

ARR/C/2217.71

30th June 2023

One Stop

Assessment of the external plant
noise for the recently opened store at
Lloyd St South, M14 7HT.

Prepared for :-

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1.0 **SUMMARY**

The noise generated by the external units was substantially below background levels, even at distances much shorter than the distances to the nearby residential properties. The noise was impossible to measure and assess in a mathematically robust way and so the numerical presentations should be taken as guidance only. However, it is very clear that the impact is negligible and in fact likely to be essentially zero.



A R Raymond



P J Durell

2.0 **INTRODUCTION**

ADC was asked to carry out a post-completion test of the installed equipment at the above site.

3.0 **PLANNING CONDITION**

Condition 4 is as follows:-

4) Prior to the operation of the scheme a verification report shall be submitted to and approved in writing by the City Council as local planning authority to validate that the work undertaken throughout the development conforms to the recommendations and requirements in the approved acoustic report. The report shall also undertake post completion testing to confirm that the noise criteria have been met. Any instances of non-conformity with the recommendations in the report shall be detailed along with any measures required to ensure compliance with the agreed noise criteria.

The following was agreed with Environmental Protection Officer, Sharon McAndrew:-

As discussed, we are in a bit of a quandary as to how to approach the discharge of planning condition 4 (essentially a requirement to verify that noise criteria have been met). Basically, the design stage was based on an assumption that all units would run constantly on full load throughout the night. The reality, however, is that there is rarely more than one or two units running at the same time, particularly at night, and I cannot recall ever seeing all units running together at any time. So, while (this) should mean that there is a significant safety margin in the design, it basically means but it will be difficult to "verify" at the nearest receptors, particularly when the criterion was to have all units operating below background noise at those positions.

We discussed a pragmatic approach, where we would attend site during the current warm conditions. We will endeavour to catch all items operating on an individual basis, even if that is only briefly. Unless there has been some sort of catastrophic failure, we will not be able to make these measurements at anything like the distance of the nearest residential recipients, and we will have to locate ourselves much closer to the sources, possibly only a few metres away. We can put these measured levels back into the model to illustrate how this can be expected to affect nearby properties. We would also propose to locate ourselves as closely as possible to the nearest residential receptors where we would (presumably) report that the equipment was inaudible and unmeasurable.

It is difficult to give you a definitive, step-by-step, method statement, as there will be some degree of "improvisation" when we are there but we will of course endeavour to provide as much pragmatic information as possible.

One final point, which we did not discuss when we spoke, is the time of day. If it is daytime, it is inevitably going to be warmer and the equipment is more likely to be running. However, background levels will inevitably be higher which makes measurements more difficult. At the other end of the scale, the small hours of the night would provide low background levels, but the store will be closed and it will be very much a case of "get what you are given" in terms of what may or may not be running, as it is all automated. Lots of past experience suggests that very little actually runs during the night. I am inclined to suggest that we do the test in the mid/late evening. That way the background level should be reasonably low, and with the assistance of the mechanical services engineers, we should be able to turn equipment on and off from within the store which will be open until 22:00. Note, of course, that actual measurements of background noise for the impact assessment have already been done as part of the initial application process.

4.0 SURVEY DETAILS

4.1 Site Times and Personnel

The survey was carried by Andrew Raymond and Mark Pimlett of ADC Acoustics on 30th May 2023 from shortly before 20:00 to shortly before 22:00. We were assisted throughout by Tom Kilvert of Pure Cold Solutions, the designers and installers of the equipment.

4.2 Instrumentation

Instrumentation used was two Rion NL-52 Class I sound level meters, which holds current calibration certificates, and which was field-calibrated before and after the measurements with no drift noted.

4.3 Survey Conditions

Times were agreed with LPA Officers and chosen to be at a time when the store was open so that the various units could be forced into a condition of full-load running by the refrigeration engineer.

Weather conditions on each occasion were as follows:-

Rain	:	none, dry roads
Cloud	:	20%
Temperature	:	18 Celsius
Wind	:	negligible

4.5 Measurement Positions

The image below is taken from the our main report of 20th July 2022, plus some additional labelling.

All of the positions were selected based on the simple fact that all equipment was inaudible at just a fraction of the actual distance to the most affected residential locations.

