



Boral Cement

Chloride Bypass Plant
Operational Noise Verification Report
December 2023

For

Berrima Cement Plant

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Boral Cement Berrima

Chloride Bypass Plant

Operational Noise Verification Report

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Report of assessment

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Executive Summary

The Berrima Cement works of Boral Cement has completed construction and commissioning of a Chloride Bypass Plant (CBP) attached to the No.6 Kiln. Approval was granted for this in May 2021 and commissioning was completed on 30 November 2023. The approval conditions included requirements to prepare a Noise Verification Report prior to construction and also within three-months of commencement of operations. This document provides the Operational Noise Verification Report and compares the noise emissions and predicted sound level contributions at residential and compliance monitoring receiver locations with those provided in the Pre-construction Noise Verification Report, prepared by others in 2021 prior to construction.

This report provides a Verification Report of the operational CBP, based on measurements on 14 December 2023 with the Cement plant fully operational, as well as measurements with the CBP shut-down while the rest of the Cement plant was operating. Sound level measurements were taken during the same time as the measurements for the annual environmental noise assessment for the Cement Plant, which is covered in a separate report.

The section of the Chloride Bypass System which is located adjacent to Cement Mill No.7 and No.5 buildings, was not operating during the measurements. This is not considered to be significant as the surrounding buildings provide very good shielding for sound propagation to all compliance locations.

Sound levels around the CBP were found to be affected significantly by emissions from the other parts of the cement plant. This is to be expected because the noise specification sound levels for the new CBP were intended to be relatively low, compared to other sources at the plant. Sound levels measured at many locations around the CBP were not significantly different (i.e. within 3 dB of each other) for the **On** and **Off** cases. In some locations, the **Off** condition sound level was higher, probably due to minor changes in process conditions in the rest of the Cement plant at the time. For this reason, sound levels measured at residential receiver locations and Location 20 did not change for the two CBP operational conditions and it was not discernible.

In order to demonstrate compliance with the recommended sound level contribution objectives given in the Preconstruction Verification Report, the Noise Policy for Industry allows use of prediction modelling. Two different methods of predictions and models were used because of the difficulty of accurately measuring the sound levels of emissions from the different sources in the CBP. The main method used sound intensity (SI) measurements of sound emissions from sources with the *Predictor* computer noise model. Because of the difficulties of accurate measurements with the CBP *On*, a second method was used based on sound pressure level measurements and ENM computer noise model, to give greater assurance of the predicted results. Both of methods are considered suitable and accurate for the purpose. Using the two different methods provides greater assurance of the results indicating compliance. Both methods used predictions for typical worst-case meteorological conditions used for the Berrima Cement Plant in the past and these were for Class F stability conditions. The noise objectives in the approval were based on modelling with these conditions. Both models were also used to predict results with the CBP approval meteorological conditions of Class D stability and 0.5m/s wind speed.

For the *Predictor* model predictions with sound intensity results, the predicted sound levels for Class F stability were a minimum of 9 dB below the compliance objective. For Class D conditions they were a minimum of 12 dB below the objectives.

For the ENM model predictions with sound pressure level measurements, the results depend on which approach is taken to adjusting the measured **On** sound levels when they are within 3.5 dB of the **Off** sound levels. Methods according to Australian and International standards require ignoring values when the differences are less than 3.5 dB and adjusting the sound levels for those values with greater differences, and results were calculated with this approach. A modified method was also used to present a more realistic or expected emission condition calculation. Additionally, a third method using the maximum possible **On** condition sound level, not recommended by Standards, was also used to provide a comparison. The results calculated showed for the more realistic emission condition calculation, sound levels predicted for residential receivers for Class D stability and 0.5 m/s wind speed were more than 10 dB below the compliance objectives of the Pre-construction Noise Verification Report. For the compliance location 20, the predicted contribution was 20 dB below the objective.

For Class F conditions used in the calculations, the predicted contribution sound levels were at least 5 dB below the objectives. Even with the maximum possible noise emission and Class F conditions, the predicted sound levels did not exceed the recommended compliance objectives.

Based on these two calculation methods, it is the assessment of this report that the noise emissions from the operational CBP are in compliance with the recommended objectives of the Pre-construction Verification Report.

1 Introduction

Boral Cement Limited operates the New Berrima cement works near Berrima and Moss Vale in the New South Wales' Southern Highlands region. In May 2021, approval was granted to construct and operate a Chloride Bypass Plant (CBP) attached to the No.6 Kiln. The approval conditions included requirements to prepare a Noise Verification Report prior to construction and also within three-months of commencement of operations.

The Pre-construction Verification Report was prepared by SLR Consulting in September 2021 (610.18553-R02-v1.0). The plant was constructed in 2022 to 2023 and completed commissioning in November 2023. A photograph of the completed CBP is shown in Figure 1.1.



Figure 1.1: View of the CBP from the north-west, with the Kiln 6 Preheater tower behind

This report provides a Verification Report of the operational CBP, based on measurements on 14 December 2023 with the Cement plant fully operational, as well as measurements with the CBP shut-down while the rest of the Cement plant was operating. Sound level measurements were taken during the same time as the measurements for the annual environmental noise assessment for the Cement Plant, which is covered in a separate report.

