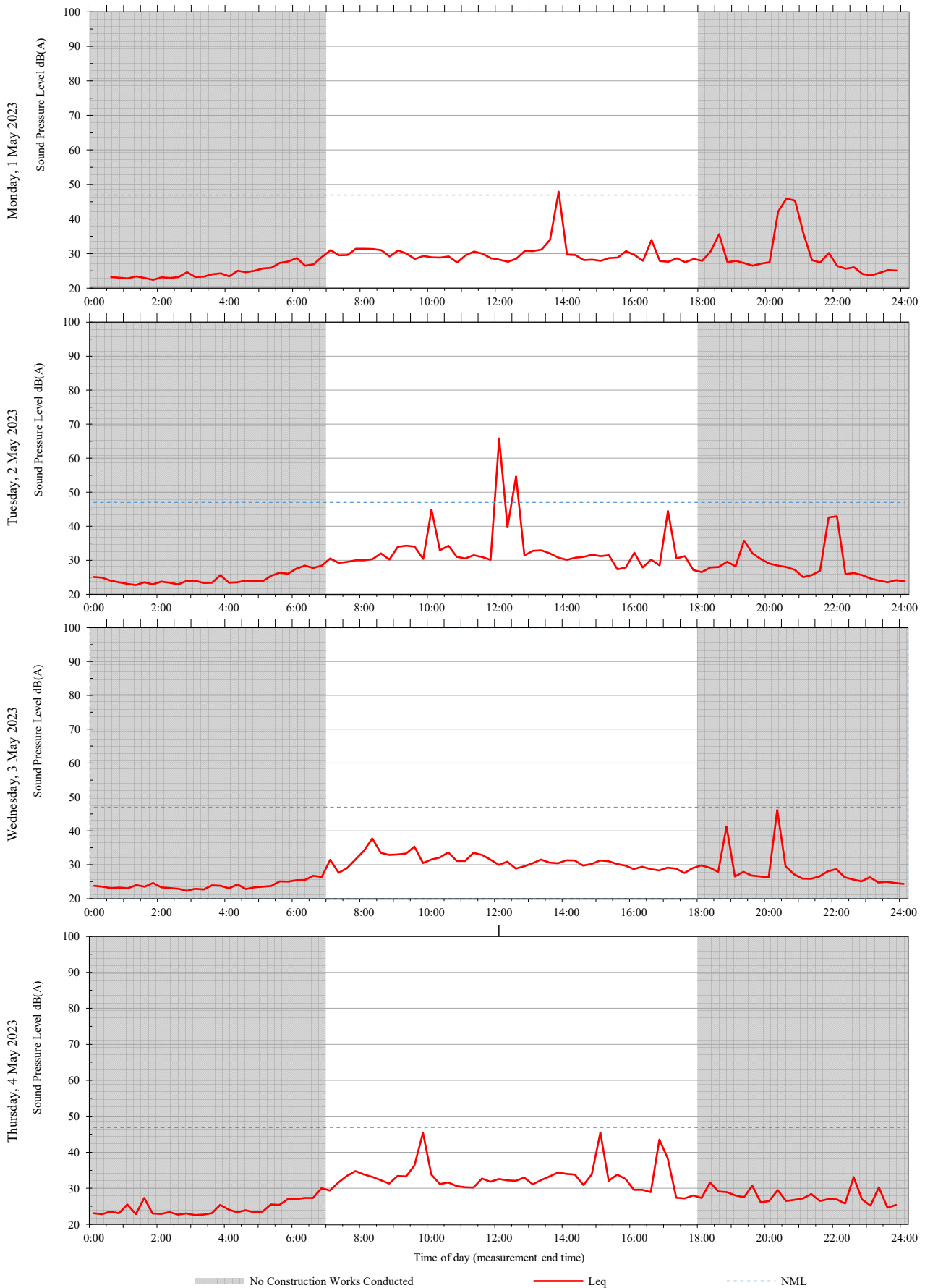


Unattended monitoring: CHW Level 2 Parent Kitchen 92BW025 (Internal)

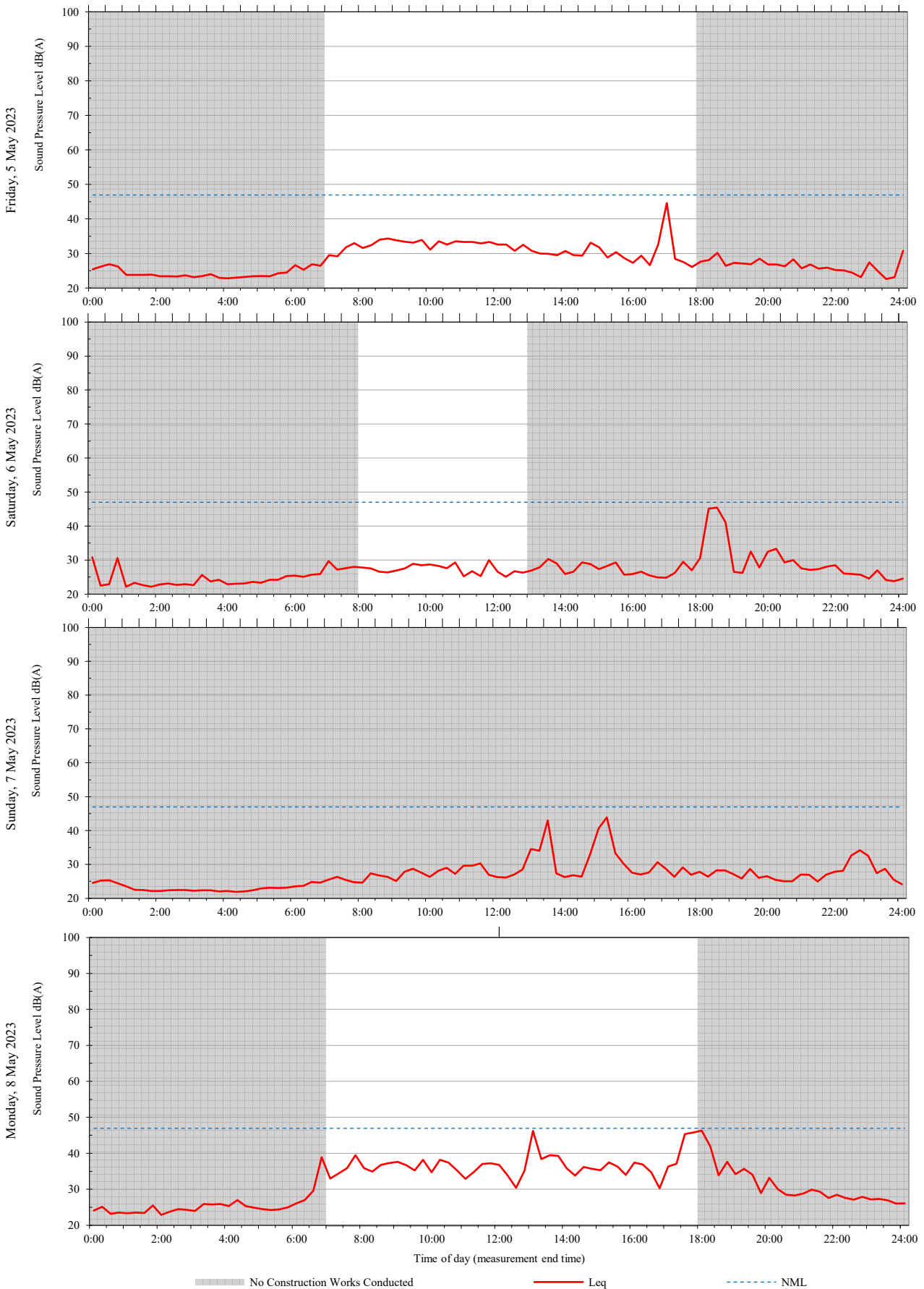


A6 RMH Level 1 Store Room 101 (Westmead 3)

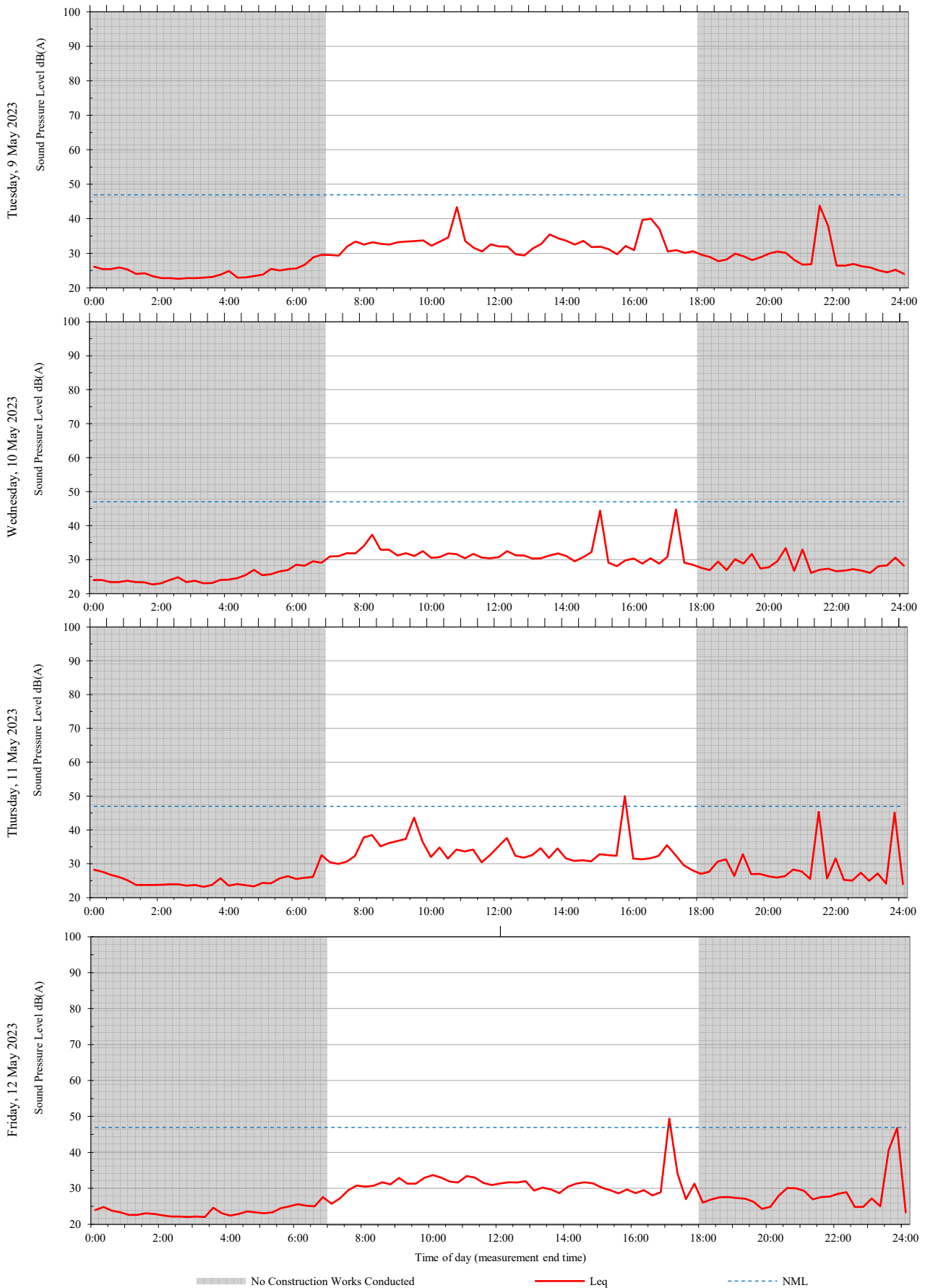
Unattended monitoring: RMH Level 1 Store Room 101 (Internal)



