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NOISE COMPLAINT – VALIDATION MEASUREMENTS

BAE SAMLESBURY

REPORT REFERENCE NO. J003269-5623-RDC-01

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Document Control Sheet

Details of Assessment	
Client	BAE Systems
Document Title	Noise Complaint – Validation measurements – BAE Samlesbury
Report Reference	J003269-5623-RDC-01

Client Address:	Company Address:
Samlesbury Aerodrome Balderstone Blackburn Lancashire BB2 7LF	PDA Ltd 3 Bridgewater Court Barsbank Lane Lymm WA13

Issue	Date	Author	Remark	Status
01	14/06/2022	Richard Cookson	Initial Issue	

	Name	Position
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This report has been prepared based upon a scope of works and associated resources agreed between the client and Philip Dunbavin Acoustics Ltd (PDA). This report has been prepared with all reasonable skill, care and diligence and has been based upon the interpretation of data collected. This has been accepted in good faith as being accurate and valid at the time of the collection. This report has been based solely on the specific design assumptions and criteria stated herein.

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1.0 SUMMARY

At the request of BAE Systems (Operations) Ltd, noise measurements have been made of the treatments scrubber plant fan following remediation works to reduce the tonal noise in the 160Hz frequency band.

Measurements show that the frequency bands containing the tone (160Hz – 200Hz) have reduced by 13-19 close to the scrubber (15m) and that the tonal frequencies are no longer significantly higher than the surrounding octave bands indicating that the tone is unlikely to be subjectively prominent.

Measurements at Branch Road show a reduction of 3-4 dB in the tonal frequencies, despite the noise levels generally being higher in the other frequency bands. Subjectively the tone could not be heard at Branch Road.

Considering that previously the absolute noise levels in the complainant's house were at a level which would be considered to be acceptable with regard to environmental noise , the issue leading to complaint being the prominent tone, it is now unlikely that the noise from the scrubber will attract complaint with the tonal noise having reduced significantly such that it is no longer measurable as a prominent tone.

2.0 BRIEF FOR CONSULTANCY

PDA Ltd. was engaged to carry out the following:

A) Noise Survey - Following remediation

We will travel to the site and carry out an ambient noise survey to assess the level of noise in the previously measured locations on Branch Road and close to the scrubber on-site.

We would propose to undertake manned measurements after 22:00 hours when noise due to road traffic noise is reduced.

We will carry out all noise surveys in accordance with the provisions of BS7445 "Description and Measurement of Environmental Noise". The measurements made will include both dBA and octave band noise levels including L_{eq}, L_{max}, and L_{90} parameters. During the survey duration, we will require unrestricted access to the site.

B) Survey Processing and Report - Following Remediation

The results of the noise survey will be processed and compared with the survey conducted prior to the remediation works in March 2021. An assessment will be undertaken of the reduction of the tone at ~160Hz previously identified in the scrubber noise spectrum.

The results of the measurement and assessment will be submitted in a full technical report.

3.0 INTRODUCTION

An investigation into complaints of a noise affecting residences on Branch Road, Mellor Brook, found a strong tonal source emitted from the stack of the treatments scrubber unit. Remedial works have subsequently been carried out on the fan to reduce the problem tone. This report details follow-up measurements taken to validate the remediation works.

4.0 SURVEY

Following remediation works a repeat survey of the scrubber stack was undertaken to determine the effectiveness of the remediation.

4.1 Instrumentation and personnel

The survey was carried out by Richard Cookson of PDA Ltd on 23/05/2022 between 21:50 and 22:30.

Measurements were made using an NTi XL2 sound level meter on. The measurements were carried out with the meter on a tripod 1.3 – 1.5m above ground level in free-field conditions. The meter used was a Class 1 sound level meter in accordance with IEC 61672-1:2002 capable of operating as an integrating sound level meter with statistical functions. The sound level meter is in current calibration with certificates available on request. The meter was set to measure frequency spectra in one-third octave bands measuring continuously. The meter was also set to carry out audio recording of the sounds.