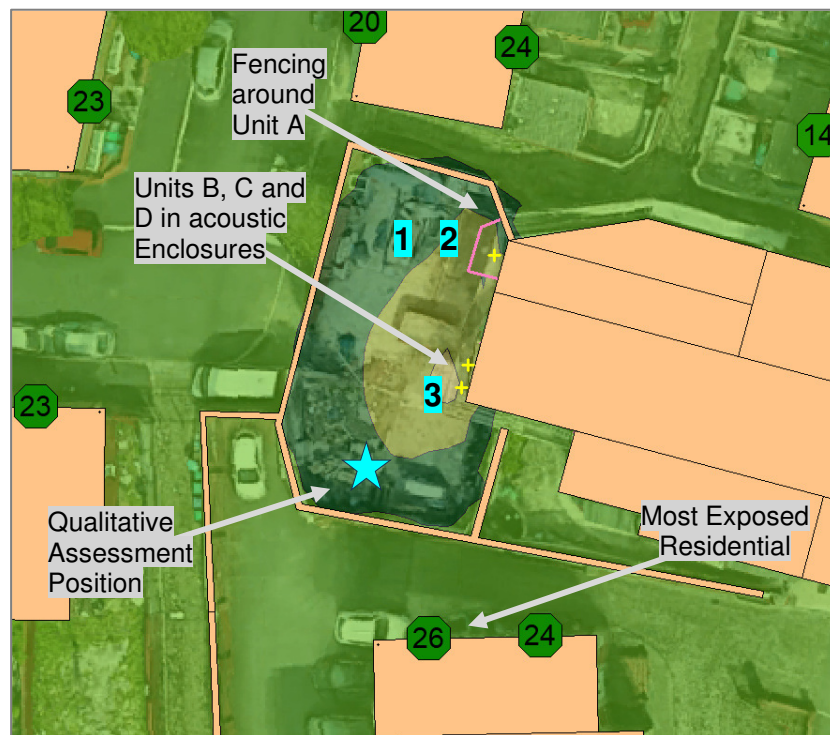
Position 1 was 4 m from acoustic fence in front of Unit A. The unit was just audible but measurements were difficult. Moving closer made little difference.

Position 2 was at 1m from the acoustic fencing but with the doors open. Reasonable measurements could be made here but clearly the doors would not be open and are normally locked shut.

Position 3 was in and amongst the acoustic enclosures of Units B, C and D. These units were completely inaudible, even at distances well under 1m from the inlets and outlets. Measurements were made over the open faces of the inlets and outlets.

Finally the blue star shows where qualitative assessments were made at a position reasonably representative of the most exposed residential

location to the south. It was at less than half the distance and with a clear line of site to all units.



5.0 RESULTS AND DISCUSSIONS

The refrigeration engineer confirmed that all units were running on full load. It was immediately obvious that the impact was going to be negligible. In the case of Units B, C and D in the acoustic enclosures, we had to place our ears right next to the inlets and outlets, and feel for air movement in order to confirm it to ourselves. Unit A was just audible at around 4 m from the acoustic fence.

5.1 Unit A

Measurements were made at 4 m from the acoustic fence. The unit was just audible at this position. Measurements were fairly steady at 45 to 46 dB L_{Aeq} , with a logarithmic average of 45 dB L_{Aeq} . With the unit not running, measurements were again around 45 to 46 dB L_{Aeq} , with a logarithmic average of 45 dB L_{Aeq} . In other words, Unit A was making no contribution to the overall measurements. If it assists Officers, we can take this to one decimal place. It is not a mathematically robust way to present figures to one decimal place, but we do so for guidance and to offer further comfort. The logarithmic average of Unit A running was 45.5 dB L_{Aeq} and without it running it was 44.8 dB L_{Aeq} . This gives a (guidance only) level of 36.9 dB L_{Aeq} at 4 m from the fencing with Unit A running alone¹.

