

Health Infrastructure NSW  
**Westmead PSB and MSCP**  
**Construction Noise Monitoring**

Noise monitoring report  
2023-02-01 to 2023-02-28

AC15

v1 | 8 March 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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### Appendix A

Noise Monitoring Daily Results

# 1 Introduction

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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 February 2023 to 28 February 2023** inclusive.

## 2 Noise logger locations

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Acoustic Research Labs Ngarra 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.

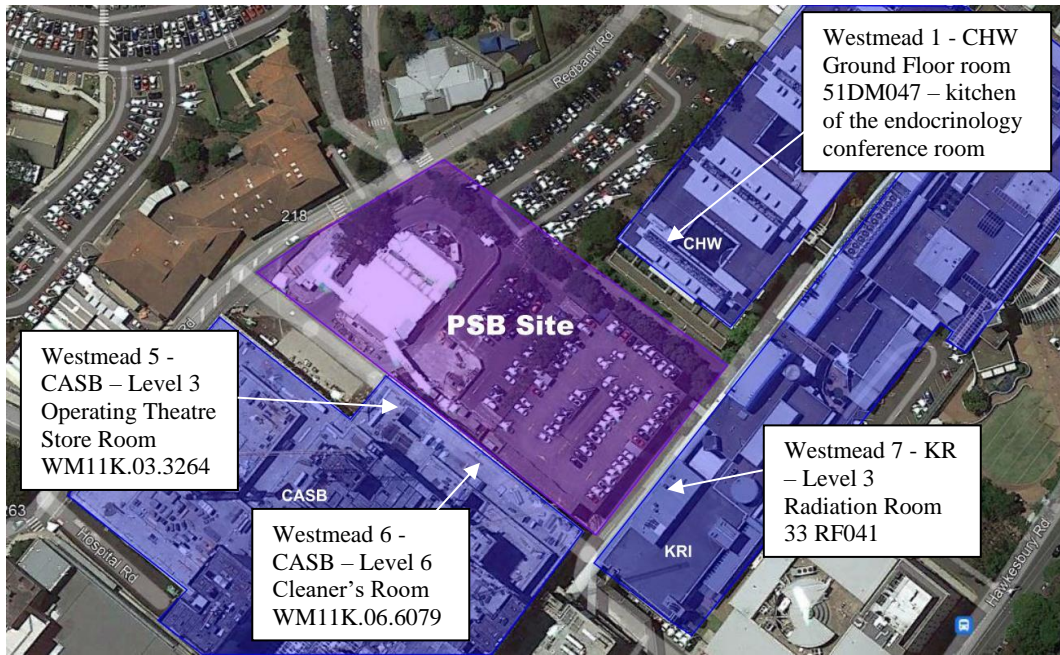


Figure 1: PSB noise monitoring locations.



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* report<sup>1</sup> 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 <sub>Aeq,15min</sub>
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.

<sup>1</sup> 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)	17/02/23-17/02/23 19/02/23-19-02/23
Westmead 5	CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (facing PSB site)	1/02/23-8/02/23 17/02/23-17/02/23 18/02/23-18/02/23
Westmead 6	CASB Level 6 Cleaner’s Room WM11K.06.6079 (facing PSB site)	6/02/23-6/02/23
Westmead 7	KR Level 3 Radiation Room 33 RF041(facing PSB site)	01/02/23-28/02/23 <sup>1</sup>
Westmead 2	CHW Level 2 Parent Kitchen 92BW025 (facing MSCP site)	-
Westmead 3	RMH Level 1 Store Room 101 (facing MSCP site)	17/02/23-18/02/23

Note:

1\_ Westmead 7 is currently showing signs of malfunction, this issue is currently being investigated.

### 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)	32
Westmead 5	CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (facing PSB site)	16
Westmead 6	CASB Level 6 Cleaner’s Room WM11K.06.6079 (facing PSB site)	8
Westmead 7	KR Level 3 Radiation Room 33 RF041(facing PSB site)	-
Westmead 2	CHW Level 2 Parent Kitchen 92BW025 (facing MSCP site)	2
Westmead 3	RMH Level 1 Store Room 101 (facing MSCP site)	13

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**

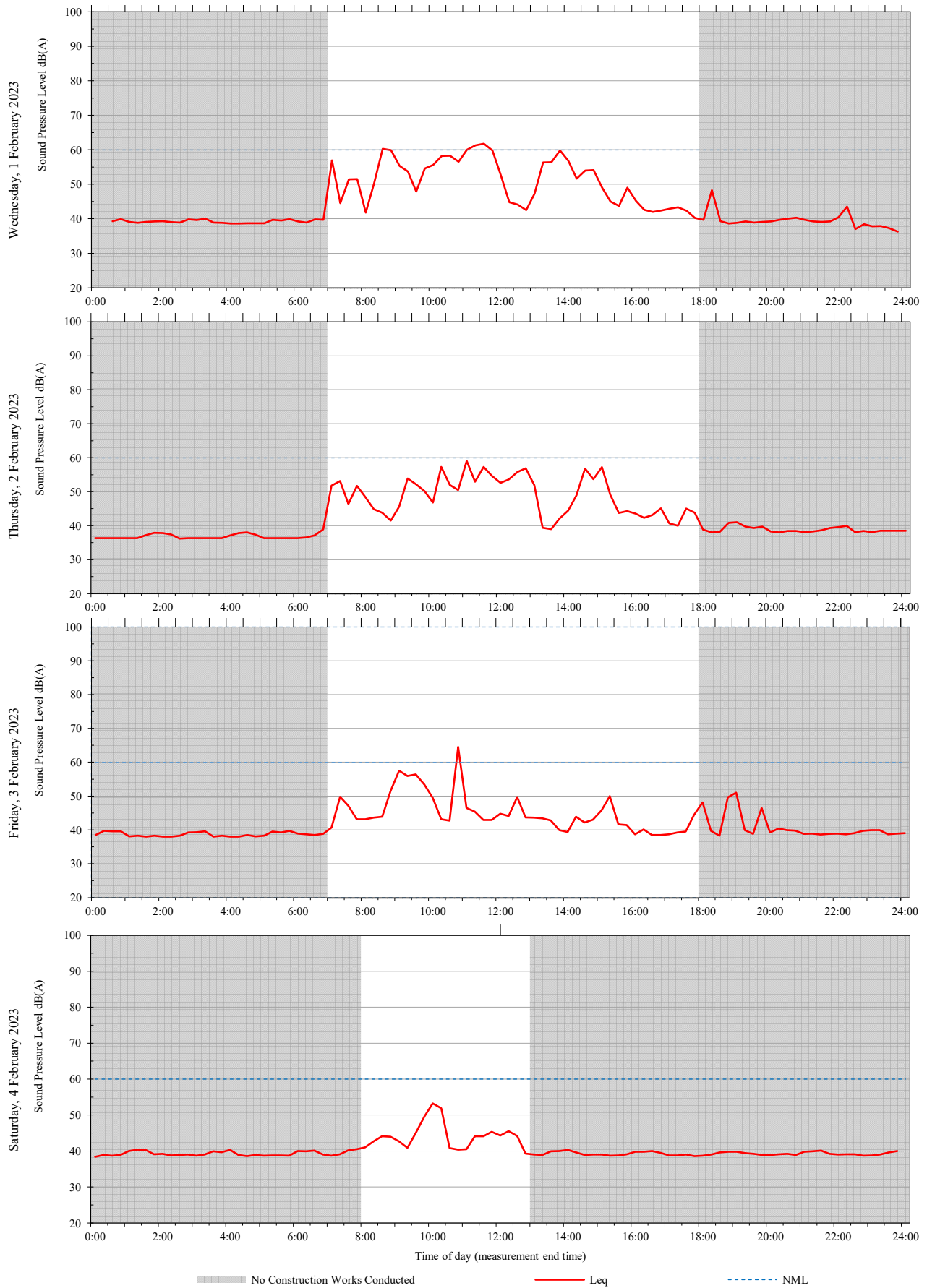
Daily noise monitoring results are showing for each location in Appendix A.

## **Appendix A**

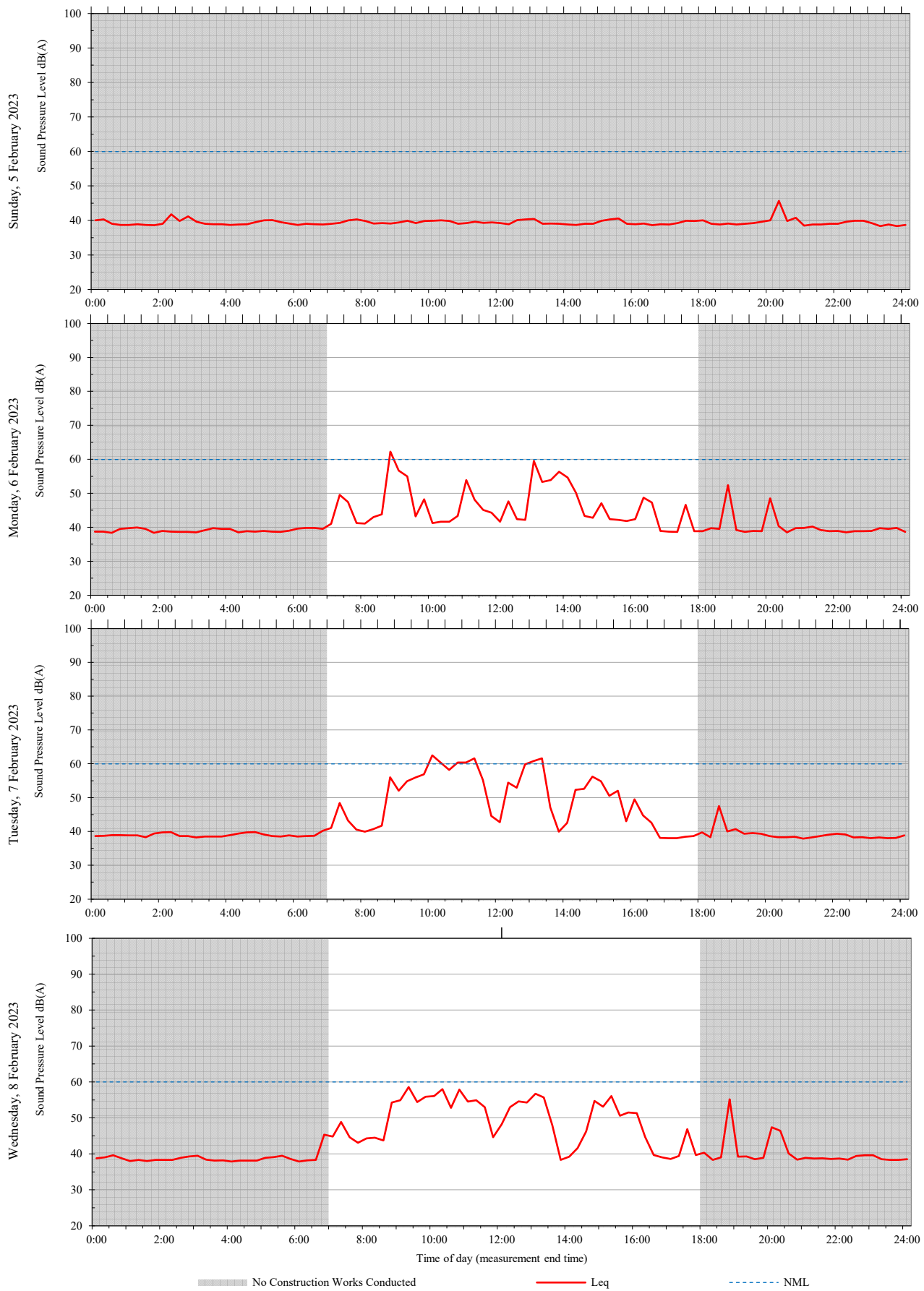
### **Noise Monitoring Daily Results**

# A1 CHW Ground Floor room 51DM047 (Westmead 1)

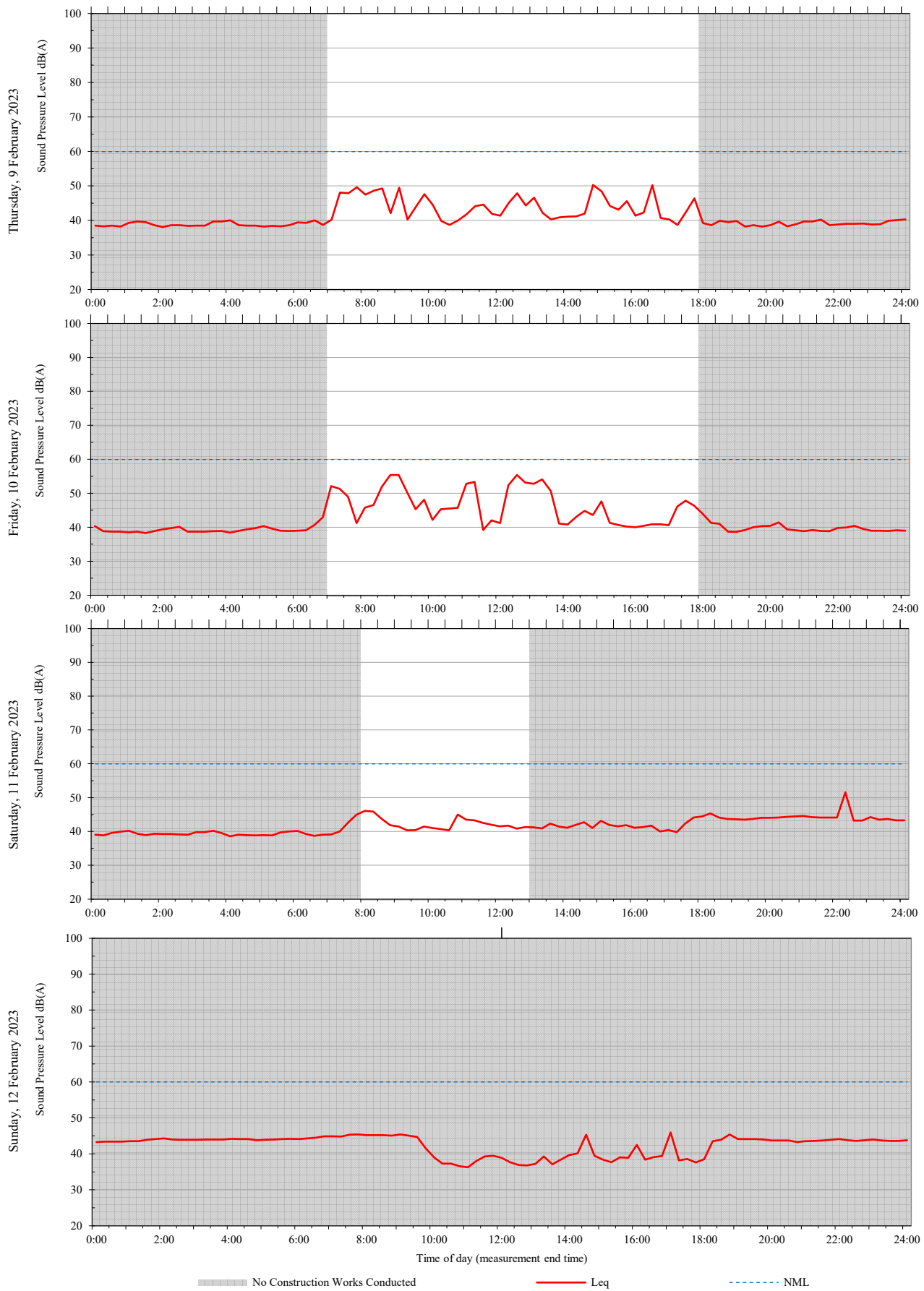
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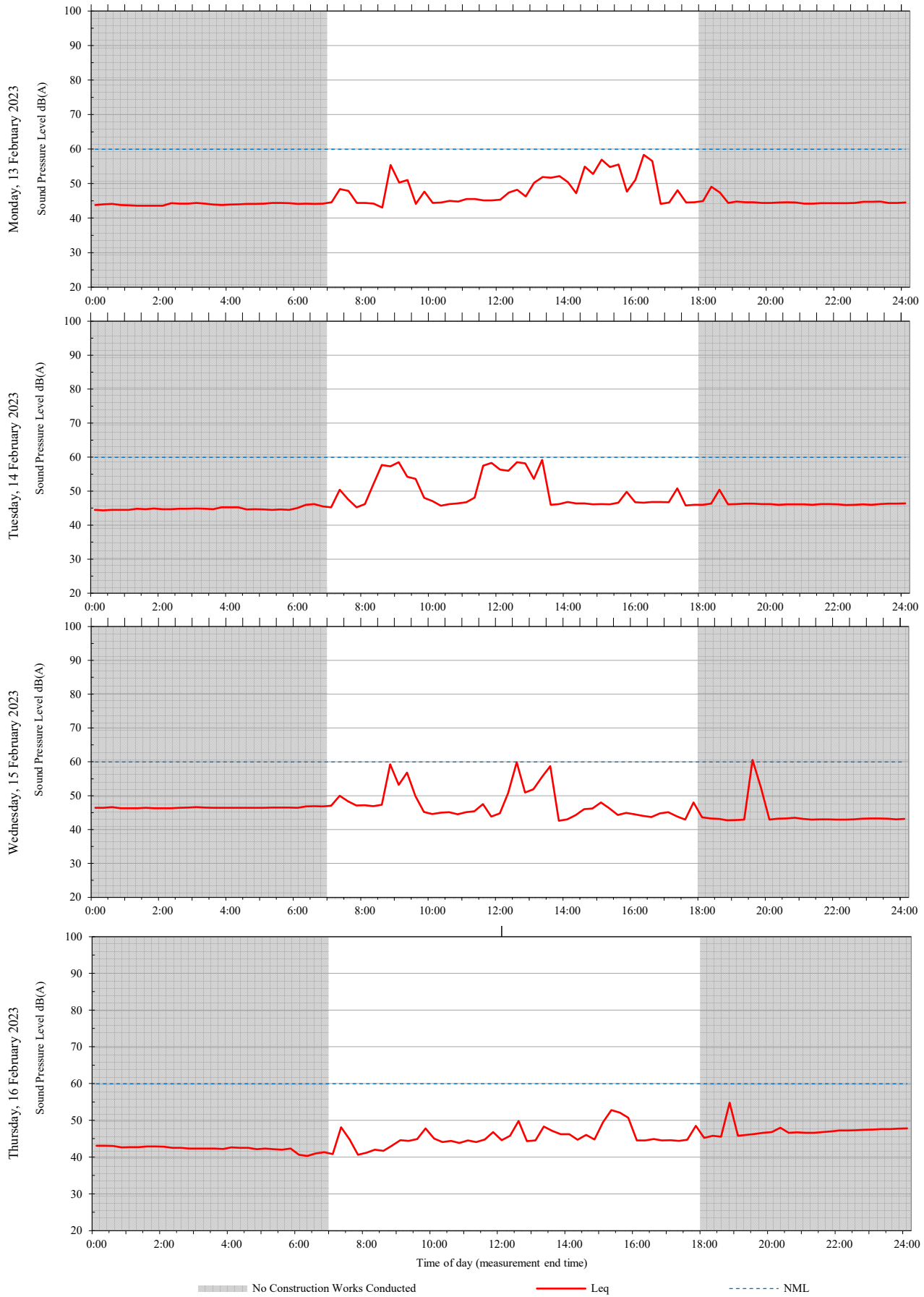
Unattended monitoring: CHW Ground Floor room 51DM047 – endocrinology kitchen (Internal)



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

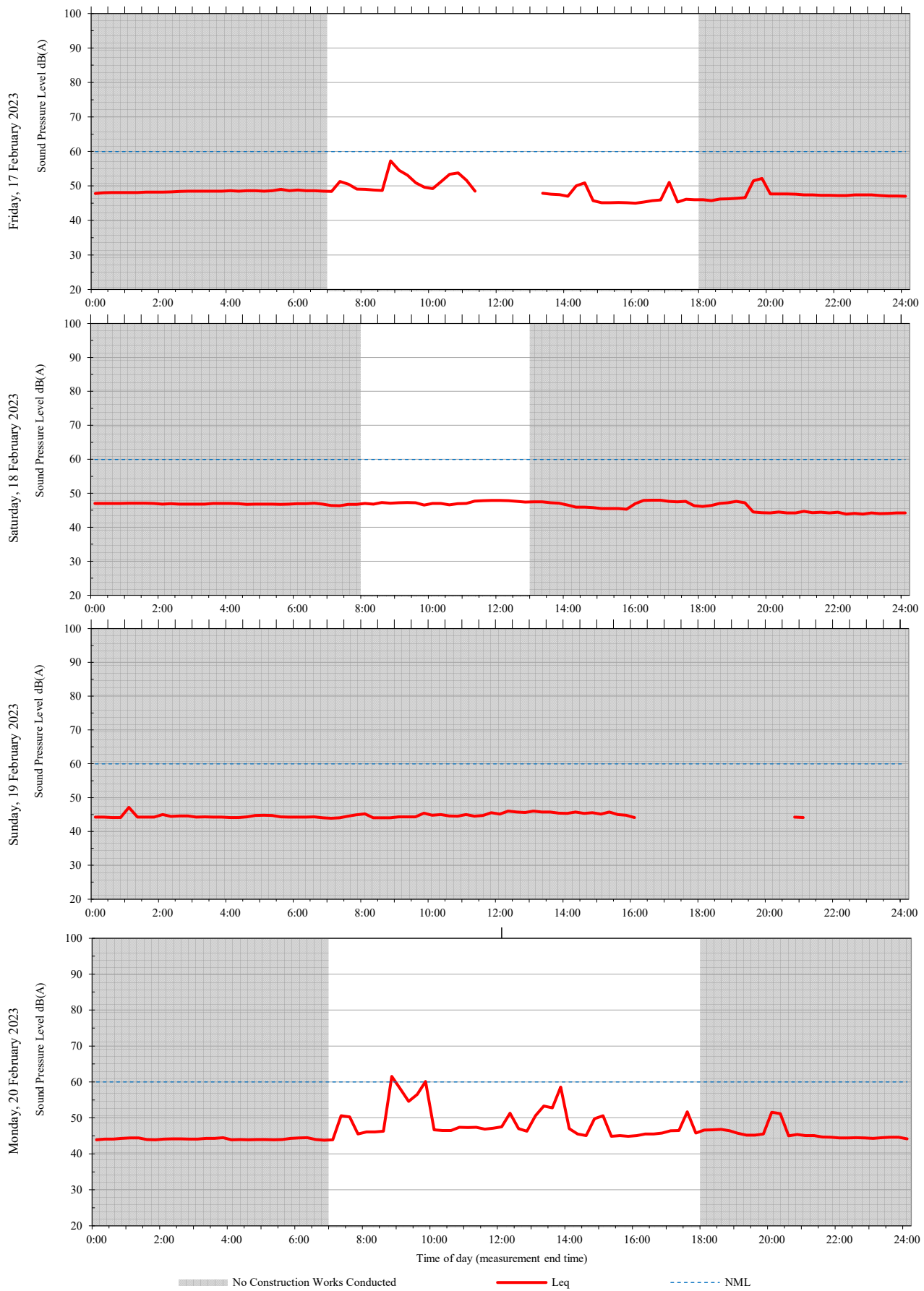


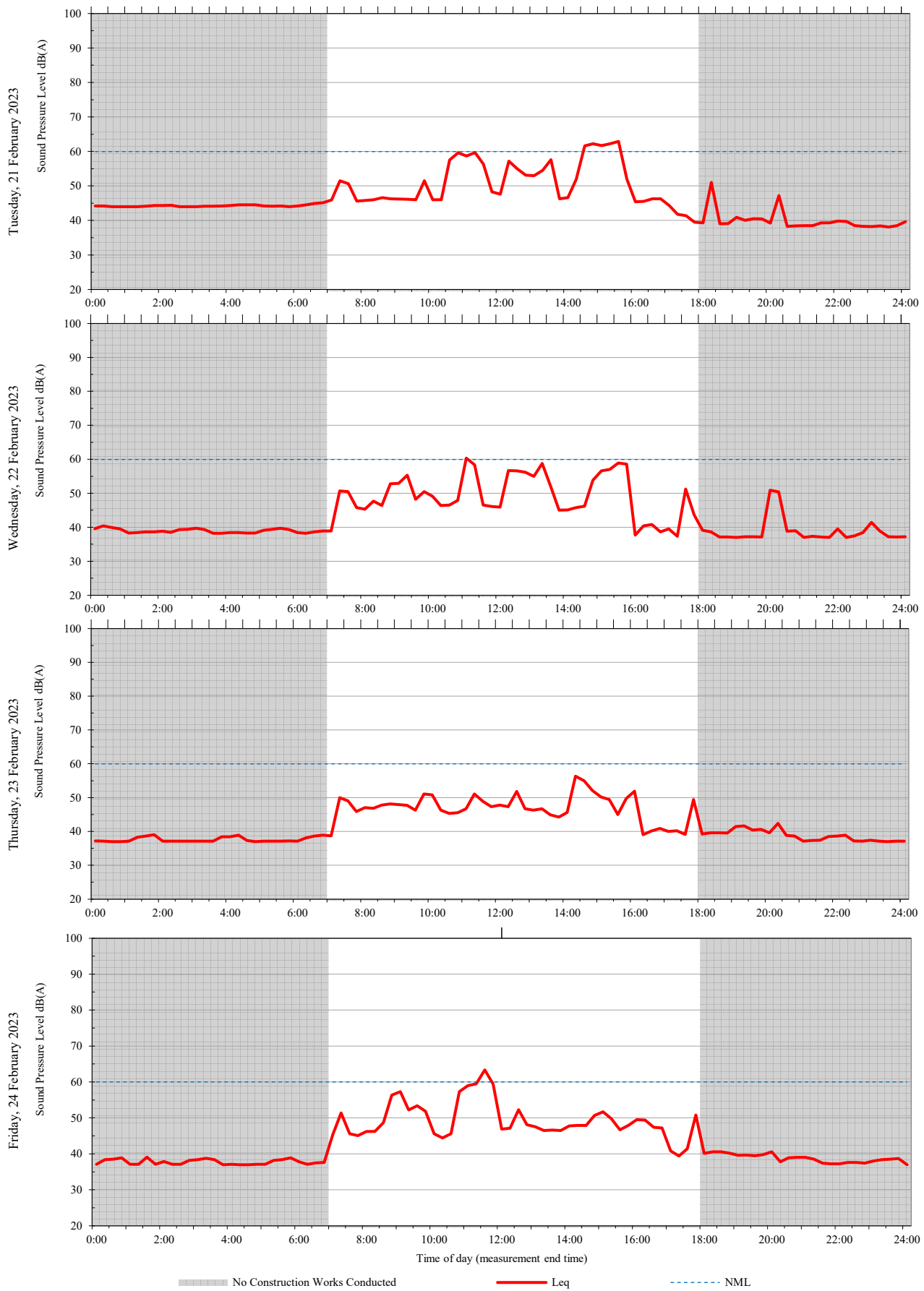
Unattended monitoring: CHW Ground Floor room 51DM047 – endocrinology kitchen (Internal)