4.2 Plant Measurements

Measurements were taken at 2m and 15m from the scrubber plant, in similar locations to those taken prior to remediation. Measured levels are shown in the figures below:

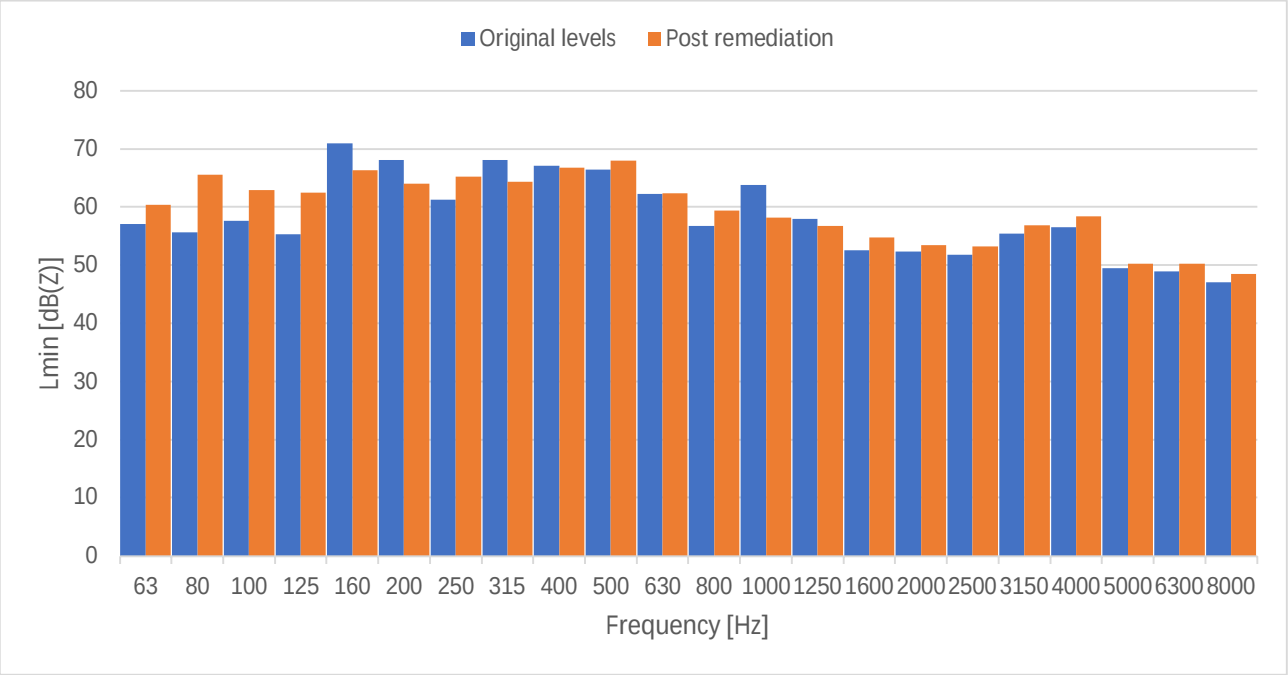

Figure 1 – Scrubber noise levels at 2m from scrubber plant (base of plant)

