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3 March 2024

Mr. Norman R. Benjamin
Senior Project Manager
MaineHealth
22 Bramhall Street
Portland, Maine 04102

Re: Rooftop Helicopter Pads
Follow-up Sound Study

Dear Mr. Benjamin:

Russell Acoustics was retained to conduct another follow-up study of your helicopter operation to assess the resulting community sound levels with respect to the Federal Aviation Administration's (FAA) sound level criteria. We did one study in May of 2017 and a second in September of 2020. At that time, it was mutually decided to use the FAA aircraft noise criterion, which is used for helicopter sound as part of its methodology for aircraft sound overall. This is based on the "Sound Measurement Plan" of 10 October 2019. The process, definitions, and the use of the Day-Night Sound Level (DNL or Ldn) as the appropriate sound metric, are all discussed our report to you of 22 October 2020, so I won't repeat all of that here. [See "Sound Measurement Plan," revised 10 October 2019, Section 3 "Standards for Aircraft Sound," and Section 4, "Measuring Sound Generated by Helicopter Operations at MMC's Helipad."]

Summary

Sound measurements made at the nine locations around the hospital, the same locations used in previous studies, were all under the FAA aircraft sound criterion of Ldn 65.

Methodology

The measure of sound we used is the A-weighted decibel, or dBA. It is probably the most commonly used sound measurement in the world. The A-weighted sound pressure level is a measurement method that is modeled after the frequency response of the human ear. Measurements of sound using this frequency weighting correlate very well with how "loud" sounds are. Within the U.S. five major Federal agencies - FAA, DOT, DOL (OSHA), HUD and DOD - use it. Maine standards, regulations and procedures use dBA measurements.

The Ldn is a long-term measure of sound over days; for aircraft it is really the annual average level that is judged, but as a practical matter it is assessed on sound measurements over several days. It needs sound levels around the clock; it is not something that can be determined by holding up a sound level meter, taking a reading and then calling that readding the Ldn. It is calculated by

logarithmically averaging the sound levels over one or more full days, with a 10 dBA "penalty" added the levels from 10 PM to 7 AM. In other words, sounds at "night" are considered more annoying than the same sound during the "day."

For this study (as in the past) we set up environmental sound level meters at nine locations around the greater hospital area, as shown on Figure 1 (CP-1 through CP-9). These locations were used for our previous studies. The measurements were made from noon on 15 December 2023 to noon on 20 December 2023; 120 hours of continuous measurements.

Thomas Judge, from LifeFlight of Maine (Maine's sole air medical provider), provided us with details on flights in and out of MainHealth's two roof-level helipads; arrival and departure times, aircraft identification, etc.

Figure 2 is a general explanation of how we typically graph long-term sound measurements. It is followed by graphs of the sounds measured at the nine test points, Figures 3 through 11. Figure 12 comes from an instrument at was on the roof at a helipad for a reference point (it was not used when assessing the Ldn levels).

The graphs also have green dots at the top of the red bars highlighting the hours during which, from the LifeFlight information, showing when one or more helicopter flights arrived at and/or departed from the hospital's helipads.

(I find it interesting that there were many times when the helicopters were not arriving or departing yet there were high sound levels at a given sound testing location louder without a helicopter than during the hours when helicopter were using the helipads. As we found in previous studies here, there are other loud sounds, not just from the helicopters.)

Calculations

Calculating aircraft/helicopter Ldn calls for identifying the sounds from the aircraft – excluding all the other sounds – and using just the aircraft sounds in determining the Ldn. This would involve examining the detailed information of each approach and departure in detail.

Figure 13 shows the sound from a single approach as measured at CP-3. The sound goes from around 55 to 60 dBA up to a maximum of 97 dBA and then back down to 55-60 dBA. The total sound the helicopter contributes to the long-term Ldn takes place during the "duration" of the event. That occurs for the sound that is generated from the time where the sound comes to within 10 dBA of the maximum sound level to when the sound level come back down to 10 dBA below the maximum. As you can see on Figure 13 that is all of a 30 second window.

A truly rigorous Ldn calculation would only include the sound from the helicopter events as defined above.

To keep things simpler (in a conservative manner) we used all of the sound during any hour during which one or more helicopters used the pads. When we added up the helicopters' sound over the five days, we did not pick out the 30 seconds or so of each arrival or departure; we used the entire hour of sound for each time there was helicopter activity. Thus, the total sound attributed to the helicopters in this report is high. We're of the opinion that the question to be answered is whether the helicopter use is under the FAA's aircraft noise criterion or not, not what is the exact number.

There were 15 hours of the 120 of total measurements when there was one or more helicopter approaches and/or departures to/from the two helipads. The 15 hours sound is averaged over the 120 hours for all the measurements.

For the nine measurement locations the table below shows the Ldn for each test location shown on Figure 1

Measurement Location (see Figure 1)	**Ldn**
CP-1	47.4
CP-2	57.0
CP-3	61.0
CP-4	55.8
CP-5	46.4
CP-6	45.9
CP-7	52.7
CP-8	54.8
CP-9	49.0

The FAA criterion is Ldn 65. The Ldns determined for each location are all under 65, and that's including more sound than is from just the helicopter operations. If the Ldns are below 65 with the additional sounds included, they are certainly under Ldn 65 if just the actual helicopter sound, only was included.