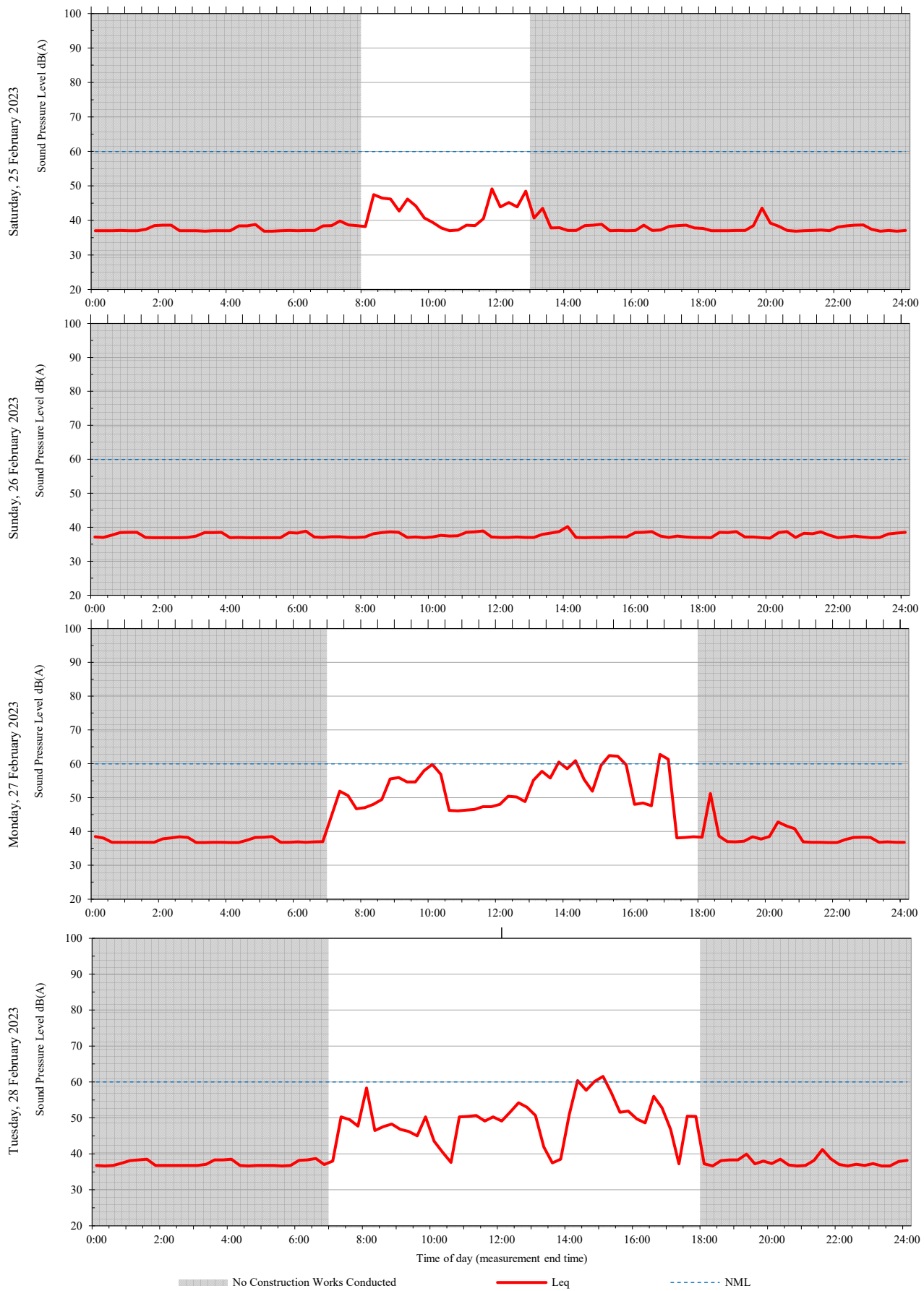




Unattended monitoring: CHW Ground Floor room 51DM047 – endocrinology kitchen (Internal)



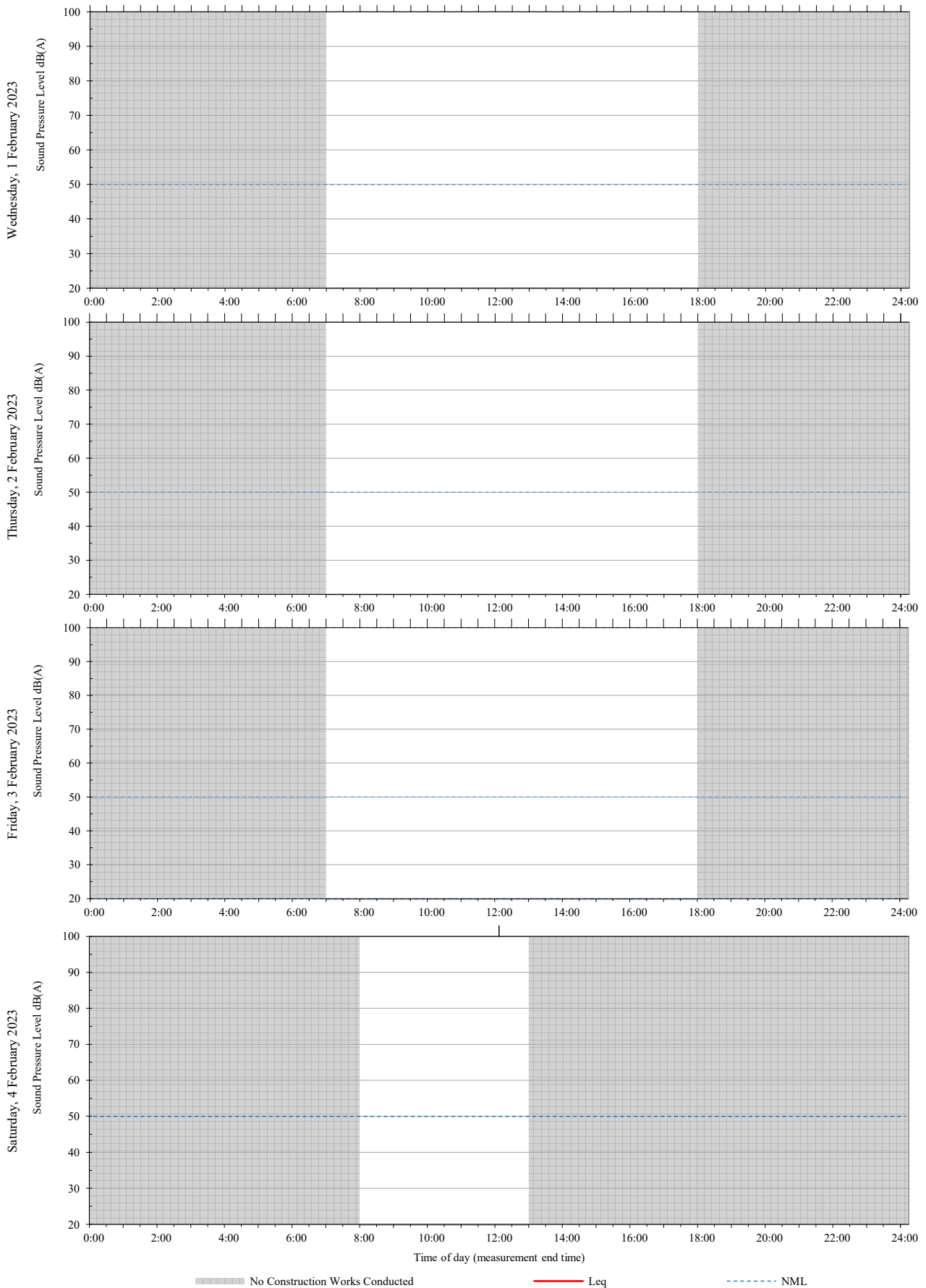




## **A2 CASB Level 3 Operating Theatre Store Room WM11K.03.3264 (Westmead 5)**

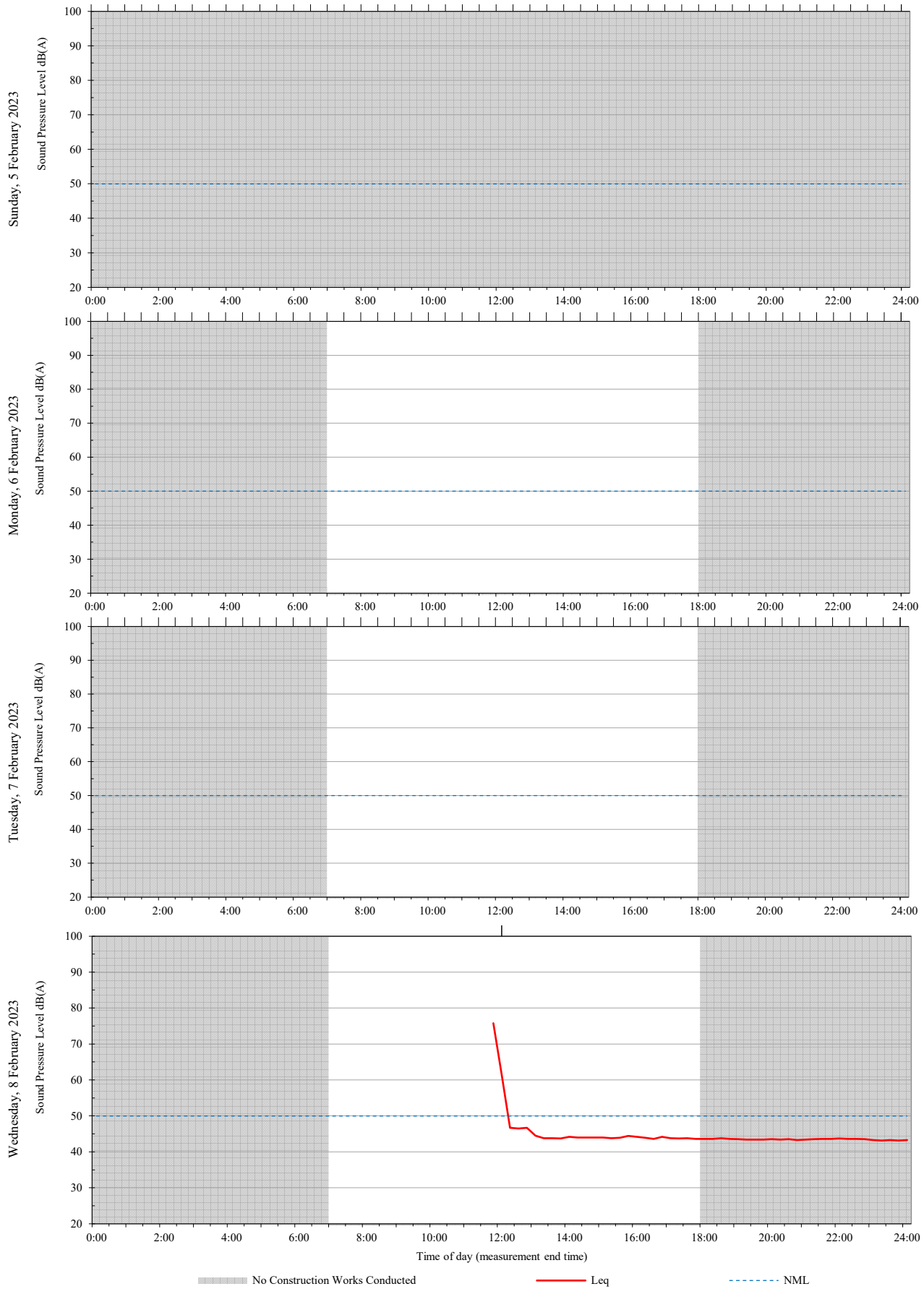
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# Unattended monitoring: CASB Level 3 Operating Theatre Store Room (Internal)

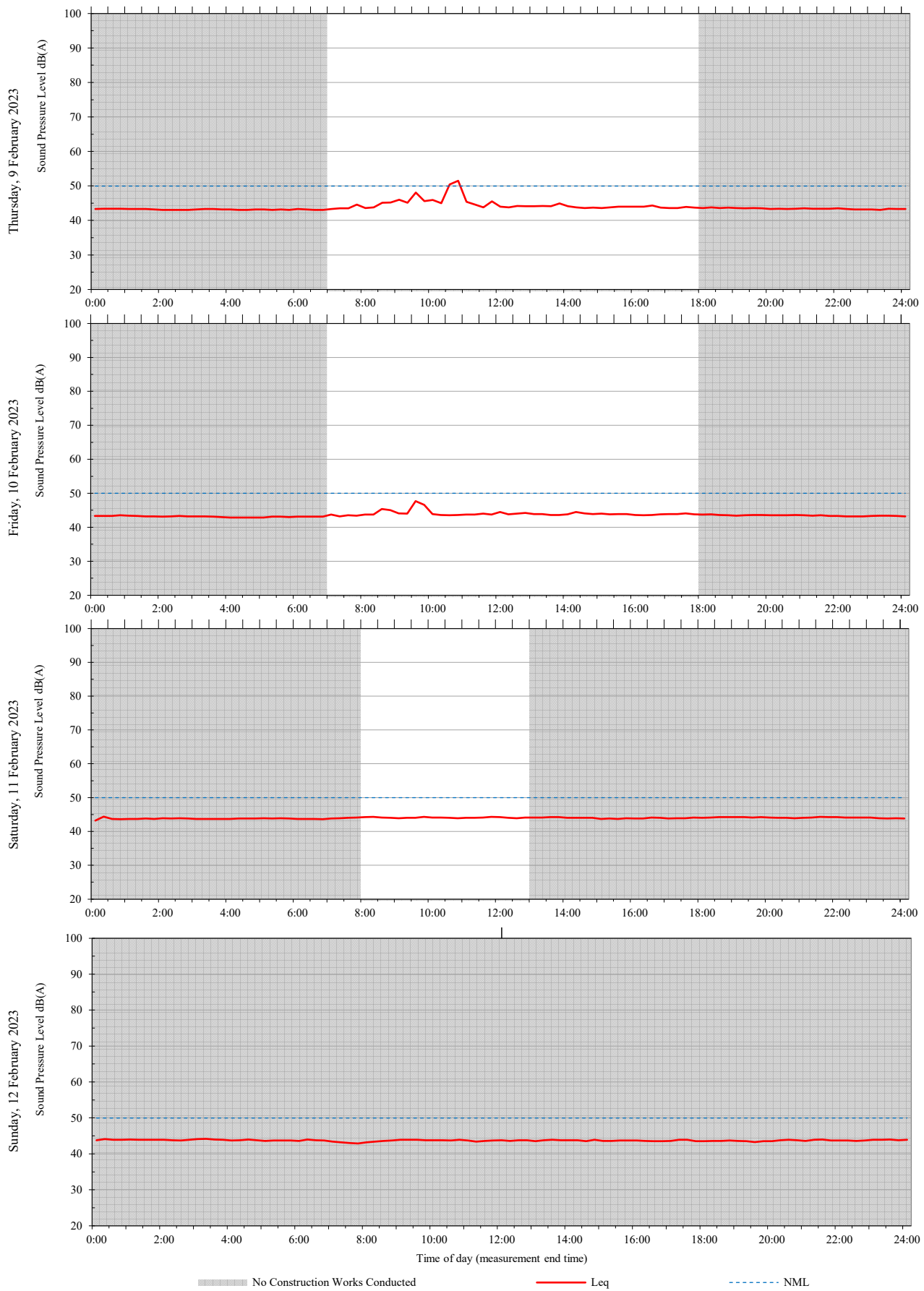


Unattended monitoring: CASB Level 3 Operating Theatre Store Room (Internal)

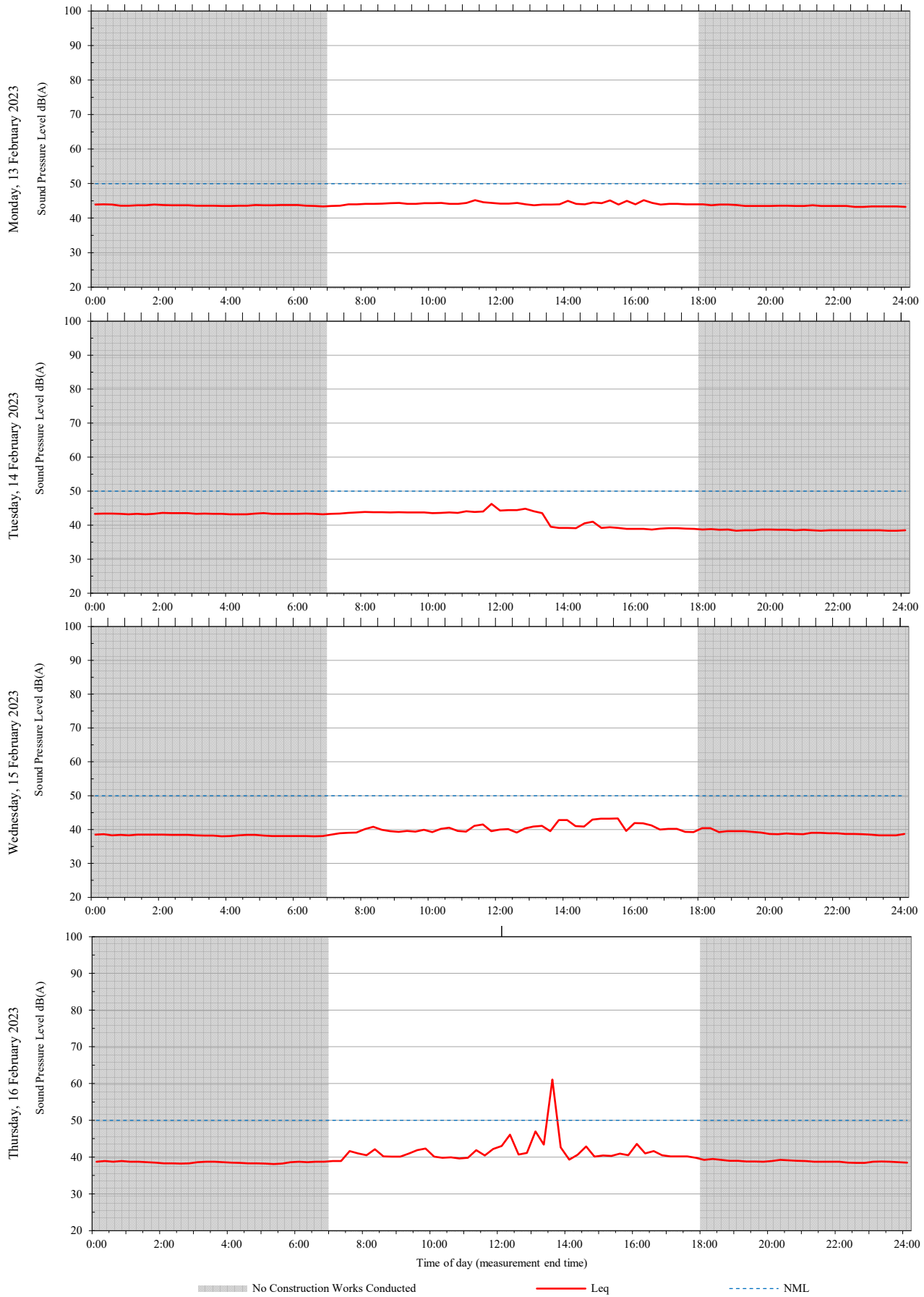
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Unattended monitoring: CASB Level 3 Operating Theatre Store Room (Internal)

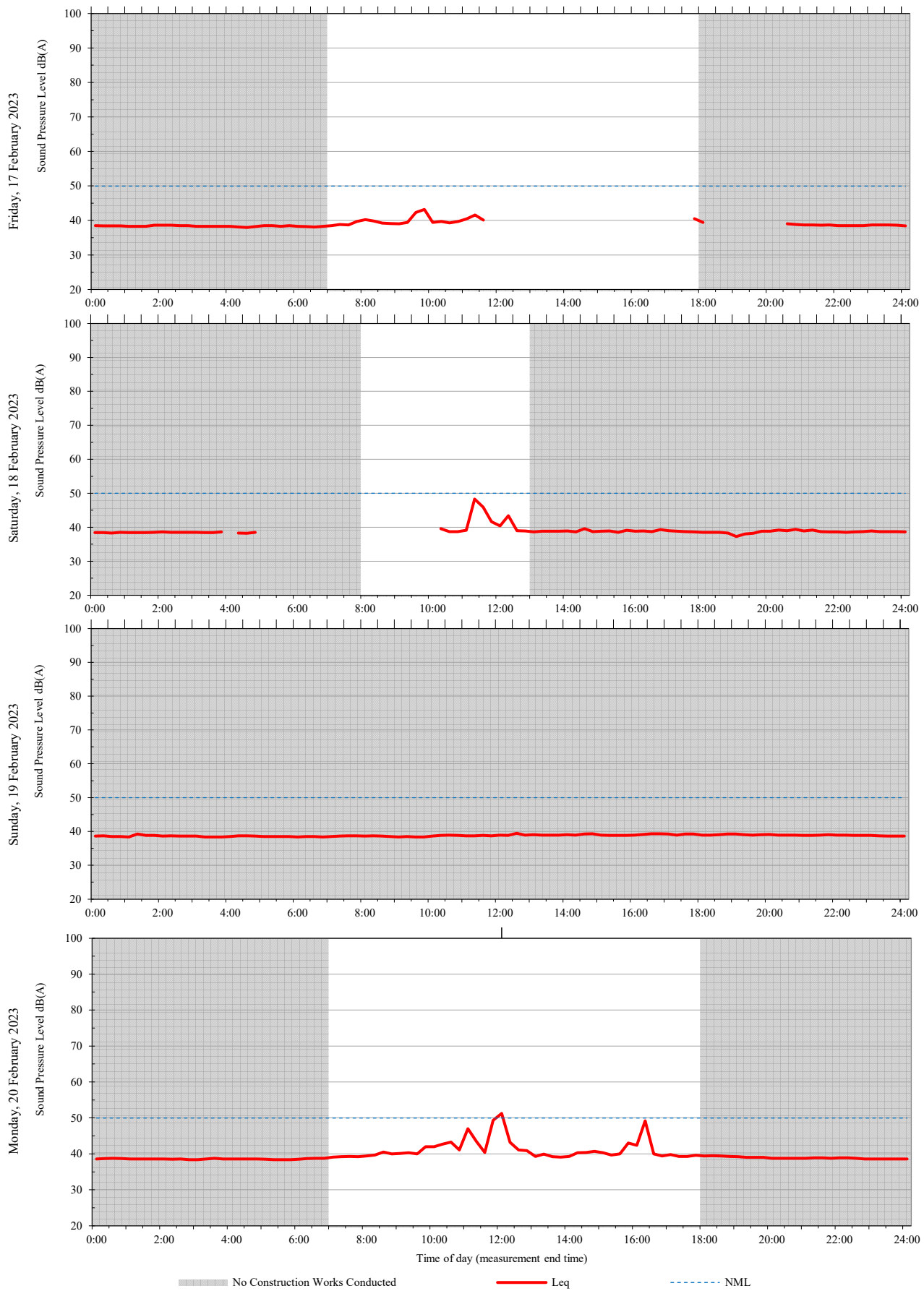


# Unattended monitoring: CASB Level 3 Operating Theatre Store Room (Internal)

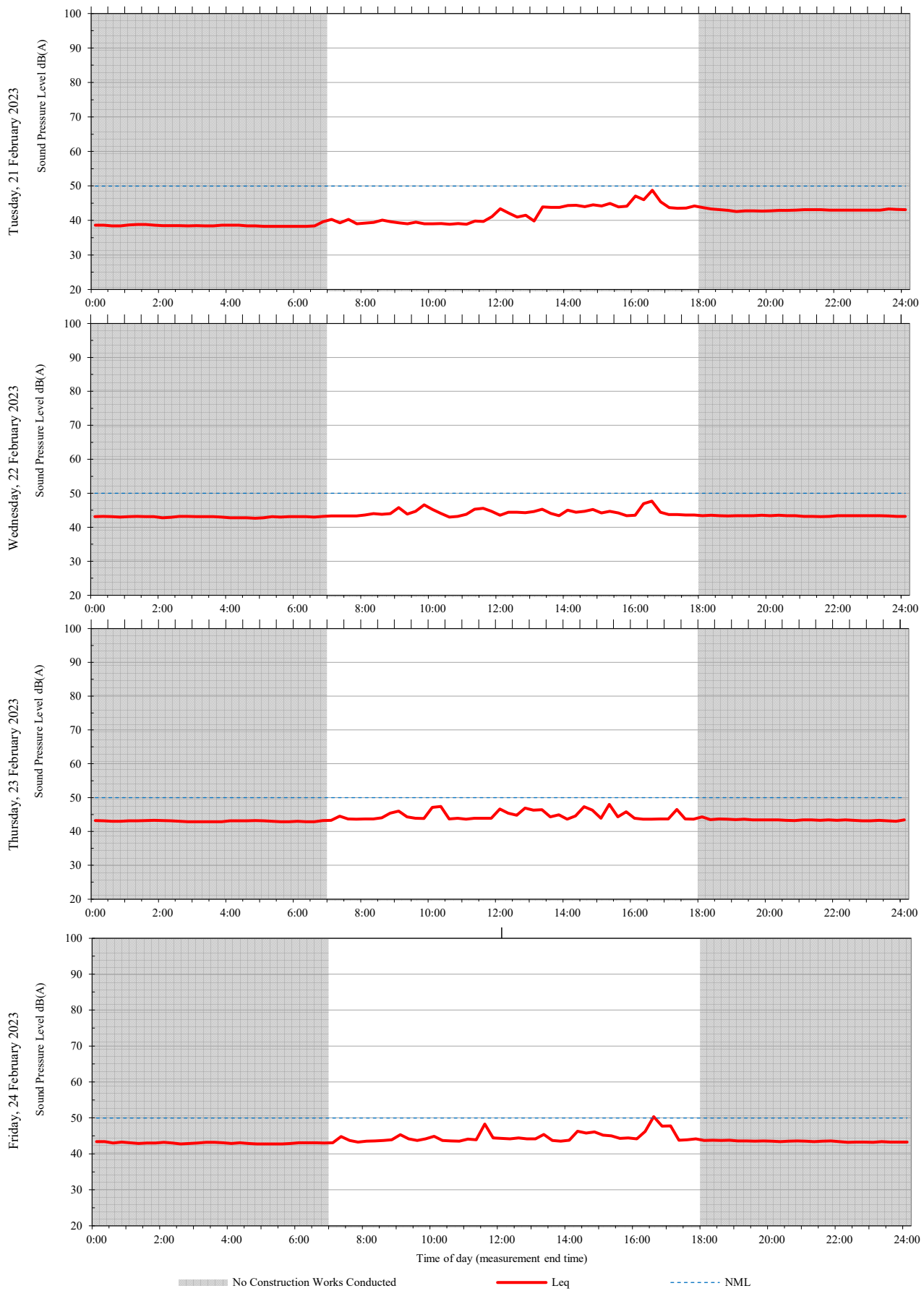




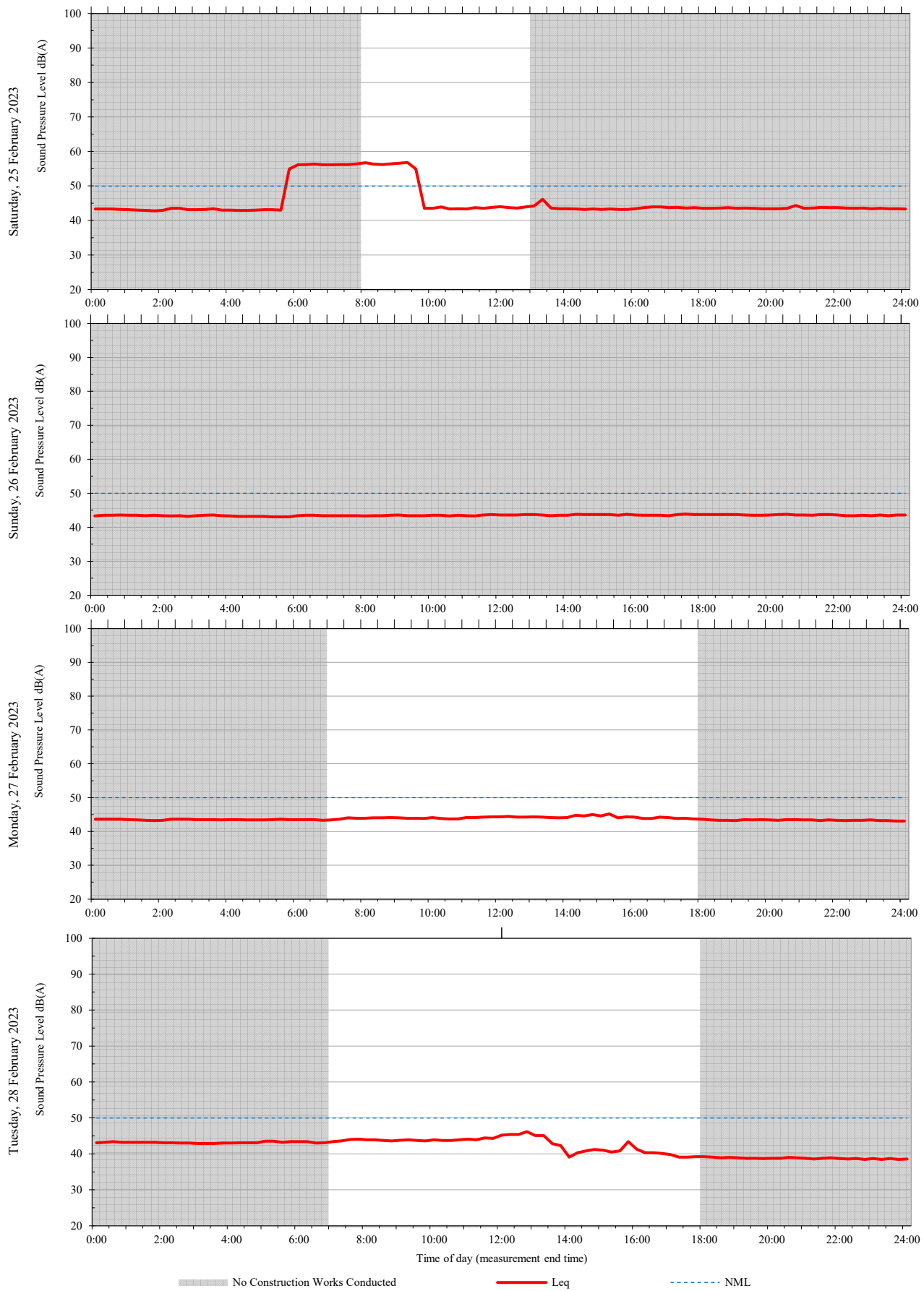
Unattended monitoring: CASB Level 3 Operating Theatre Store Room (Internal)