The section of the Chloride Bypass System which is located adjacent to Cement Mill No.7 and no.5 buildings, shown in Figure 1.2, was not operating during the measurements. This is not considered to be significant as the surrounding buildings provide very good shielding for sound propagation to all compliance locations.



Figure 1.2: View of the satellite section of the Chloride Bypass System near CM5 and CM7

This report has been prepared by Colin Tickell and Stephen Collings of Recognition Research Pty Limited, an engineering consulting business in acoustics. Both of these are experienced and qualified to provide the assessment. Colin is a Fellow of the Australian Acoustical Society and has worked continuously in assessment and management of environmental noise in heavy industry in Australia for over 40 years. He is currently Chair of Standards Australia Technical Committee AV-001 Acoustics, and has been engaged to advise Boral Cement Berrima plant on noise since 2002. Stephen is a full Member of the Australian Acoustical Society and has worked with Colin on environmental noise assessment for eighteen years.

2 Scope of work for the verification

The scope of work was to provide an assessment of the contribution sound levels predicted to occur from the CBP at nominated residential receivers (4 Melbourne St, 12 Brisbane St and Taylor Avenue near Adelaide St) and the Licence condition assessment Location 20. A noise verification report of the assessment to be provided, according to CBP approval condition 3.6. The assessment will be done for typical worst-case sound propagation conditions, as required by the NPfl and noted in the conditions of approval for the plant L5.3 and L5.4.

The work included the following:

- i. Attended measurements of sound pressure level and one-third octave band spectra taken at locations close to and on the structure of the CBP at accessible locations. Measurements were taken during the plant in the two conditions of not operating and in normal operation.
- ii. If possible from the sound pressure level measurements, the noise emission of the CBP in terms of its sound power levels to be determined. (The reason the term 'if possible' is used is because there is a possibility that the sound levels of the CBP may be masked by the existing sound levels from the Kiln 6 and preheater tower operations – this will occur if the operating sound levels are within 5 dB of the non-operating sound levels and is more likely on the southern side of the CBP. This condition was found to occur.)
- iii. Measurements of sound power levels of CBP source items were obtained using a Sound Intensity (SI) measurement system, which includes the direction of the sound near a source and is more likely to obtain source sound power levels in the presence of other noise sources, than occurs using sound pressure level measurements. However, the SI measurement system is also constrained for some source locations where the ambient noise from other external sources is much higher than the subject source or in the same direction as sound from the subject. This was also found to occur in this case.
- iv. Attended measurements were also taken at the environmental noise monitoring location, Location 20, while unattended monitoring also occurred at the same location as well as the North Fence and 4 Melbourne St monitoring locations (used for the Annual Noise Assessment). These were obtained with the CBP operating and then idle. The two sets of measurements are compared to identify if there are any changes in the received sound levels and spectra identified from operation of the CBP.
- v. The noise emission of the CBP obtained in paragraphs i and iii above have been used in computer noise modelling software to predict the receiver contribution sound levels during typical worst-case weather conditions for the site and those noted in L5.3 and L5.4 of the approval conditions. Two different prediction methods were used for this – one for the results of the sound pressure level measurements and one from the SI measurements.

- vi. The results of the calculations have been compared with the noise objectives for the CBP provided in the Pre-construction noise verification report, as these have already been accepted by the EPA. A comparison is also made with attended and unattended monitored sound levels for those locations from the annual environmental noise assessment.
- vii. This document provides a report of the assessment as a verification noise report and lists all results and the basis of the assessment of compliance.

3 Compliance objectives

The Pre-construction Verification Report provided the following noise objectives for the CBP. These were based on Approval Conditions 3.6A and 3.6B. These are shown in Table 3.1 below.

Table 3.1: Noise Compliance Objectives for Chloride Bypass Plant Operation

Location	Time of Day	Objective $L_{Aeq, 15-min}$
Location 20 – noise compliance point	Day	52
	Evening	52
	Night	52
Taylor Ave near Adelaide St	Day	42
	Evening	38
	Night	37
12 Brisbane St	Day	40
	Evening	36
	Night	34
4 Melbourne St	Day	45
	Evening	39
	Night	34

The values shown are 6 dB below the recommended total contribution sound level objective for any additional new plant and projects at the cement plant, as provided in the report '*PRP7 Response – Identifying Environmental Noise Objectives For Cement Plant*'.

The values shown in Table 3.1 are contribution sound levels. That means they are the theoretical sound levels that might be caused by the CBP and measured if there were no other noise sources discernible or measurable at the receiver locations; such a condition is unlikely to occur with the addition of noise from other cement plant operations, road traffic and other environmental noise sources. Because of this, the assessment will need to provide prediction modelling of the receiver sound levels. The approval included the following meteorological conditions for the assessment:

Stability Categories A, B, C and D with wind speeds up to and including 0.5m/s at 10m above ground level. For those meteorological conditions not referred to, the noise limits that apply are the noise limits plus 5dB.