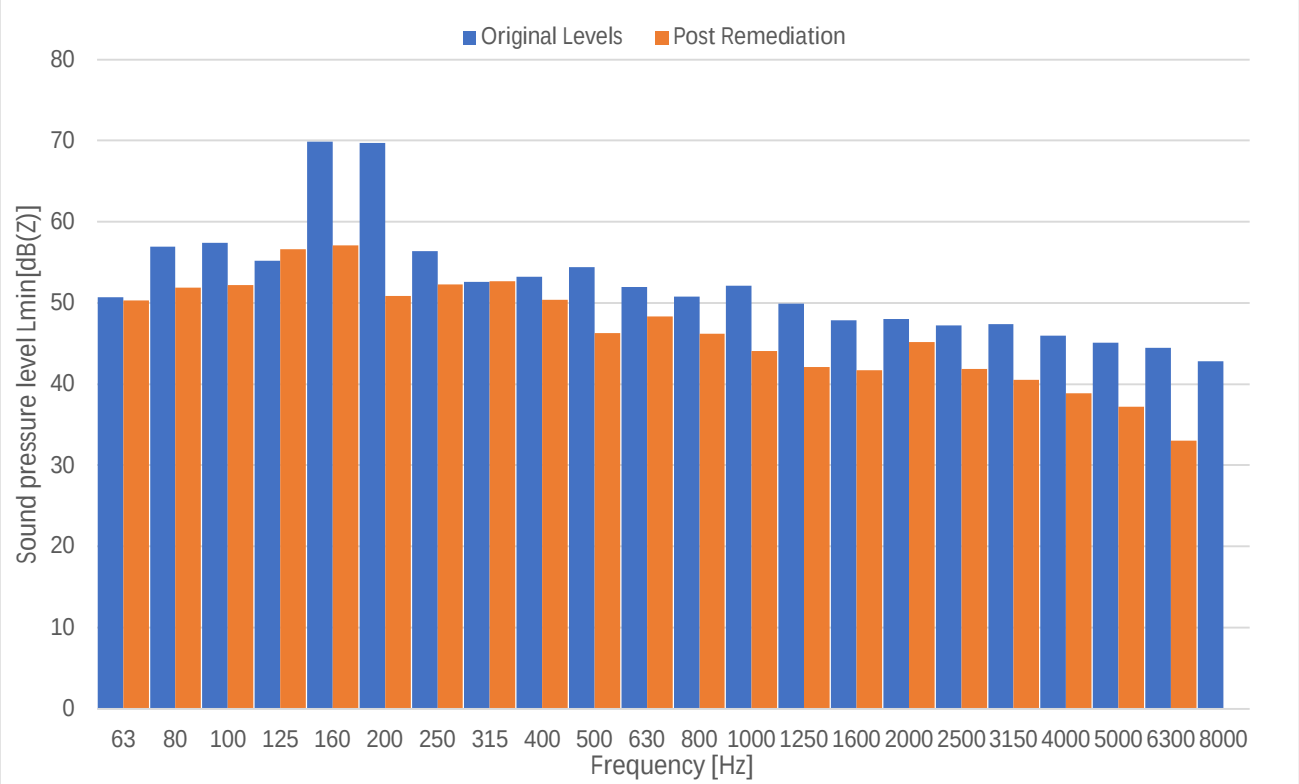

Figure 2 – Scrubber noise levels at 15m from scrubber plant in direction of Branch Road

Reviewing the measurements of Figure 1 and Figure 2 it is apparent that there is little change in noise levels in Figure 1, however, this measurement location was close to the base of the plant and is

dominated by noise breaking out of the body and ductwork of the scrubber. For the measurements in Figure 2, the noise from the stack is expected to become more prominent as the diffraction angle between the stack axis and the propagation path from the top of the stack to the measurement position reduces. In this measurement a very large reduction is seen in the 160Hz and 200Hz 1/3 octave bands, of 13dB and 19dB respectively. We would note that a 10dB reduction is approximately equivalent to a halving of loudness and a 20 dB reduction approximately equivalent to a quartering of loudness.

The Objective Method for assessing the audibility of tones in sound in BS4142:2014+A1:2019 states that for a prominent tone to be present, the 1/3 octave band should be 8 dB higher than the neighbouring bands in the frequency range 160Hz to 400Hz. It is noted that following remediation the sound levels in the 160Hz and 200Hz bands are no longer 8 dB higher than the neighbouring bands suggesting that there is no longer a prominent tone present.

4.3 Branch Road

Measurements were taken from the same location on Branch Road as the measurements taken prior to remediation. Measurements were taken between 22:13 and 22:18.