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

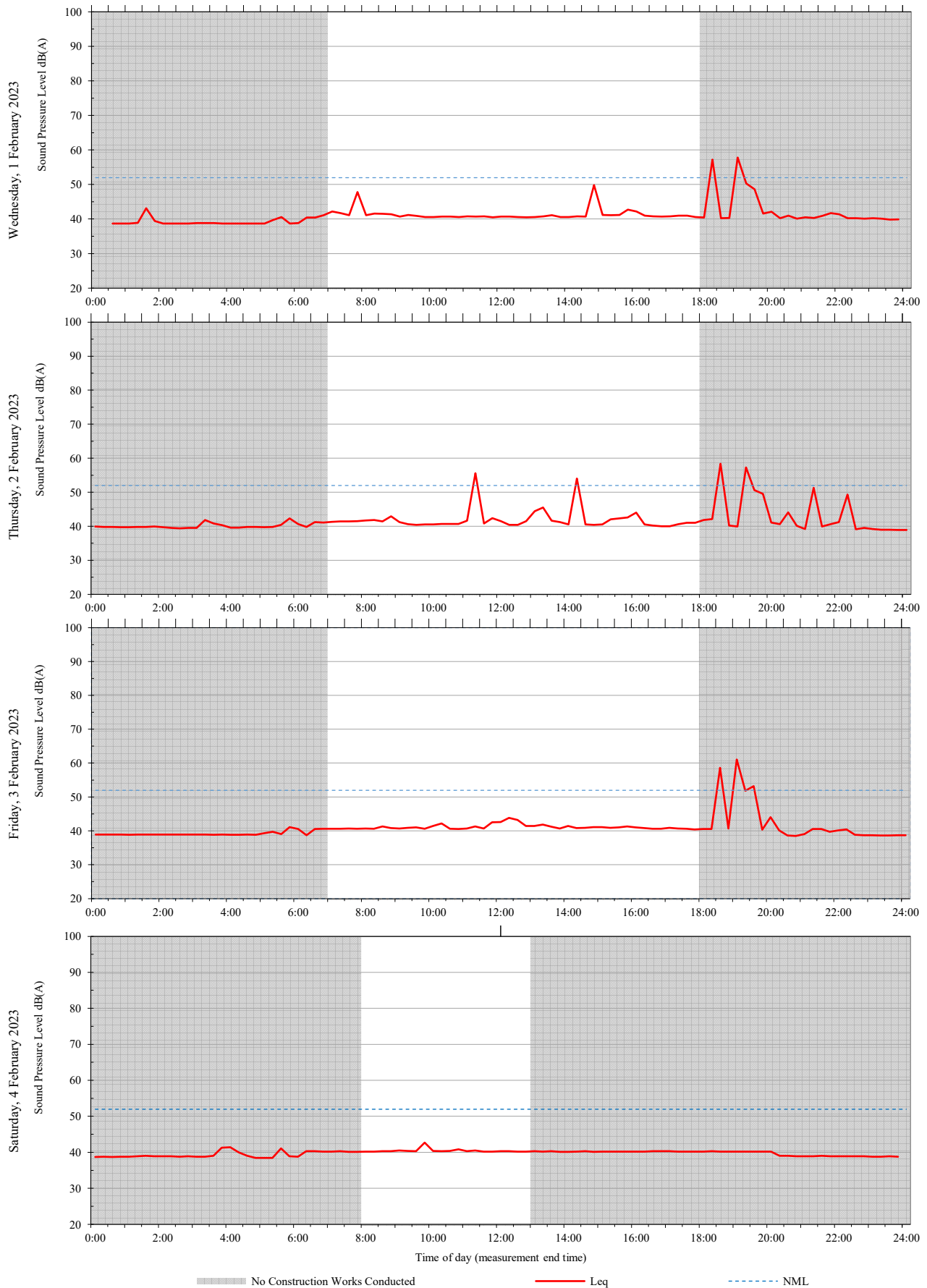


Unattended monitoring: CASB Level 3 Operating Theatre Store Room (Internal)

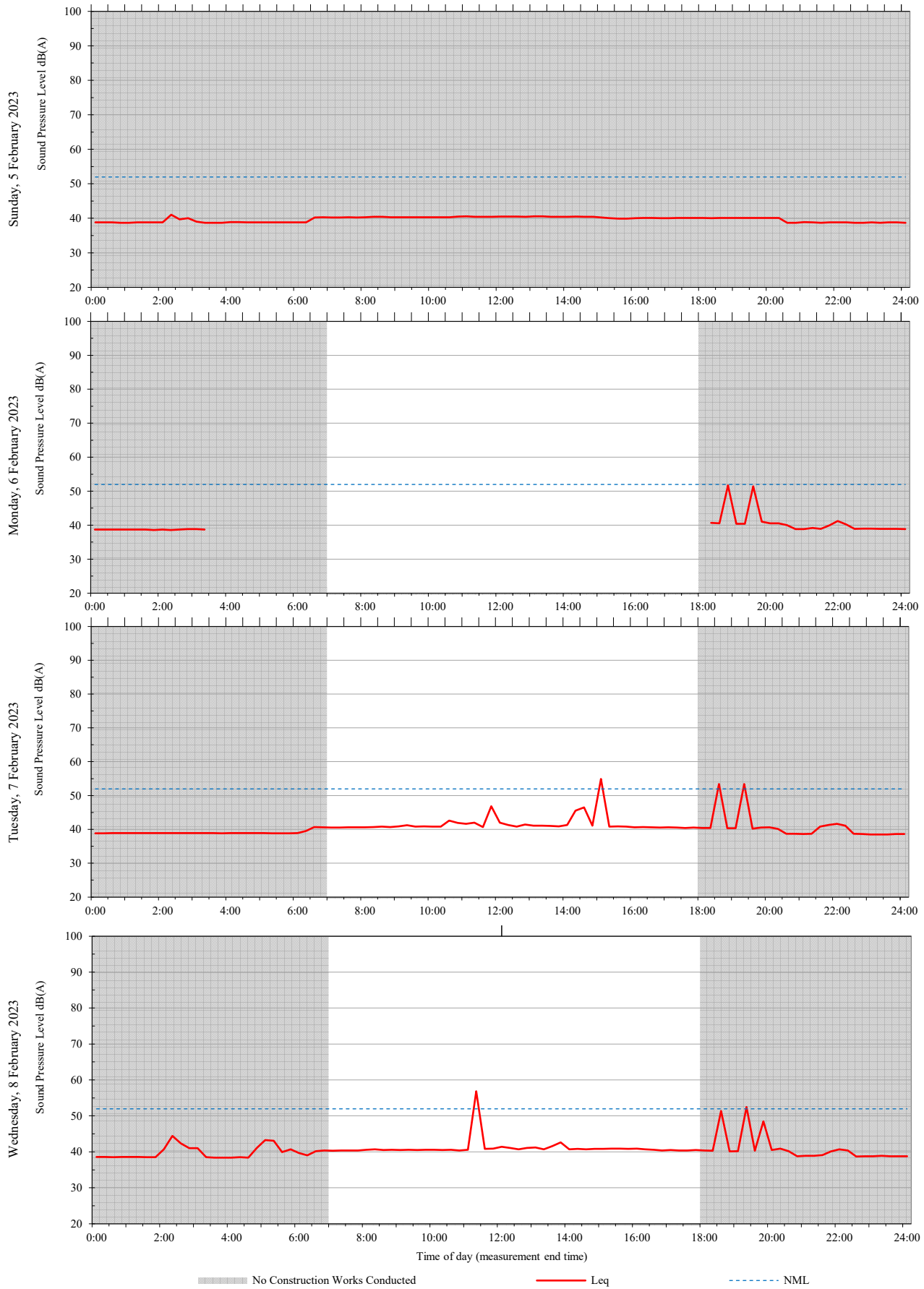


## **A3 CASB Level 6 Cleaner's Room WM11K.06.6079 (Westmead 6)**

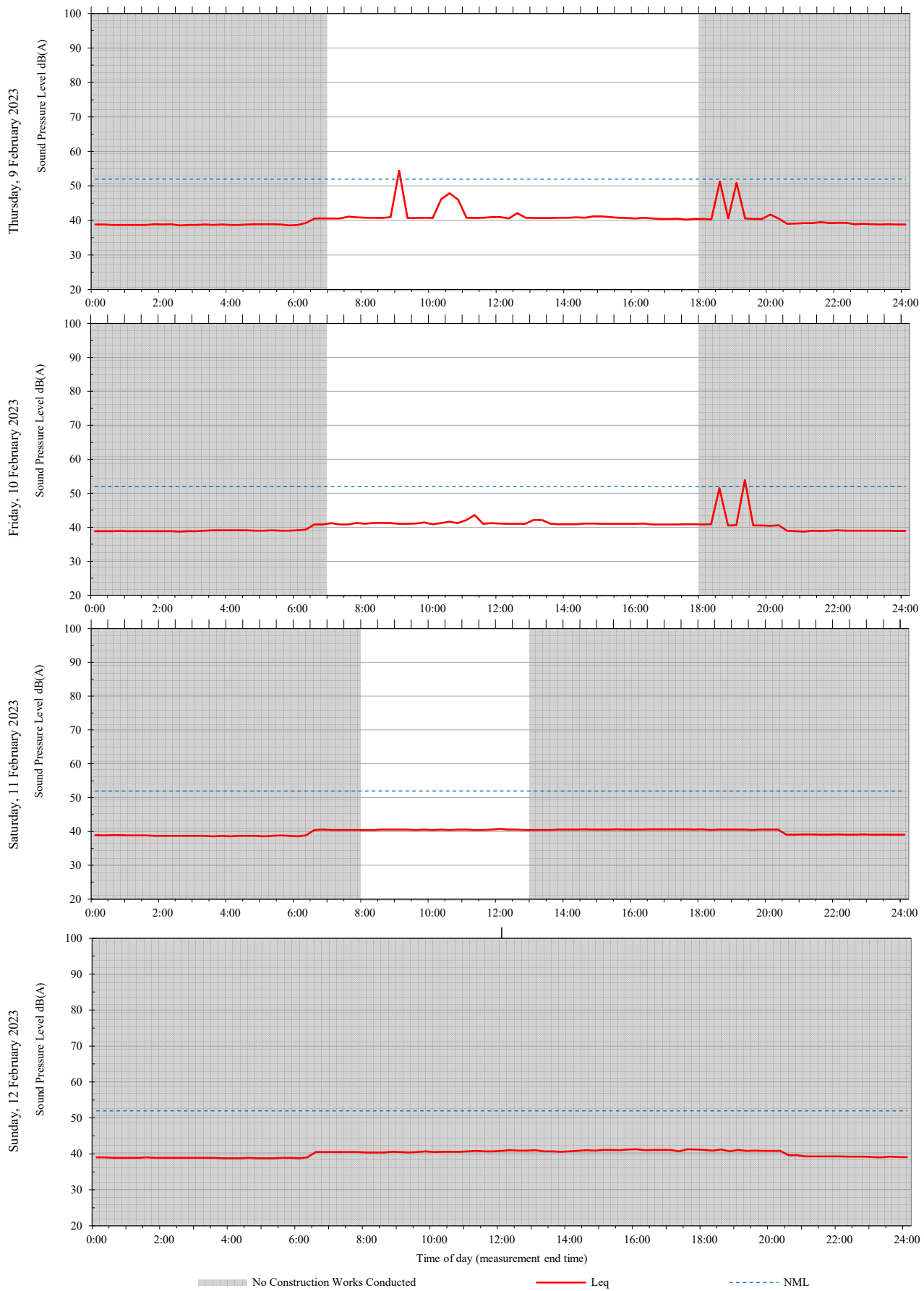
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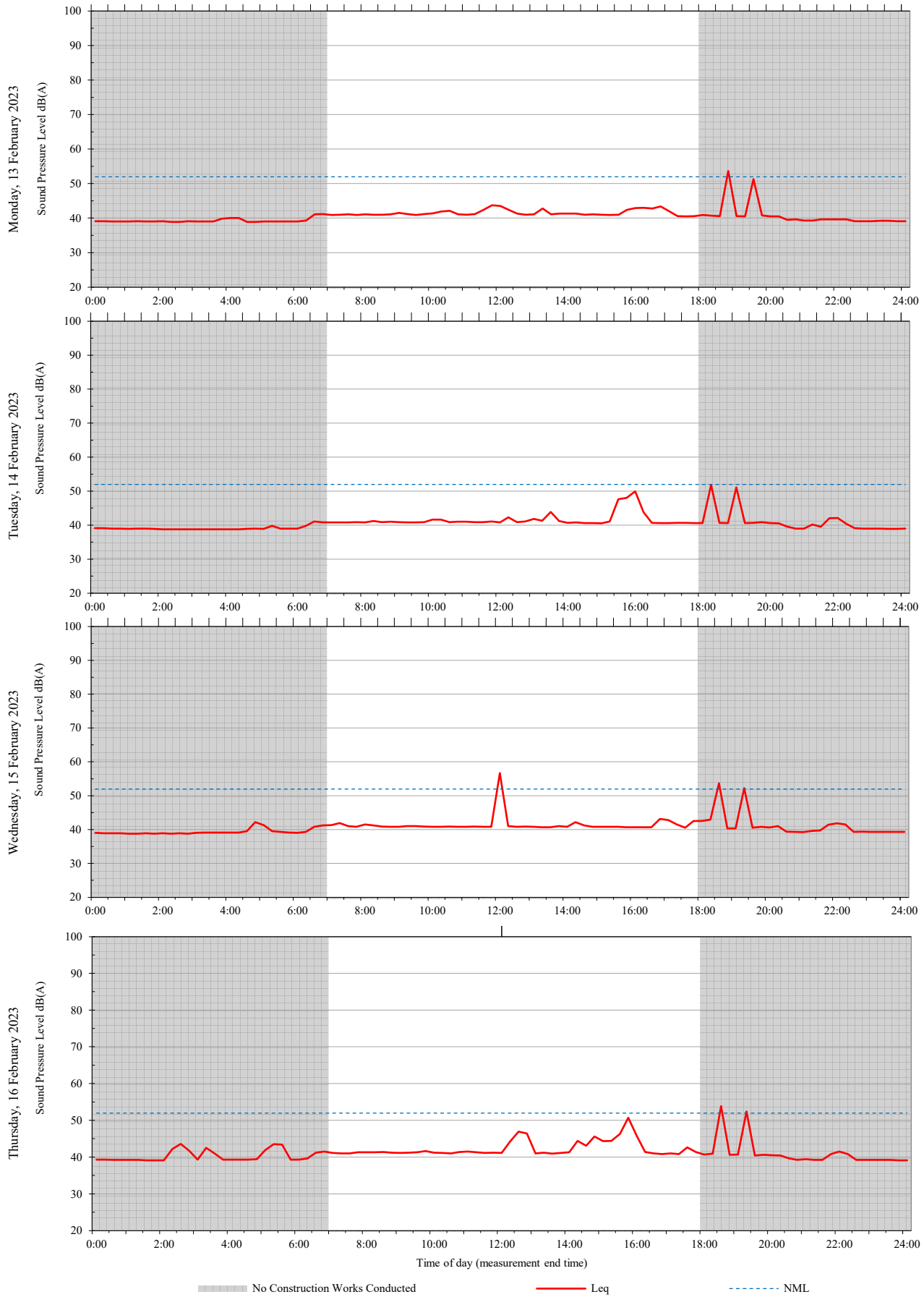
Unattended monitoring: CASB Level 6 Cleaner's Room WM11K.06.6079 (Internal)



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



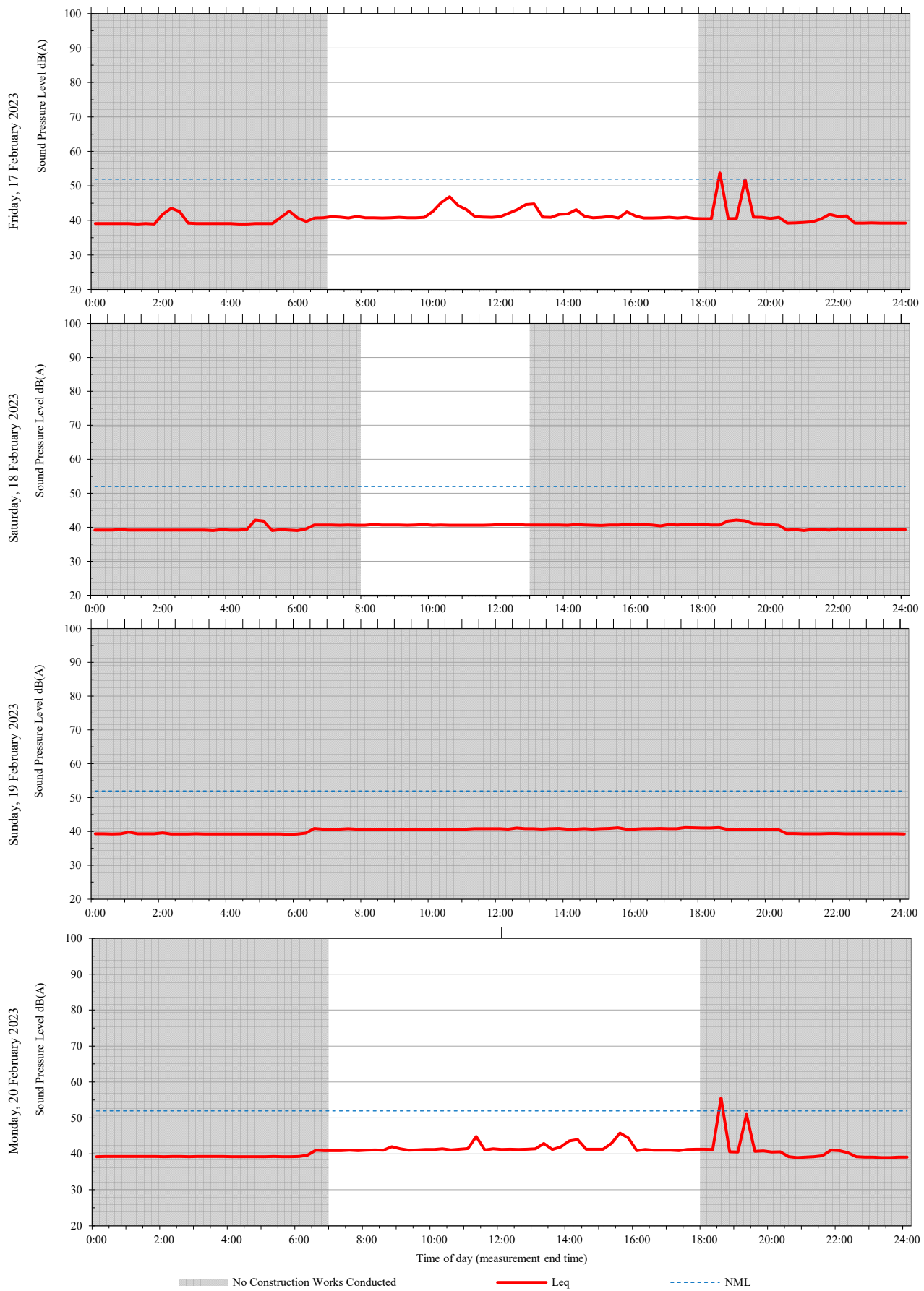
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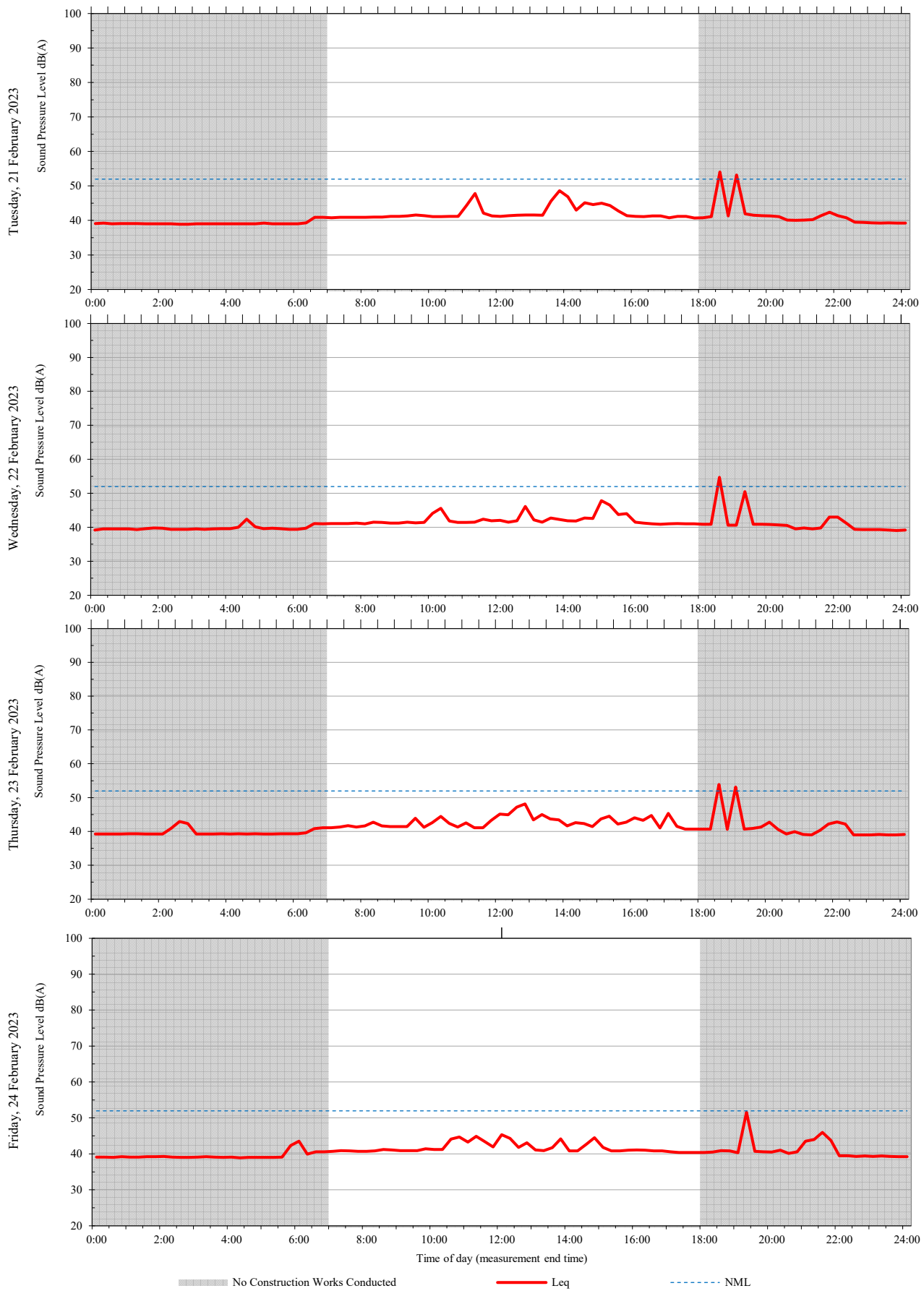