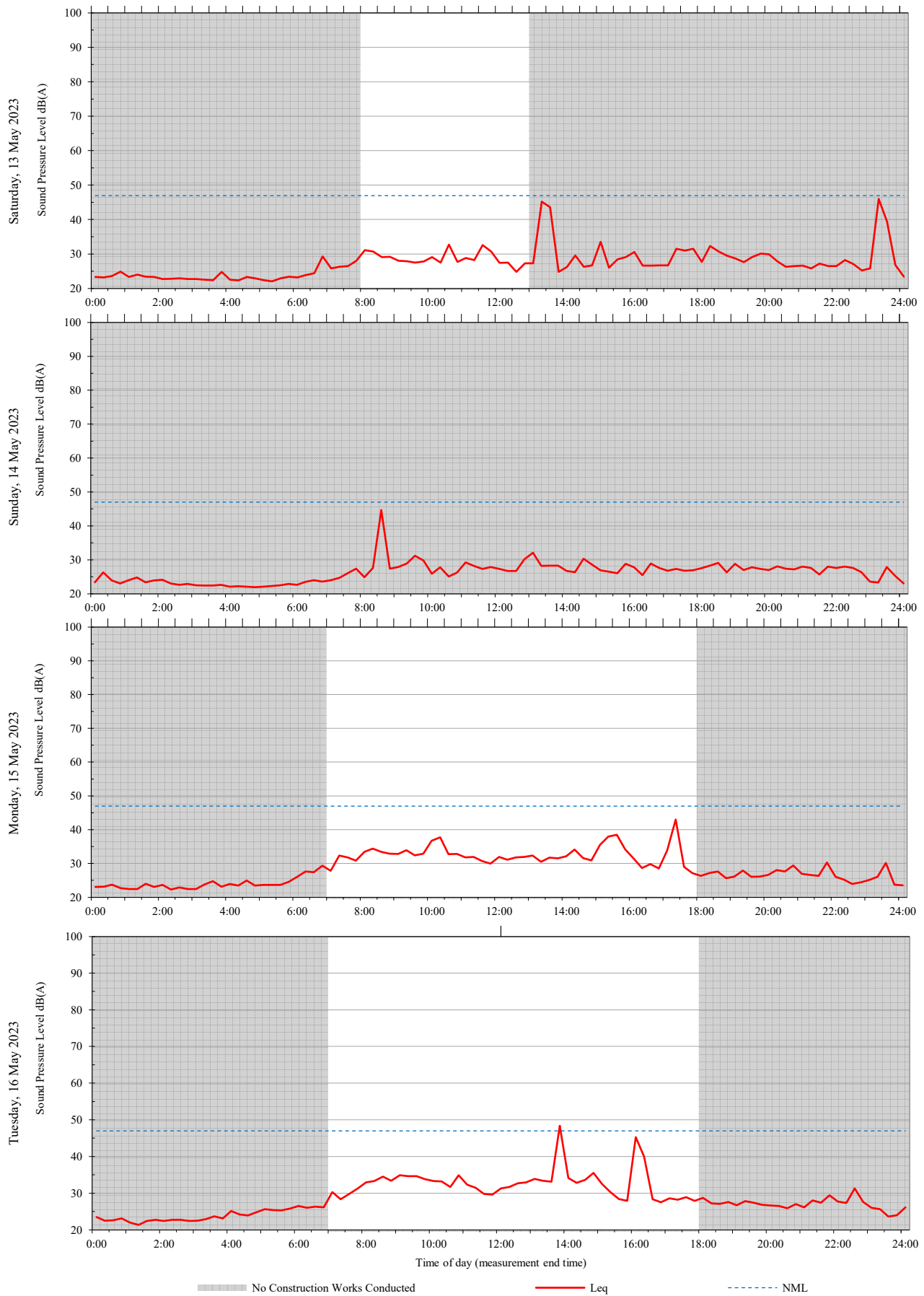
Unattended monitoring: RMH Level 1 Store Room 101 (Internal)



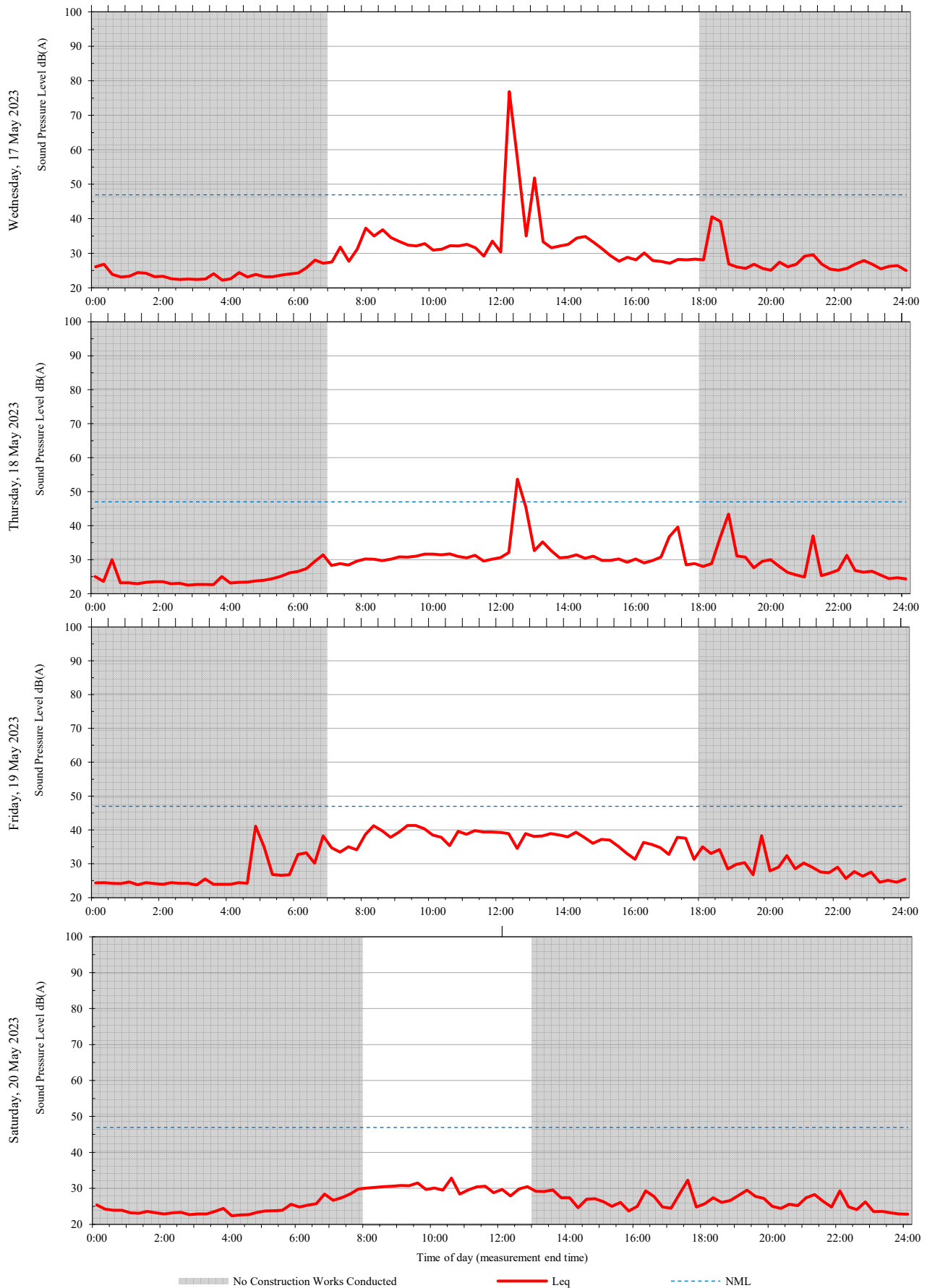
Unattended monitoring: RMH Level 1 Store Room 101 (Internal)



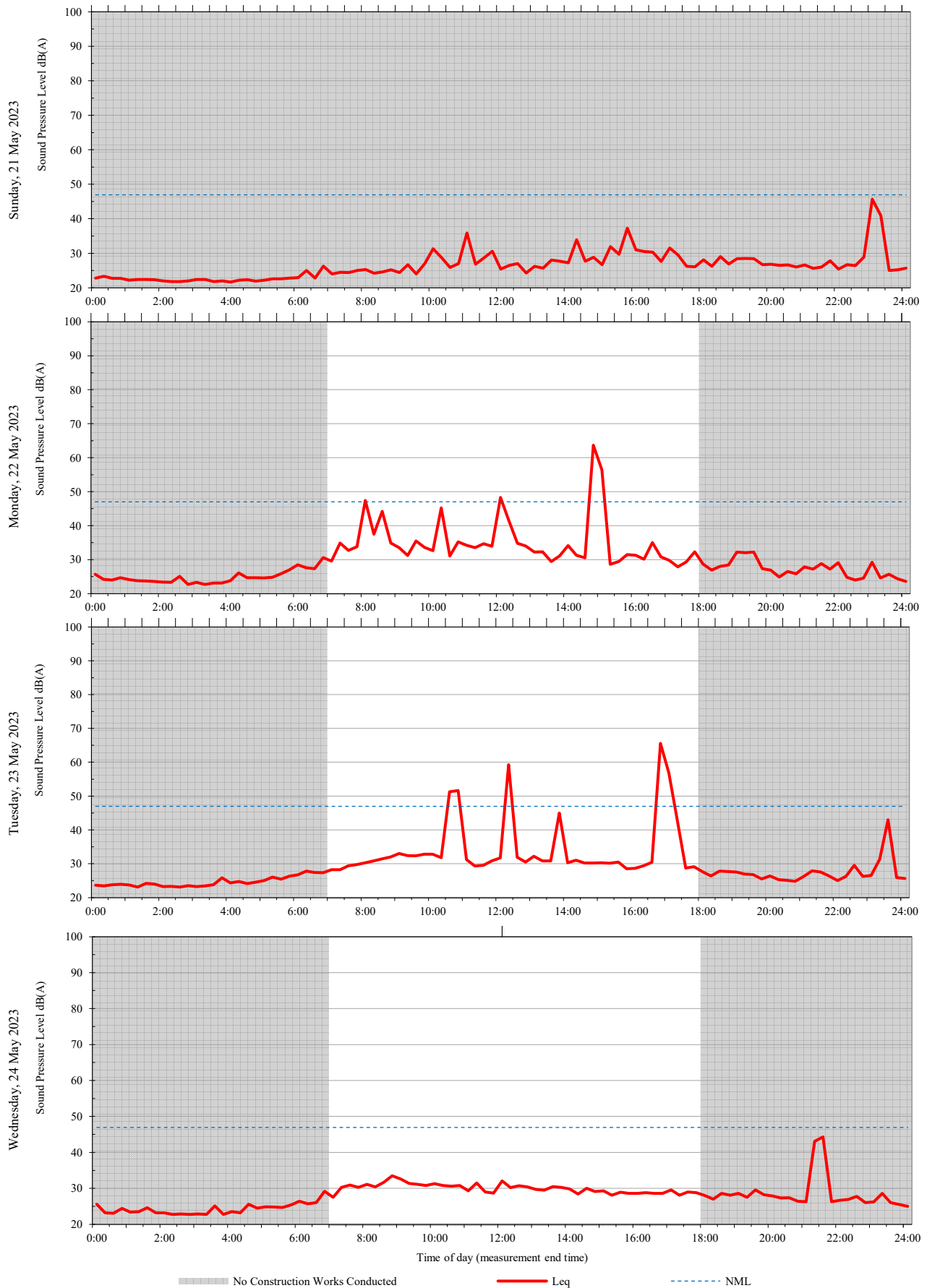
Unattended monitoring: RMH Level 1 Store Room 101 (Internal)