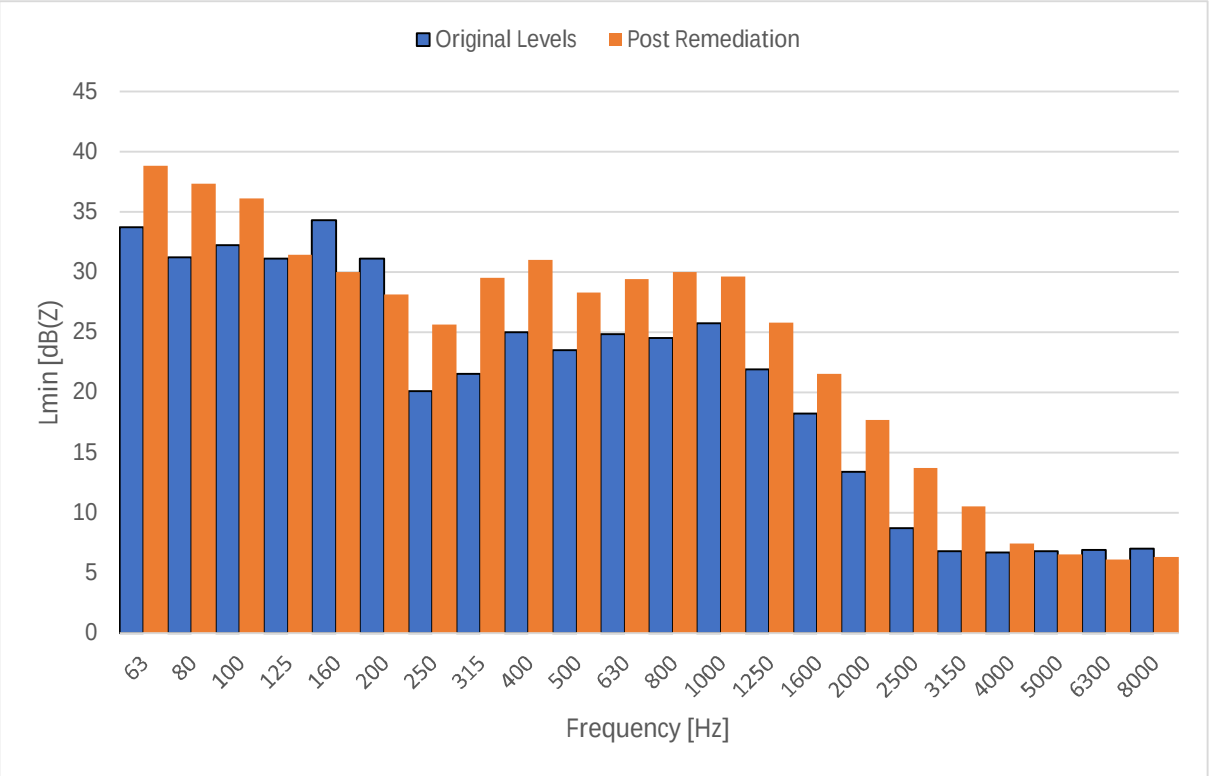

Figure 3– Noise levels measured at Branch Road

Comparing the post remedial measurement with the previous measurement it can be seen that in general noise levels are higher during the post-remedial measurements, possibly due to differing wind directions affecting noise propagation from the A59 and also due to the post-remedial measurement being taken somewhat earlier than the original measurement. However, when considering the 160Hz and 200Hz frequency bands in isolation it can be seen that these bands associated with the tonality of the scrubber fan have reduced by 3-4 dB.

Subjectively there was no tone audible at the location on Branch Road.

5.0 CONCLUSION

At the request of BAE Systems (Operations) Ltd, noise measurements have been made of the treatments scrubber plant fan following remediation works to reduce the tonal noise in the 160Hz frequency band.

Measurements show that the frequency bands containing the tone (160Hz – 200Hz) have reduced by 13-19 dB close to the scrubber (15m) and that the tonal frequencies are no longer significantly higher than the surrounding octave bands indicating that the tone is unlikely to be subjectively prominent.

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APPENDIX A – DEFINITION OF ACOUSTIC TERMS

The decibel

This is the basic unit of noise, denoted dB.

A Weighting

This is a weighting process which simulates the human ear's different sensitivity at different frequencies. A weighting can be shown two typical ways, 50 dB(A) L_{eq} or 50 dB L_{Aeq}. Both mean the same thing. (See below for a definition of L_{eq}). The dB(A) level can be regarded as the overall level perceived by human beings.

L_{eq} and $L_{eq(s)}$

This is the equivalent continuous noise level which contains the same acoustic energy as the actual time-varying sound. In other words it is a kind of average noise level. It is denoted dB L_{eq} or, for A-weighted figures dB(A) L_{eq} or dB L_{Aeq}. It can also be expressed in terms of frequency analysis (see later). $L_{eq(s)}$ is the sample L_{eq} level.

L_n

This is the level exceeded for n% of the time. It is denoted dB L_n or, for A-weighted figures dB(A) L_n or dB L_{An}. It can be expressed in terms of frequency analysis (see later). L_{90} is the level exceeded for 90% of the time and is a measure of the lowest level typically reached. L_{10} is the level exceeded for 10% of the time and is the highest level typically reached. L_{50} is the level exceeded for 50% of the time and, mathematically, it is the median.

L_{max}

This is the maximum level reached during a measurement period. The "time constant", or the ability of the equipment to respond to impulses is usually expressed along with it, e.g. "Fast", "Slow", etc. It is denoted dB L_{max} or, for A-weighted figures dB(A) $L_{max,}$ dB $L_{Amax,}$ etc. It can also be expressed in terms of frequency analysis.

Frequency Analysis

Whereas dB(A) gives a very useful overall figure, it has its limitations in that it cannot be used to model or predict the effect of noise control and mitigation as this nearly always has radically different performance at different frequencies.

Frequency analysis expresses an overall noise level at each frequency or band of frequencies in the audible range. Octave band analysis divides the audible range into 10 bands from 31.5 Hz to 16 kHz and the noise level in each band can be expressed in any form e.g. L_{eq}, L_{90}, L_{max} etc. One third octave band analysis uses 30 bands.

Narrow band analysis takes the process to resolutions of less than 1 Hz. This is useful for identifying the existence of tones (whines, hums, etc.) and in pin-pointing the sources.