Yours truly,

Norman R. Dotti, PE, PP, INCE
Principal

NRD/me

enclosures

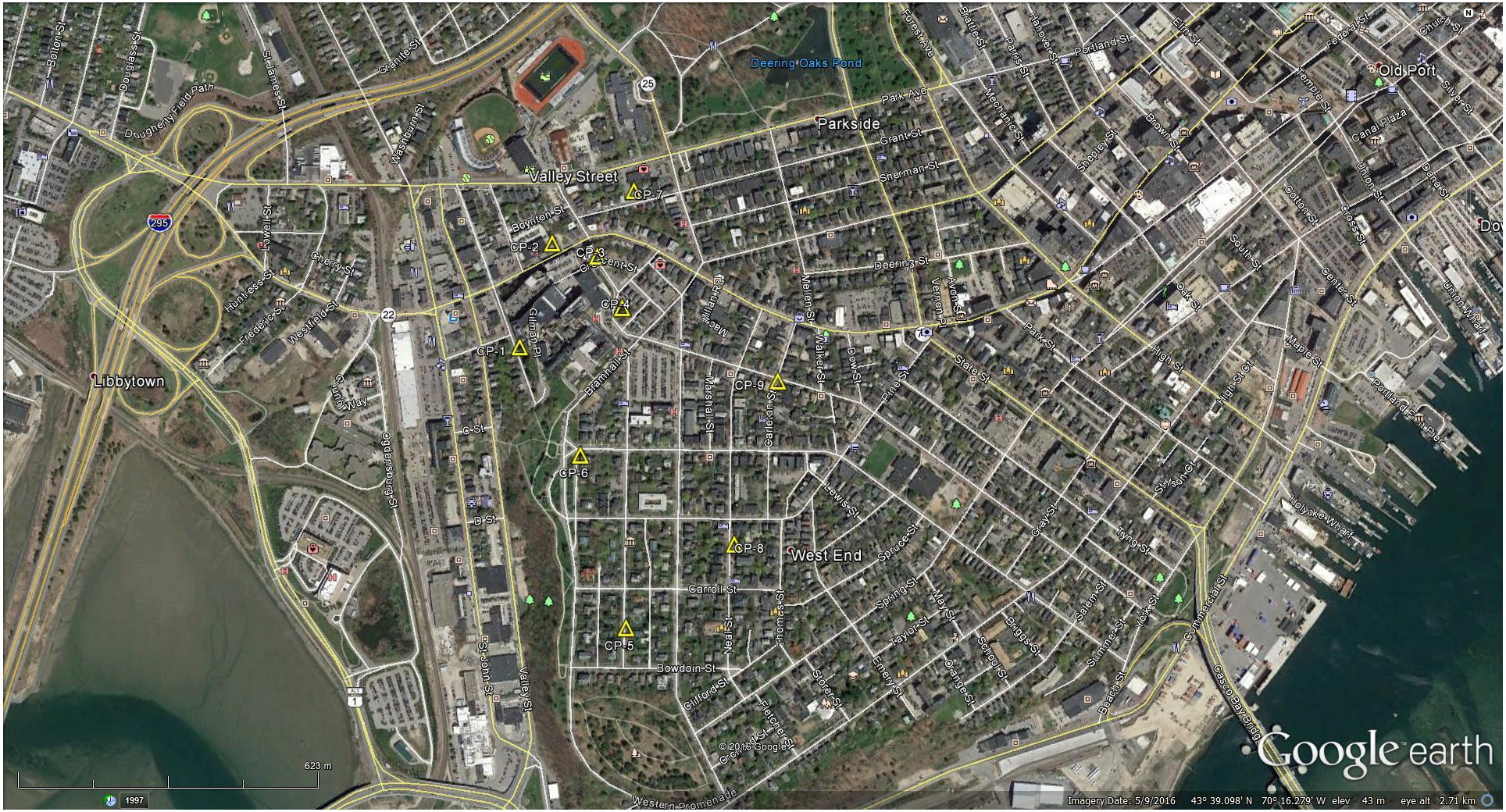

Figure 1 - Sound Measurement Locations, CP-1 through 9

Long-term sound level monitoring is often done to establish the existing acoustical environment before (and sometimes after) a project is begun. It can be used to just document current conditions, to compare existing sounds to those expected from the new operation or to document compliance. Usually multiple monitors are set up around an area and run for at least several days. Weekdays and/or weekend days might be covered, depending on when the proposed use will be operating. These measurements of the "ambient" include all sounds, regardless of source.

Below is a typical ambient sound level graph with notes pointing out various features. Some versions of these graphs might be customized for a specific circumstance.