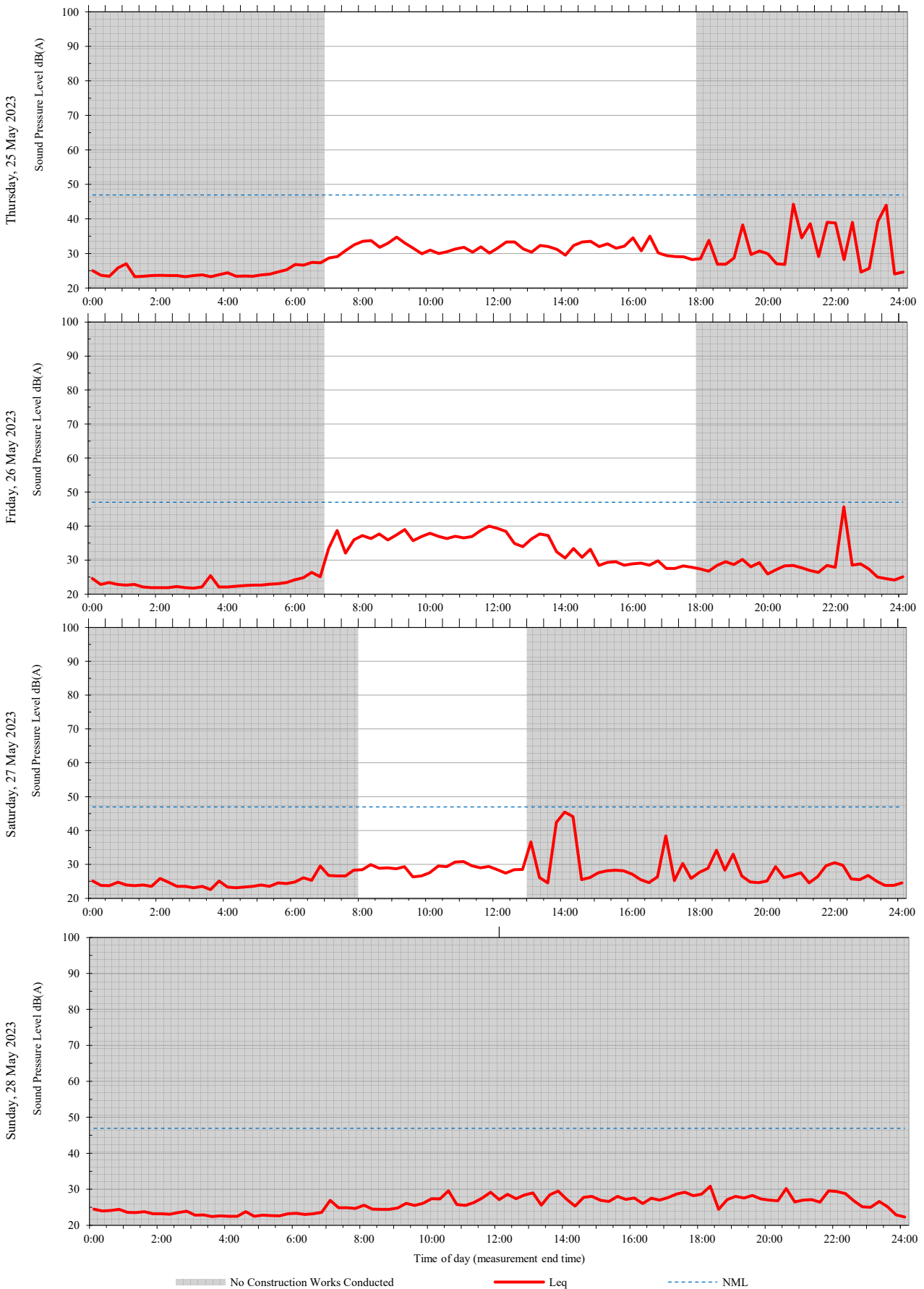
Unattended monitoring: RMH Level 1 Store Room 101 (Internal)



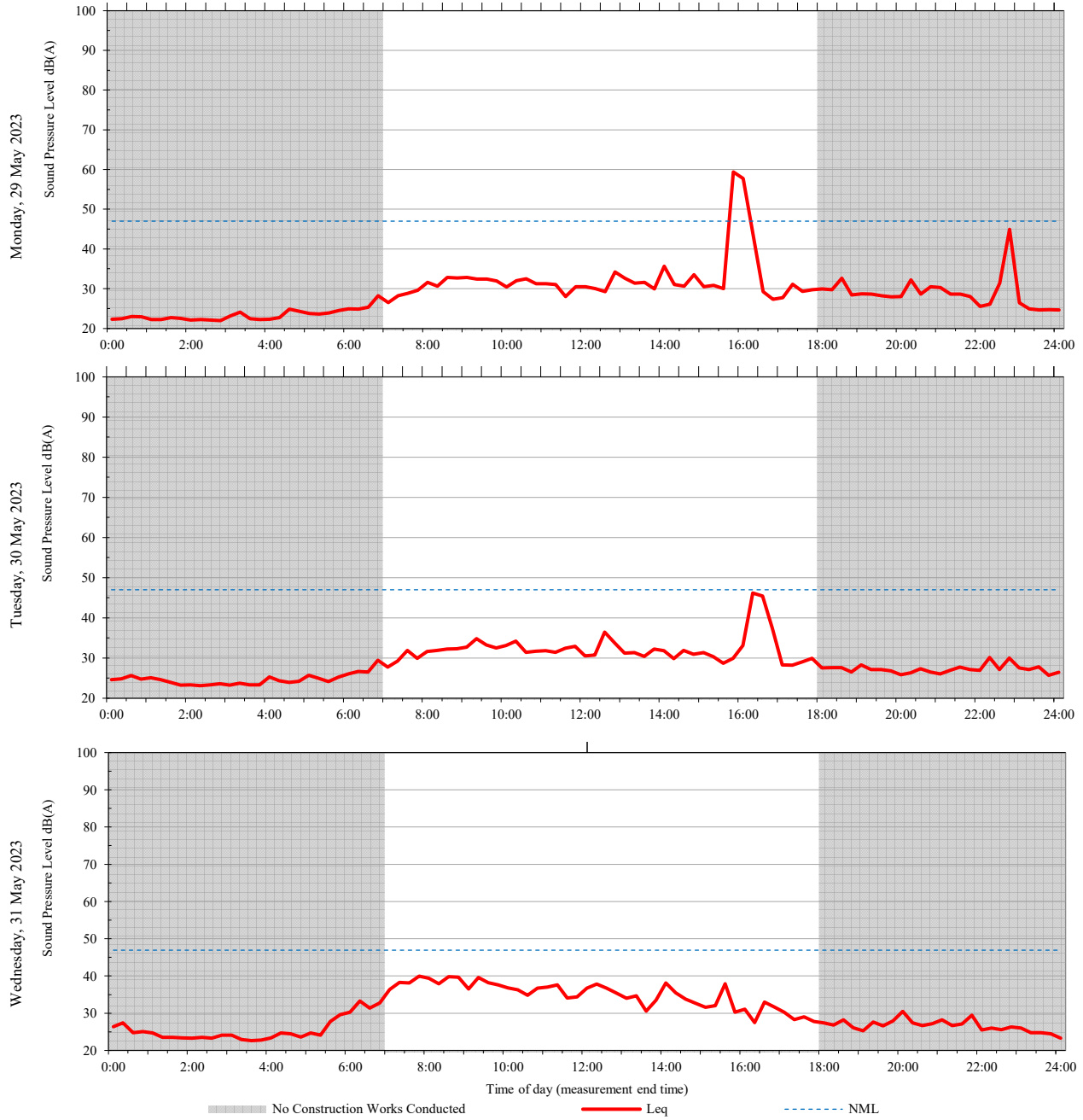
Unattended monitoring: RMH Level 1 Store Room 101 (Internal)



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



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





Health Infrastructure

Children's Hospital Westmead

**Vibration Monitoring - KR L4 44-4873 -
May 2023**

CVM/ KRL4/202305

Issue 1 | 19/06/2023

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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Issue 1	19/06/2023		Issue

	Prepared by	Checked by	Approved by
Name	PR	MJW	MJW
Signature			

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Signature				

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Name				
Signature				

Issue Document Verification with Document

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Appendix A: Calibration Certificates.....	Error! Bookmark not defined.

Executive Summary

This report summarises the vibration monitoring data recorded at KR Level 4 in Room 44-4873, over one month – from 01/05/2023 to 31/05/2023. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMS Acceleration Levels

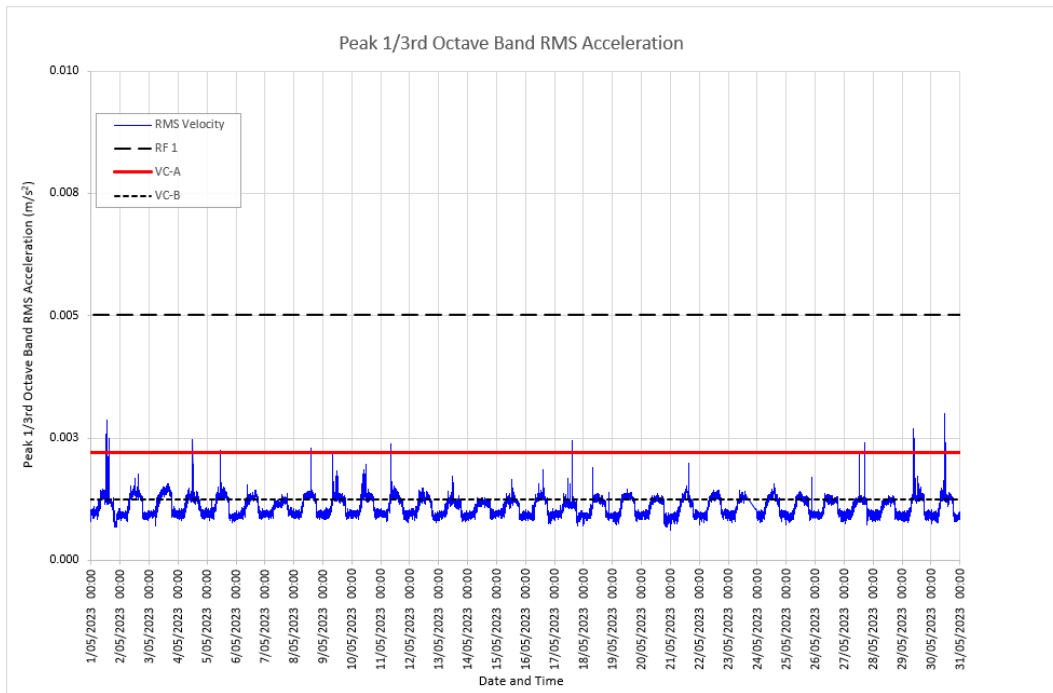


Figure 1: Measured RMS acceleration vibration levels for 01/05/2023 to 31/05/2023 at the KR L4.

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
28	1

1. Introduction

Arup has been commissioned by PricewaterhouseCoopers (PwC) on behalf of NSW Health Infrastructure to monitor vibration levels in facilities adjacent to the 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 01/05/2023 to 31/05/2023.

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.