4 Noise measurement results

4.1 Sound pressure levels

Sound levels were measured on 14 December during daytime operation. The CBP was operating while the satellite plant for feed to No.7 Cement Mill was not. During the afternoon, the CBP was turned off for 30 minutes specifically to obtain sound levels with it not operating. During these measurements the kiln and associated plant were operating normally. Sound levels around the CBP were noted to be significantly affected by noise emissions from the Kiln 6 and pre-heater tower.

Table 4.1 shows the tabulated list of sound level measurements at locations on and around the CBP with it operating and not operating. Approximately 54 measurement locations were used for this section. The difference between the two measurements is also shown. Detailed one-third octave band sound levels for these measurements are shown in Table 4.2 in Appendix A. This table also highlights where the difference between the **On** and **Off** measurement is less than 3.5 dB, which is relevant for using the source data in prediction calculations according to methods in Australian and ISO Standards. Graphs comparing the one-third octave band spectra for the $L_{Aeq,t}$ and $L_{A90,t}$ data are provided in Appendix A. Table 4.1 has a page number for Appendix A relating to the spectral graphs for the location. All tables and graphs for sound pressure levels are given in Appendix A.

Tables 4.1 and 4.2 and the spectral graphs show that in most of the measurement locations there is not a significant difference in the **On** and **Off** sound levels, indicating that the rest of the plant is providing sound levels similar to or greater than those from the CBP. In some cases, the **Off** sound level was higher than the **On** sound level, possibly related to minor variations in external sound levels at the time. This small difference provides a great difficulty in assigning a sound level specifically to the CBP source. For this reason, the Sound Intensity measurement method was also used to try to get a more accurate value on CBP source sound levels. This is described in the next section.

Table 4.1: Boral Cement Berrima - Comparison of On and Off Sound Pressure Levels for CBP 14 December 2023