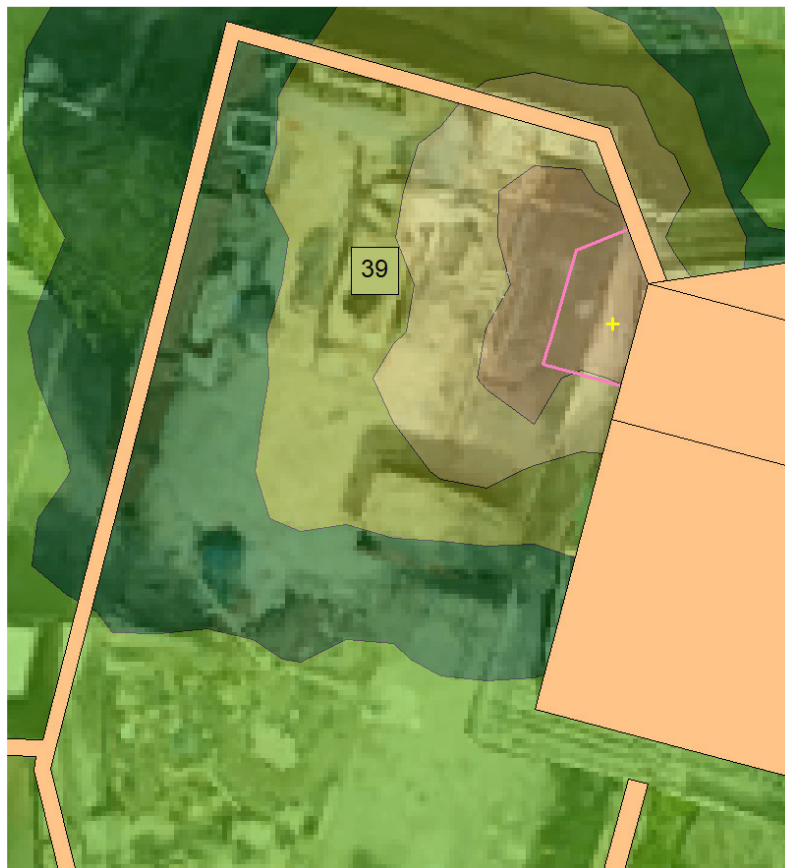
¹The equation is $LA = 10 \cdot \log(10^{(LM/10)} - 10^{(LO/10)})$

Where LA is the Level of the unit running alone, LM is the measured level with the unit running, and LO is the measured level with the unit off.

Note that it can also be done using the L_{50} and L_{90} indices. Again this is not mathematically robust, but provides further confidence.

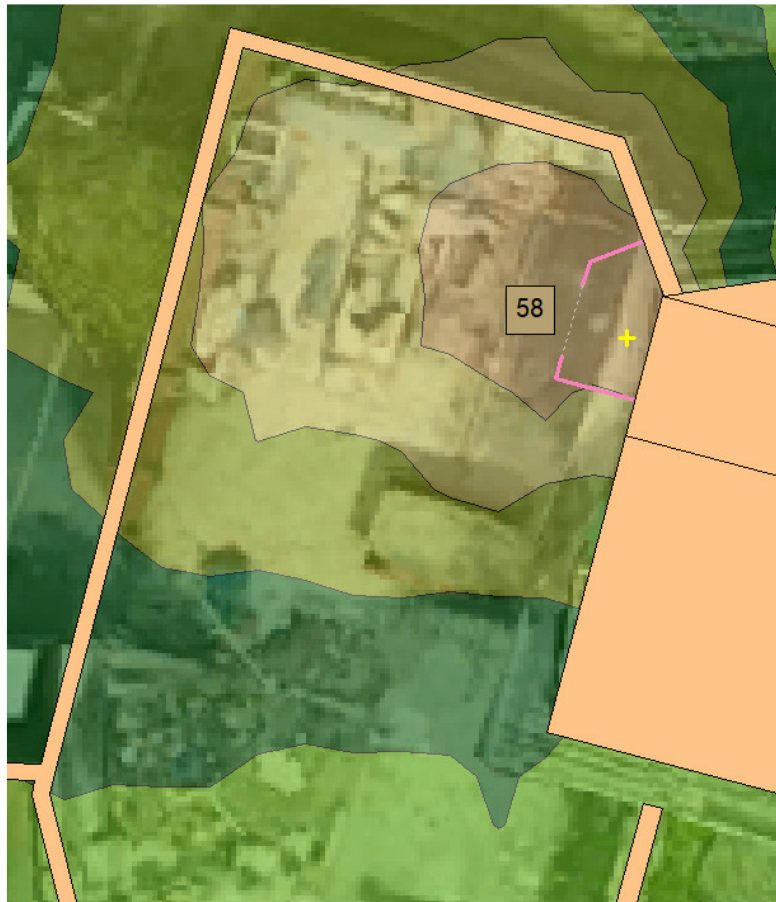
<i>Running Condition</i>	<i>Index</i>	<i>dB(A)</i>
3m from Unit A Full Load	Leq	45.5
	L50	44.9
	L90	43.4
Unit A Not Running	Leq	45.4
	L50	44.8
	L90	43.3
Unit A alone at 3 m	Leq	37.0
	L50	35.9
	L90	36.9

We can now compare the derived figure of around 37 dB L_{Aeq} at 4m from the fencing with the modelled levels on which the assessment was originally based. The level at a position 4m from the fencing in the model is as follows:-



So, the actual level appears to be 2 dB lower than the level originally modelled.

We also carried out some brief measurements at 1m from the fence but with the doors open. The measured level was 56 dB L_{Aeq} . If we simulate the modelled level with the doors open, we get the following.



Again, the actual level appears to be 2 dB lower than the level modelled.