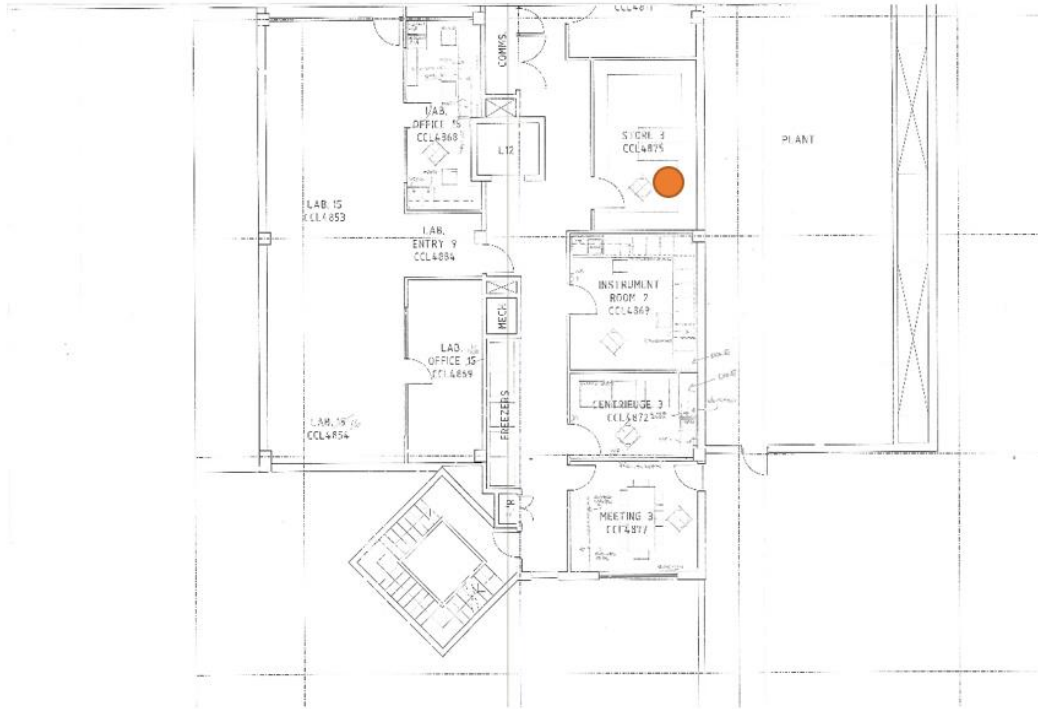


Figure 2: KR – L4 vibration monitor location

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 01/05/2023 and 31/05/2023. The recorded data is shown in blue, while the limit of 0.002 m/s^2 (VC-A) is shown in red.

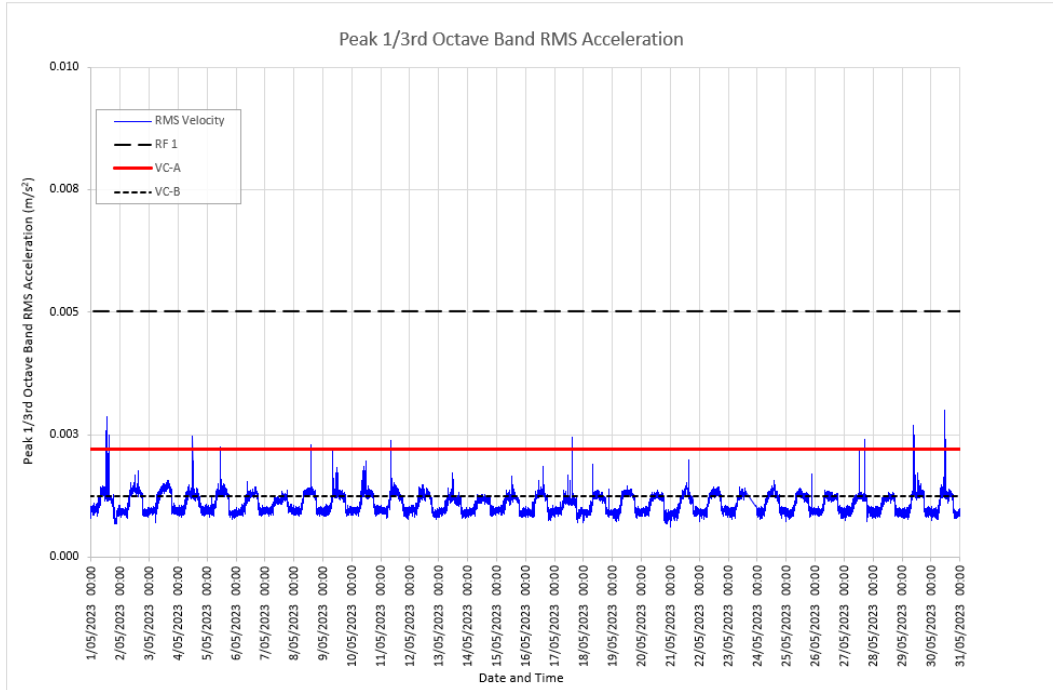


Figure 3: Measured RMS acceleration vibration levels for 01/05/2023 to 31/05/2023 at KR – L4.

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
28	1



Health Infrastructure

Children's Hospital Westmead

**Vibration Monitoring - SCHN - 1.5t MRI
- May 2023**

CVM/ SCHN/202305

Issue 1 | 16/06/2023

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

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Job number 271985

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File reference -

Revision	Date	Filename
		Westmead Hospital – 103677 SCHN - 1.5t MRI - Summary of Recent Vibration Measurements (01-05 to 31-05).docx
Issue 1	16/06/2023	Description 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 - 1.5t MRI, over one month – from 01/05/2023 to 31/05/2023. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

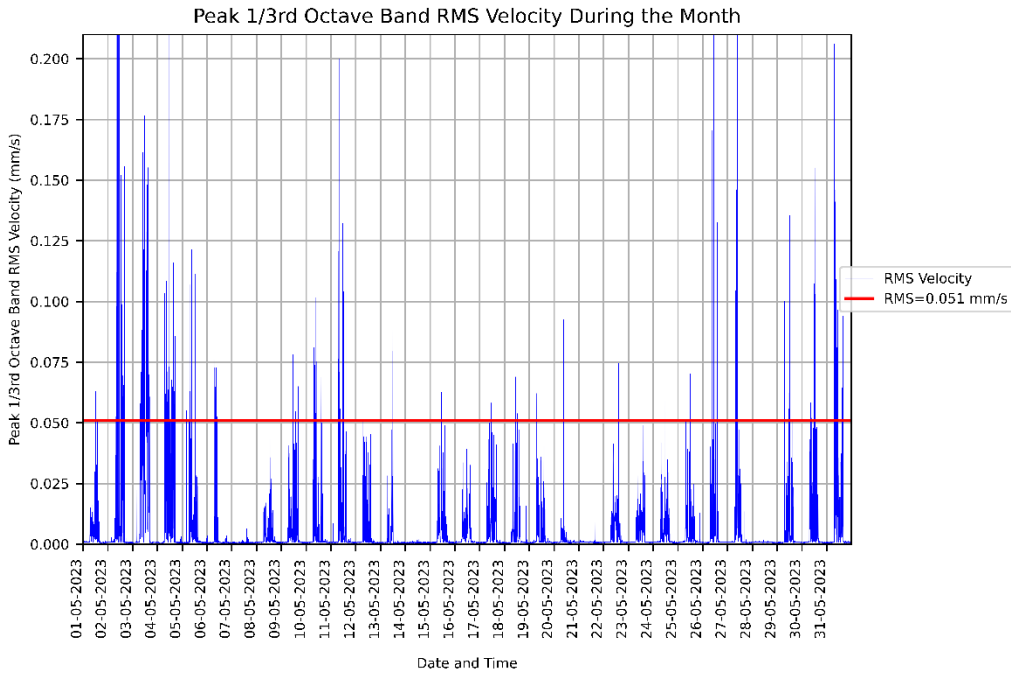


Figure 1: Measured RMSV vibration levels for 01/05/2023 to 31/05/2023 at the SCHN - 1.5t MRI.

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
421	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 Forecourt development sites to ensure facility operations are not excessively impacted by the construction works. This report summarises the vibration monitoring data recorded at SCHN - 1.5t MRI during the period of the 01/05/2023 to 31/05/2023.

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: SCHN - 1.5t MRI 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 01/05/2023 and 31/05/2023. The recorded data is shown in blue, while the limit of 0.051mm/s (V_{RMS}) is shown in red.

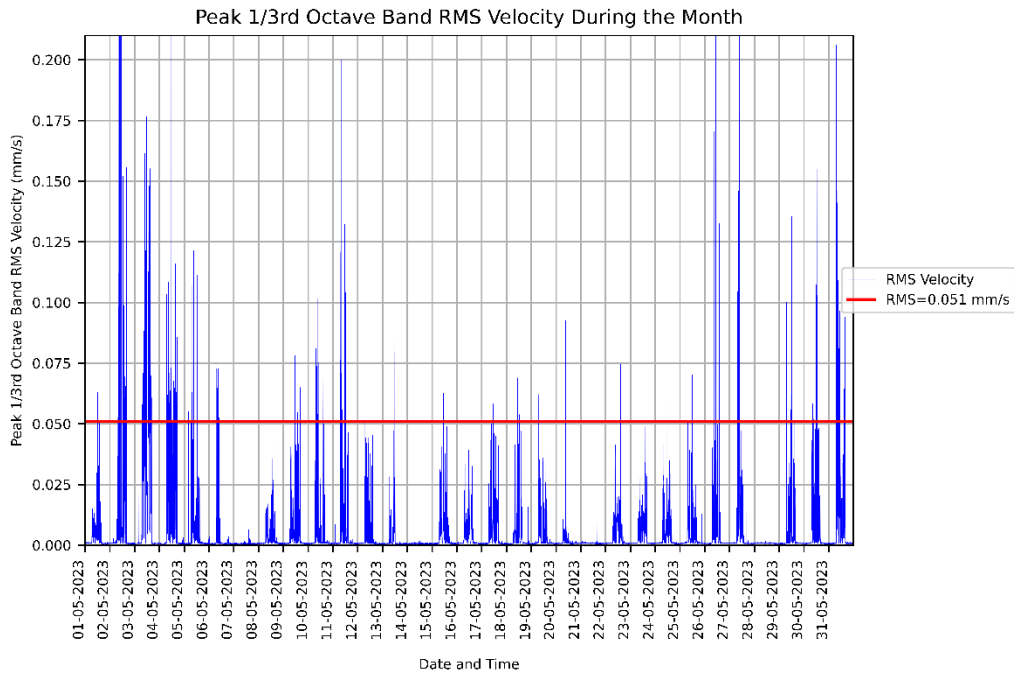


Figure 4: Measured RMSV vibration levels for 01/05/2023 to 31/05/2023 at the SCHN - 1.5t MRI.

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
421	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 - Gait Lab -
May 2023**

CVM/ KR/202305

Issue 1 | 16/06/2023

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
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Revision	Date	Filename	
		Westmead Hospital – 103156 KR - Gait Lab - Summary of Recent Vibration Measurements (01-05 to 31-05).docx	
Issue 1	16/06/2023	Description	Issue

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Name	PR	MJW	MJW
Signature			

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Signature			

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Name			
Signature			

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Executive Summary

This report summarises the vibration monitoring data recorded at KR - Gait Lab, over one month – from 01/05/2023 to 31/05/2023. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

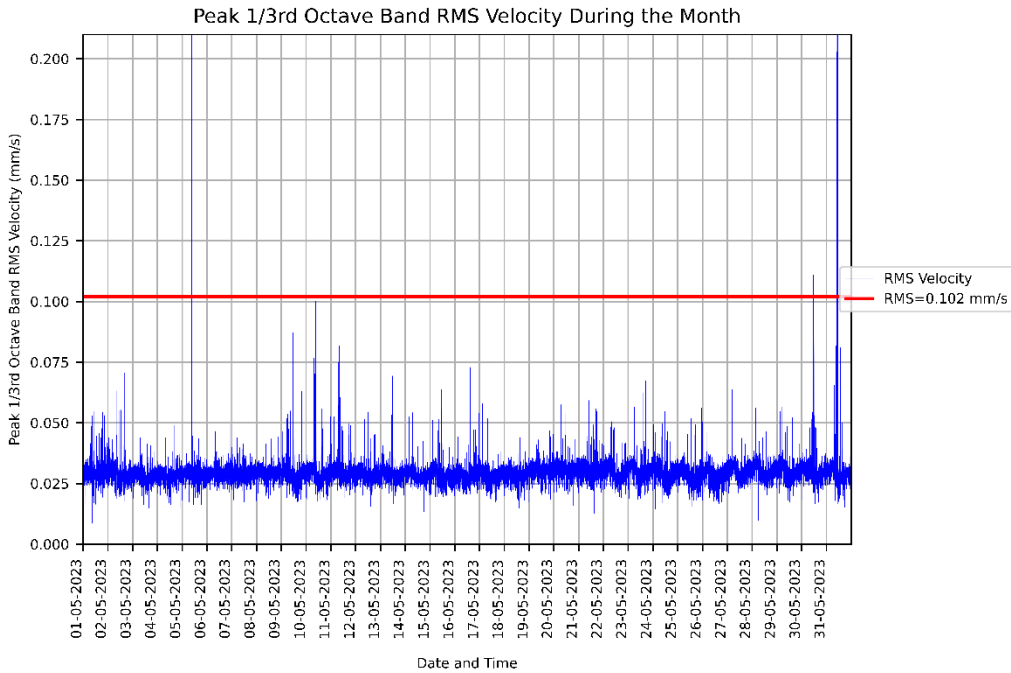


Figure 1: Measured RMSV vibration levels for 01/05/2023 to 31/05/2023 at the KR - Gait Lab.