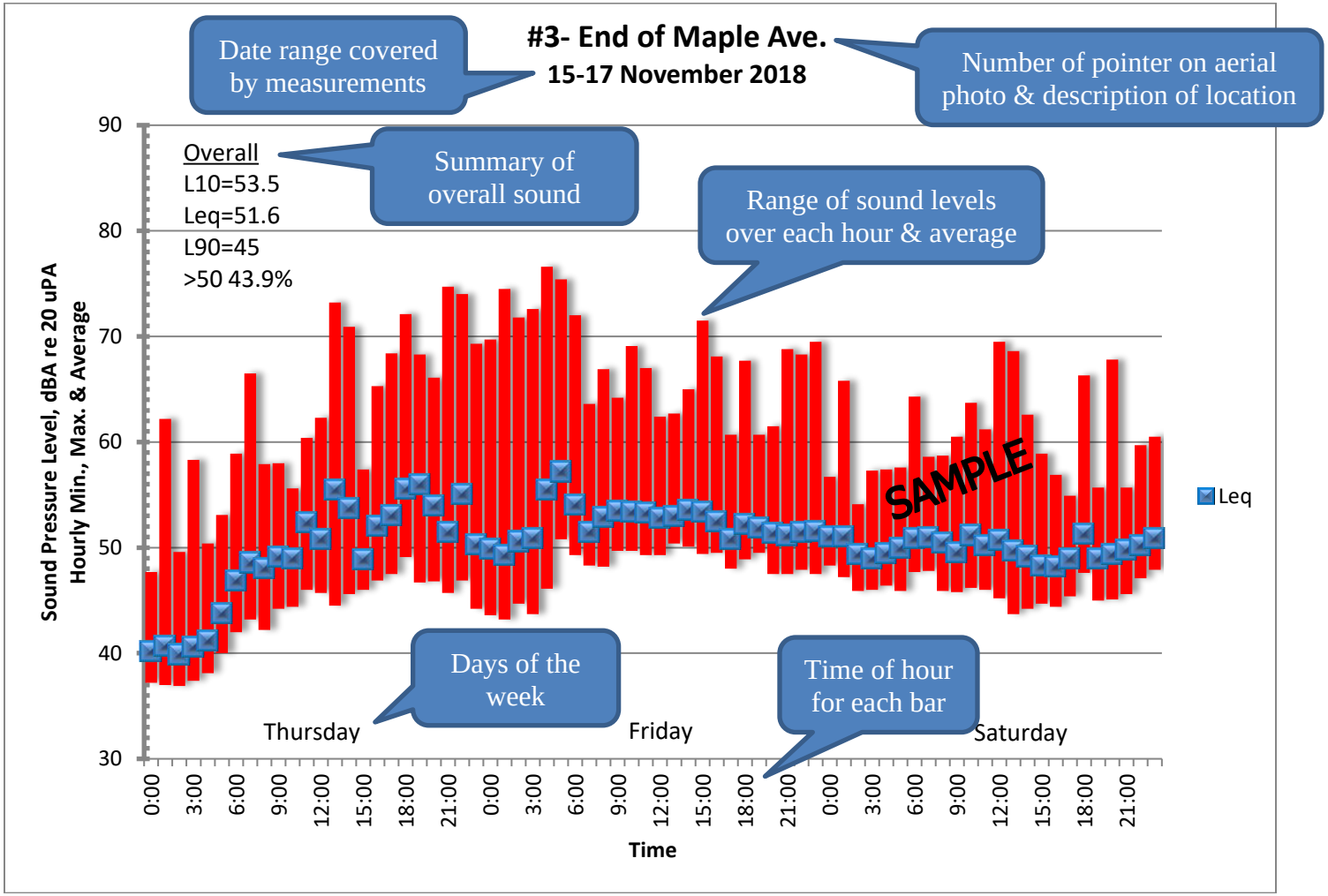

Figure 2

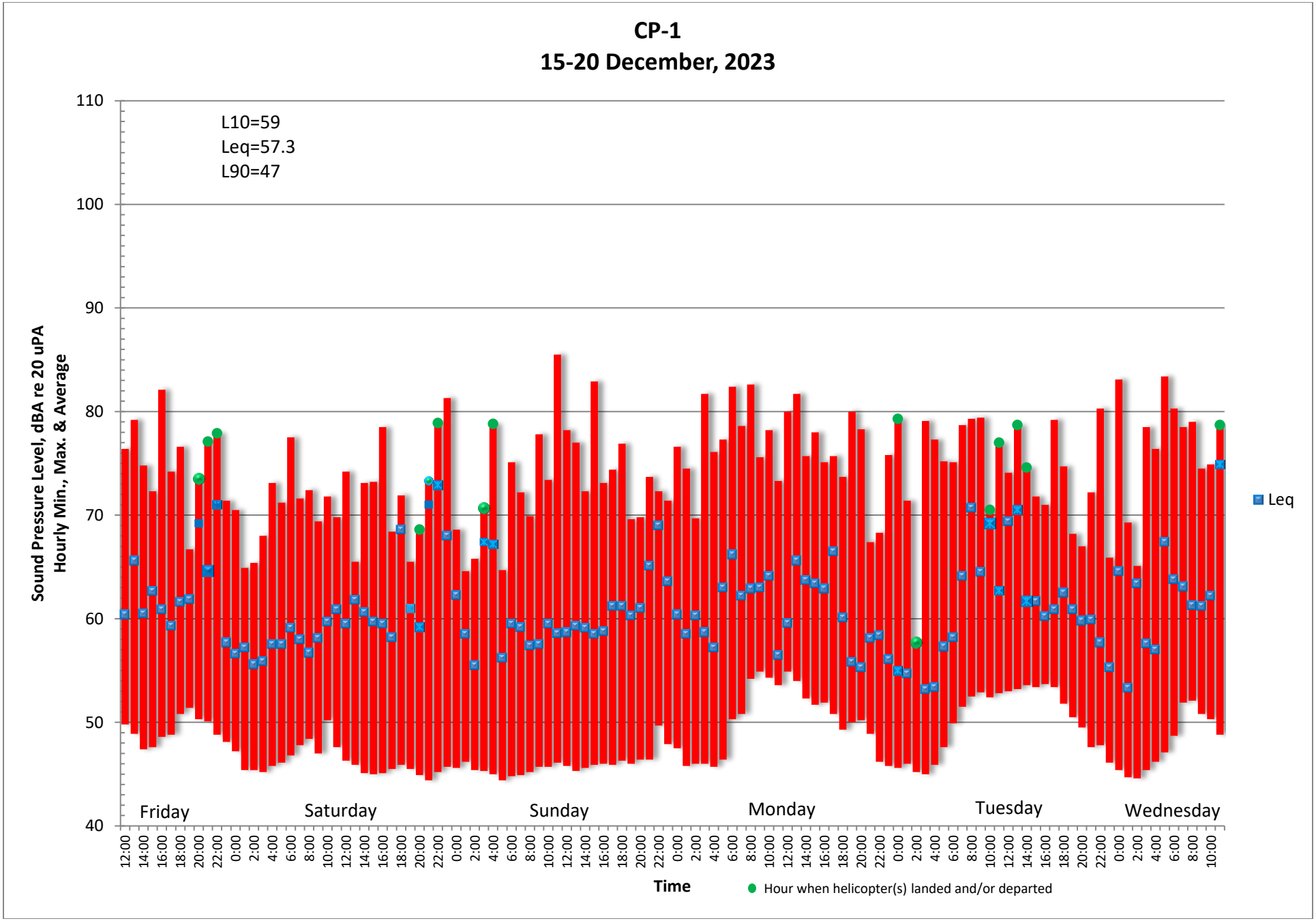
CP-1
15-20 December, 2023
L10=59
Leq=57.3
L90=47
Sound Pressure Level, dBA re 20 uPA
Hourly Min., Max. & Average
110
100
90
80
70
60
50
40
Friday
Saturday
Sunday
Monday
Tuesday
Wednesday
Time
Leq
Hour when helicopter(s) landed and/or departed

Figure 3

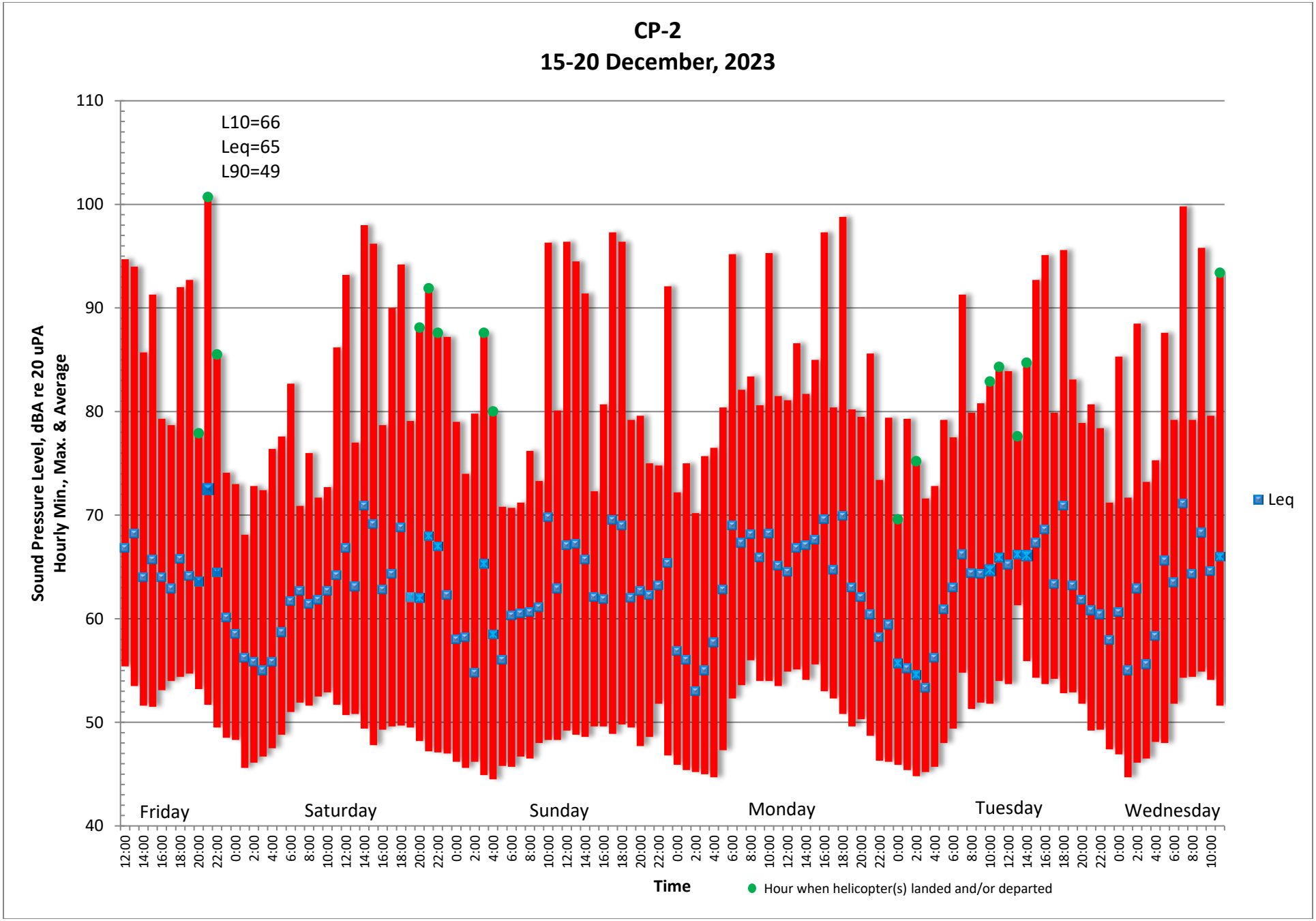
CP-2
15-20 December, 2023
L10=66
Leq=65
L90=49
Sound Pressure Level, dBA re 20 uPA
Hourly Min., Max. & Average
110
100
90
80
70
60
50
40
Friday
Saturday
Sunday
Monday
Tuesday
Wednesday
Time
Leq
Hour when helicopter(s) landed and/or departed