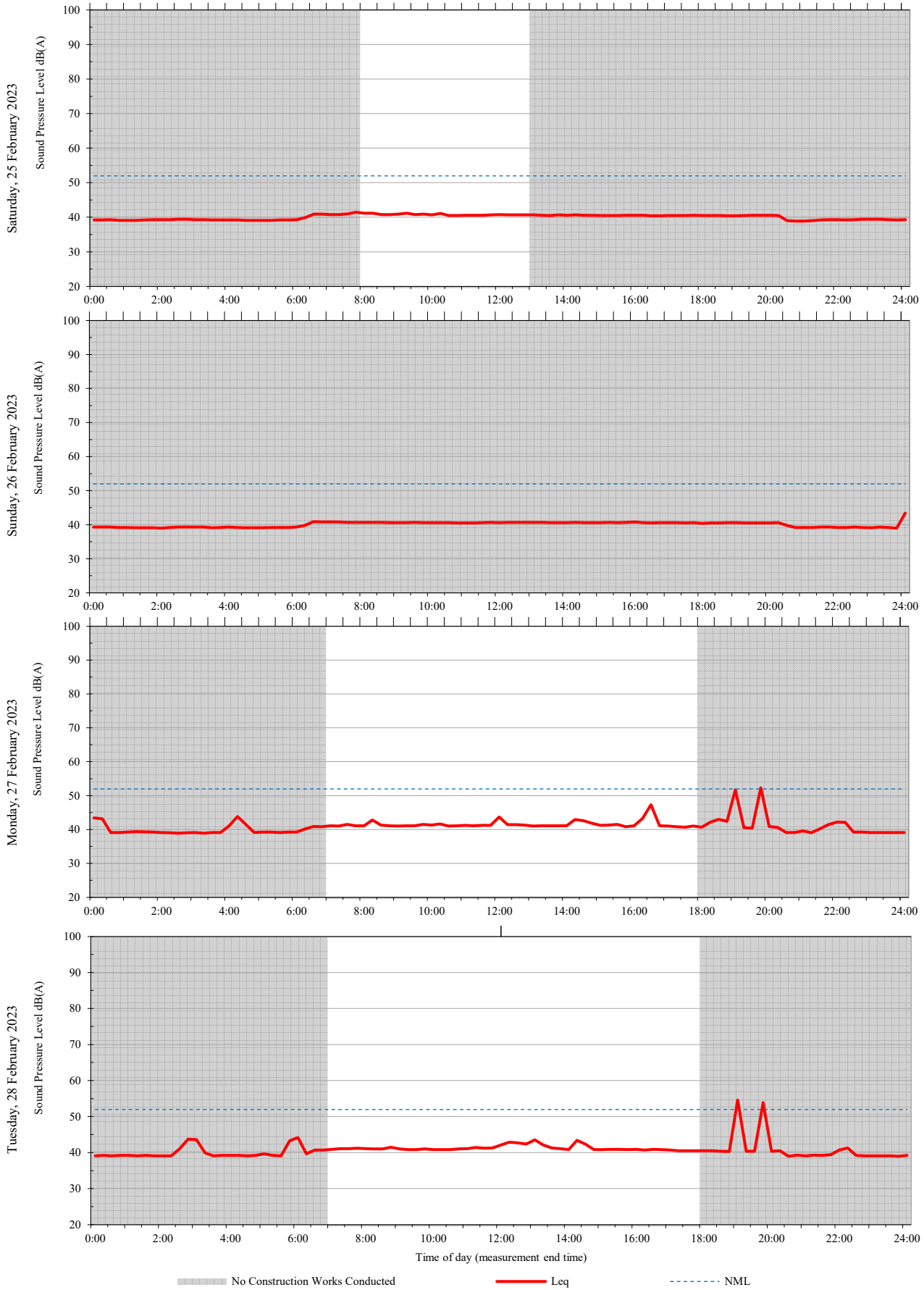
Unattended monitoring: CASB Level 6 Cleaner's Room WM11K.06.6079 (Internal)

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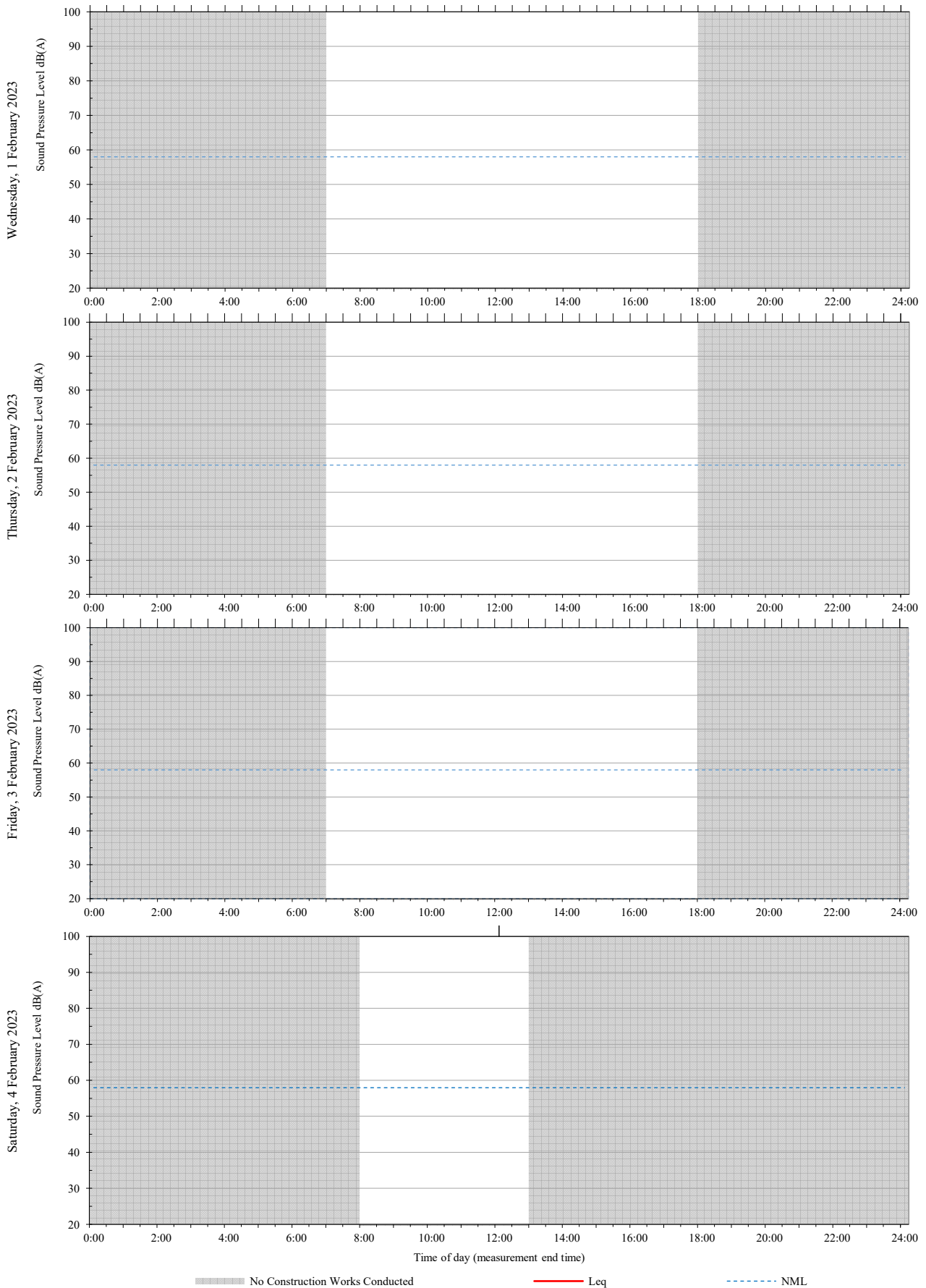
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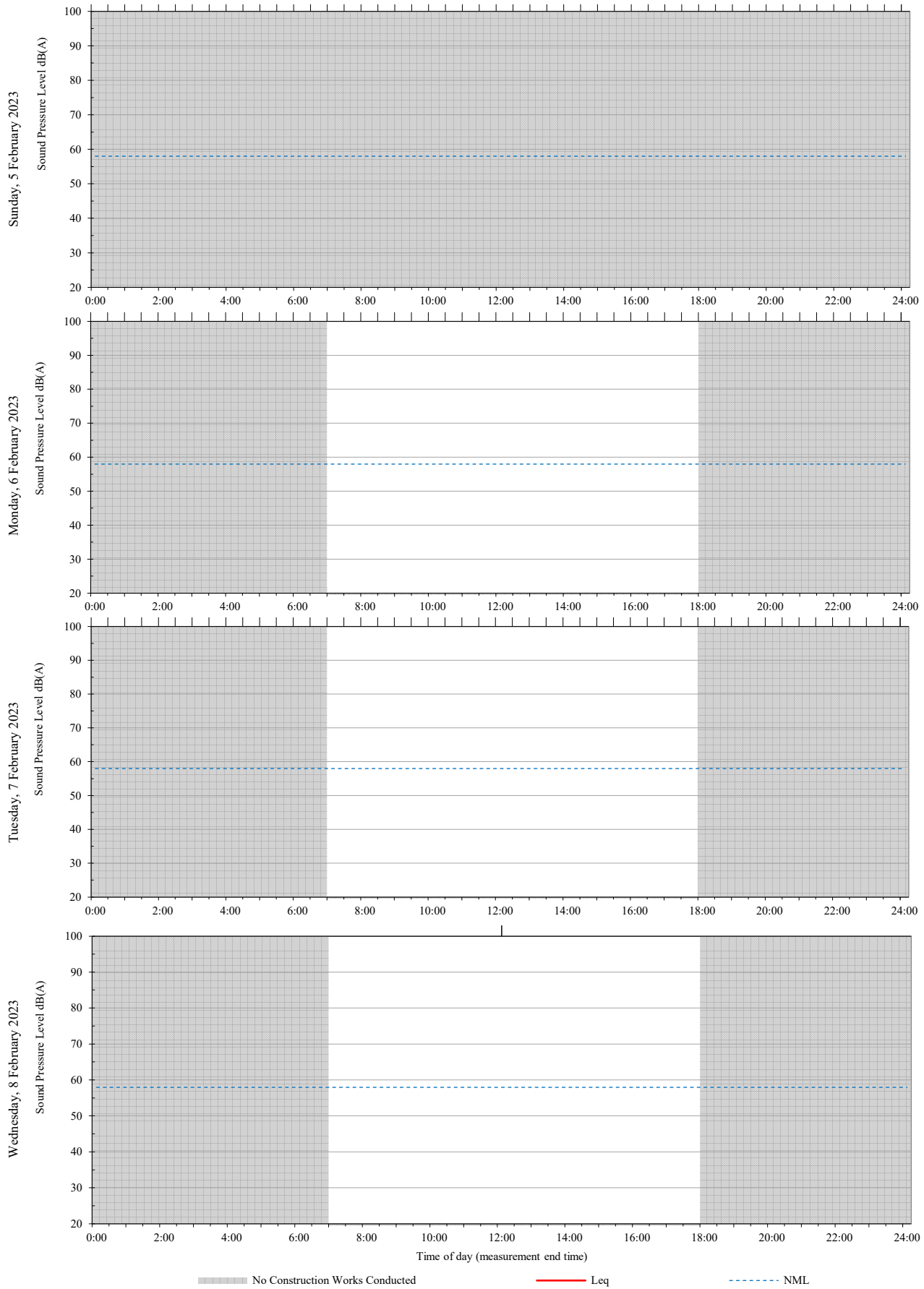
# **A4 KR Level 3 Radiation Room 33 RF041 (Westmead 7)**

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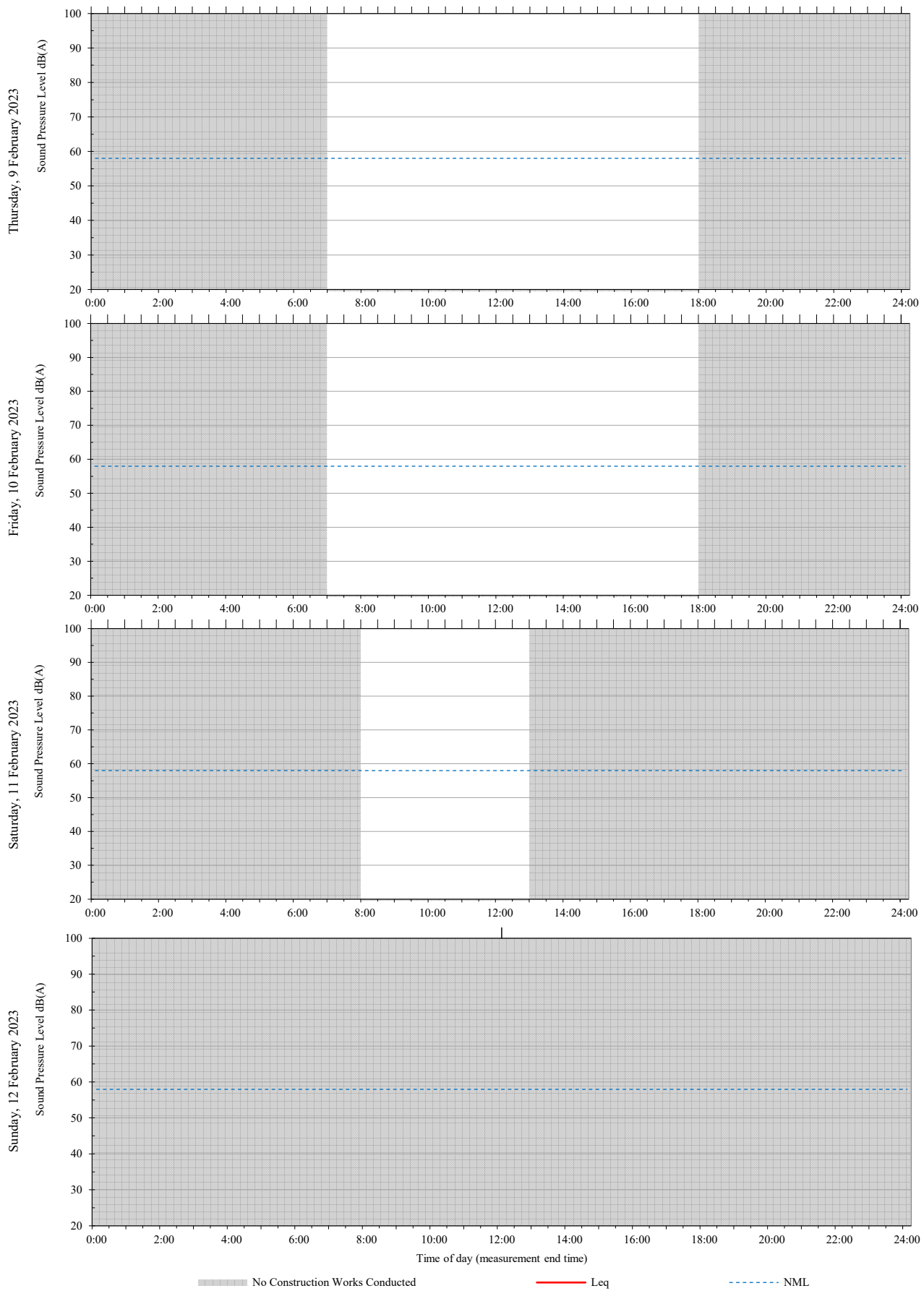
Unattended monitoring: KR Level 3 Radiation Room 33 RF041(facing PSB site) (Internal)



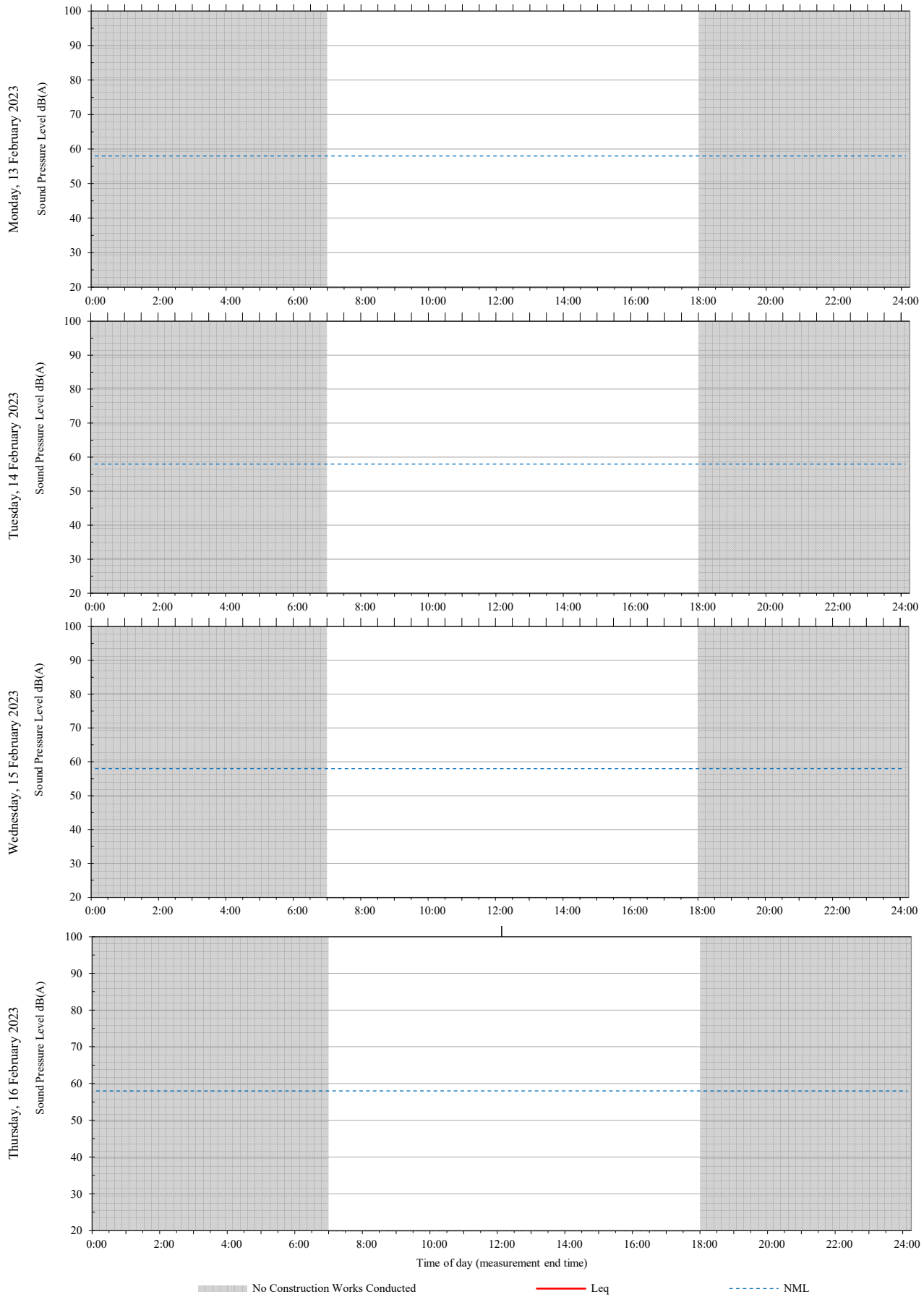
Unattended monitoring: KR Level 3 Radiation Room 33 RF041(facing PSB site) (Internal)



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

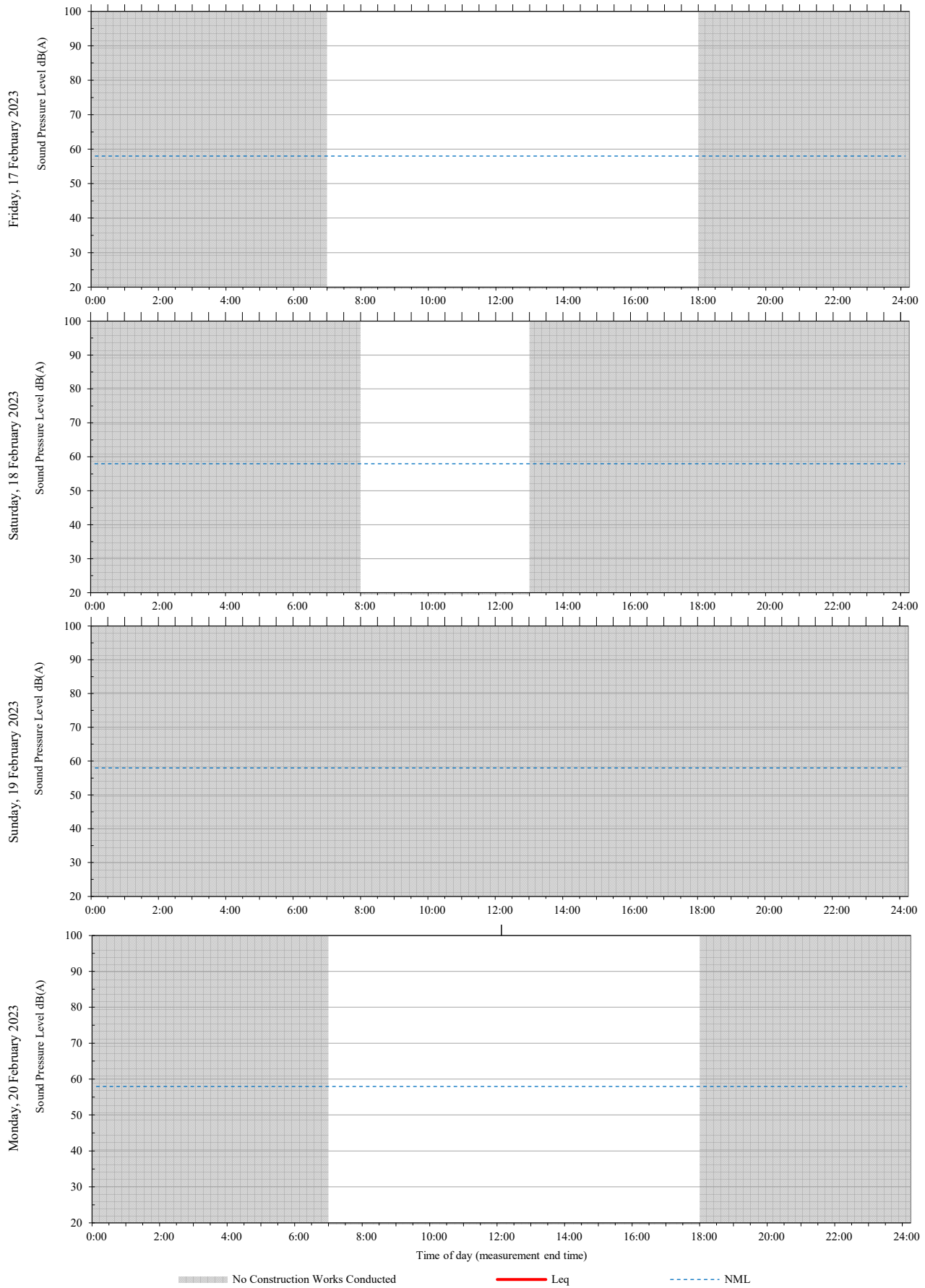


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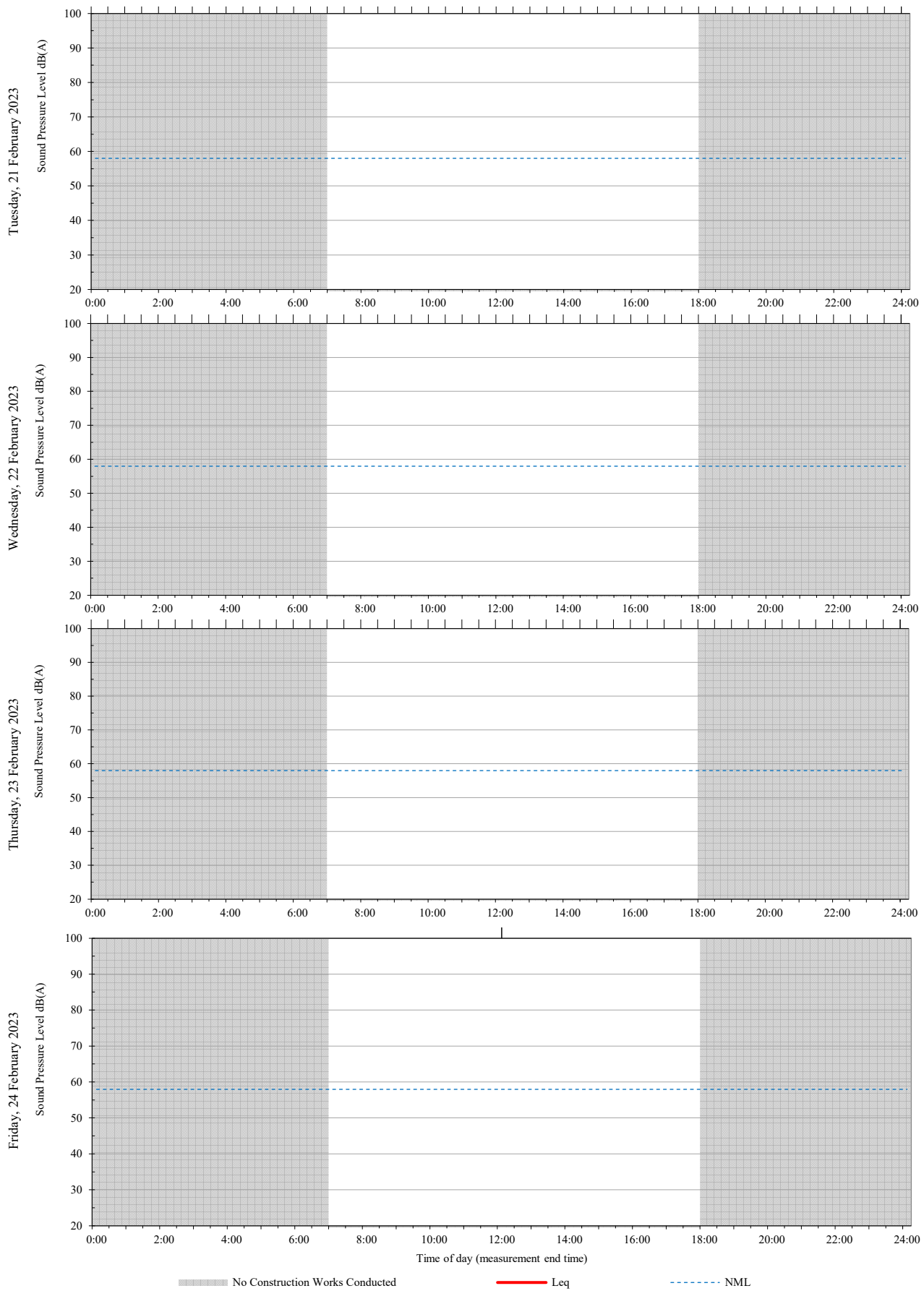