Location Description	Graph Page	L _{Aeq} On	L _{Aeq} Off	L _{Aeq} Diff	L _{A90} On	L _{A90} Off	L _{A90} Diff	Comment based on spectra comparison
A: N side opp. Baghouse Fan motor @ 6.4m to motor end	1	75	74	1.2	75	74	1.2	Influence from VFD
B: N side centre, edge concrete between N columns opp. Pump	2	75	75	-0.1	75	75	-0.1	Minor VFD
C': BH fan Motor Platform discharge casing exp. Joint N side 0.5m	3	79	77	2.2	79	77	2.1	Influence from VFD
C': BH Fan Casing discharge W side 0.5m	4	79	79	-0.1	79	79	-0.1	Minor VFD
C: W side near BH fan, between duct support and fan discharge expansion joint @ 0.79m	5	79	79	-0.1	79	79	-0.1	Minor VFD
C: W side near BH fan, between duct support and fan discharge expansion joint @ 0.79m 2nd Off	6	79	79	0.0	79	79	0.0	Negligible difference
D': BH fan Motor platform Casing N on W side 0.5m								
D: BH Fan motor platform NW side 2.1m to fan shaft bearing at casing	7	80	76	3.4	79	76	3.2	Influence from VFD
D: BH Fan motor platform NW side 2.1m to fan shaft bearing at casing, 2nd On	8	77	76	0.4	76	76	0.5	Negligible difference
E': BH fan Motor W side 0.5m	9	88	76	11.4	87	76	11.2	Significant VFD
E': BH fan Motor W side 0.5m, 2nd On	10	76	76	0.0	76	76	0.0	No VFD
E'': BH fan Motor platform coupling W side 0.5m	11	83	76	6.8	82	76	5.8	Significant VFD
E'': BH fan Motor platform casing E on N side 0.5m	12	84.6	76	9	83.4	75	8	Significant VFD
E*: BH fan Motor end 0.5m	13	84	76	7.3	81	76	5.5	Significant VFD
E'': Motor E side by VFD box 0.5m	14	85	76	9.4	83	75	7.8	Significant VFD
E: BH fan Motor platform motor end @ 1.0m	15	82	76	5.4	81	76	4.9	Significant VFD
F: W side of BH fan platform area 3.97m to duct support	53	76	78.9	-3	76	78.5	-3	Increase with off
G': BH fan Inlet platform S side @ 0.5m scan over 2mx1.5m	16	77	77	0.1	77	77	-0.2	Negligible difference
G: S side of BH fan inlet platform@ 1.09m to duct	17	77	77	0.4	77	77	0.3	Minor VFD
H': E side of plant opp. BH fan @ 9.0m and in-line with edge of tower columns	18	76	76	0.5	76	75	0.7	Negligible difference
H: S side of plant at kerb on Kiln Road, opposite W side of PHT & stairway platform @ 4.7m	19	81	81	0.0	80	80	-0.2	Negligible difference
I: Level 1, S of fan inlet @ 2.1m	20	78	77	0.7	77	77	0.7	Minor VFD
J''': Centre Ducon valve on its N side @ 1m	21	77	77	0.1	77	76	0.2	Negligible difference
J': W side Ducon valve on its N side @ 1m	22	77	77	0.2	77	76	0.2	Negligible difference
J'': W side Ducon valve on its W side @ 1m & above SC drive	23	77	77	0.0	77	76	0.1	Negligible difference
J: Level 1, 1m S of Ducon valve	24	77	78	-0.6	77	77	-0.3	Marginally higher off
K: Level 2 opp fan inlet duct by column @ 2.5m	25	77	77	0.6	77	77	0.5	200 Hz effect 5 dB
L: Level 3 N side of fan discharge on E side by pipe @ 1.8m	26	78	75	2.9	78	75	3.0	Minor increase On
M': L3 W side of fan & motor @ 1m	27	78	75	2.4	77	75	2.9	Minor increase On
M: Level 3 N side of fan & motor @ 1m	28	78	74	3.7	78	74	4.0	Minor increase On
N'': L3 E side of expansion joint on S side of baghouse hopper	29	78	79	-1.5	77	79	-1.6	Marginally higher off
N: Level 3 W side of valve expansion joint @ 0.8m by frame	30	78	79	-1.0	78	79	-1.0	Negligible difference
O': Big duct at bend @ 0.5m	31	79	80	-0.2	79	79	-0.1	Negligible difference
O: Level 3 W side on platform @ 1m by duct	32	79	79	-0.3	79	79	-0.3	Negligible difference
P'': L6 baghouse doorway @ 0.5m closed	33	79	79	0.0	78	78	-0.3	Negligible difference
Q: Top of BE tower, 0.9m on W side of BE	34	77	79	-2.1	76	76	-0.1	Negligible difference
R: Top level BE tower, S side of Dust Collector Motor @ 1m	35	77	79	-1.6	76	77	-0.4	Negligible difference
S': same location pointing towards PHT @ 30m	36	77	78	-0.9	77	77	-0.4	Negligible difference
S: Top level of BE tower S side of platform	37	78	78	-0.8	77	77	-0.5	Negligible difference
T': Top of Rad cooler no fans	38	78	79	-0.7	77	78	-0.9	Marginally higher off
T: Level 5 Radicon cooler top fan level opp S fan @ 1.2m	39	79	80	-0.9	78	79	-0.9	Marginally higher off
U: L5 Rad cooler N fan @ 1.2m	40	78	80	-2.4	77	79	-2.3	Marginally higher off
V': L4 northern fan	41	78	80	-2.3	77	80	-2.3	Marginally higher off
V: Level 4 Rad cooler S fan @ 1.4m	42	80	80	-0.9	79	80	-1.2	Marginally higher off
W: Bottom level Rad cooler S side valve @ 1m	43	78	80	-1.9	78	79	-1.7	Marginally higher off
FA276 #1: 2m S of casing	44	86	85	0.6	83	84	-0.2	Negligible difference
FA276 #2: 1m S of motor	45	85	85	0.2	84	84	0.1	Negligible difference
FA276 #3: 1m W of motor end	46	84	85	-1.4	83	84	-0.7	Marginally higher off
FA276 #4: 1m N of motor	47	85	82	3.2	84	81	3.2	Marginally higher on
FA276 #5: 0.5m N of discharge casing	48	84	82	1.9	83	81	2.2	Marginally higher on
FA276 #6: 0.5m N of inlet silencer side	49	83	81	1.7	82	80	2.5	Marginally higher on
FA276 #7: 1m E of inlet silencer opening	50	86	83	2.9	85	81	3.6	Marginally higher on
FA276: Above fan	51	84	83	1.1	83	82	1.0	Negligible difference
Admin Building Roof SE Corner	52	73	72	0.2	71	71	0.3	Negligible difference
Admin Building Roof SE Corner 2nd On	52	71	72	-1.5	68	71	-3.3	Negligible difference

4.2 Sound Intensity measurements

4.2.1 Basics

The use of sound intensity rather than sound pressure to determine sound power means that measurements can be made in the presence of similar ambient noise. A sound source radiates power and this results in a sound pressure. Sound power is the cause, while sound pressure is the effect. Sound power is parameter that is required as an input to the sound model. It is measured with a probe with 2 microphones, mounted face to face with a solid spacer in-between, directed towards the source in one direction along the probe axis; this probe is attached to a special sound level meter which then can determine the amount of sound power being produced in a direction along the probe's axis. Sound intensity is the amount of power per area and is a vector quantity, so the probe system is moved in a swept motion across a plane normal to the direction of sound from the source; in this case the area of the sweep was 1m^2 . The standard *ISO 9614-2 Acoustics - Determination of sound power levels of noise sources using sound intensity - Part 2: Measurement by scanning* indicates the process and desired accuracy that can be obtained and is the method used by the meter software. Survey accuracy was selected for these measurements.