Figure 4

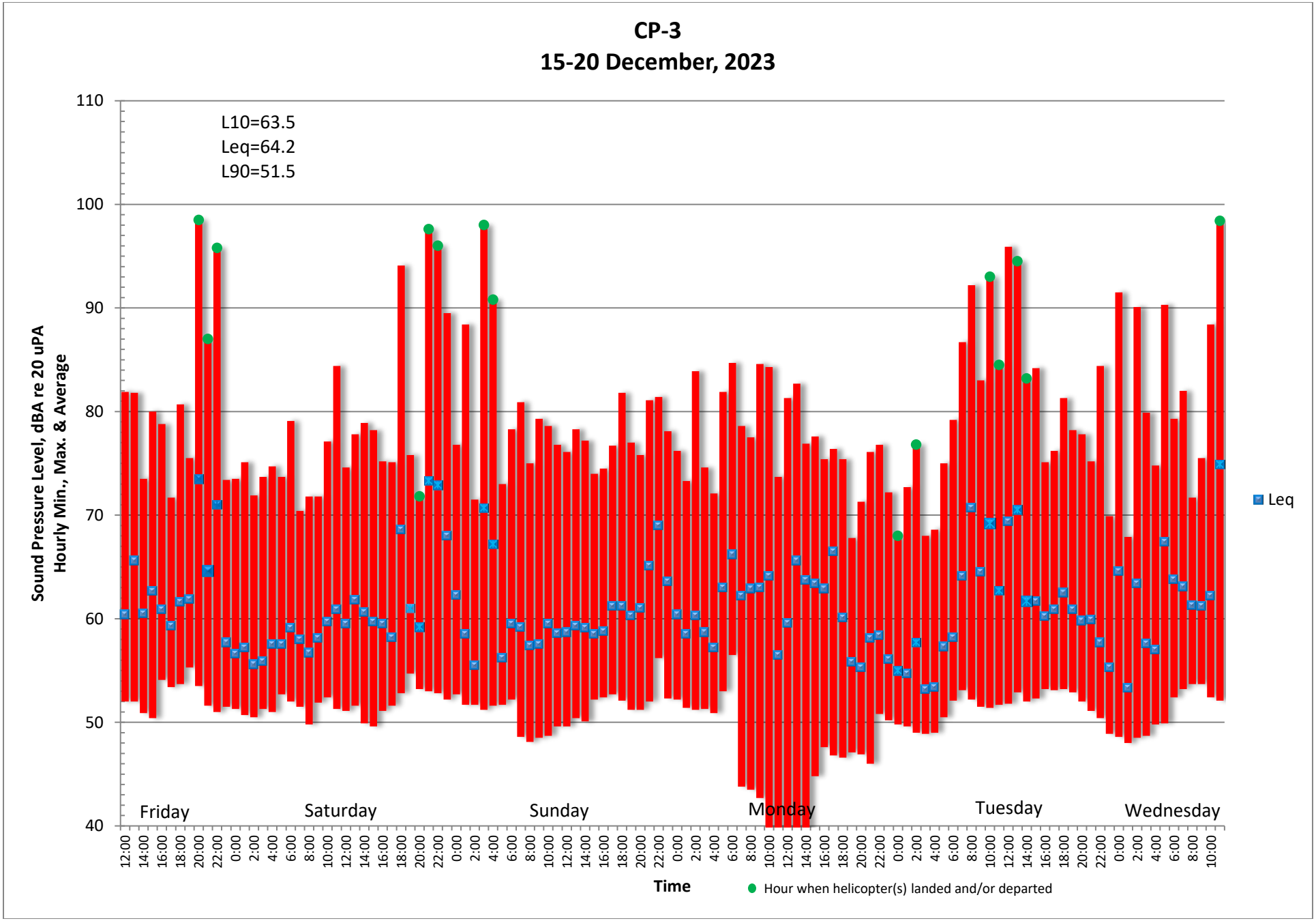
CP-3
15-20 December, 2023
L10=63.5
Leq=64.2
L90=51.5
Sound Pressure Level, dBA re 20 uPA
Hourly Min., Max. & Average
110
100
90
80
70
60
50
40
Friday
Saturday
Sunday
Monday
Tuesday
Wednesday
Time
Leq
Hour when helicopter(s) landed and/or departed

Figure 5

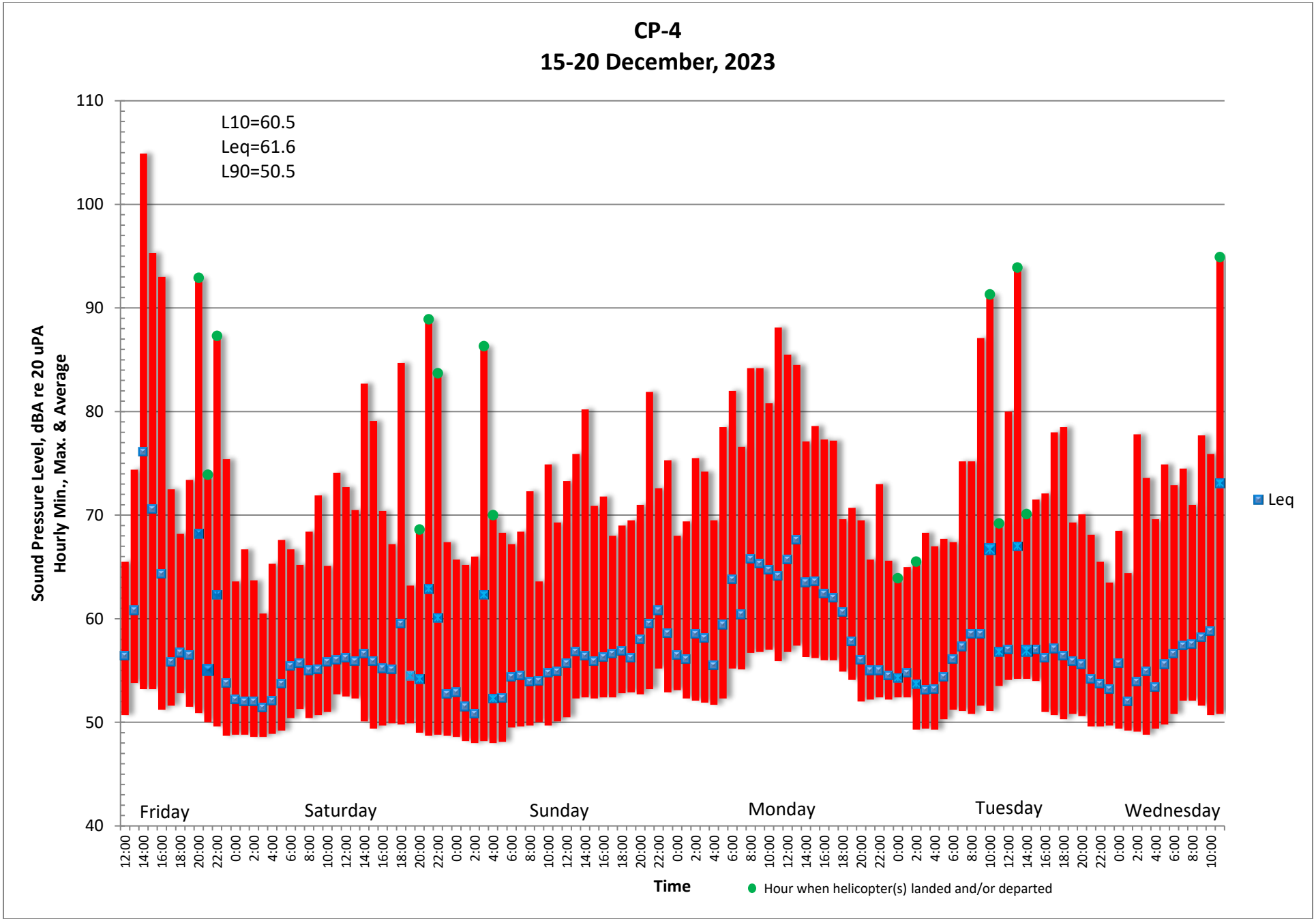
CP-4
15-20 December, 2023
L10=60.5
Leq=61.6
L90=50.5
Sound Pressure Level, dBA re 20 uPA
Hourly Min., Max. & Average
110
100
90
80
70
60
50
40
Friday
Saturday
Sunday
Monday
Tuesday
Wednesday
Time
Leq
Hour when helicopter(s) landed and/or departed