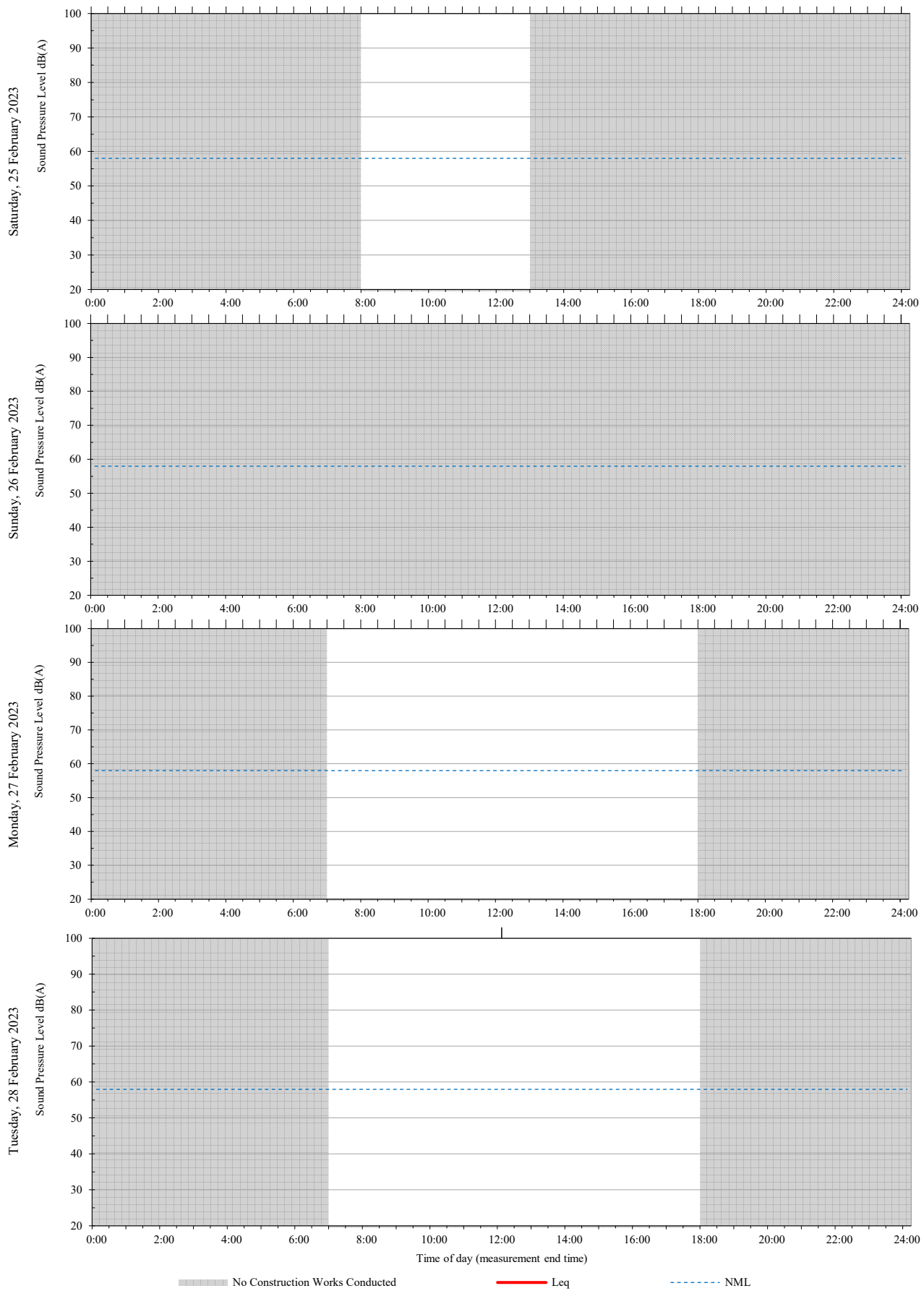
Unattended monitoring: KR Level 3 Radiation Room 33 RF041(facing PSB site) (Internal)



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



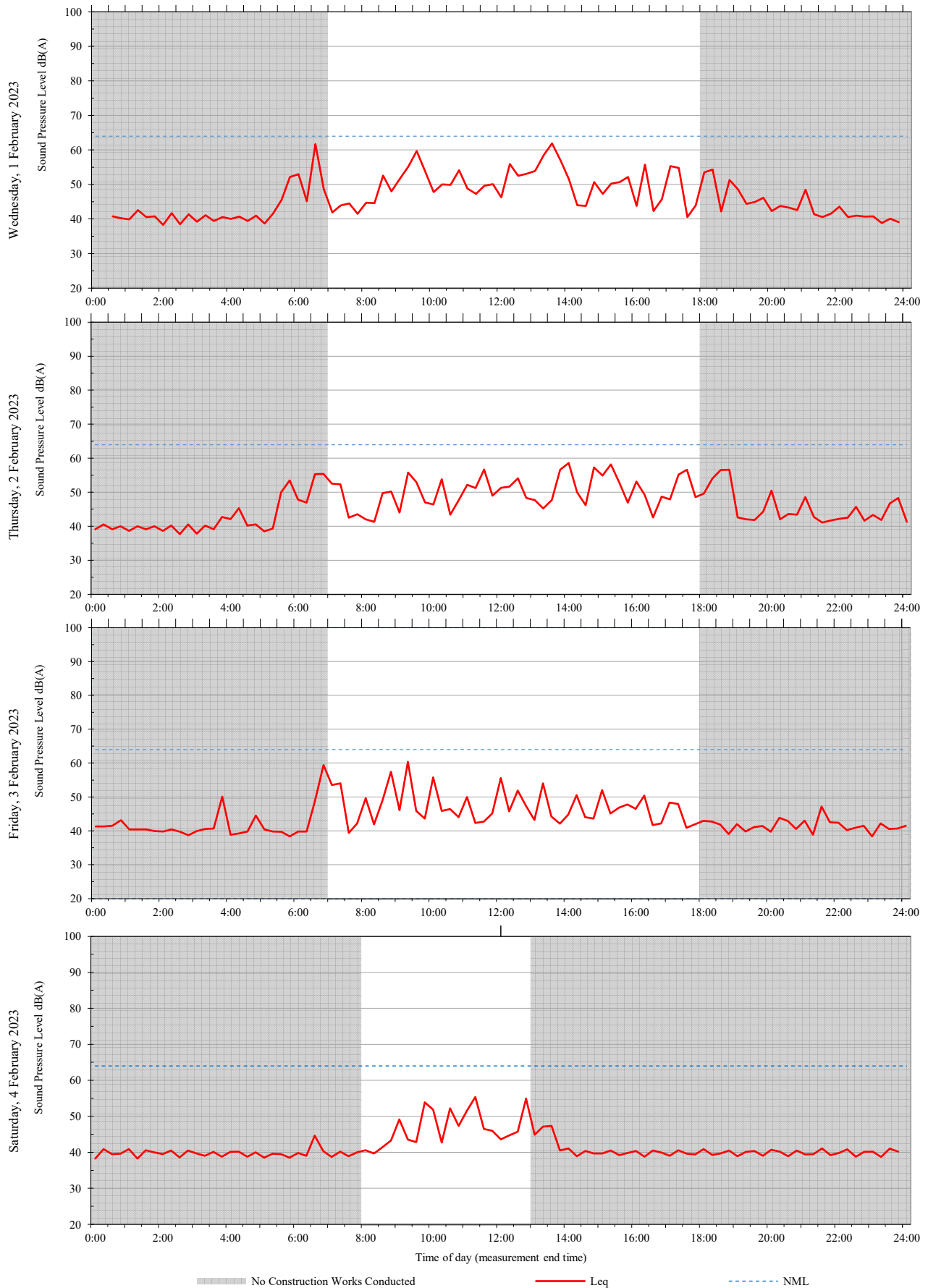
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## **A5 CHW Level 2 Parent Kitchen 92BW025 (facing MSCP site) (Westmead 2)**

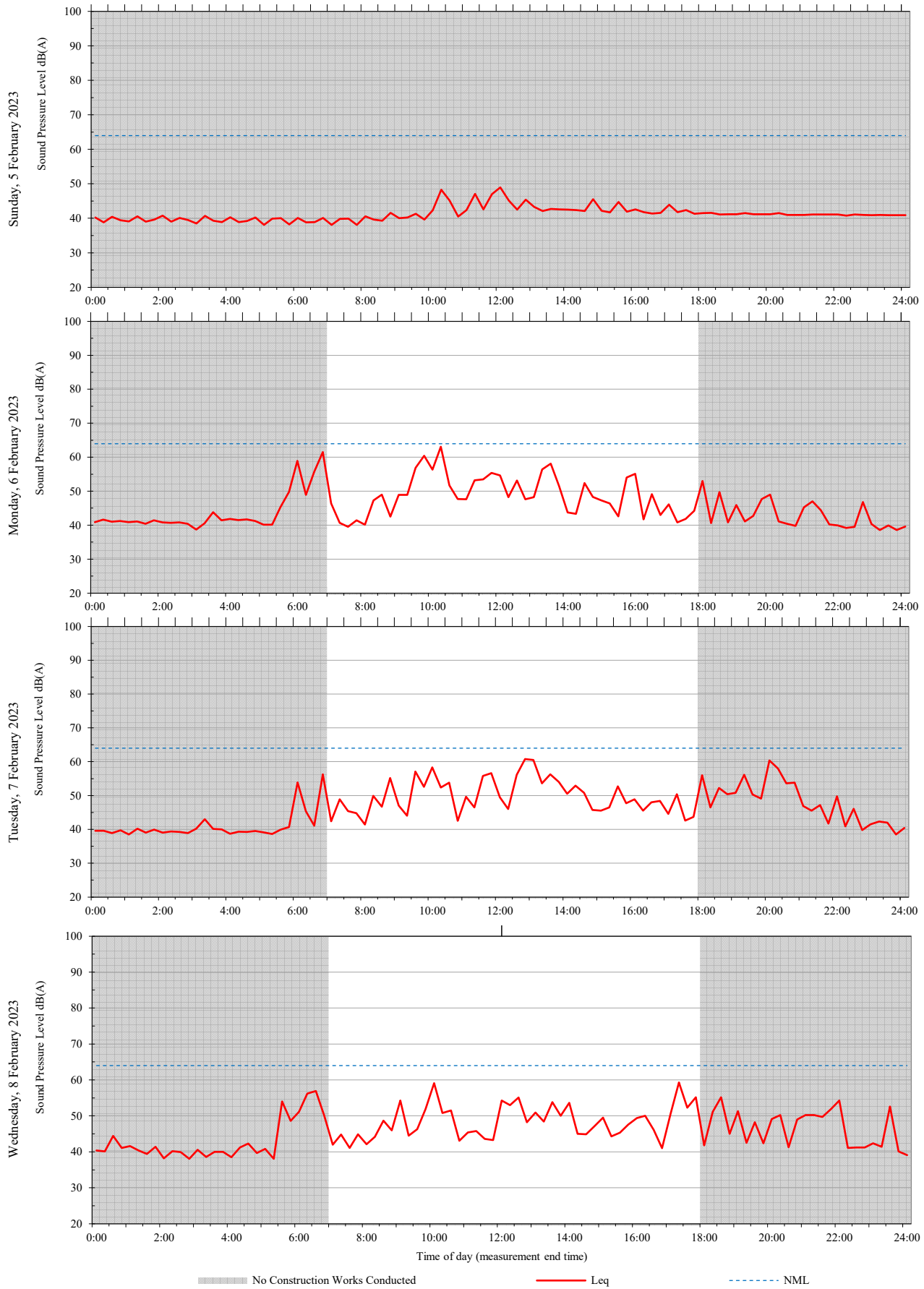
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Unattended monitoring: CHW Level 2 Parent Kitchen 92BW025 (Internal)



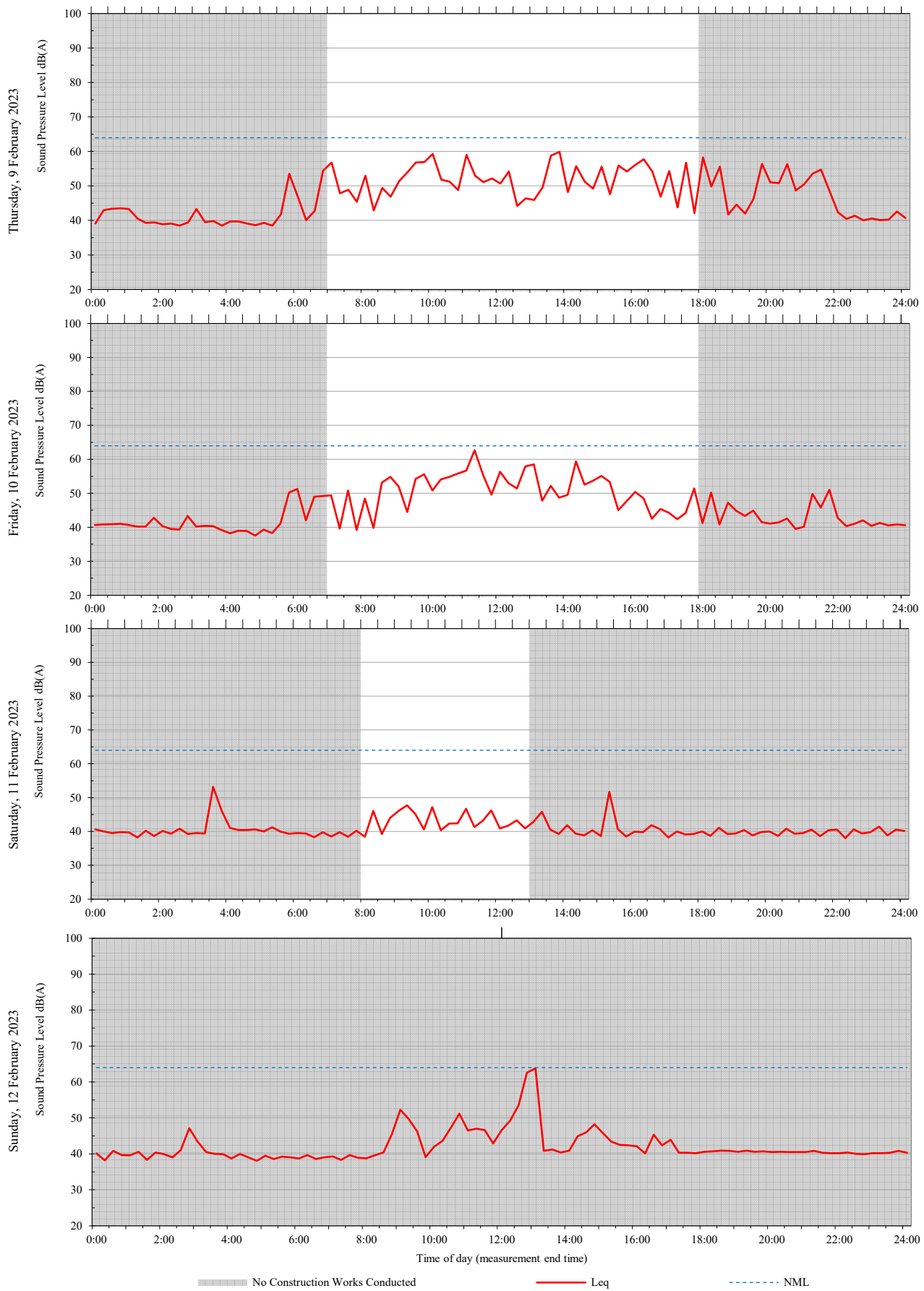
Unattended monitoring: CHW Level 2 Parent Kitchen 92BW025 (Internal)

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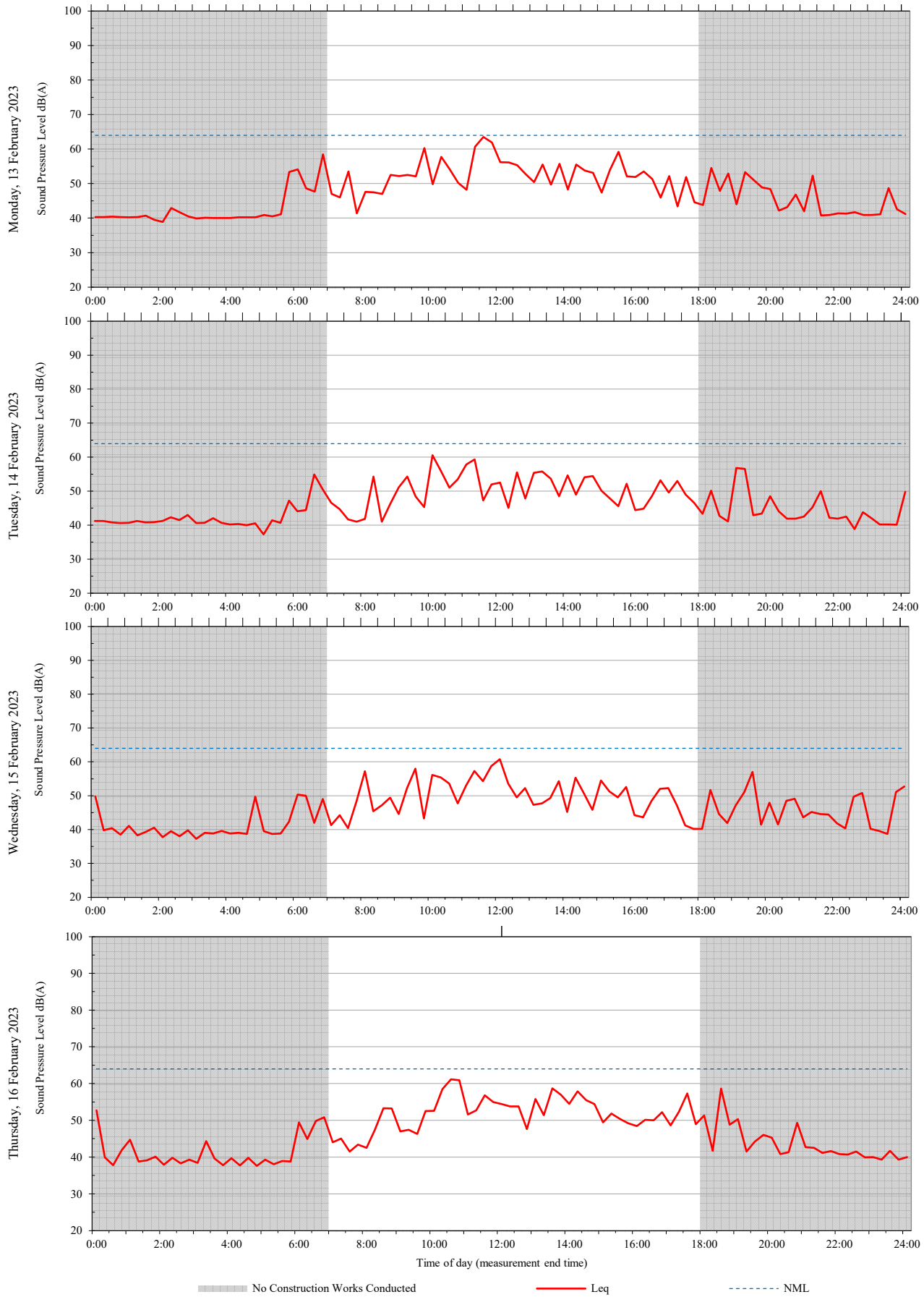
Unattended monitoring: CHW Level 2 Parent Kitchen 92BW025 (Internal)

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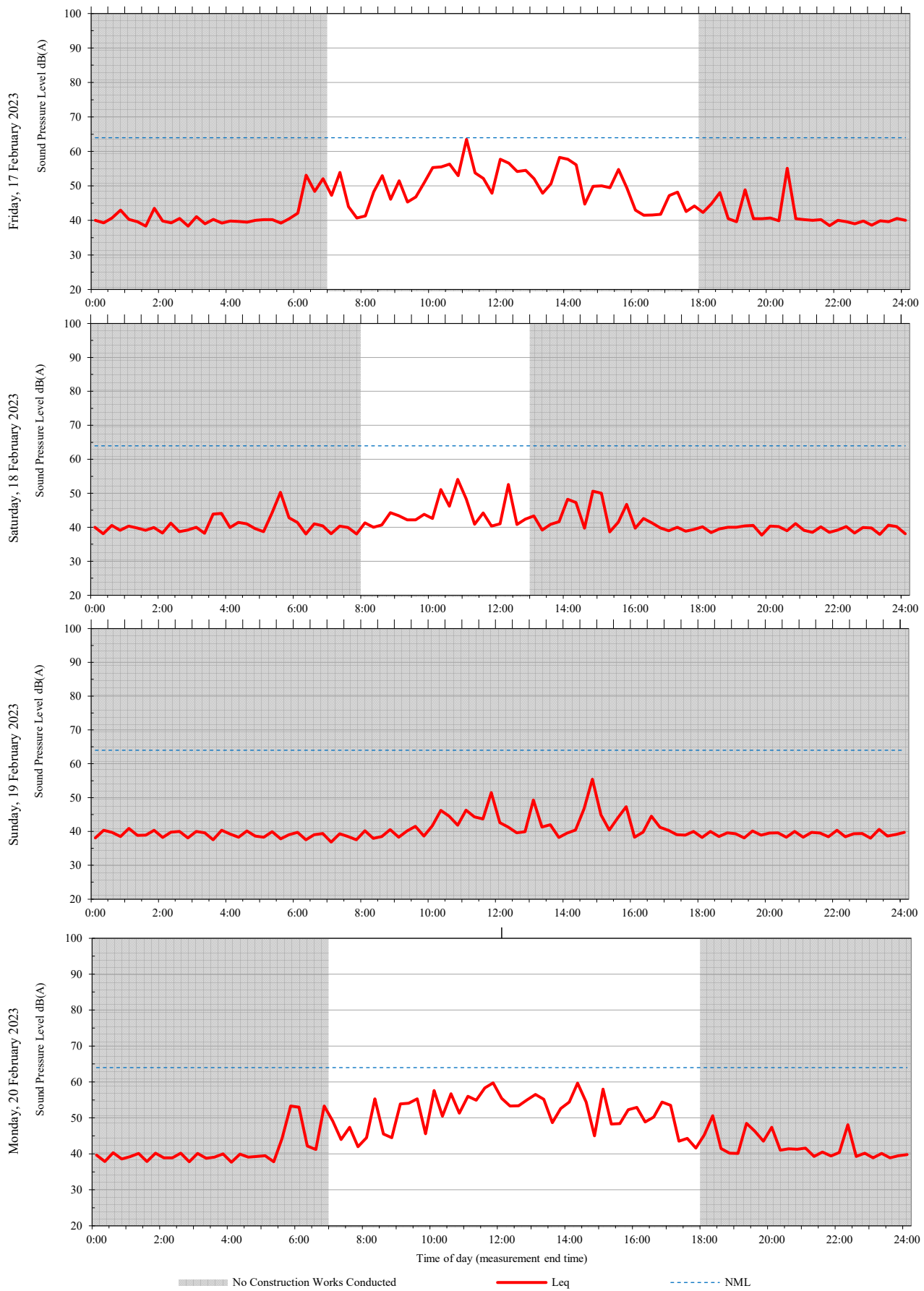
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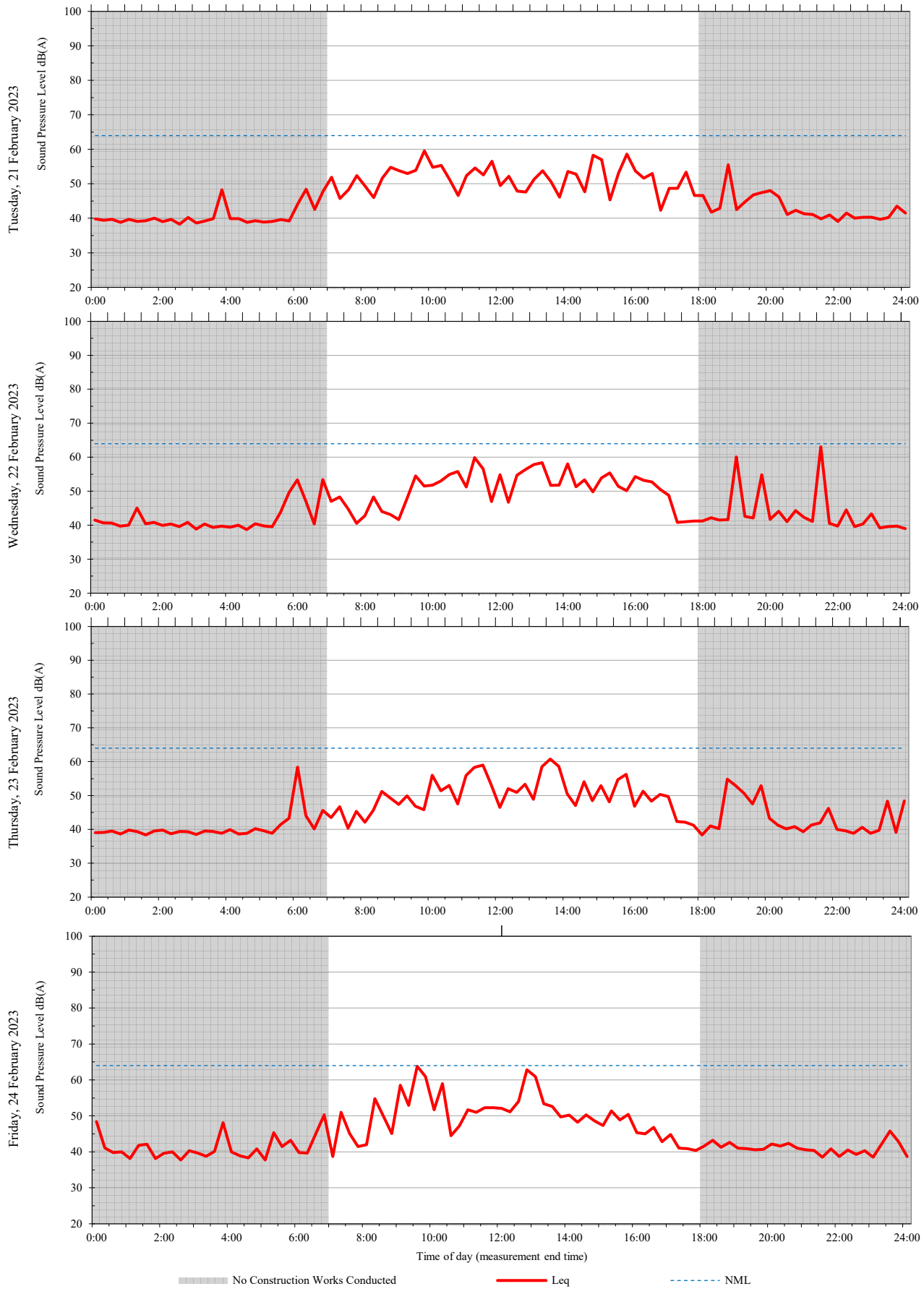


Unattended monitoring: CHW Level 2 Parent Kitchen 92BW025 (Internal)

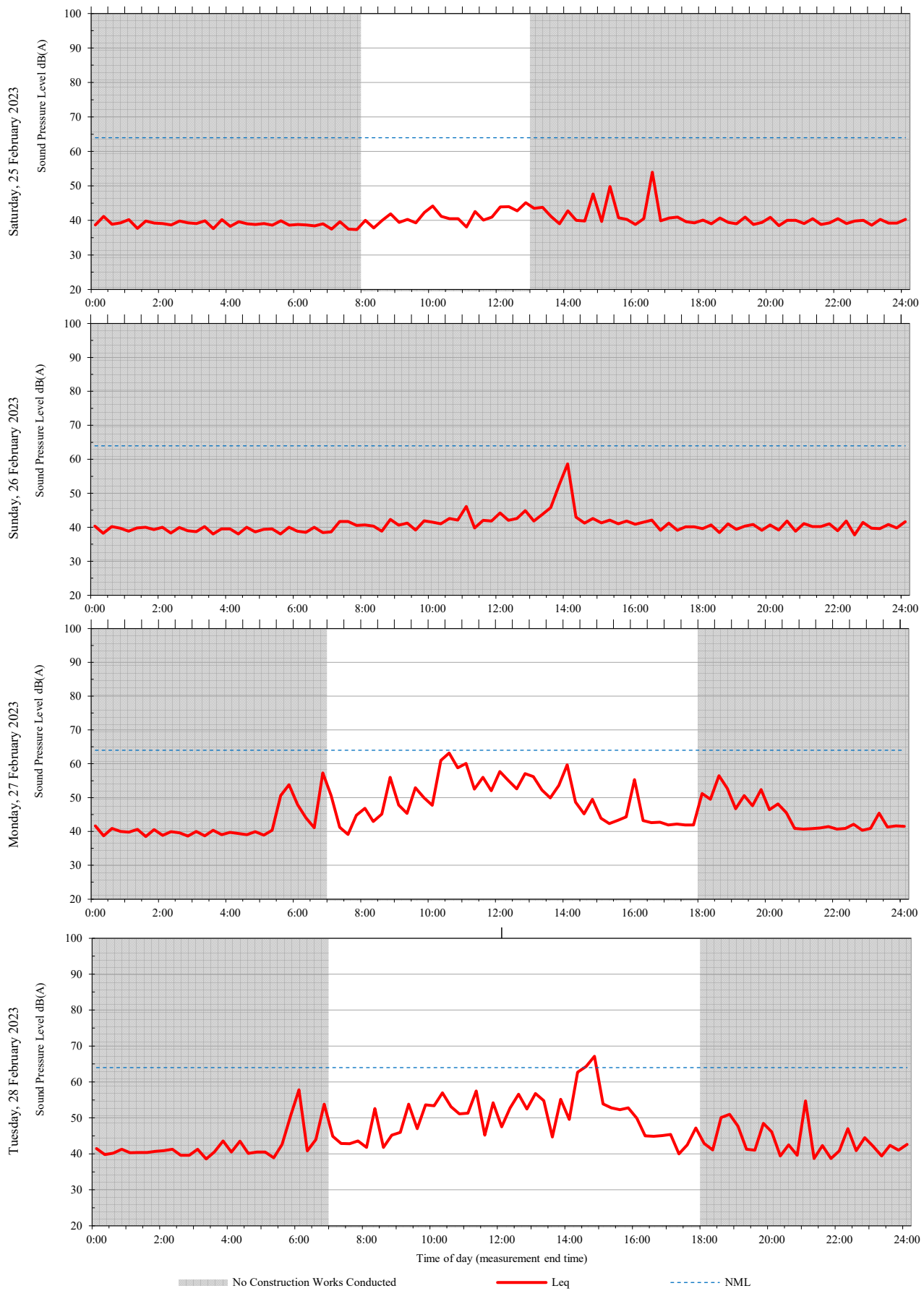


Unattended monitoring: CHW Level 2 Parent Kitchen 92BW025 (Internal)