The instrument used was a Norsonic NOR150 meter with associated probe Kit and scanning method as shown in Figure 4.2.1 below

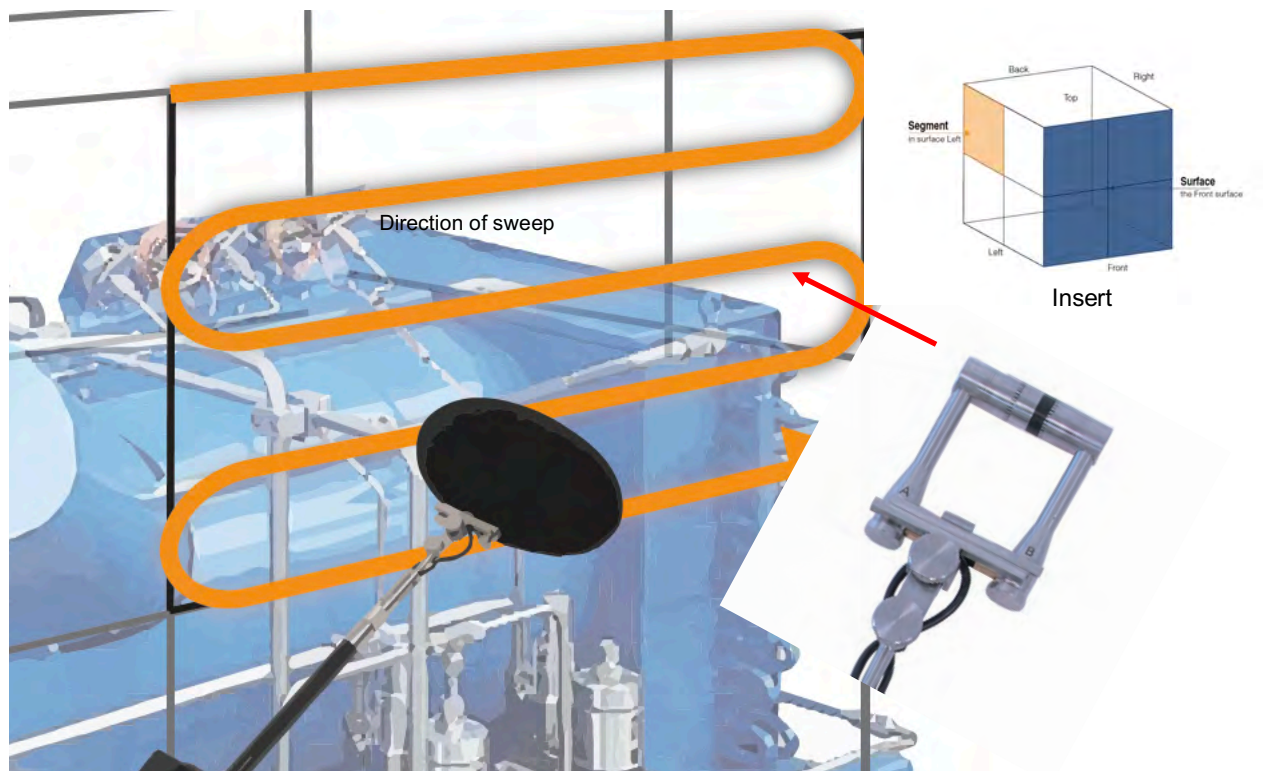


Figure 4.2.1 The Norsonic probe system indicating the scan process used for these Sound Power measurements using the sound intensity method.

4.2.2 Methodology and Results

As with the sound pressure measurements, scans were performed with the CBP plant working and not working. Even though this method is designed to reduce the effect of background noise, certain locations that were measured were directly facing both the item in question and the kiln behind, and in some cases reflections from buildings produced from the kiln, consequently including both sources in the measurement. One-Third Octave frequency bands from 50 Hz to 6300 Hz were measured as per the Standard ISO 9614-2. Table 4.2.1 describes the working sheet for Position B (refer to Appendix B Figure B1 - facing the CBP and the Kiln) by which the A-weighted One-Third Octave bands were obtained. In some cases, not all bands are included. This is because if the '**On**' case received a negative measurement, this indicates that noise is not coming normal to the leading microphone, and it should be discarded. If the '**Off**' case is larger than the '**On**' case, then the result in that band is also discarded.

There were two larger fan motors involved in the survey, kiln fan FA276 (refer to Appendix B Figure B6) and the CBP Baghouse Fan located near Position D & E (refer to Appendix B Figure B1) and the method of sound intensity determination for these was to encase the motor in an imagery box (cuboid) and the front, top and 2 surfaces were measured as shown in the insert of Figure 4.2.1.

The calculation sheet of the motor can be shown in Table 4.2.2 indicating the surface types and sound power for the Fan 276 motor as an example.