We can confidently conclude that Unit A is within the levels assumed in the original assessment and that its impact on nearby residential property is negligible.

5.2 Units B, C and D

These units were completely inaudible at positions well within 1m of the enclosure inlets and outlets. There is no worthwhile processing and analysis to be done. For the record, measurements were made over the surfaces of the inlets and outlets and ranged from 46 to 49 dB L_{Aeq} .

We can confidently conclude that Unit B, C and D are substantially below levels assumed in the original assessment. These are shown in the image below. The impact on nearby residential property is essentially zero.



5.3 All Units

It was agreed with the Environmental Protection Officer that it would be impossible to measure levels at anything like the distances to the nearby residential locations, but that we would qualitatively assess the impact. None of the equipment was audible at more than a few meters away, and certainly not outside the yard. The position shown by the blue star in 4.5 above was less than half the distance to the most exposed residential location. It had a clear line of sight to the units but was sheltered from other immediately surrounding sources of noise. All of the equipment was completely inaudible and the impact was essentially zero. Even in the middle of the night when background levels are lower, it is inconceivable that there would be any significant impact.

6.0 **CONCLUSIONS/RECOMMENDATIONS**

The noise generated by the external units was substantially below background levels, even at distances much shorter than the distances to the nearby residential properties. The noise was impossible to measure and assess in a mathematically robust way and so the numerical presentations should be taken as guidance only. However, it is very clear that the impact is negligible and in fact likely to be essentially zero.

We recommend that you issue this report to planners and we would encourage Officers to contact us directly with any. Queries.

Appendix 1: Definition of Acoustic Terms

The Decibel

The decibel is the basic unit of noise measurement and is denoted dB. Technically, it is a means of expressing the difference in noise level between the measured noise and a standard level of noise. Most often the threshold of human hearing is used as the standard reference but it really should be stated. The threshold of human hearing is a sound pressure of 20 μ Pa or a sound power of 1pW.

A sound pressure level or SPL should be expressed in dB(re. 20 μ Pa). A sound power level or SWL should be expressed in dB(re. 1pW). If the reference levels are omitted, it will often (but not always) be safe to assume that they are referenced to the threshold of human hearing.

A-Weighting and dB(A)

The human hearing system responds differently to different frequencies. The A-weighting system takes account of this by emphasising mid and high frequencies more than low frequencies to give an overall level. An A-Weighted noise level, therefore, reflects the way normal, healthy hearing would perceive the overall level of the noise. The basic unit is dB(A), although other systems of expressing an A-weighted levels are discussed below.

Other weighting systems, such as C-Weighting, denoted dB(C), reflect the human hearing system's response at higher noise levels.

Equivalent Continuous Sound Level, L_{eq}

This can be simplistically described as a way of expressing the average noise level.

The unit is dB L_{eq} . For A-weighted levels the unit is dB(A) L_{eq} or, in more modern units, dB L_{Aeq} .

Maximum Level, $L_{\max}$

This is the maximum level reached (usually for a fraction of a second) in the measurement period.

The unit is dB $L_{\max}$. For A-weighted levels the unit is dB(A) $L_{\max}$ or, in more modern units, dB $L_{A\max}$.

Statistical (Percentile) Levels, L_n

During a measurement of fluctuating noise, it is often useful to establish the levels exceeded for a percentage of the time. L_n is the index representing the level exceeded for $n\%$ of the measurement period.

The unit is dB L_n . For A-weighted levels, the unit is dB(A) L_n or, in more modern units, dB L_{An} .

Common examples are as follows :-

dB L_{A90} is the A-weighted level exceeded for 90% of the time and is often used to describe the underlying background noise.

dB L_{A50} is the A-weighted level exceeded for 50% of the time. Mathematically, it is the median, another kind of average.

dB L_{A10} is the A-weighted level exceeded for 10% of the time and has traditionally been used to describe the intermittent highs in the noise climate such as passing cars or aircraft.

Frequency Analysis

Here the audible frequency range is divided up into bands and the noise level is expressed in each frequency band from low pitches to high pitches.

Octave Band analysis is where the frequency range is divided into 8 bands from 63 Hz to 8kHz, or sometimes into 10 bands from 31.5 Hz to 16kHz.

1/3 Octave Band analysis provides more detailed subdivision into 24 bands from 50 Hz to 10kHz, or sometimes into 30 bands from 20Hz to 20kHz.

Narrow Band analysis takes this further with the possibility of many thousands of bands, possibly only 1Hz wide, or even less.

In all types of frequency analysis, the level in each band can be expressed in terms of L_{eq} , $L_{\max}$, L_n , etc. as defined above.