Figure 6

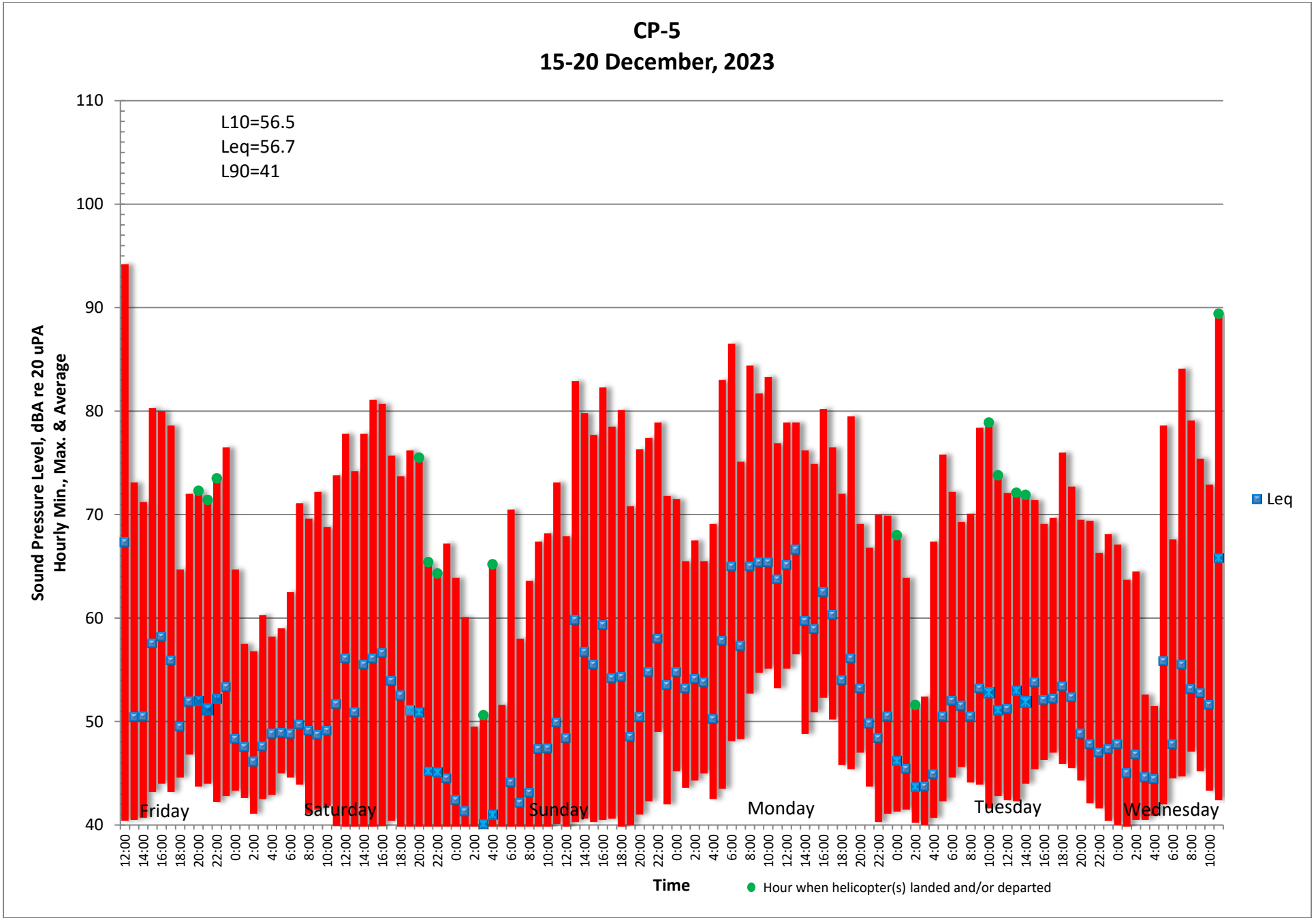
CP-5
15-20 December, 2023
L10=56.5
Leq=56.7
L90=41
Sound Pressure Level, dBA re 20 uPA
Hourly Min., Max. & Average
110
100
90
80
70
60
50
40
Friday
Saturday
Sunday
Monday
Tuesday
Wednesday
Time
Leq
Hour when helicopter(s) landed and/or departed

Figure 7

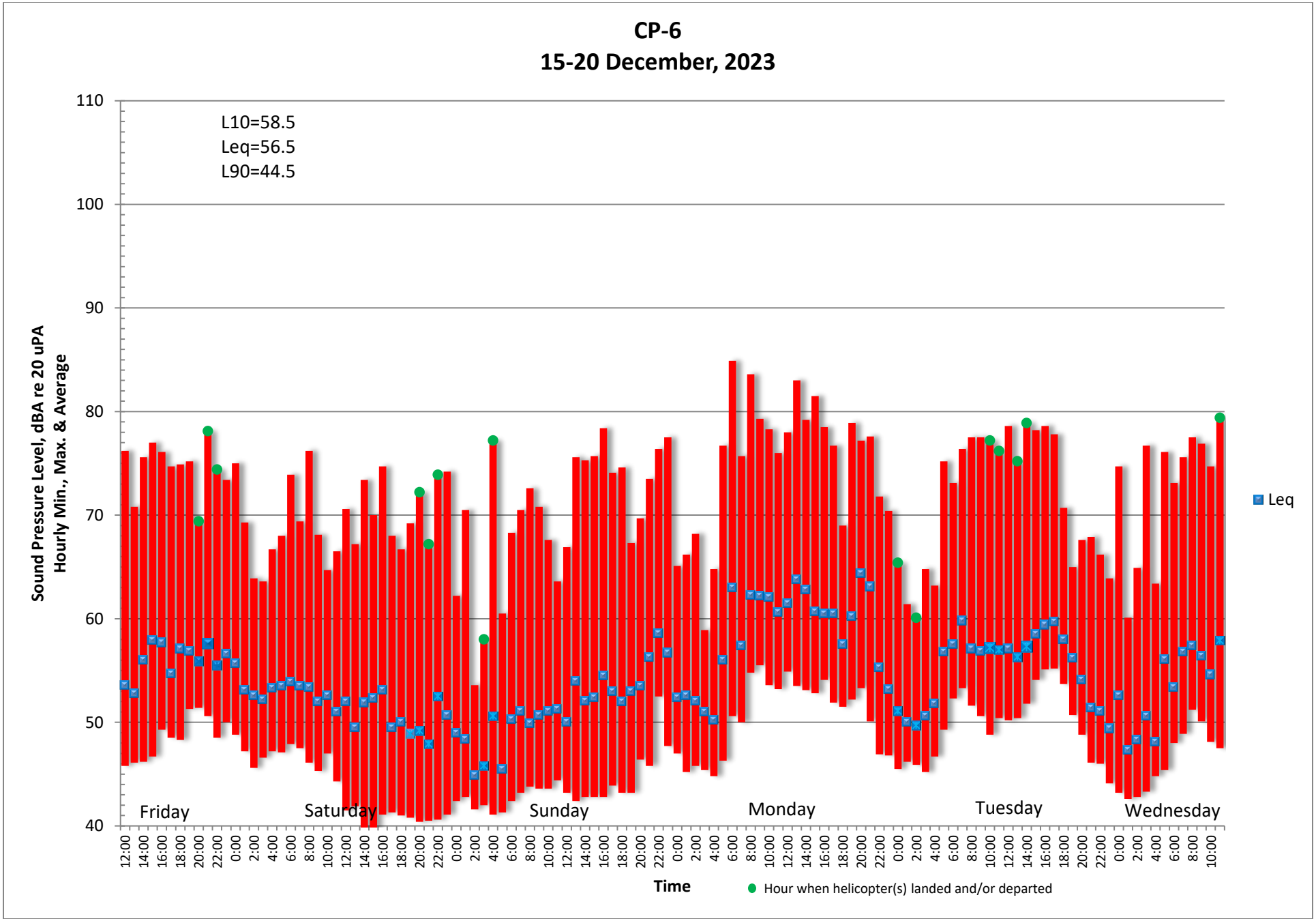
CP-6
15-20 December, 2023
L10=58.5
Leq=56.5
L90=44.5
Sound Pressure Level, dBA re 20 uPA
Hourly Min., Max. & Average
110
100
90
80
70
60
50
40
Friday
Saturday
Sunday
Monday
Tuesday
Wednesday
Time
Leq
Hour when helicopter(s) landed and/or departed