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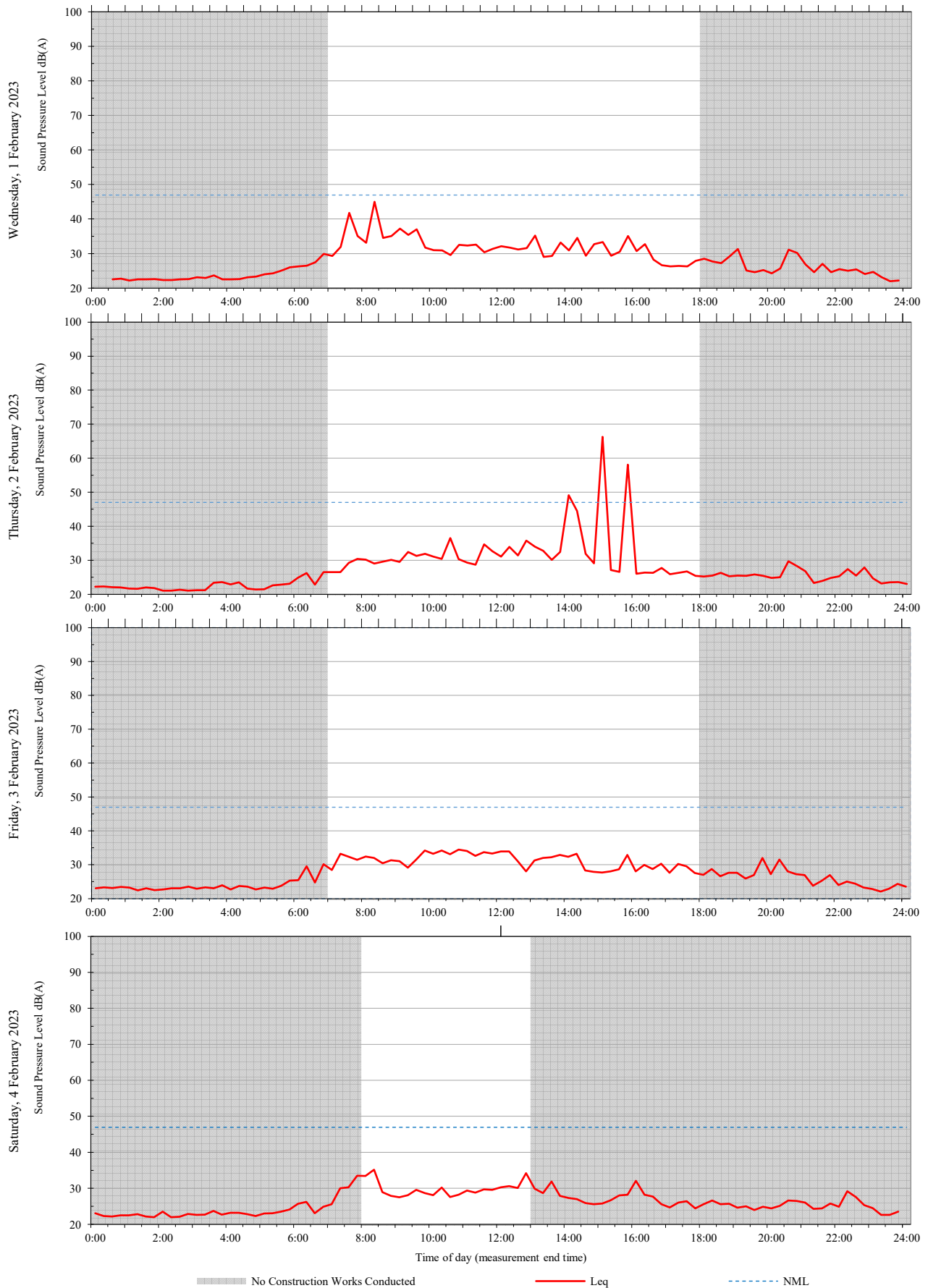
Unattended monitoring: CHW Level 2 Parent Kitchen 92BW025 (Internal)



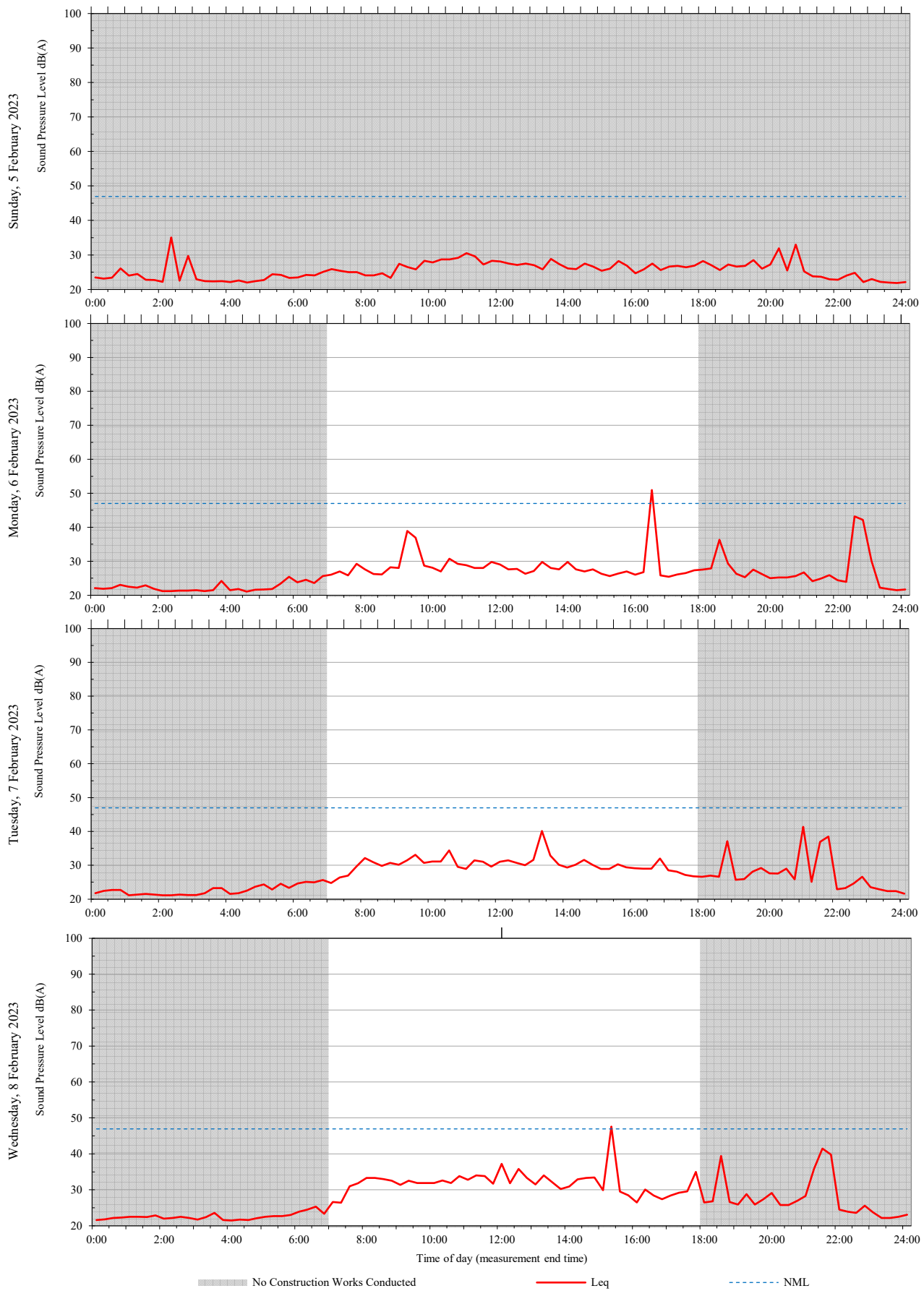
## A6 RMH Level 1 Store Room 101 (Westmead 3)

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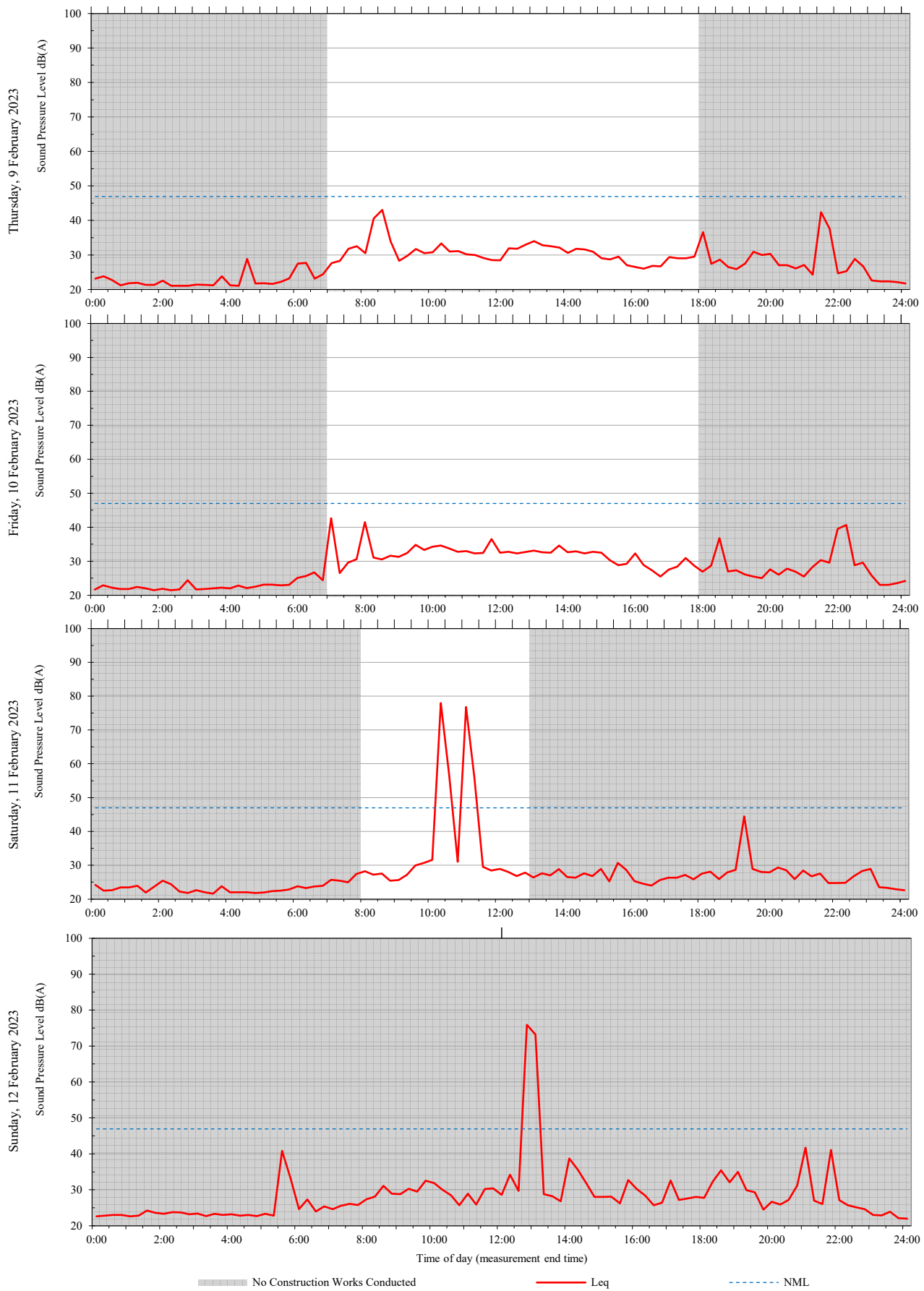
Unattended monitoring: RMH Level 1 Store Room 101 (facing MSCP site) (Internal)



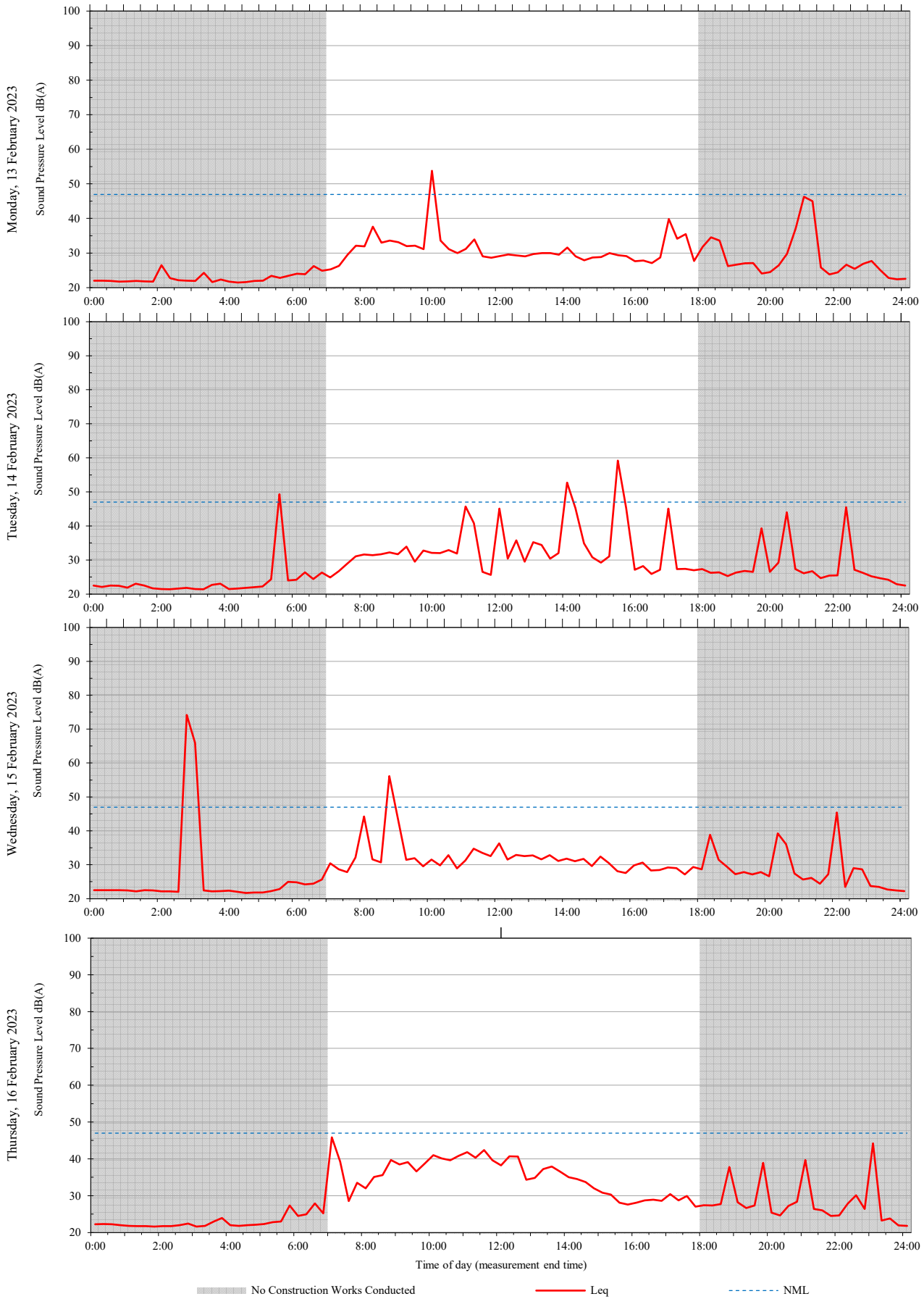
Unattended monitoring: RMH Level 1 Store Room 101 (facing MSCP site) (Internal)



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

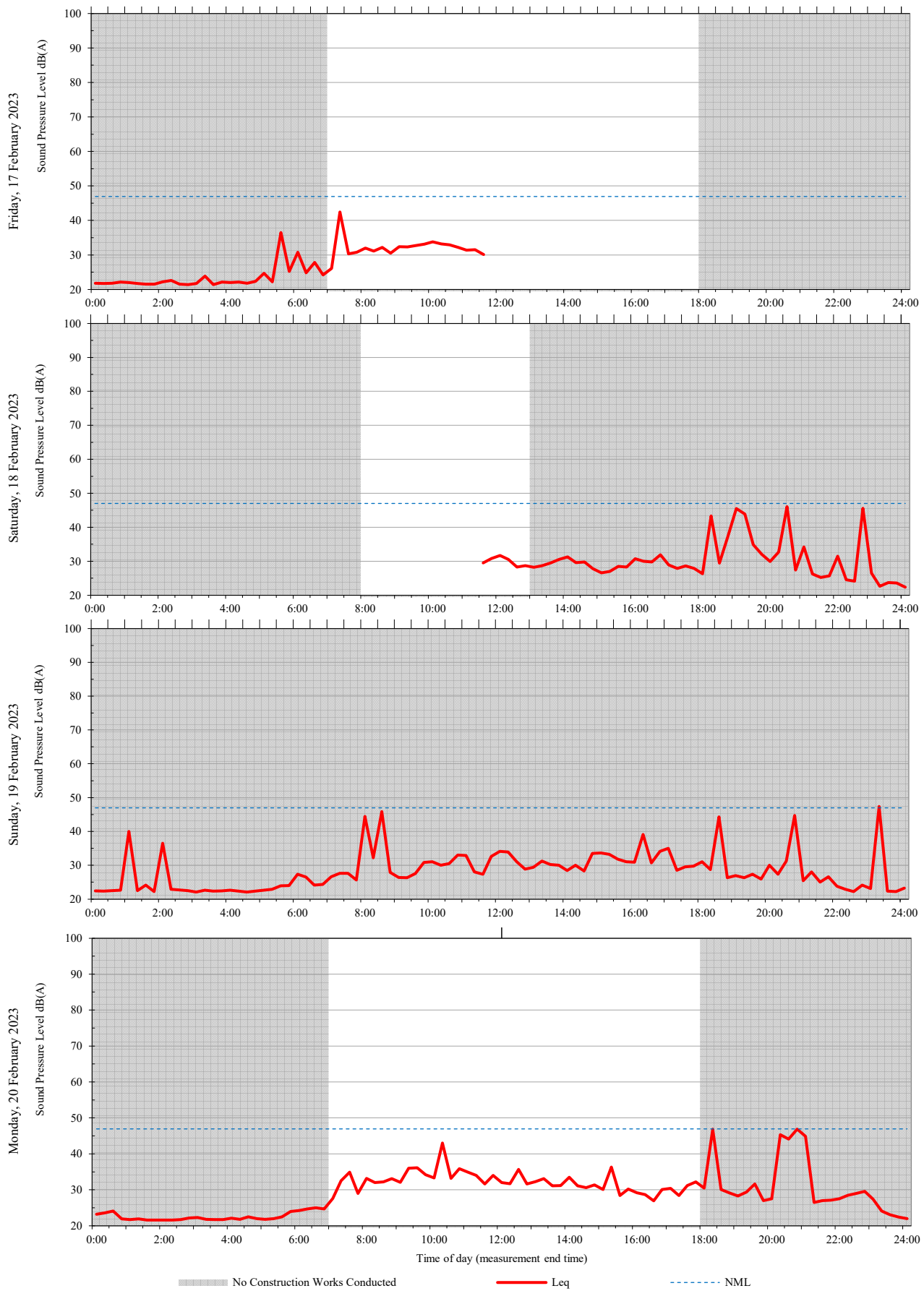


Unattended monitoring: RMH Level 1 Store Room 101 (facing MSCP site) (Internal)

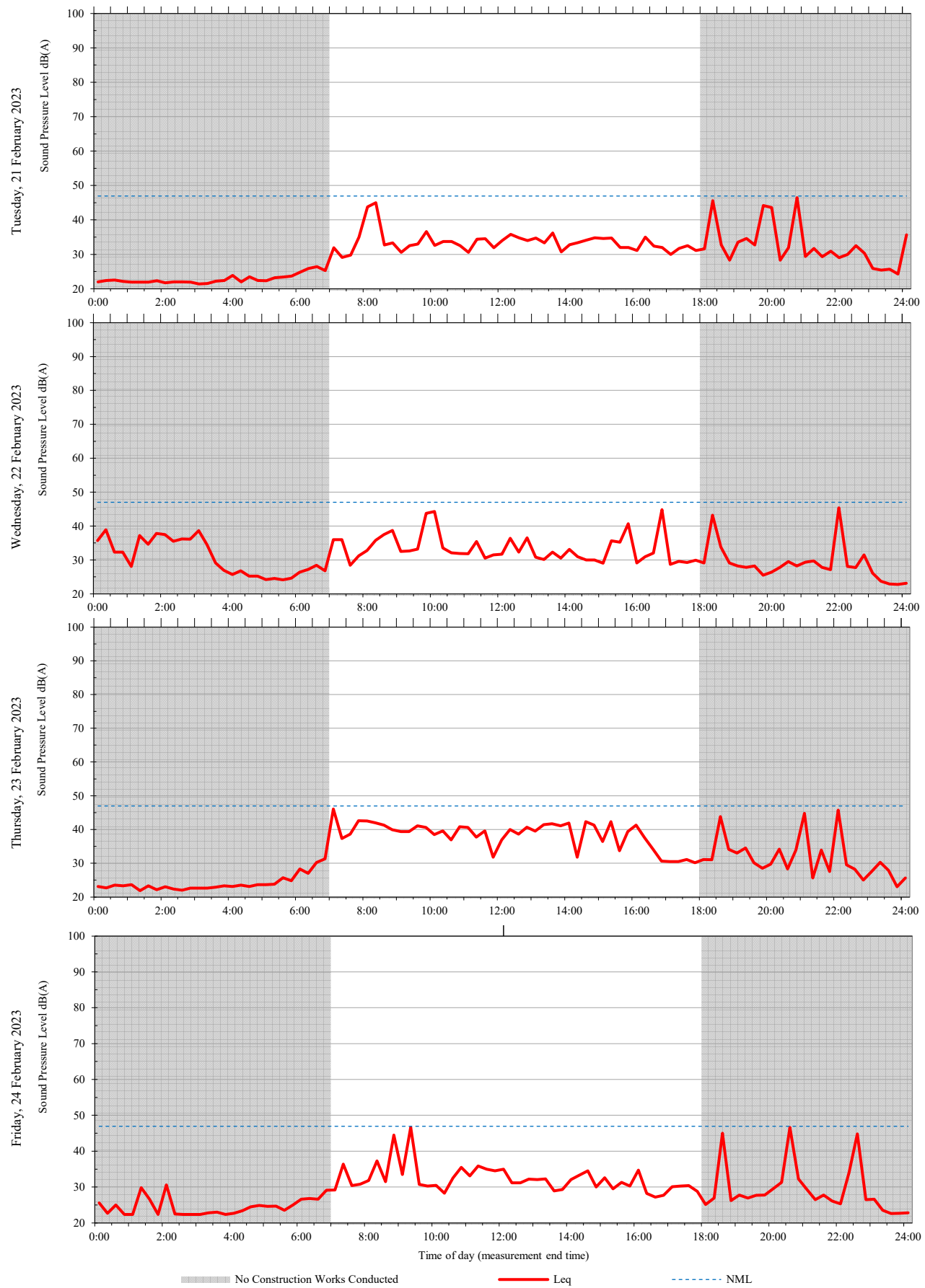




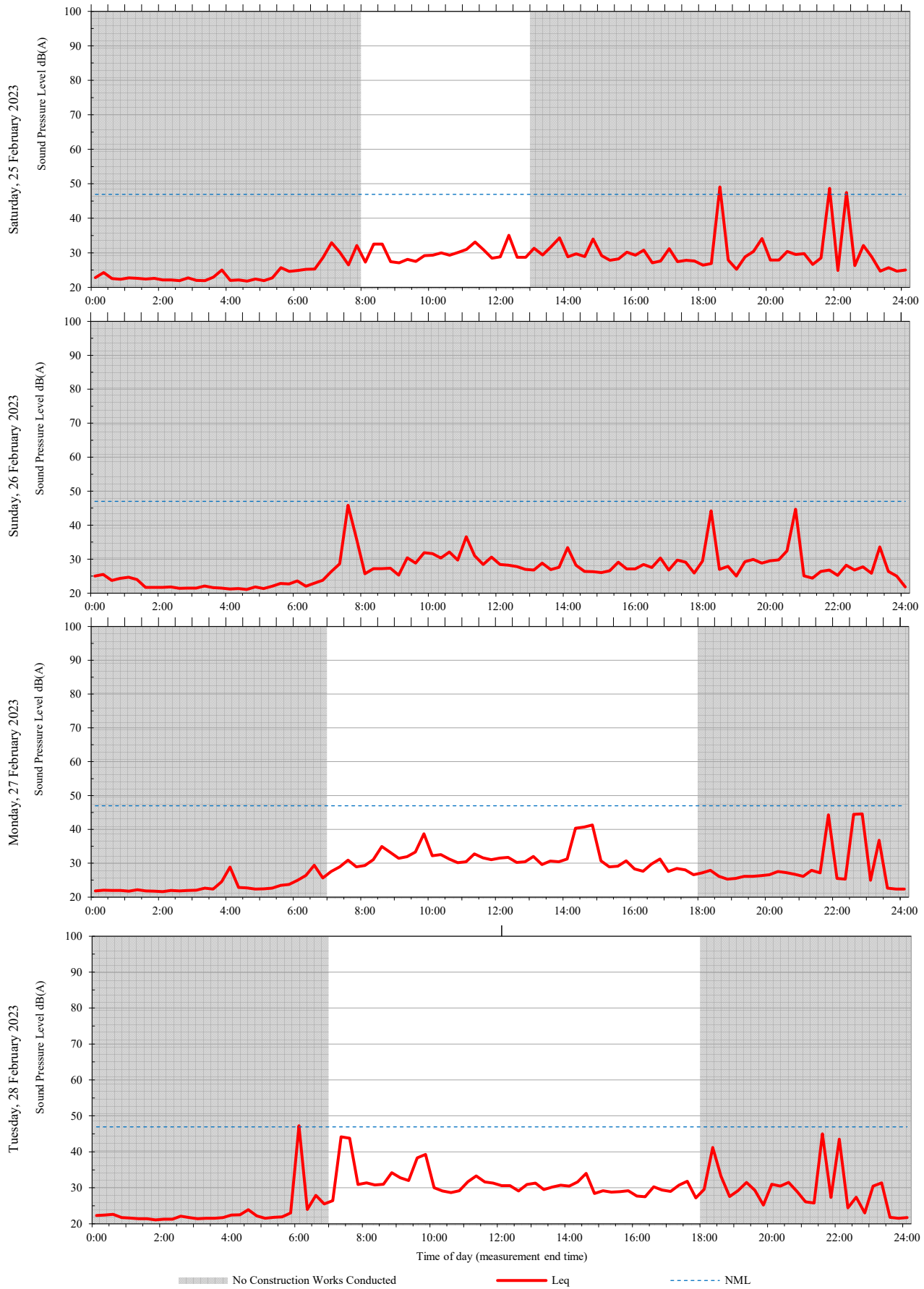
Unattended monitoring: RMH Level 1 Store Room 101 (facing MSCP site) (Internal)