Table 4.2.1: Working sheet example for the one-third octave spectrum value for Position B

Frequency Band (Hz)	Lw Microphone Direction pointing out (Z weighting)		Difference between On & Off (dB)	1/3 Octave Band (dBA)
	Pos B CBP On	Pos B CBP Off		
50		81.6		
63	76.8	70.7	6.1	49.4
80	70.1	62.9	7.2	46.7
100	74	72.4	1.6	49.8
125	65.2	65	0.2	35.6
160	63.8	67.8	-4	
200	70	68.5	1.5	53.8
250	59.6	64.2	-4.6	
315		-45.9		
400	62.2	63.6	-1.4	
500	60.9	62.6	-1.7	
630	59.8	61.6	-1.8	
800	59.6	60.9	-1.3	
1000	59.4	60.8	-1.4	
1250	58.1	59.1	-1	
1600	56	58	-2	
2000	56.1	57.5	-1.4	
2500	53.4	56.5	-3.1	
3150	52.6	55.1	-2.5	
4000	59.4	53.7	5.7	59.0
5000	50.2	51.6	-1.4	
6300	48.4	49.2	-0.8	

Total LW 61.0

Table 4.2.2: Total Sound Power Level Summary for Fan276 Motor (as an example)

1/3rd Octave Band Frequency - Hz	A-weighting	Front	East	West	Top	Total PWL	Total PWL _A
50	30.2		65			65	35
63	26.2		56			56	30
80	22.5	31	59			59	36
100	19.1	58	58		53	62	43
125	16.1	51	63		55	64	48
160	13.4		66	57		66	53
200	10.9		63			63	52
250	8.6		63			63	54
315	6.6		65			65	59
400	4.8		64			64	59
500	3.2		65		59	66	63
630	1.9	65	67		62	70	68
800	0.8	63	74		61	75	74
1000	0	74	70			75	75
1250	-0.6	65	62			67	67
1600	-1		64			64	65
2000	-1.2	55	60			62	63
2500	-1.3	39	63		46	63	65
3150	-1.2	61	66	57	63	69	70
4000	-1	66	56	65	68	71	72
5000	-0.5	53	53	50	56	60	60
6300	0.1	52	53	51	55	59	59
Total	46					81.3	80.5
Total		76	79	67	71	81	81

A full list of the sound power measurements using the Sound Intensity method including the Eastings and Northings coordinates can be found the Appendix B Table B1.

4.3 Receiver location sound levels

Sound levels were measured with the CBP **On** and **Off** using the unattended logging sound level meters.

The results are provided in Table 4.3.1. They indicate no significant difference between the **On** and **Off** conditions of the CBP while the rest of the Cement Plant continued to operate.

**Table 4.3.1 The unattended Logged data at
Location 20 for the periods when the CBP was
Operating (ON) and Not Operating (OFF)**

Location 20			
		LAeq.15min dBA	LA90.15min dBA
CBP OFF	11/12/23 22:00	57	56
	11/12/23 22:15	57	56
	11/12/23 22:30	57	55
	11/12/23 22:45	57	55
CBP ON	12/12/23 2:00	57	56
	12/12/23 2:15	57	56
	12/12/23 2:30	57	56
	12/12/23 2:45	57	56

5 Prediction of Contribution sound levels

Two methods of sound level prediction contribution calculations were used. This was because of the sound levels from the CBP being mostly less than the sound levels caused by the rest of the cement plant at the CBP source locations. The first method used the values for sound power levels derived using the SI measurements and a recently developed computer noise model *Predictor 2023.01*, which satisfies the requirements of ISO standards for prediction noise modelling.

The second method uses sound power levels derived from the sound pressure level measurements and the computer noise model ENM. While this model is older it has been successfully used for over three decades and is accepted by the EPA.

The reason for using two methods was to provide a better assurance of the compliance of the CBP emissions with its objective contribution sound levels.

5.1 Prediction model using SI derived Lw sound power levels and *Predictor Software*

5.1.1 Computer noise model and basis of calculation

A computer noise prediction model was used to calculate the contribution sound levels from individual sources as received at each of three residential receiver locations. Computer noise models include ground topography and ground type, source locations within the topography and meteorological conditions as inputs to the calculations. The noise modelling program used for this project is *Predictor 2023.01* (produced by Softnoise software – a Dutch and German joint venture company) using the International Standard *ISO 9613-2 Acoustics – Attenuation of sound propagation outdoors – Part 2 General method of calculation*.

As indicated in section 4.2, the sound power levels of the noise sources which were obtained by using the Scanning Sound Intensity method were used as inputs into the model as Sound power levels L_w . The one-third octave band spectra of the noise sources are provided in Appendix B.

The objective of the modelling is to obtain the worst-case contribution sound level night time period and therefore be able to compare it to the criteria at residential receivers. There were three scenarios considered:

1. The combined noise sources listed in Table B1 with no meteorological correction
2. The combined noise sources listed in Table B1 with the CONCAWE method with Class F wind speed 2m/s from the south to correct for meteorological conditions.
3. The combined noise sources listed in Table B1 with the CONCAWE method with Class D wind speed 0.5 m/s from the south to correct for meteorological conditions as required by the approval.

The approval calls for the *Stability Categories A, B, C and D with wind speeds up to and including 0.5m/s at 10m above*. As well running the approval meteorological corrections in scenario 3, the Stability Category of F was used with a wind speed of 2m/s coming from the south. These conditions are more enhancing for sound propagation than the approval condition, and were used in the development of the noise objectives for new projects at the site in the PRP Response report.

Atmospheric absorption factors were also set to be worse case i.e. air temperature at 5 °C and relative Humidity of 95% was used.