Figure 8

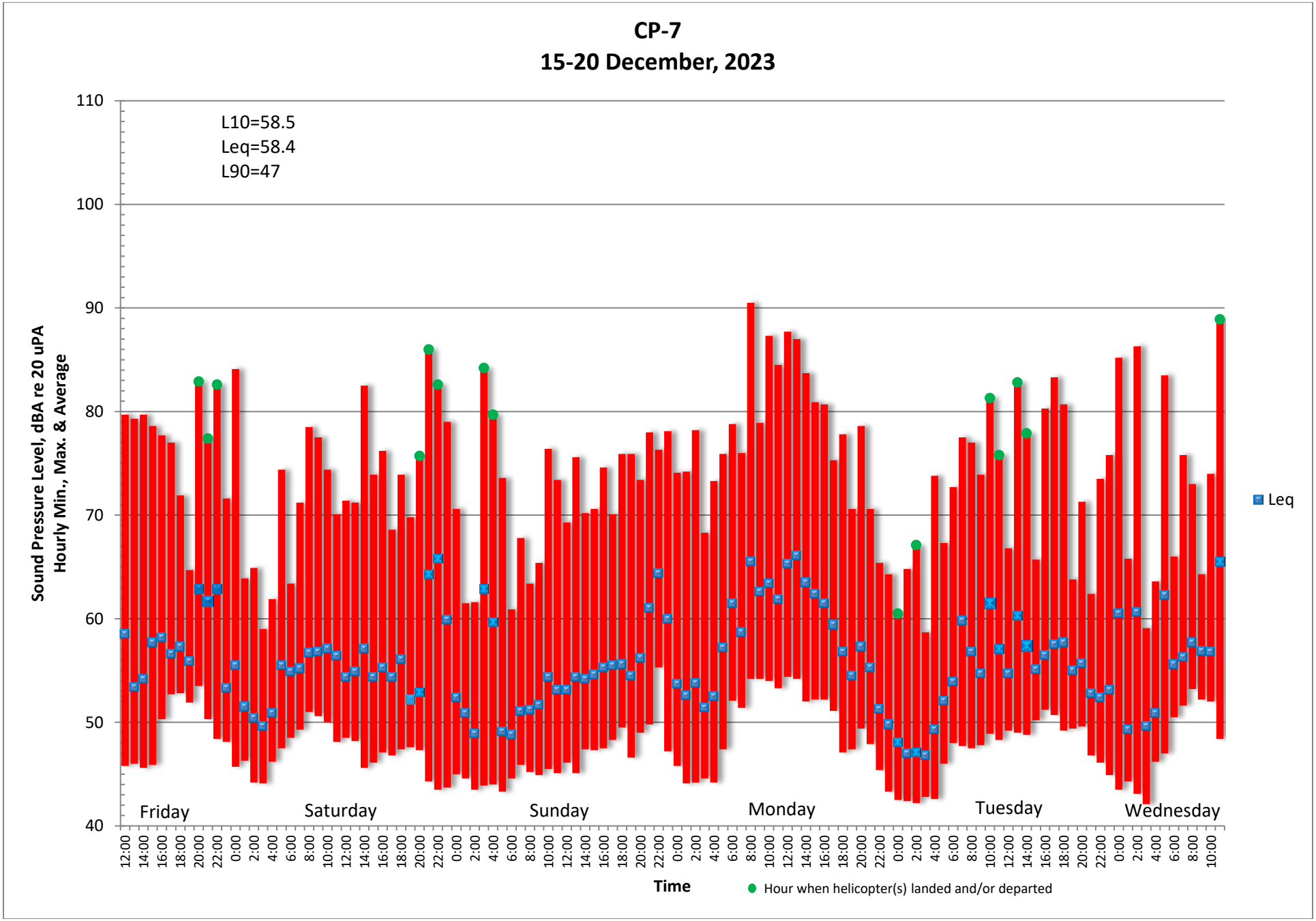
CP-7
15-20 December, 2023
L10=58.5
Leq=58.4
L90=47
Sound Pressure Level, dBA re 20 uPA
Hourly Min., Max. & Average
110
100
90
80
70
60
50
40
Friday
Saturday
Sunday
Monday
Tuesday
Wednesday
Time
Leq
Hour when helicopter(s) landed and/or departed