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



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





**Health Infrastructure**

# **Children's Hospital Westmead**

**Vibration Monitoring - KR - L4 Lab 9 -  
February 2023**

CVM/ KR/202302

Issue 1 | 08/03/2023

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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**Job number** 271985  
**Document ref** CVM/KR/202302  
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Issue 1	08/03/2023		First issue

	Prepared by	Checked by	Approved by
<b>Name</b>	PR	MJW	MJW
<b>Signature</b>			

Filename	Description

	Prepared by	Checked by	Approved by
<b>Name</b>			
<b>Signature</b>			

Filename	Description

	Prepared by	Checked by	Approved by
<b>Name</b>			
<b>Signature</b>			

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 01/02/2023 to 28/02/2023. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

## RMSV Vibration Levels

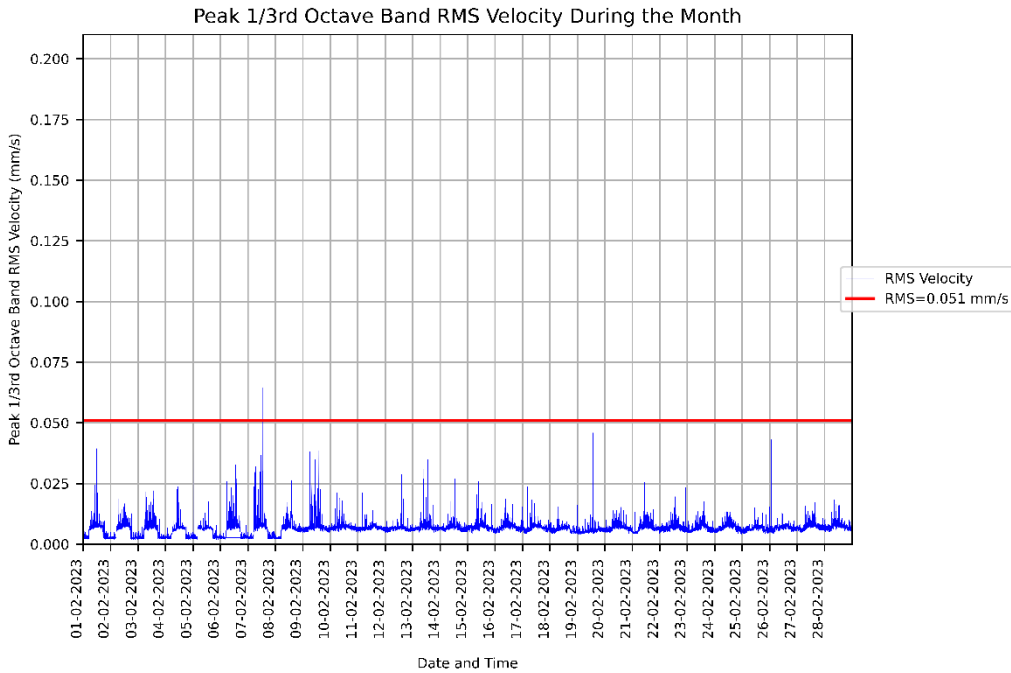


Figure 1: Measured RMSV vibration levels for 01/02/2023 to 28/02/2023 at the KR - L4 Lab 9.

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	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 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 01/02/2023 to 28/02/2023.

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

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The location of this monitor is shown below in Figure 2.



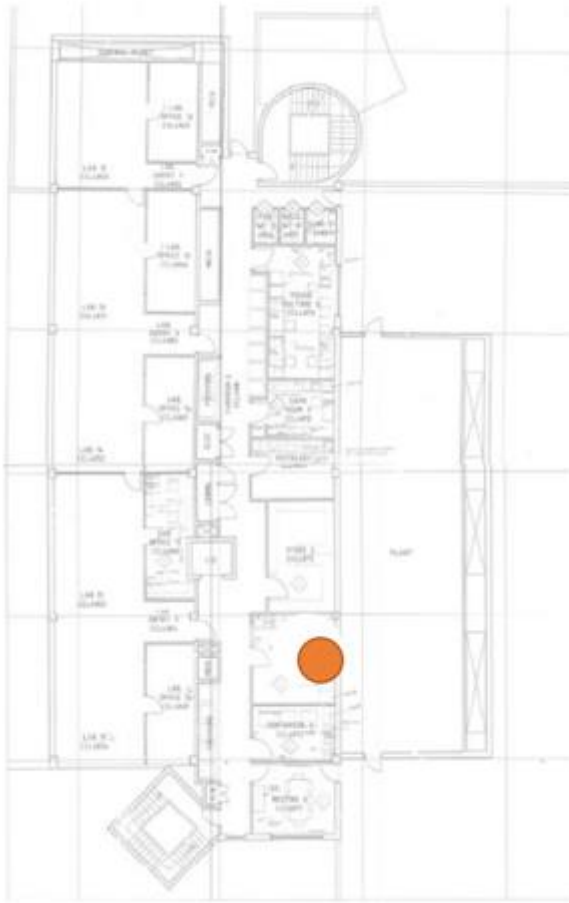


Figure 2: KR - L4 Lab 9 vibration monitor location shown in orange

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

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Figure 3 below shows the vibration levels (RMS velocity) recorded between 01/02/2023 and 28/02/2023. The recorded data is shown in blue, while the limit of 0.051mm/s ( $V_{RMS}$ ) is shown in red.

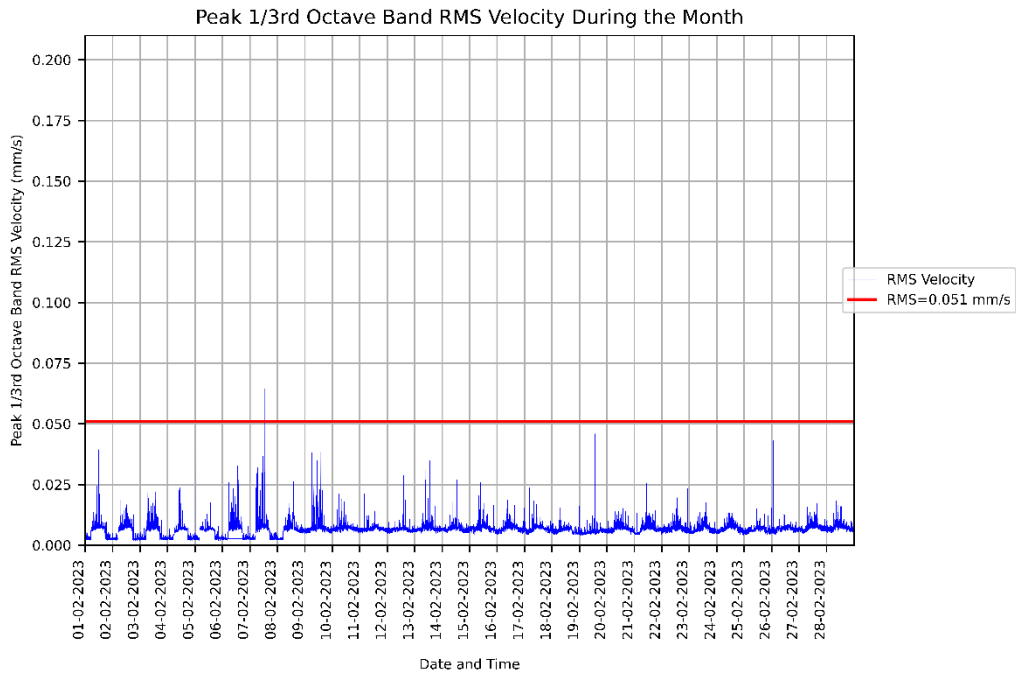
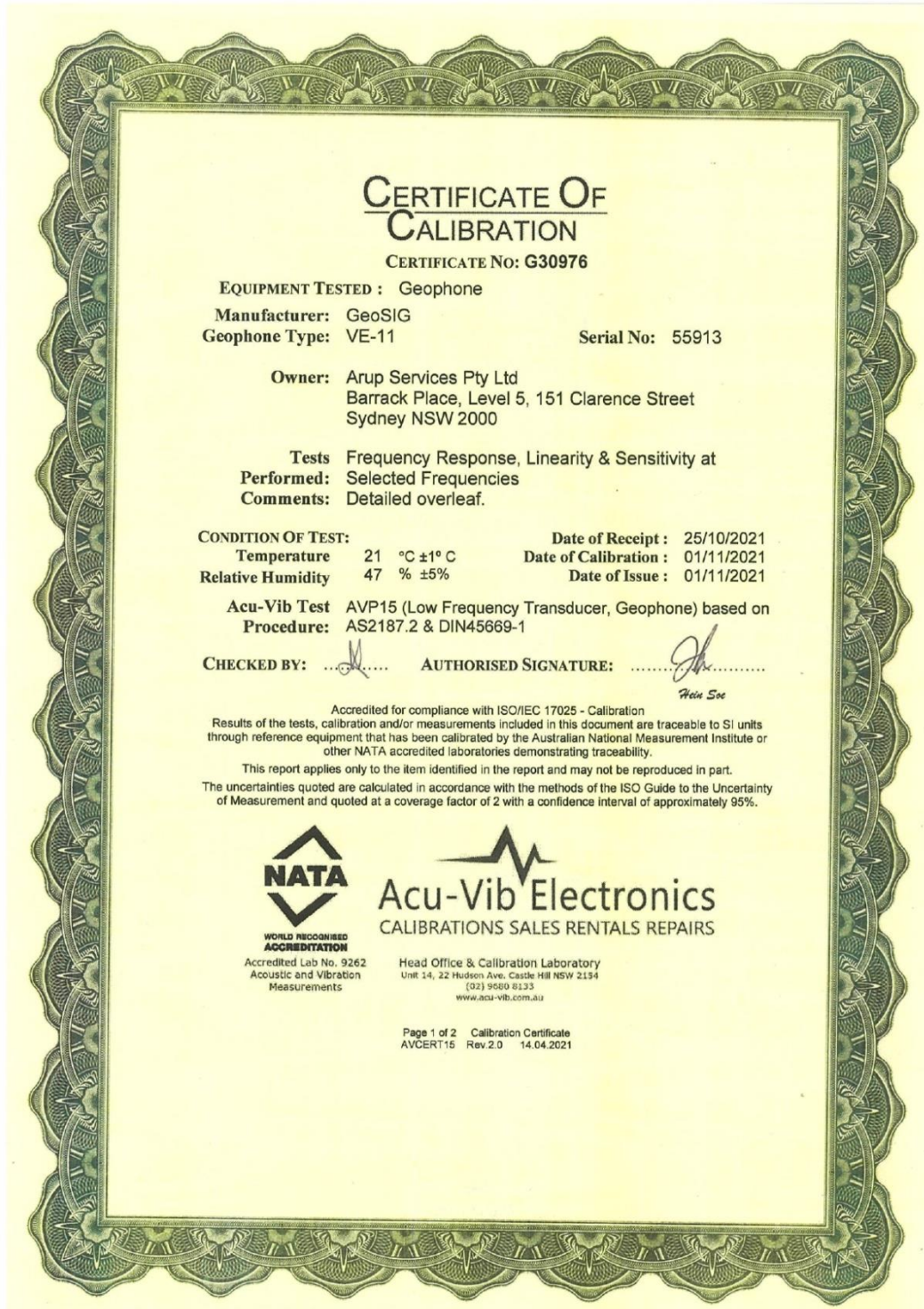


Figure 3: Measured RMSV vibration levels for 01/02/2023 to 28/02/2023 at the KR - L4 Lab 9.

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	1

# 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 $\text{mV}/\text{mms}^{-1}$	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%
<b>15.92</b>	<b>94.25</b>	<b>10.0</b>	<b>85.77</b>	<b>0.90%</b>
15.92	94.25	50.0	85.76	0.90%
15.92	94.25	100	N/A	0.50%
30.00	188.50	10.0	89.27	0.50%
60.00	376.99	10.0	90.17	0.50%
120.00	753.98	10.0	100.67	0.50%
150.00	942.48	10.0	115.82	0.50%
Hz	Radians/sec	Velocity mm/sec Peak	Vertical Sensitivity	$U_{95}$ %

**Note1:**

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

**Note2:**

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



**Health Infrastructure**

# **Children's Hospital Westmead**

**Vibration Monitoring - KR – Animal  
House - February 2023**

CVM/ KR/202302

Issue 1 | 08/03/2023

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  
Sydney NSW 2000  
Australia  
[www.arup.com](http://www.arup.com)



## Document Verification

**Project title** Children's Hospital Westmead  
**Document title** Monthly Vibration Monitoring Report  
**Job number** 271985  
**Document ref** CVM/KR/202302  
**File reference** -

Revision	Date	Filename	
		Westmead Hospital – 103156 KR – Animal House - Summary of Recent Vibration Measurements (01-02 to 28-02).docx	
Issue 1	08/03/2023	Description	First Issue

	Prepared by	Checked by	Approved by
Name	PR	MJW	MJW
Signature			

Filename
Description

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Name			
Signature			

Filename
Description

	Prepared by	Checked by	Approved by
Name			
Signature			

Issue Document Verification with Document

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# Executive Summary

This report summarises the vibration monitoring data recorded at KR - Animal House, over one month – from 01/02/2023 to 28/02/2023. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

## RMSV Vibration Levels

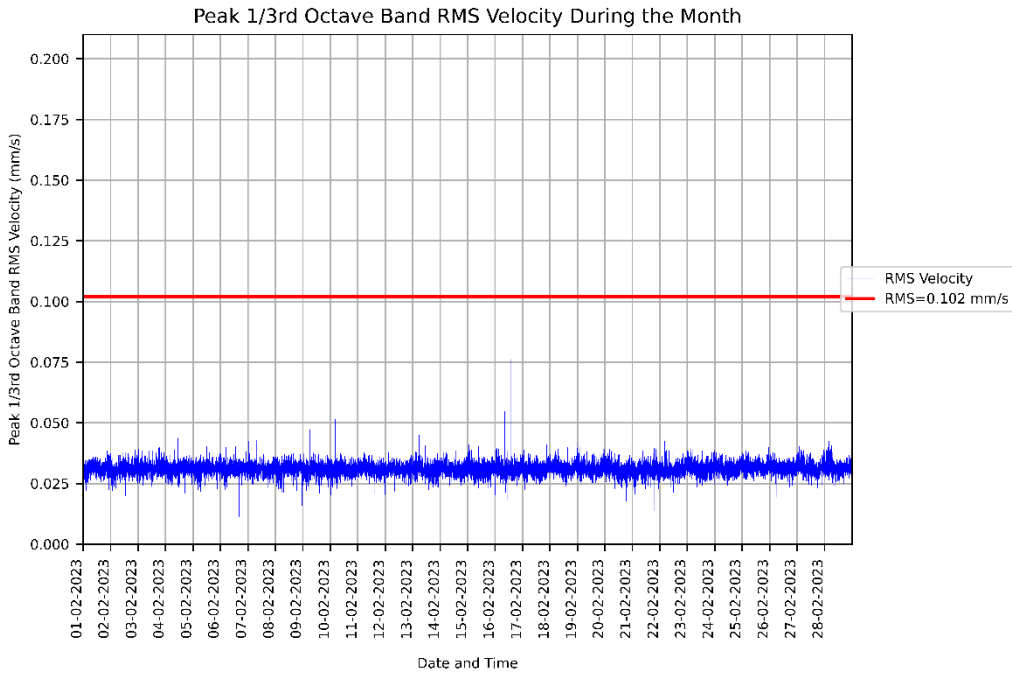


Figure 1: Measured RMSV vibration levels for 01/02/2023 to 28/02/2023 at the KR - Animal House.

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
0	0

## PPV Vibration Levels



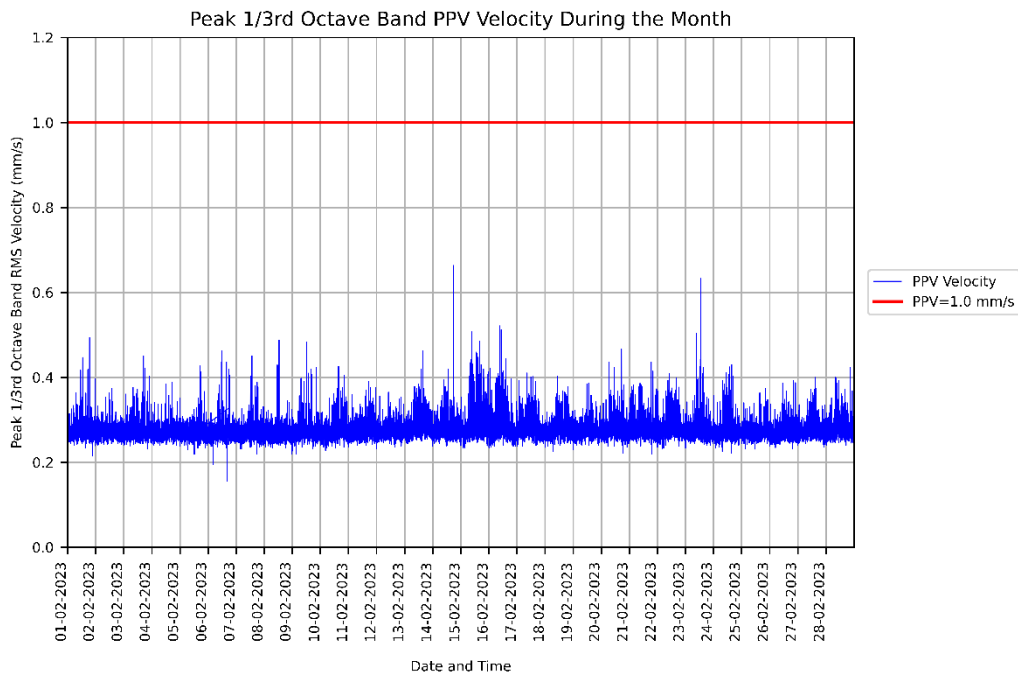


Figure 2: Measured vibration levels for 01/02/2023 to 28/02/2023 at the KR - Animal House.

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 01/02/2023 to 28/02/2023.

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.

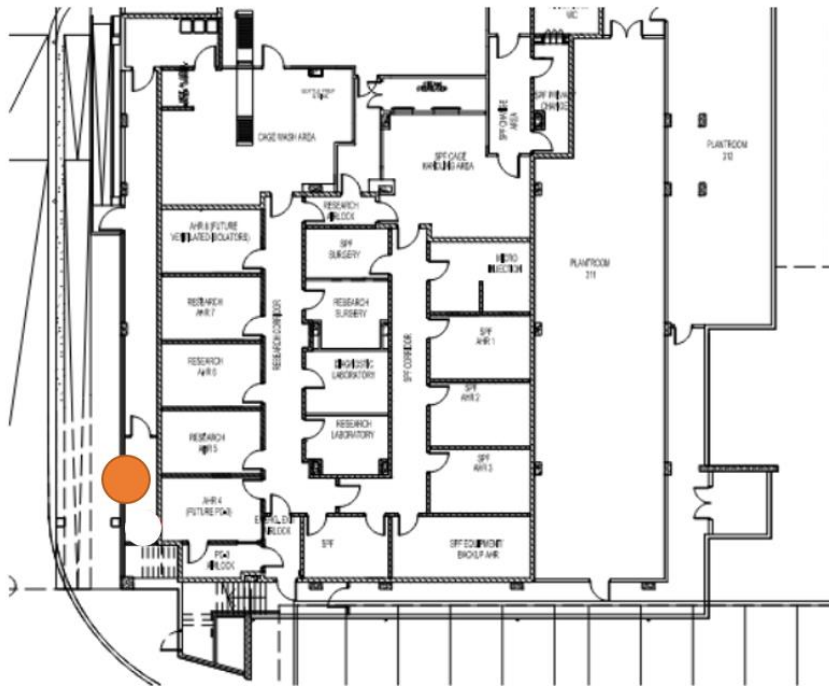


Figure 3: KR - Animal House vibration monitor location shown in orange

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

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Figure 4 below shows the vibration levels (RMS velocity) recorded between 01/02/2023 and 28/02/2023. The recorded data is shown in blue, while the limit of 0.102mm/s ( $V_{RMS}$ ) is shown in red.

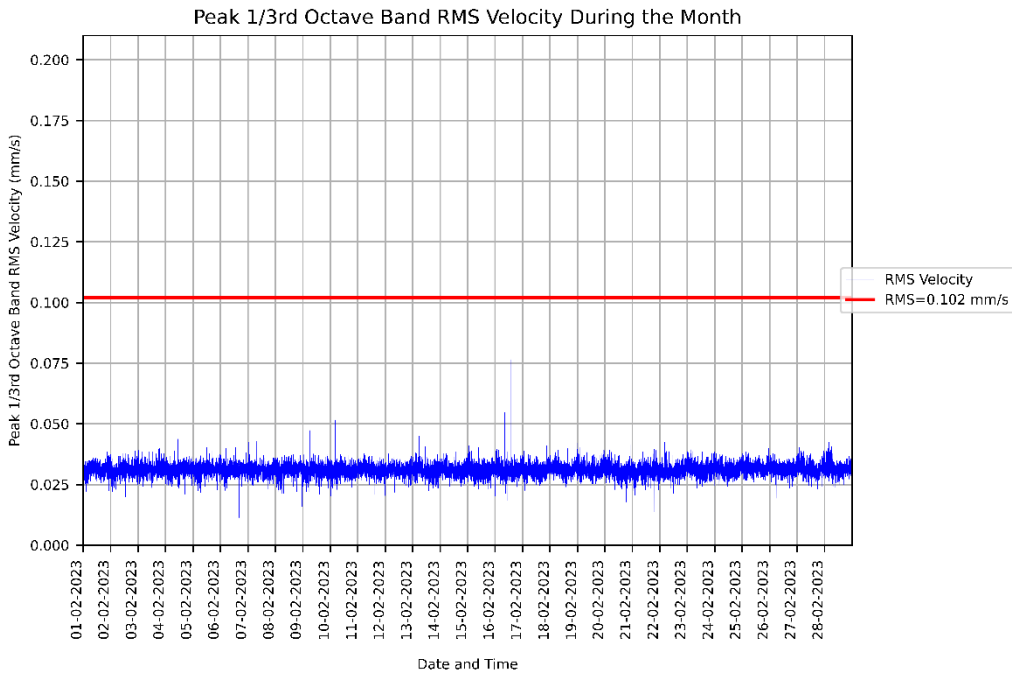


Figure 4: Measured RMSV vibration levels for 01/02/2023 to 28/02/2023 at the KR - Animal House.

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
0	0

Figure 5 below shows the peak particle vibration levels (PPV velocity) recorded between 01/02/2023 and 28/02/2023. The recorded data is shown in blue, while the limit of 1.0mm/s ( $V_{PPV}$ ) is shown in red.

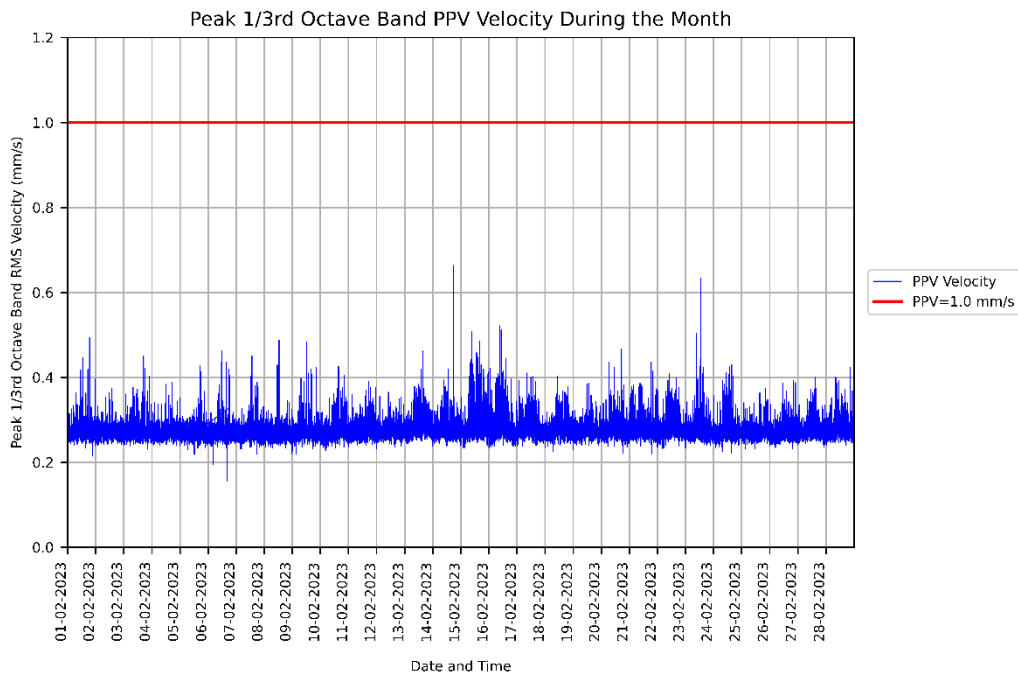


Figure 5: Measured PPV vibration levels for 01/02/2023 to 28/02/2023 at the KR - Animal House.