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

During Construction Hours	Outside of Construction Hours
9	0

PPV Vibration Levels

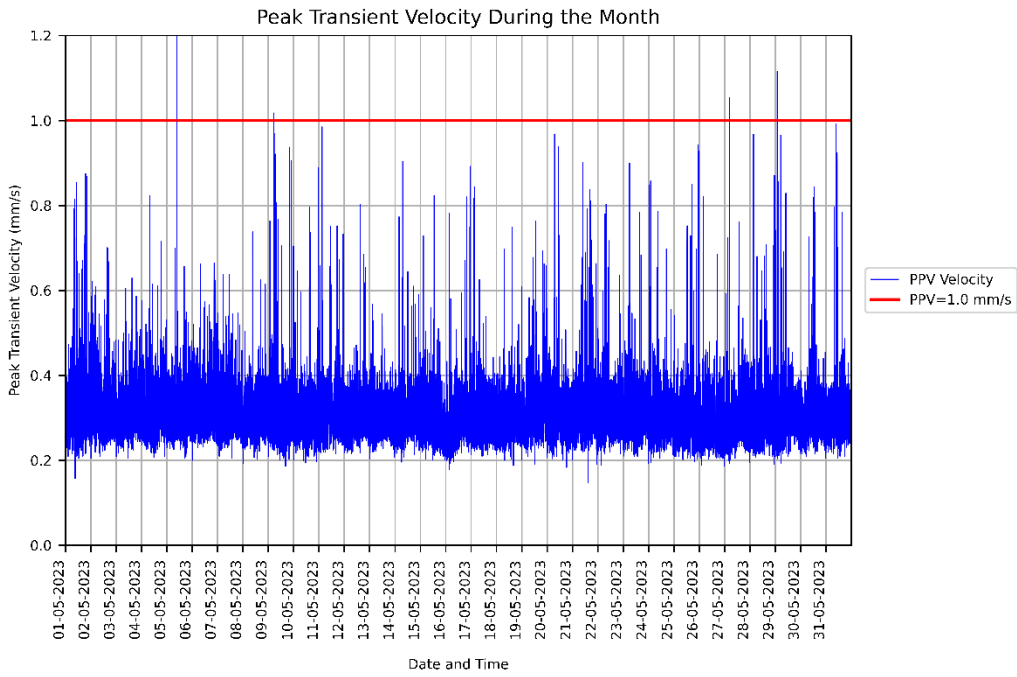


Figure 2: Measured vibration levels for 01/05/2023 to 31/05/2023 at the KR - Gait Lab.

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

During Construction Hours	Outside of Construction Hours
0	4

1. Introduction

Arup has been commissioned by PricewaterhouseCoopers (PwC) on behalf of NSW Health Infrastructure to monitor vibration levels in facilities adjacent to the Forecourt development sites to ensure facility operations are not excessively impacted by the construction works. This report summarises the vibration monitoring data recorded at KR - Gait Lab during the period of the 01/05/2023 to 31/05/2023.

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 .

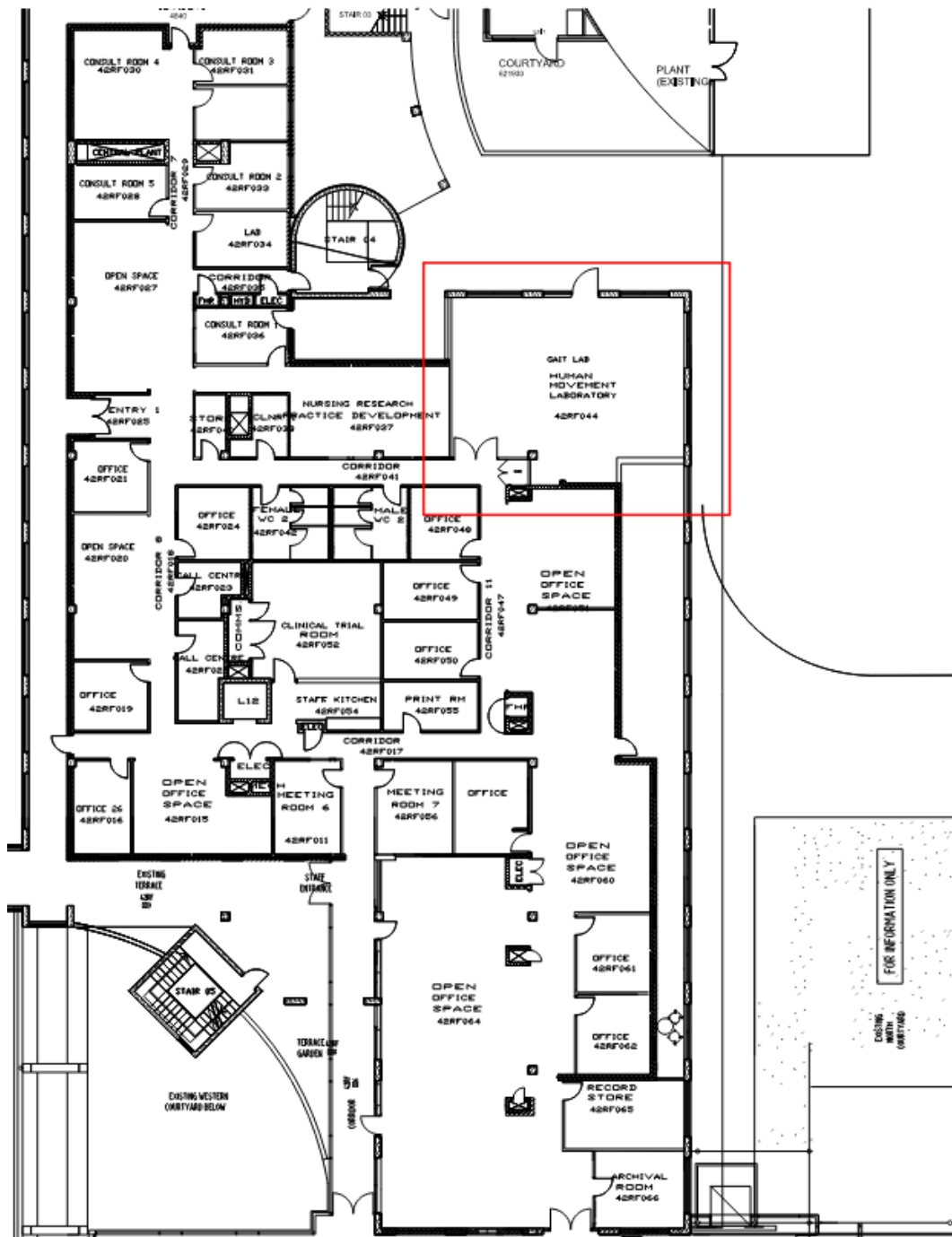


Figure 3: KR - Gait Lab vibration monitor location

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 01/05/2023 and 31/05/2023. The recorded data is shown in blue, while the limit of 0.102mm/s (V_{RMS}) is shown in red.

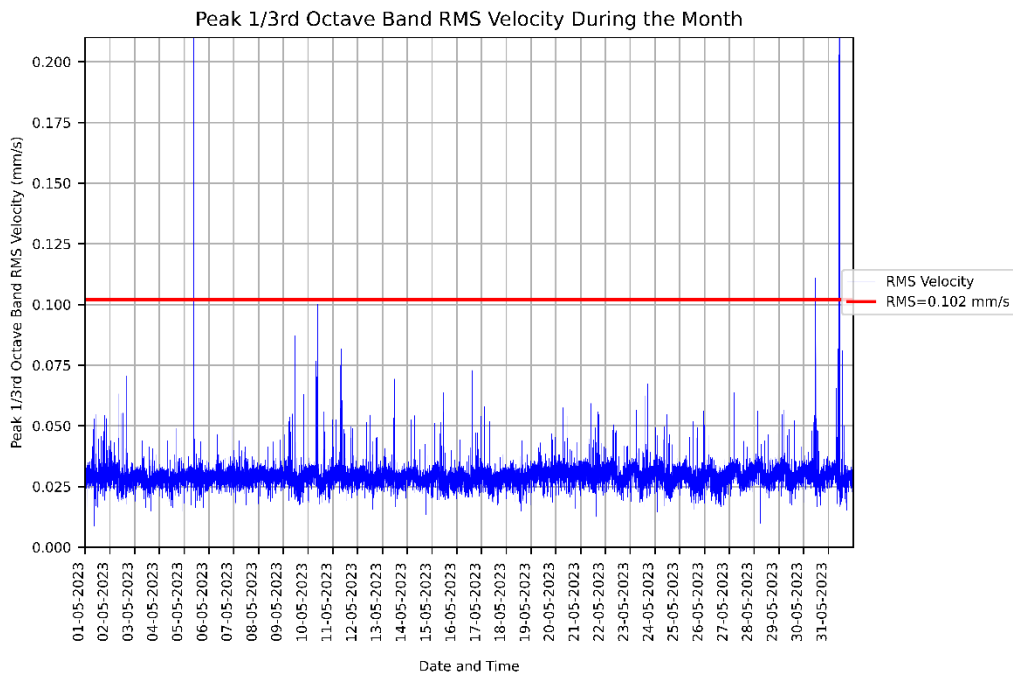


Figure 4: Measured RMSV vibration levels for 01/05/2023 to 31/05/2023 at the KR - Gait Lab.

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

During Construction Hours	Outside of Construction Hours
9	0

Figure 5 below shows the peak particle vibration levels (PPV velocity) recorded between 01/05/2023 and 31/05/2023. The recorded data is shown in blue, while the limit of 1.0mm/s (V_{PPV}) is shown in red.