Directivity was also ignored, again to evaluate the worst-case condition. For example, the fan FA267 inlet noise was measured facing east, so there would be some reduction due to directivity in the direction of the receivers to the north and north-north west.

Ground absorption was also biased for worst case condition. All the ground was considered hard (ground factor 0.0 in the general method according to the ISO 9613) except for a large green space buffer zone north of the Cement works, which the ground factor was set to 1.0 i.e. soft ground.

The geometry of the noise source location was enabled by the use of the 3D plant drawing that was supplied by the client. No buildings were included as barriers, except for one large shed on the north east and 3 Silos, which again allowed for the worst-case condition to be modelled.

5.1.1 Results of the Computer noise model

Scenario 1: Model without meteorological correction

Table 5.1.1 indicates the results of the modelling at the different receiver locations used and Figure 5.1.1 shows the contour plot associated with that model for no meteorological correction, that is for neutral conditions.

Table 5.1.1: Model results showing the contribution of CBP noise sources without Meteorological correction i.e. neutral conditions.

Receiver Description	Height of receiver	Night time Period (dBA)	Compliance Objective Night-time
Location 20	2	28	52
North Fence	2	25	
12 Brisbane St receiver	2	22	34
Cnr Taylor Ave and Adelaide St receiver	2	21	37
4 Melbourne St receiver	2	21	34

The maximum value at any of the residential receiver locations is 22 dBA at 12 Brisbane St.

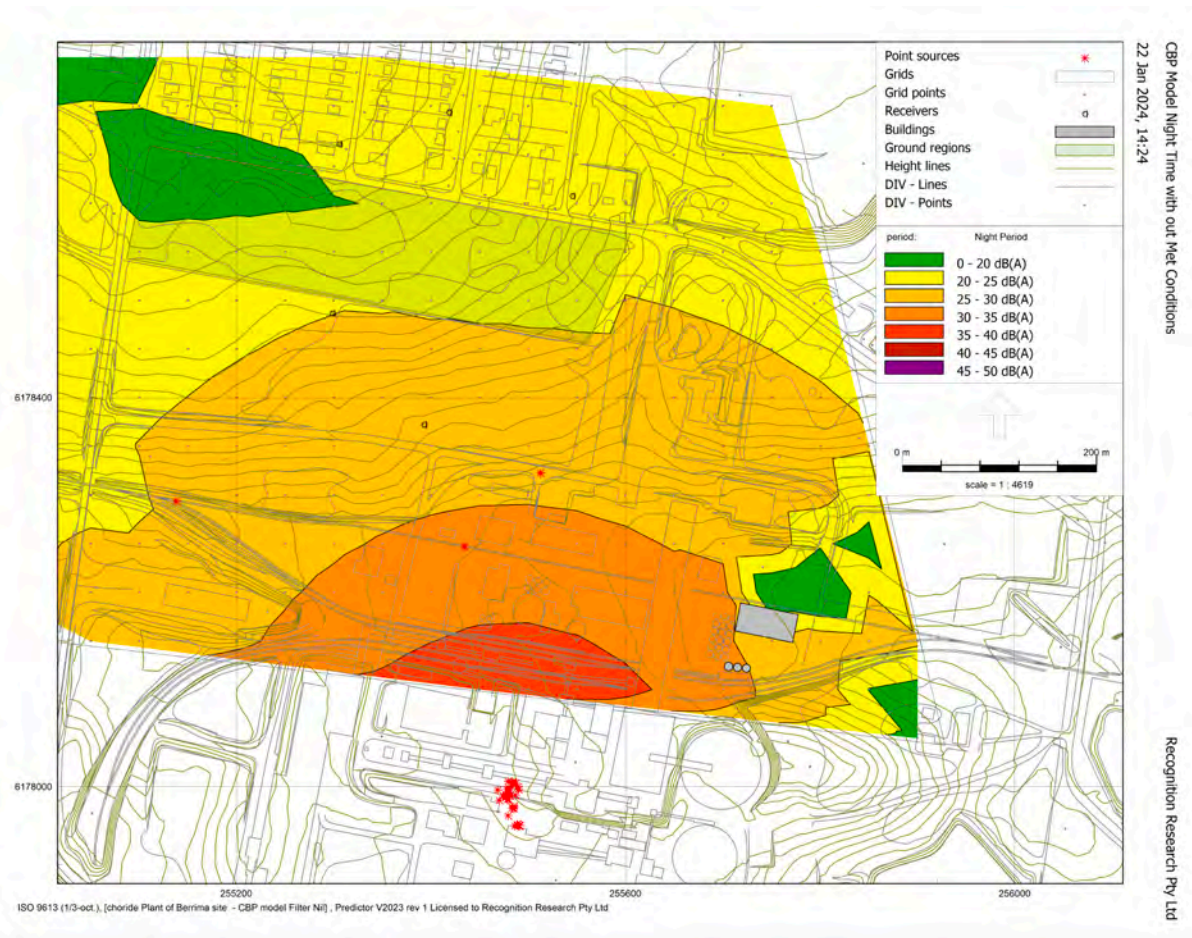


Figure 5.1.1: Sound level contour map of the Model without meteorological correction

Scenario 2: Model with meteorological correction CONCAWE method Class F wind speed 2m/s from the South

Table 5.1.2 provides the results of the modelling when meteorological conditions of stability class F are used. Figure 5.1.2 shows the contour plot associated with that model.