Figure 9

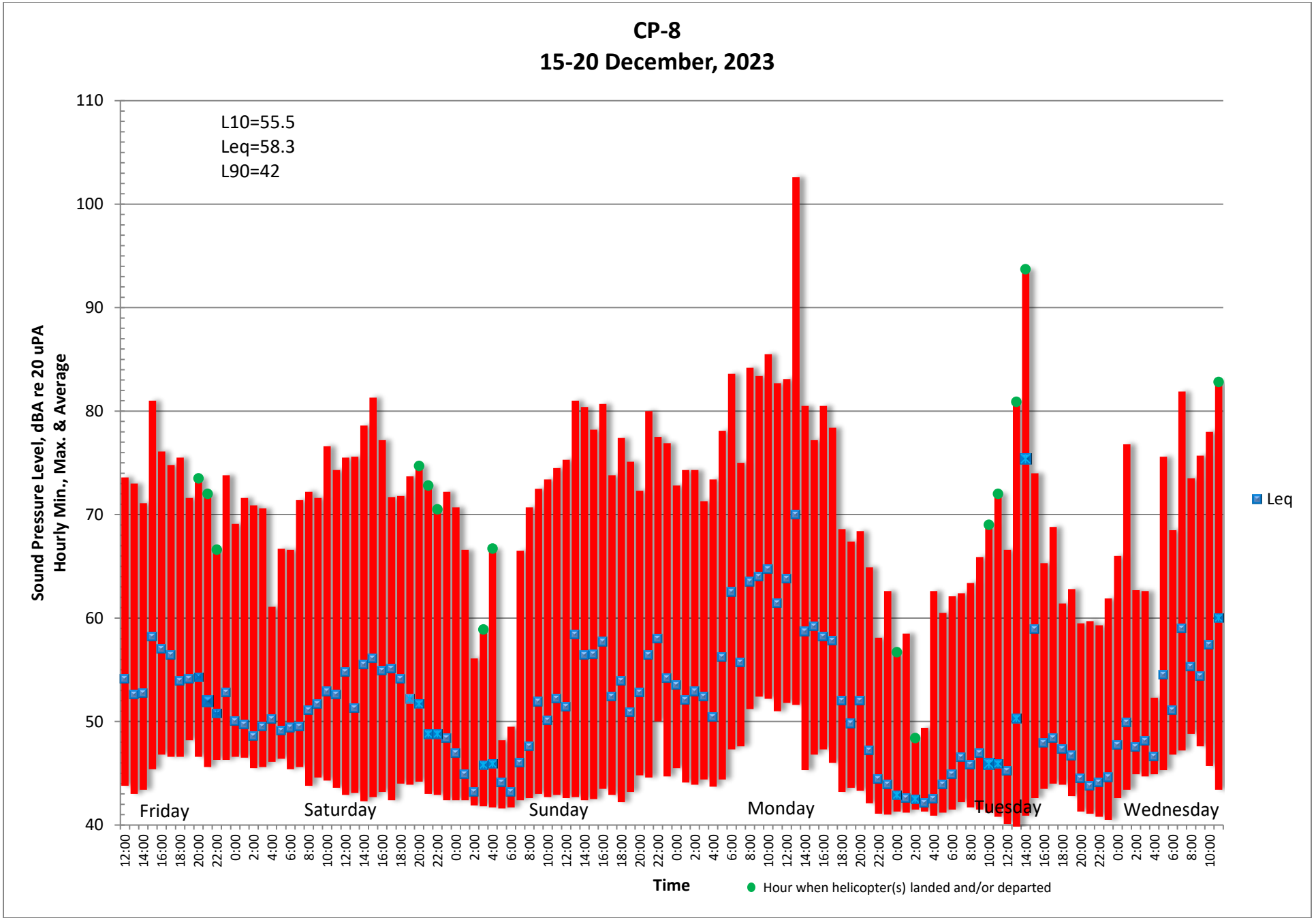
CP-8
15-20 December, 2023
L10=55.5
Leq=58.3
L90=42
Sound Pressure Level, dBA re 20 uPA
Hourly Min., Max. & Average
110
100
90
80
70
60
50
40
Friday
Saturday
Sunday
Monday
Tuesday
Wednesday
Time
Leq
Hour when helicopter(s) landed and/or departed

Figure 10

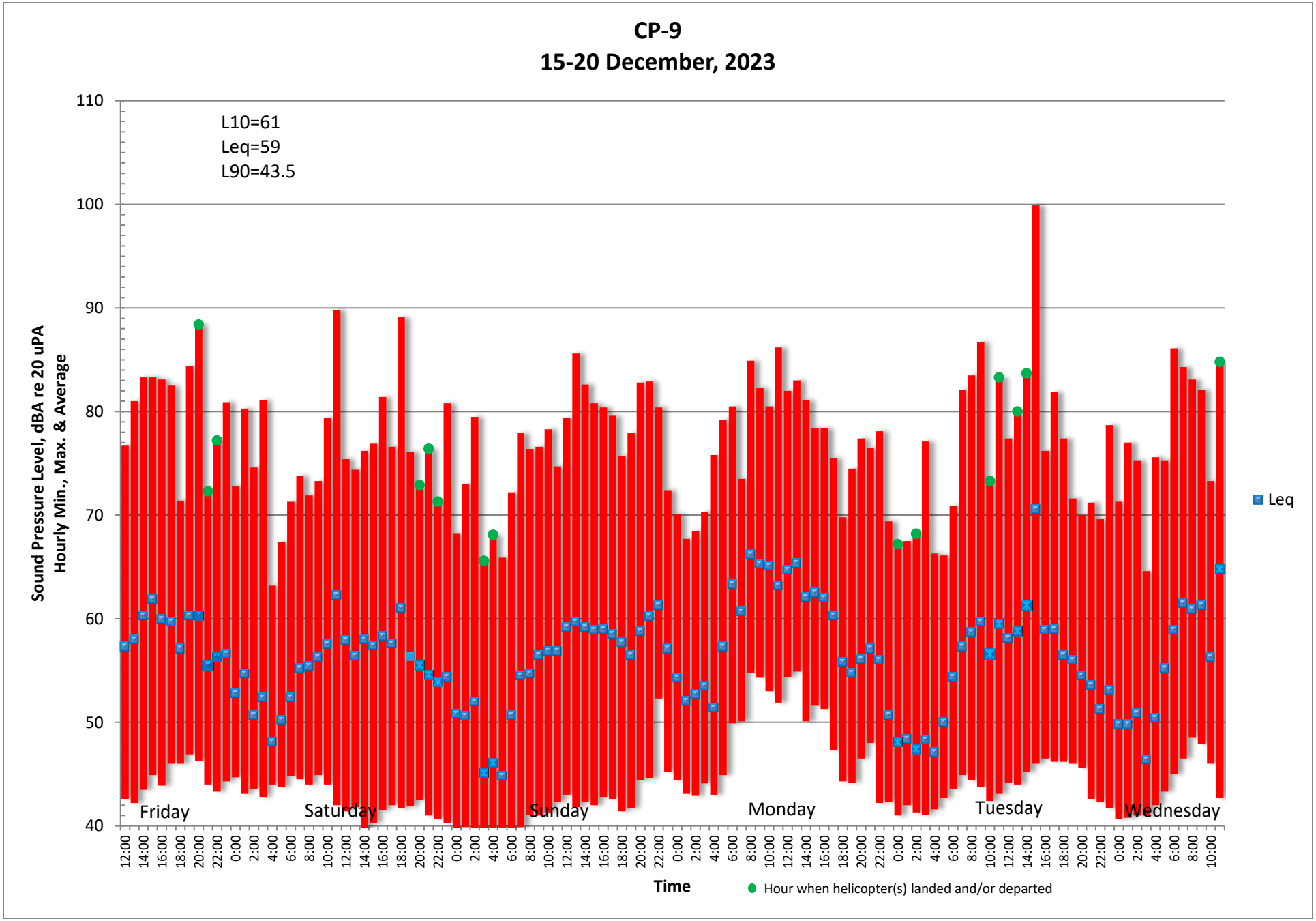
CP-9
15-20 December, 2023
L10=61
Leq=59
L90=43.5
Sound Pressure Level, dBA re 20 uPA
Hourly Min., Max. & Average
110
100
90
80
70
60
50
40
Friday
Saturday
Sunday
Monday
Tuesday
Wednesday
Time
Leq
Hour when helicopter(s) landed and/or departed