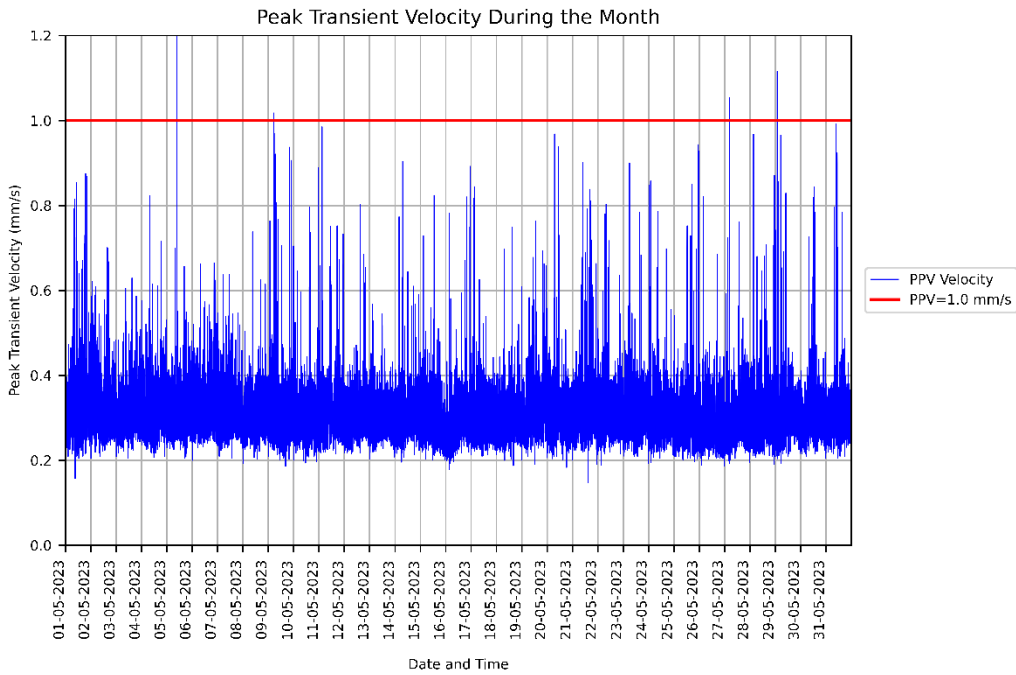


Figure 5: Measured PPV vibration levels for 01/05/2023 to 31/05/2023 at the KR - Gait Lab.

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

During Construction Hours	Outside of Construction Hours
0	4

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 $\text{mV}/\text{mm/s}^{-1}$	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 - SCHN - L1
Endocrinology Lab - May 2023**

CVM/ SCHN/202305

Issue 1 | 16/06/2023

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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Document Verification

Project title Children's Hospital Westmead
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Revision	Date	Filename
		Westmead Hospital – 103157 SCHN - L1 Endocrinology Lab - Summary of Recent Vibration Measurements (01-05 to 31-05).docx

Issue	Date	Description
Issue 1	16/06/2023	Issue

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Name	PR	MJW	MJW
Signature			

Filename

	Prepared by	Checked by	Approved by
Name			
Signature			

Filename

	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 01/05/2023 to 31/05/2023. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

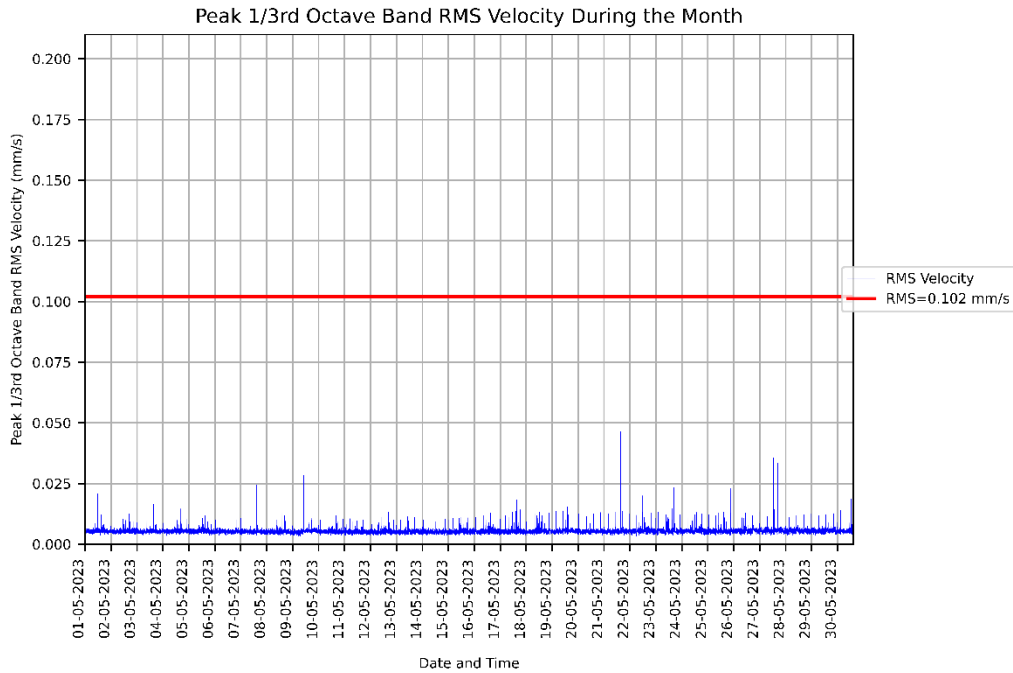


Figure 1: Measured RMSV vibration levels for 01/05/2023 to 31/05/2023 at the SCHN - L1 Endocrinology Lab.

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 01/05/2023 to 31/05/2023.

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

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

2. Monitor Location

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

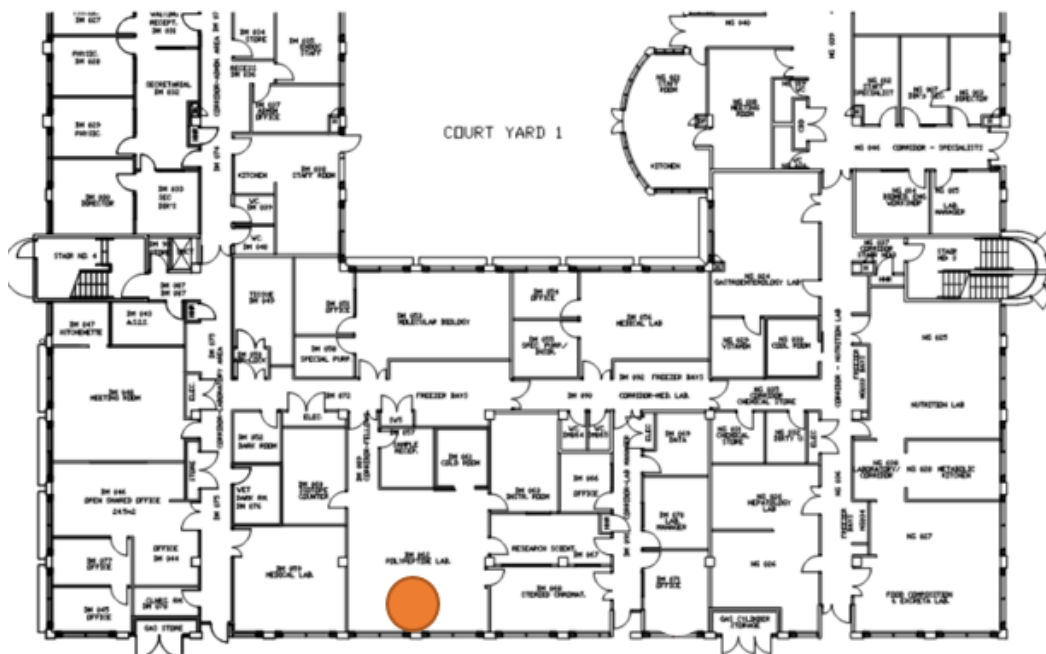


Figure 3: SCHN - L1 Endocrinology Lab vibration monitor location shown in orange. Monitoring at this location utilises a GeoSIG GMSplus with a GeoSIG VE-11 geophone. The calibration certificate for the geophone is included in Appendix A.

3. Recorded Data

Figure 4 below shows the vibration levels (RMS velocity) recorded between 01/05/2023 and 31/05/2023. The recorded data is shown in blue, while the limit of 0.102mm/s (V_{RMS}) is shown in red.

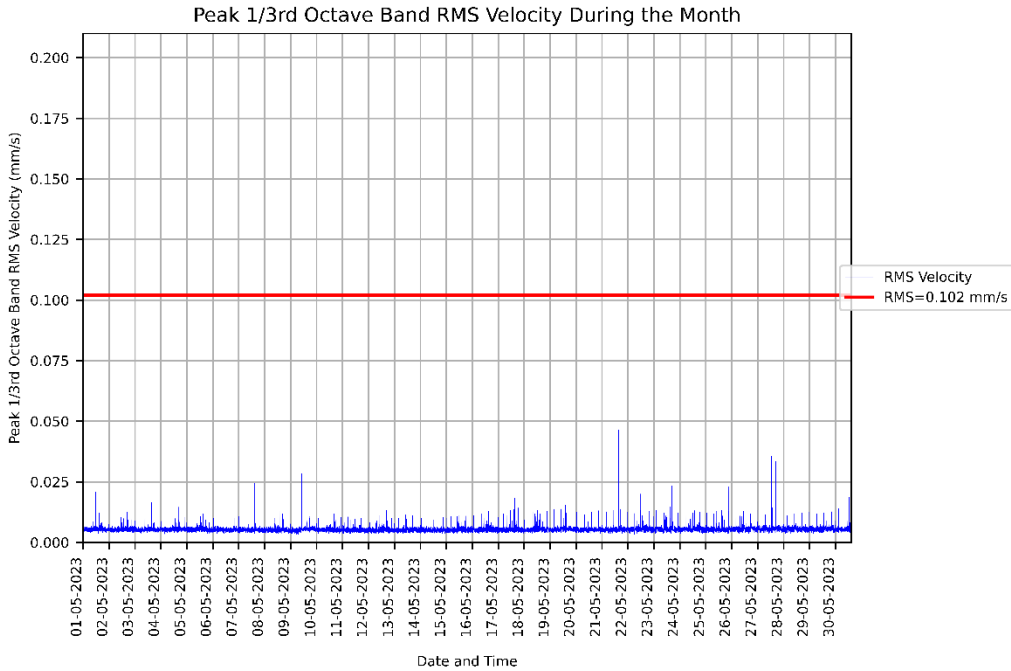


Figure 4: Measured RMSV vibration levels for 01/05/2023 to 31/05/2023 at the SCHN - L1 Endocrinology Lab.

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

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: <i>Hein See</i>
<p>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%.</p>	
 NATA <small>WORLD RECOGNISED ACCREDITATION</small>	 Acu-Vib Electronics CALIBRATIONS SALES RENTALS REPAIRS
<small>Accredited Lab No. 9262 Acoustic and Vibration Measurements</small>	<small>Head Office & Calibration Laboratory Unit 14, 22 Hudson Ave. Castle Hill NSW 2134 (02) 9680 8133 www.acu-vib.com.au</small>
<small>Page 1 of 2 Calibration Certificate AVCERT15 Rev.2.0 14.04.2021</small>	

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 - CASB level 3
Surgical Suite - May 2023**

CVM/ CASB/202305

Issue 1 | 16/06/2023

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

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Australia

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Document Verification

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		Westmead Hospital – 103160 CASB level 3 Surgical Suite - Summary of Recent Vibration Measurements (01-05 to 31-05).docx	

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Name	PR	MJW	MJW
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	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 01/05/2023 to 31/05/2023. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

Note that the vibration logger was relocated within the same facility on 04/06/2023 leading to a DC offset in the results. The logger was remotely reset on 25/05/2023, before which points the base vibration levels should be disregarded. The exceedance tables report number of exceedances within the month corrected for this offset.