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





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 $\text{mV/mm s}^{-1}$	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%
<b>15.92</b>	<b>94.25</b>	<b>10.0</b>	<b>93.15</b>	<b>0.90%</b>
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 -  
February 2023

CVM/ CHW/202302

Issue 1 | 08/03/2023

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

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

Job number 271985

Arup Pty Ltd ABN 18 000 966 165

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## Document Verification

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		Westmead Hospital – 103157 CHW - L1 Lab - Summary of Recent Vibration Measurements (01-02 to 28-02).docx	
Issue 1	08/03/2023		First issue

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<b>Name</b>	PR	MJW	MJW
<b>Signature</b>			

Filename	Description

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<b>Name</b>			
<b>Signature</b>			

Filename	Description

	Prepared by	Checked by	Approved by
<b>Name</b>			
<b>Signature</b>			

Issue Document Verification with Document

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# Executive Summary

This report summarises the vibration monitoring data recorded at CHW - L1 Lab, over one month – from 01/02/2023 to 28/02/2023. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

## RMSV Vibration Levels

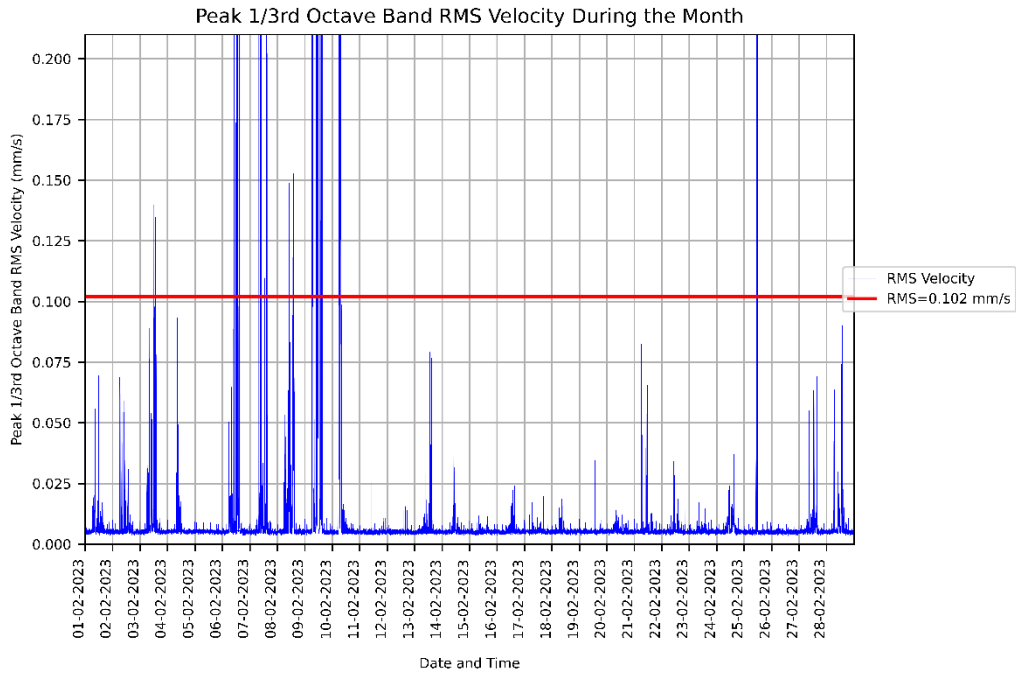


Figure 1: Measured RMSV vibration levels for 01/02/2023 to 28/02/2023 at the CHW - L1 Lab.

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
142	43

## 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 01/02/2023 to 28/02/2023.

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.

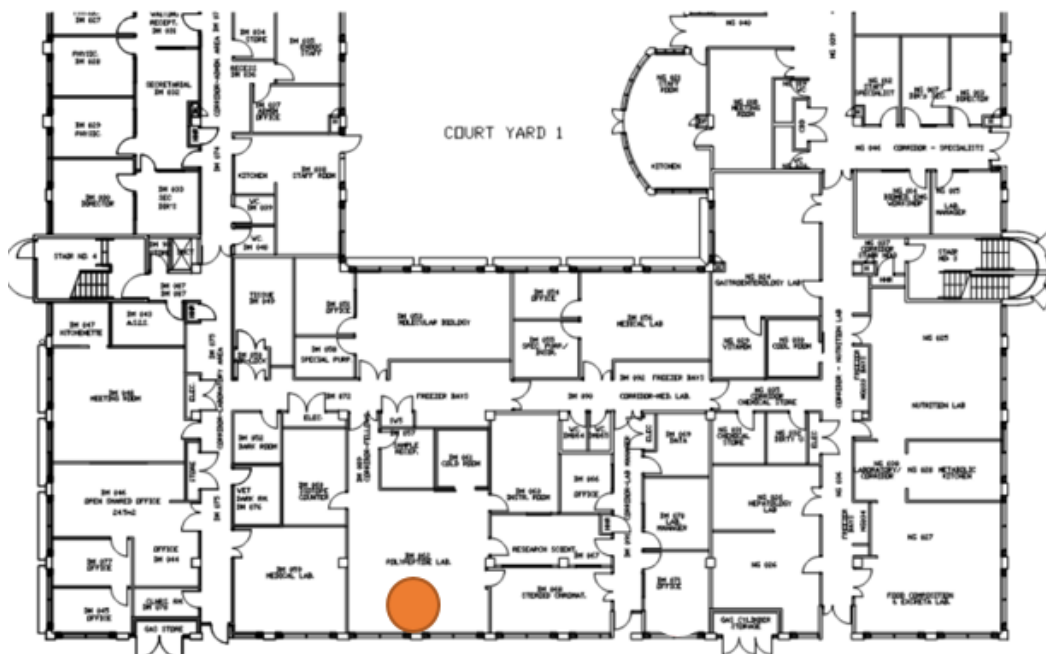


Figure 2: CHW - L1 Lab vibration monitor location shown in orange

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 01/02/2023 and 28/02/2023. The recorded data is shown in blue, while the limit of 0.102mm/s ( $V_{RMS}$ ) is shown in red.

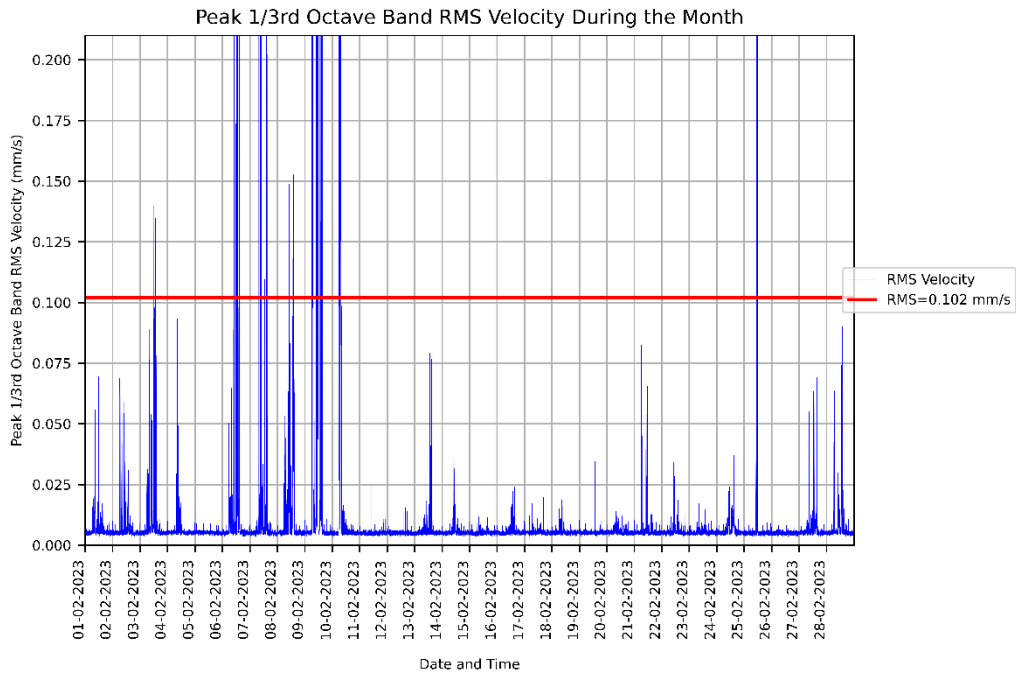


Figure 3: Measured RMSV vibration levels for 01/02/2023 to 28/02/2023 at the CHW - L1 Lab.

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
142	43





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%
<b>15.92</b>	<b>94.25</b>	<b>10.0</b>	<b>94.96</b>	<b>0.90%</b>
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 L2 MRI -  
February 2023

CVM/ CASB/202302

Issue 1 | 08/03/2023

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

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

Job number 271985

Arup Pty Ltd ABN 18 000 966 165

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## Document Verification

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**Document title** Monthly Vibration Monitoring Report  
**Job number** 271985  
**Document ref** CVM/CASB/202302  
**File reference** -

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		Westmead Hospital – 103158 CASB L2 MRI - Summary of Recent Vibration Measurements (01-02 to 23-02).docx
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		First issue

	Prepared by	Checked by	Approved by
<b>Name</b>	PR	MJW	MJW
<b>Signature</b>			

Filename
Description

	Prepared by	Checked by	Approved by
<b>Name</b>			
<b>Signature</b>			

Filename
Description

	Prepared by	Checked by	Approved by
<b>Name</b>			
<b>Signature</b>			

Issue Document Verification with Document

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## Executive Summary

This report summarises the vibration monitoring data recorded at CASB L2 MRI facility, over one month – from 01/02/2023 to 23/02/2023. After 23/02/2023 this logger was moved to the L1 CT Scanner facility (Room EDU 297). Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

### RMSV Vibration Levels

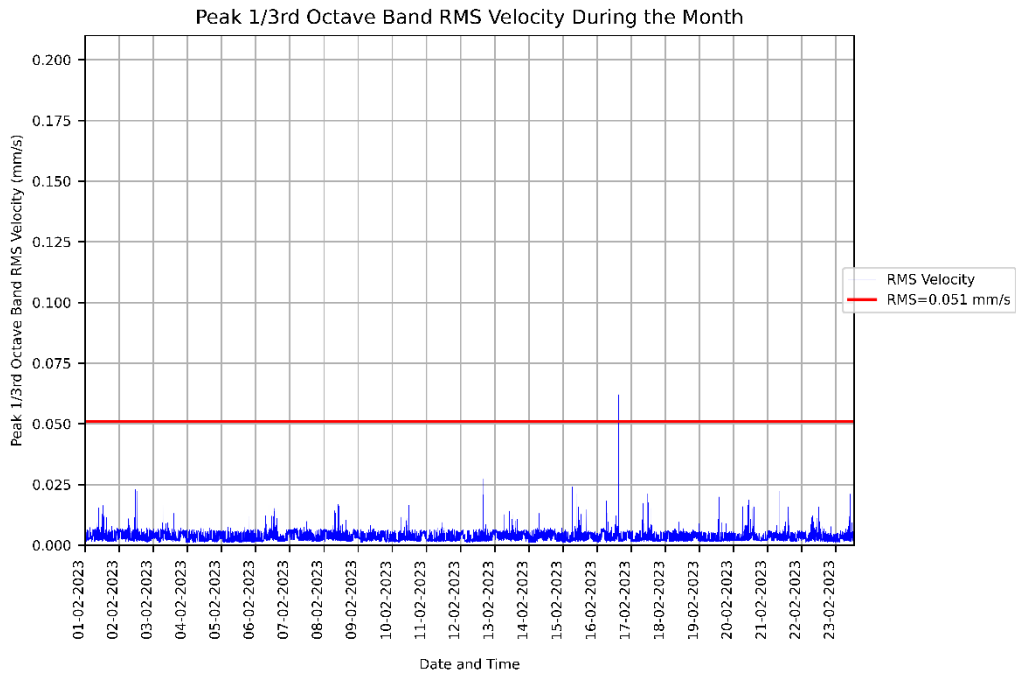


Figure 1: Measured RMSV vibration levels for 01/02/2023 to 23/02/2023 at the CASB L2 MRI.

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
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 CASB L2 MRI during the period of the 01/02/2023 to 23/02/2023.

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.

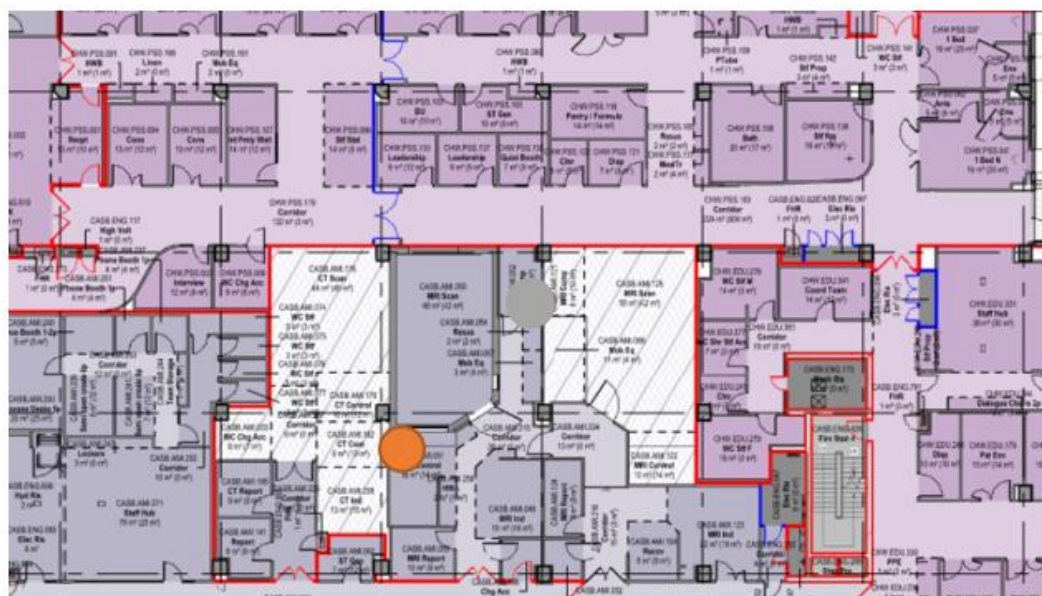


Figure 2: CASB L@ MRI vibration monitor location shown in orange

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 01/02/2023 and 28/02/2023. The recorded data is shown in blue, while the limit of 0.051mm/s ( $V_{RMS}$ ) is shown in red.

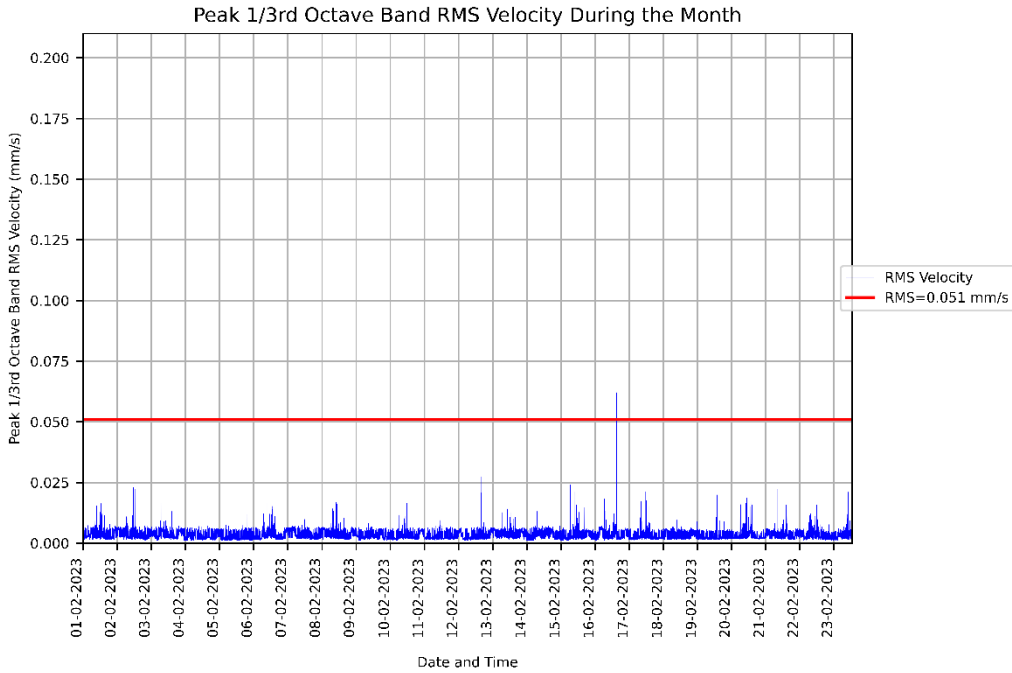

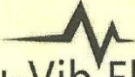


Figure 3: Measured RMSV vibration levels for 01/02/2023 to 28/02/2023 at the CASB L2 MRI facility.

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
1	0

## Appendix A: Calibration Certificates

<b>CERTIFICATE OF CALIBRATION</b>	
CERTIFICATE NO: <b>G30979</b>	
<b>EQUIPMENT TESTED :</b> Geophone	
<b>Manufacturer:</b> GeoSIG	<b>Serial No:</b> 55911
<b>Geophone Type:</b> VE-11	
<b>Owner:</b> Arup Services Pty Ltd Barrack Place, Level 5, 151 Clarence Street Sydney NSW 2000	
<b>Tests Performed:</b> Frequency Response, Linearity & Sensitivity at Selected Frequencies	
<b>Comments:</b> Detailed overleaf.	
<b>CONDITION OF TEST:</b>	<b>Date of Receipt :</b> 25/10/2021
Temperature 21 °C ±1° C	<b>Date of Calibration :</b> 01/11/2021
Relative Humidity 47 % ±5%	<b>Date of Issue :</b> 01/11/2021
<b>Acu-Vib Test Procedure:</b> AVP15 (Low Frequency Transducer, Geophone) based on AS2187.2 & DIN45669-1	
<b>CHECKED BY:</b>	<b>AUTHORISED SIGNATURE:</b> <i>Wen 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>	
 <b>NATA</b> <small>WORLD RECOGNISED ACCREDITATION</small>	 <b>Acu-Vib Electronics</b> CALIBRATIONS SALES RENTALS REPAIRS
Accredited Lab No. 9262 Acoustic and Vibration Measurements	Head Office & Calibration Laboratory Unit: 14, 22 Hudson Ave, Castle Hill NSW 2154 (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. **55911**  
Constant velocity of 10 mm/sec Peak applied for response  
(Except at 200.0 Hz where applied level limited to 1.0 mm/s peak)  
For amplitude linearity applied level varied at 15.92 Hz

12VDC Power Supply

Geophone Orientation.: Vertical

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

**Note1:**

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

**Note2:** The uncertainties quoted are estimated at a confidence level of 95% and a coverage factor of  $k=2$  applies unless otherwise stated.



**Health Infrastructure**

# **Children's Hospital Westmead**

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

CVM/ CASB/202302

Issue 1 | 08/03/2023

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  
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## Document Verification

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		Westmead Hospital – 103160 CASB level 3 Surgical Suite - Summary of Recent Vibration Measurements (01-02 to 28-02).docx	
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<b>Name</b>	PR	MJW	MJW
<b>Signature</b>			

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<b>Signature</b>			

Filename	Description

	Prepared by	Checked by	Approved by
<b>Name</b>			
<b>Signature</b>			

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 01/02/2023 to 28/02/2023. Graphs in this report show the recorded data in blue, and exceedance trigger levels in red.

## RMSV Vibration Levels

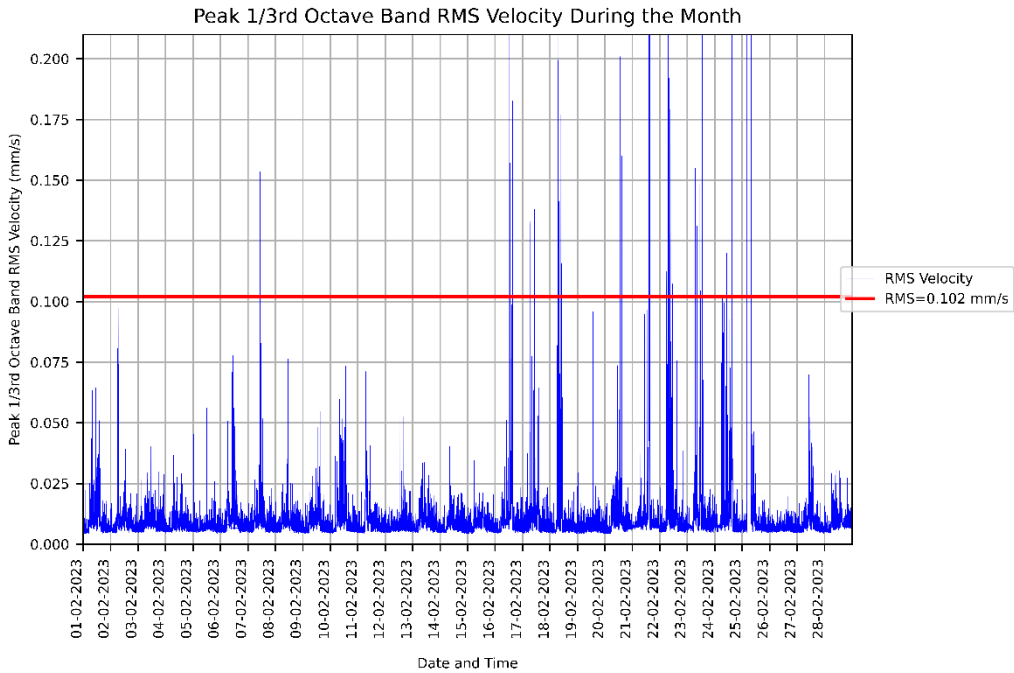


Figure 1: Measured RMSV vibration levels for 01/02/2023 to 28/02/2023 at the CASB level 3 Surgical Suite.

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
61	123

## 1. Introduction

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Arup has been commissioned by PricewaterhouseCoopers (PwC) on behalf of NSW Health Infrastructure to monitor vibration levels in facilities adjacent to the Paediatric Services Building and Multi-storey Car Park development sites to ensure facility operations are not excessively impacted by the construction works. This report summarises the vibration monitoring data recorded at CASB level 3 Surgical Suite during the period of the 01/02/2023 to 28/02/2023.

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

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The location of this monitor is shown below in Figure 2.

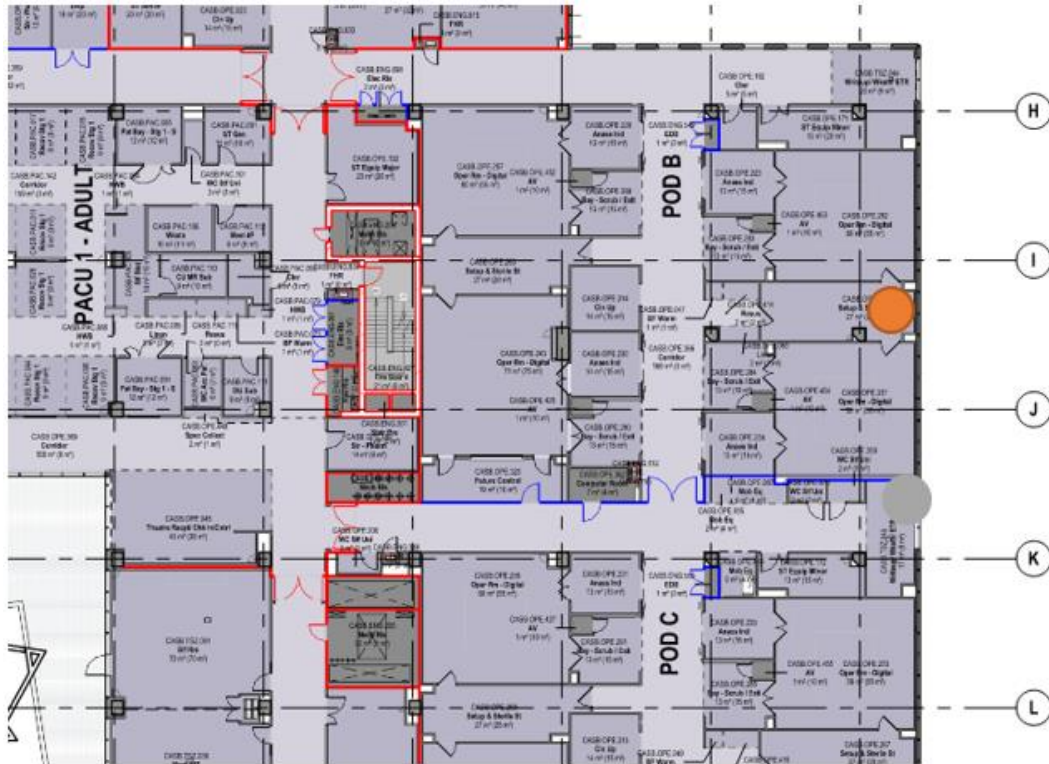


Figure 2: CASB level 3 Surgical Suite vibration monitor location shown in orange  
 Monitoring at this location utilises a GeoSIG GMSplus with a GeoSIG VE-11 geophone. The calibration certificate for the geophone is included in Appendix A.

### 3. Recorded Data

Figure 3 below shows the vibration levels (RMS velocity) recorded between 01/02/2023 and 28/02/2023. The recorded data is shown in blue, while the limit of 0.102mm/s (V<sub>RMS</sub>) is shown in red.

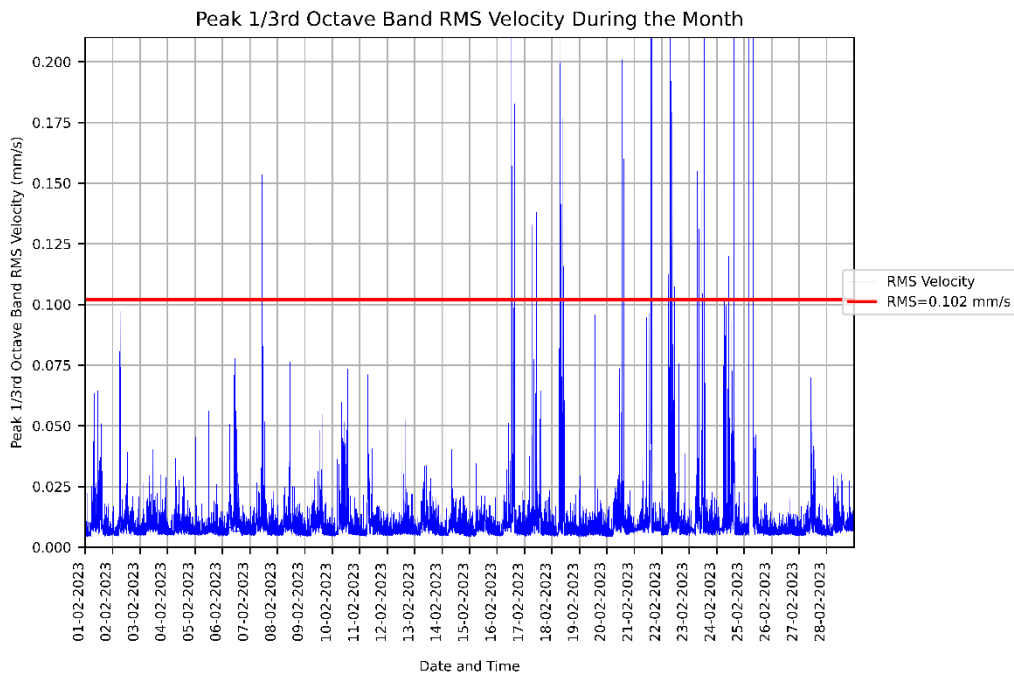


Figure 3: Measured RMSV vibration levels for 01/02/2023 to 28/02/2023 at the CASB level 3 Surgical Suite.

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
61	123

## 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/mms <sup>-1</sup>  Vertical Sensitivity	Expanded uncertainty  U <sub>95</sub> %
Hz	Radians/sec			
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%
<b>15.92</b>	<b>94.25</b>	<b>10.0</b>	<b>89.99</b>	<b>0.90%</b>
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 <sub>95</sub> %

**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 $mV/mm\cdot s^{-1}$	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%
<b>15.92</b>	<b>94.25</b>	<b>10.0</b>	<b>94.96</b>	<b>0.90%</b>
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:**

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