Figure 11

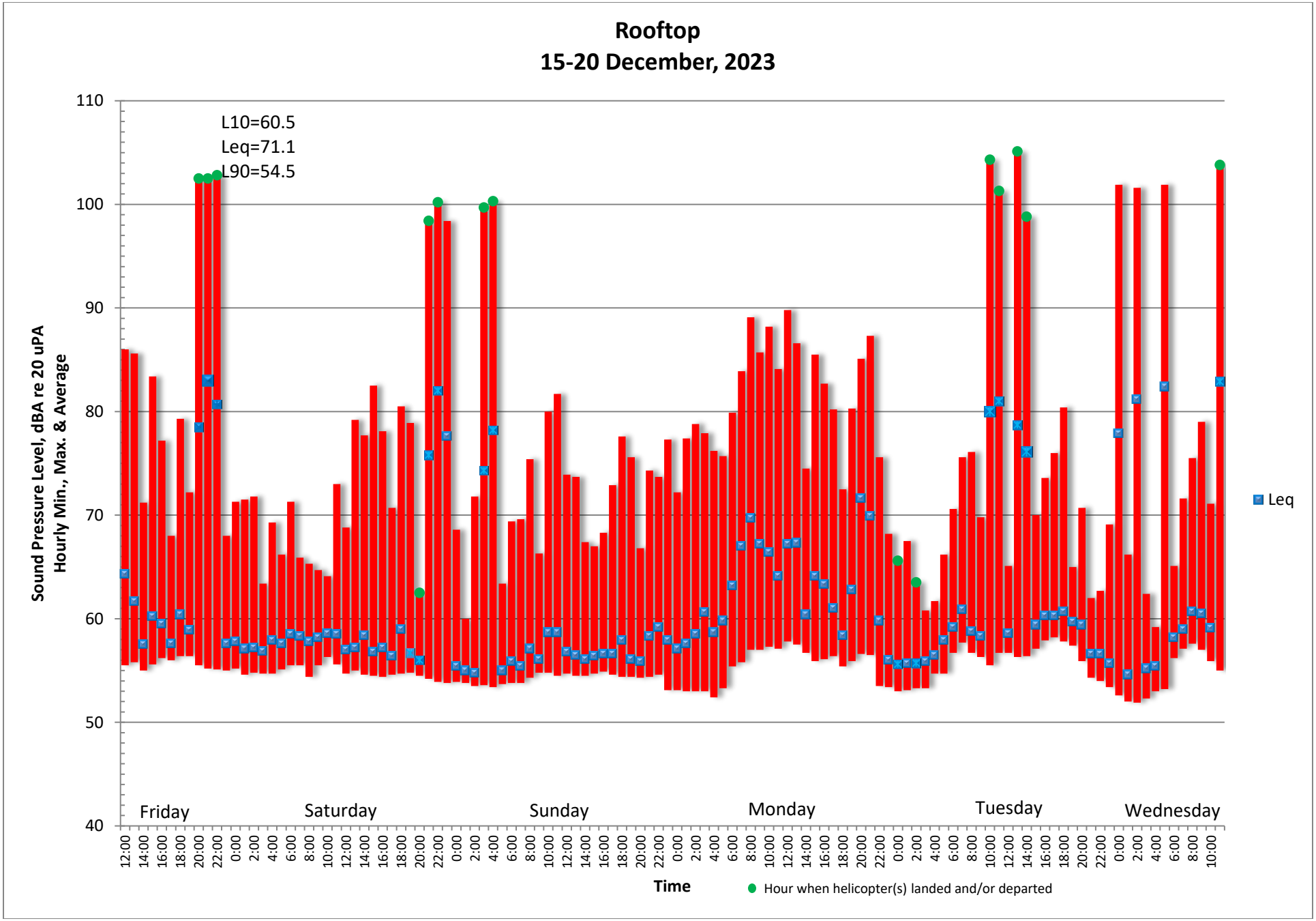
Rooftop
15-20 December, 2023
L10=60.5
Leq=71.1
L90=54.5
Sound Pressure Level, dBA re 20 uPA
Hourly Min., Max. & Average
110
100
90
80
70
60
50
40
Friday
Saturday
Sunday
Monday
Tuesday
Wednesday
Time
Leq
Hour when helicopter(s) landed and/or departed

Figure 12

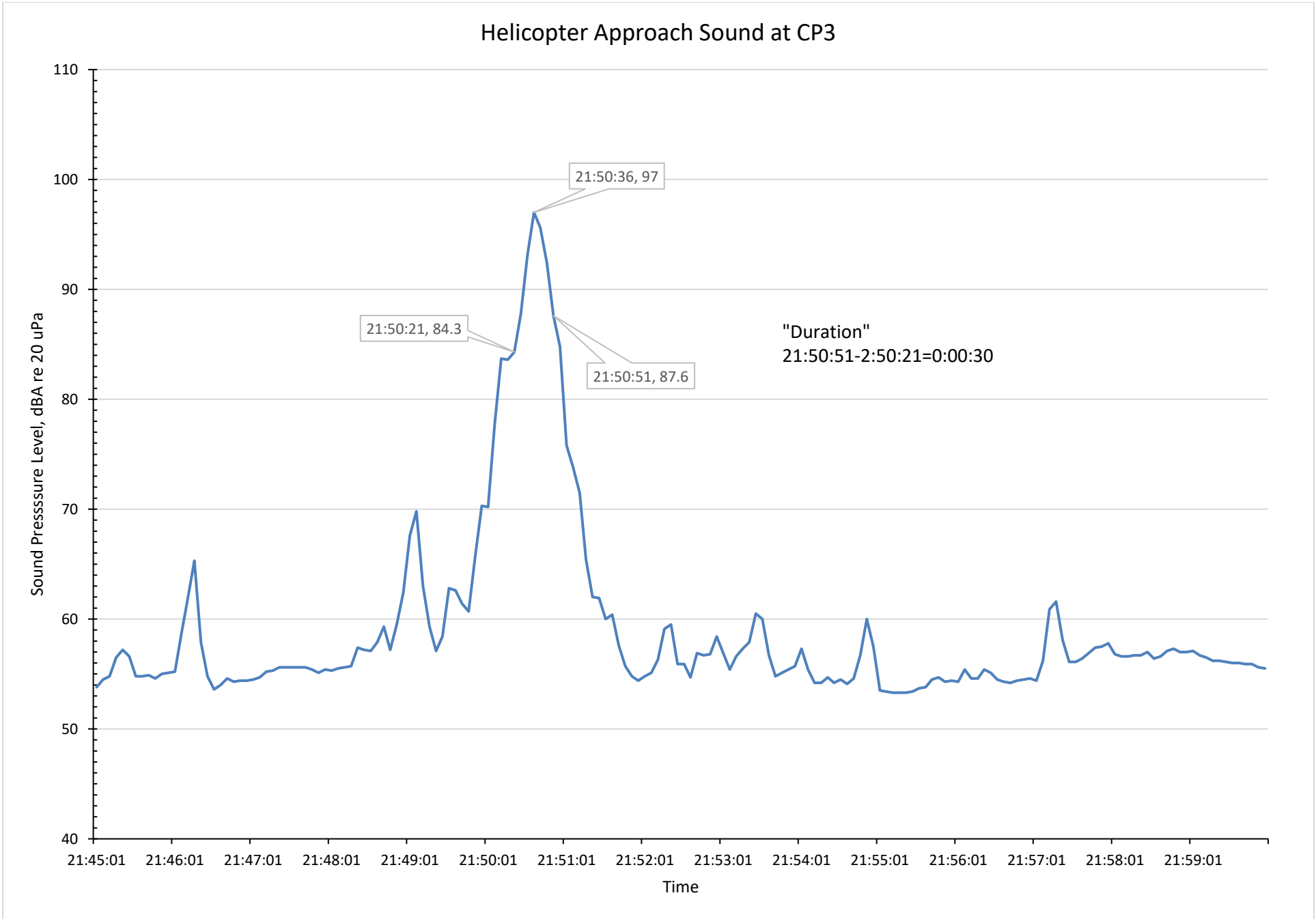

Figure 13 – Sample Helicopter Approach Sound