RMSV Vibration Levels

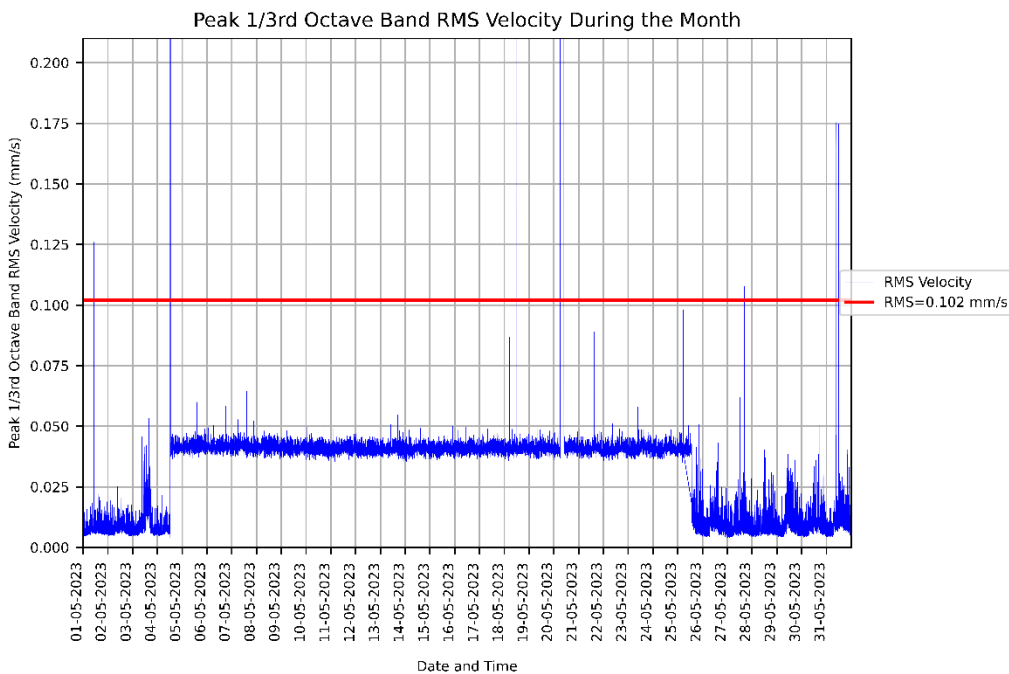


Figure 1: Measured RMSV vibration levels for 01/05/2023 to 31/05/2023 at the CASB level 3 Surgical Suite.

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

During Construction Hours	Outside of Construction Hours
74	58

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 01/05/2023 to 31/05/2023.

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 .

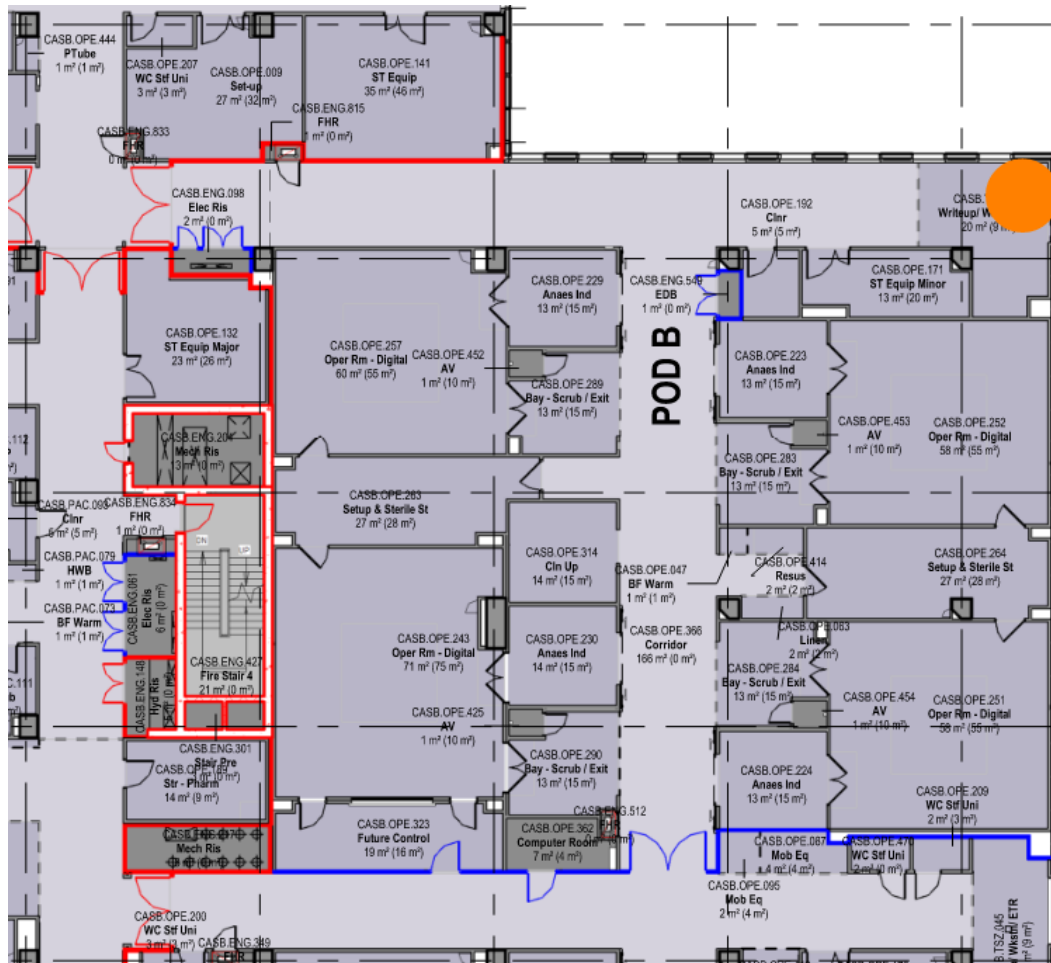


Figure 3: CASB level 3 Surgical Suite vibration monitor location

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 01/05/2023 and 31/05/2023. The recorded data is shown in blue, while the limit of 0.102mm/s (V_{RMS}) is shown in red.

Note that the vibration logger was relocated within the same facility on 04/06/2023 leading to a DC offset in the results. The logger was remotely reset on 25/05/2023, before which points the base vibration levels should be disregarded. The exceedance tables report number of exceedances within the month corrected for this offset.

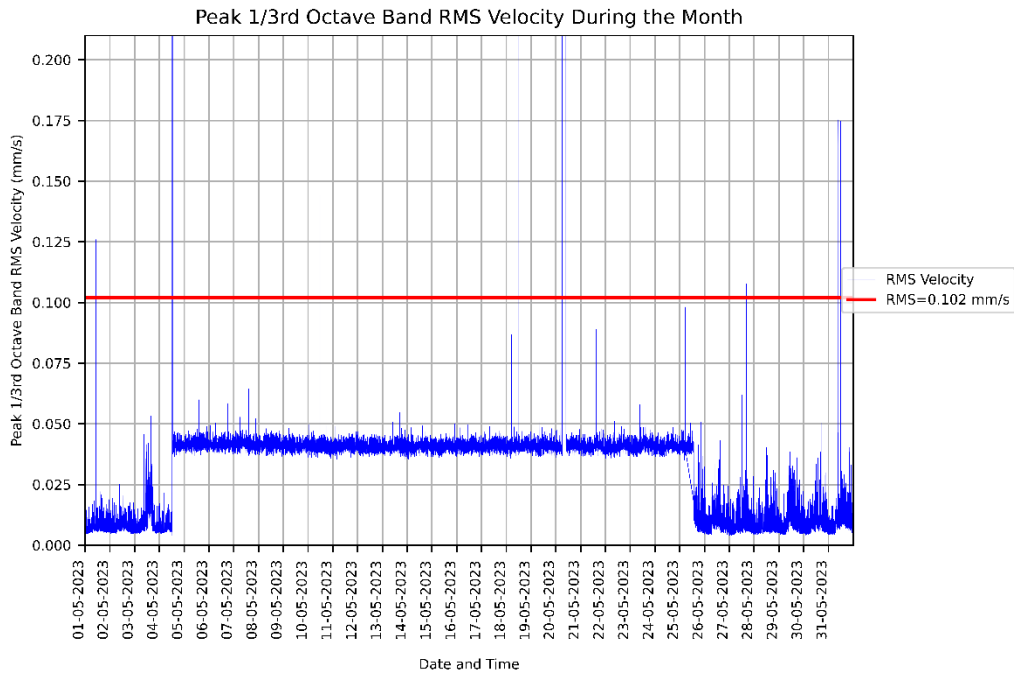


Figure 4: Measured RMSV vibration levels for 01/05/2023 to 31/05/2023 at the CASB level 3 Surgical Suite.

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

During Construction Hours	Outside of Construction Hours
74	58

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:

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:  AUTHORIZED SIGNATURE: 

Rev Sec

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

Note1:

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

Note2:

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



Health Infrastructure

Children's Hospital Westmead

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

CVM/ CMRI/202305

Issue 1 | 16/06/2023

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 CMRI Animal Holding Facility - Summary of Recent Vibration Measurements (01-05 to 31-05).docx	

Issue	Date	Description	
Issue 1	16/06/2023	Issue	

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Signature			

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Issue Document Verification with Document

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Executive Summary

This report summarises the vibration monitoring data recorded at CMRI Animal Holding Facility, over one month – from 01/05/2023 to 31/05/2023. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

RMSV Vibration Levels

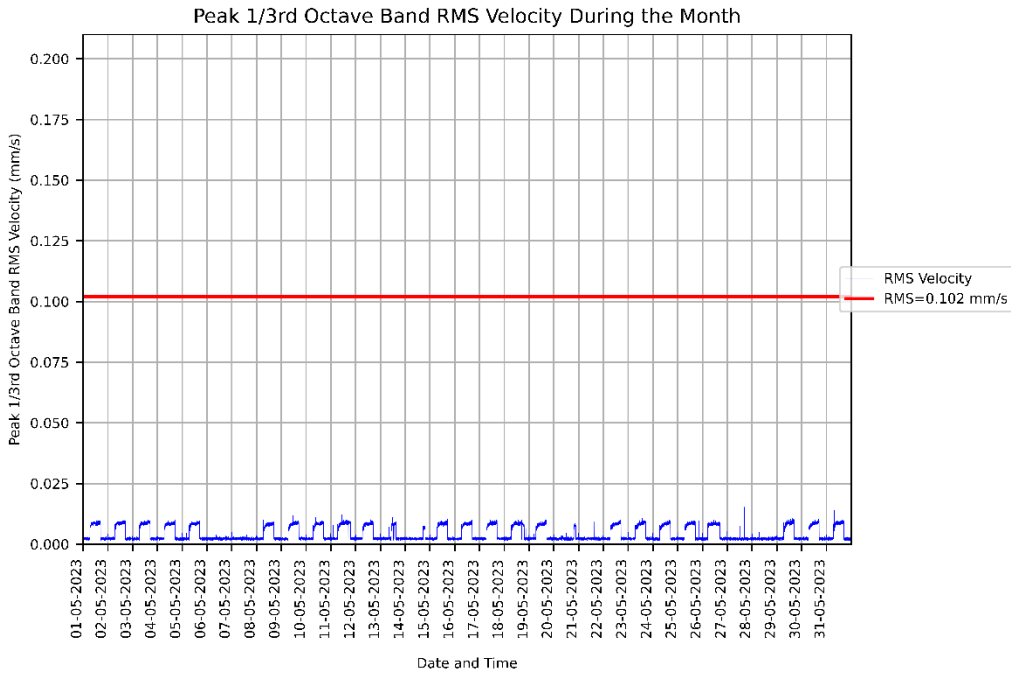


Figure 1: Measured RMSV vibration levels for 01/05/2023 to 31/05/2023 at the CMRI Animal Holding Facility.

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

During Construction Hours	Outside of Construction Hours
0	0

PPV Vibration Levels

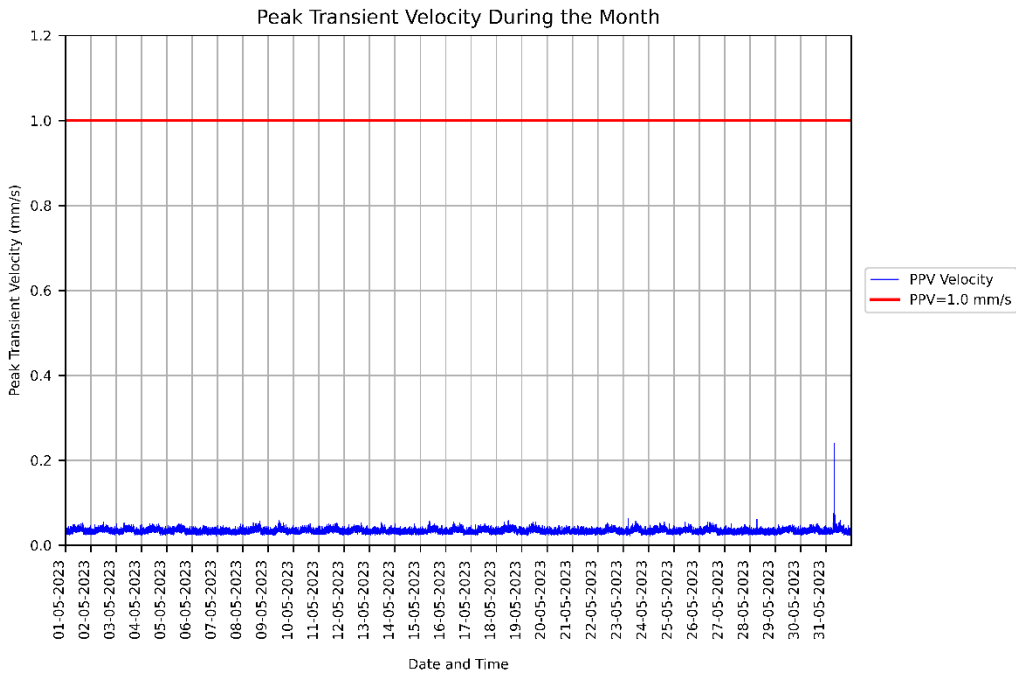


Figure 2: Measured vibration levels for 01/05/2023 to 31/05/2023 at the CMRI Animal Holding Facility.

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

During Construction Hours	Outside of Construction Hours
0	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 Forecourt development sites to ensure facility operations are not excessively impacted by the construction works. This report summarises the vibration monitoring data recorded at CMRI Animal Holding Facility during the period of the 01/05/2023 to 31/05/2023.

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

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

2. Monitor Location

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



Figure 3: CMRI Animal Holding Facility vibration monitor location

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

3. Recorded Data

Figure 4 below shows the vibration levels (RMS velocity) recorded between 01/05/2023 and 31/05/2023. The recorded data is shown in blue, while the limit of 0.102mm/s (V_{RMS}) is shown in red.

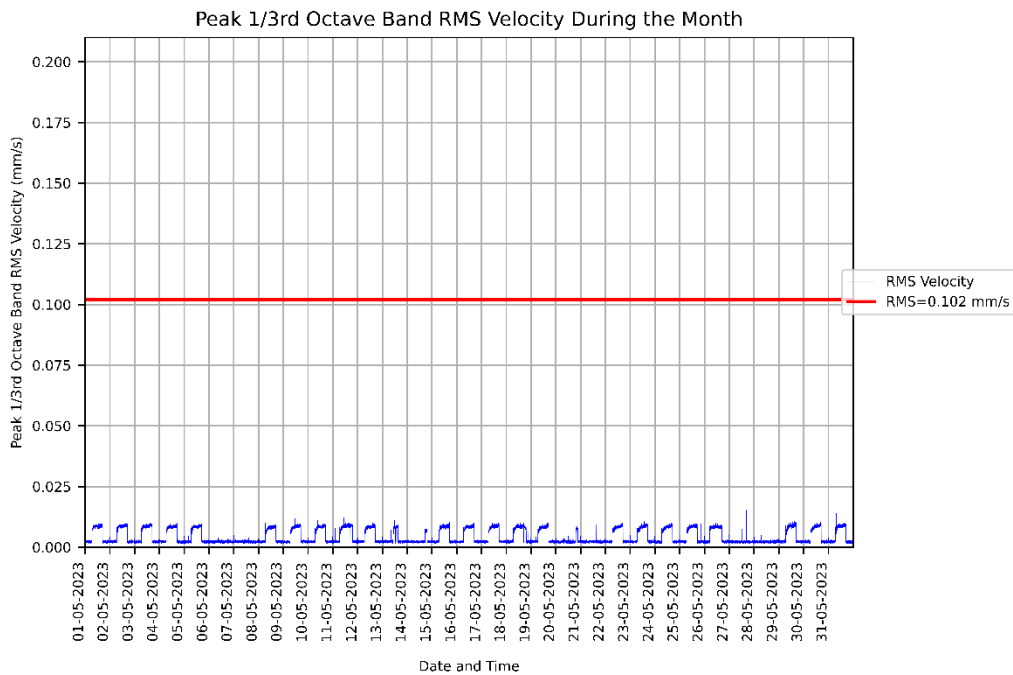


Figure 4: Measured RMSV vibration levels for 01/05/2023 to 31/05/2023 at the CMRI Animal Holding Facility.

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

During Construction Hours	Outside of Construction Hours
0	0

Figure 5 below shows the peak particle vibration levels (PPV velocity) recorded between 01/05/2023 and 31/05/2023. The recorded data is shown in blue, while the limit of 1.0mm/s (V_{PPV}) is shown in red.

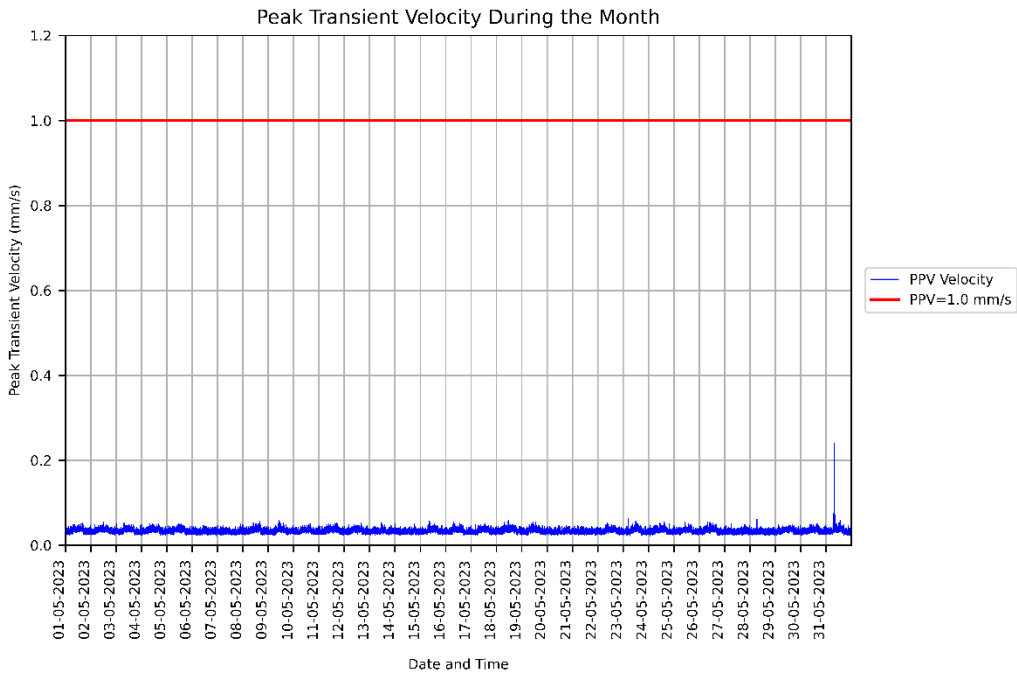
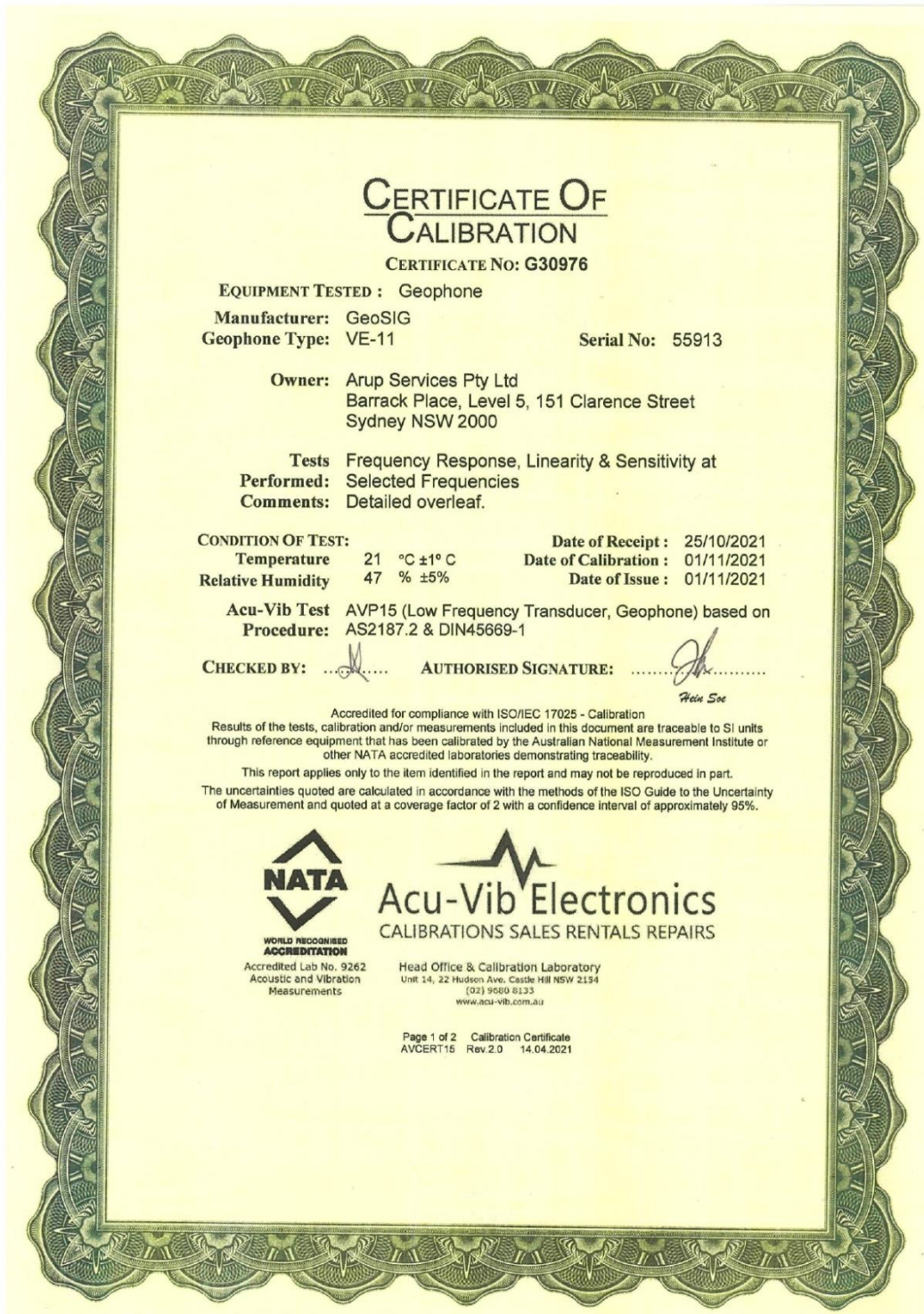


Figure 5: Measured PPV vibration levels for 01/05/2023 to 31/05/2023 at the CMRI Animal Holding Facility.

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

During Construction Hours	Outside of Construction Hours
0	0

Appendix A: Calibration Certificates



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

12VDC Power Supply

Geophone Orientation.: Vertical

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

Note1:

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

Note2:

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