Table 5.1.2: Model results showing the contribution of CBP noise sources with the Class F meteorological corrections added

Description	Height of receiver	Night time Period (dBA)	Compliance Objective
Location 20	2	30	52
North Fence	2	28	
12 Brisbane St receiver	2	25	34
Cnr Taylor Ave and Adelaide St receiver	2	24	37
4 Melbourne St receiver	2	24	34

The maximum value at any residential receiver location is 25 dBA at 12 Brisbane St.

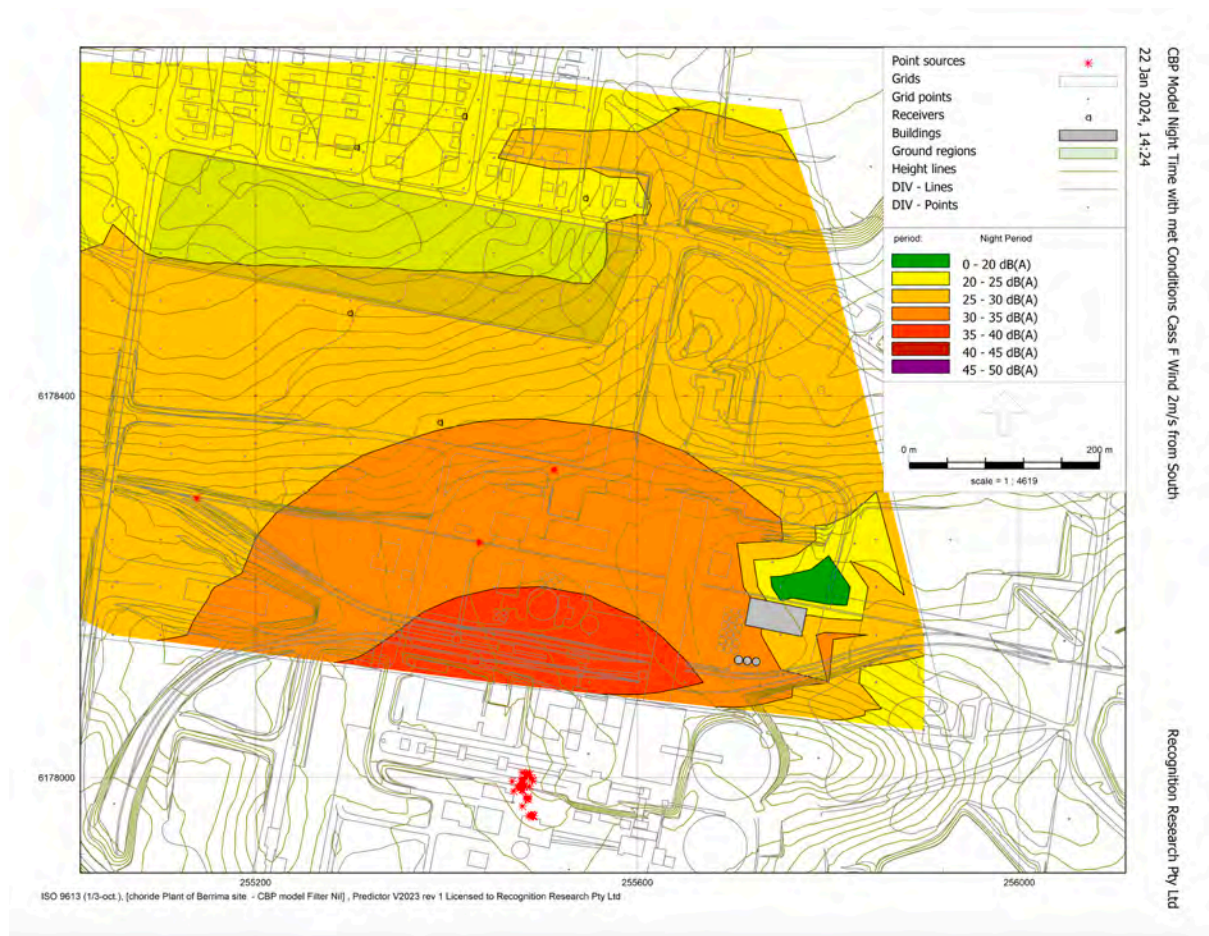


Figure 5.1.2: Sound level contour map of the Model with Class F meteorological correction added

Scenario 3: Model with meteorological correction CONCAWE method Class D wind speed 0.5m/s from the South

Table 5.1.3 provides the results of the modelling when meteorological conditions of stability class D are used. Figure 5.1.3 shows the contour plot associated with that model.

Table 5.1.3: Model results showing the contribution of CBP noise sources with the Class D meteorological corrections added

Description	Night	Compliance Objective
Location 20	28	52
North Fence	25	
12 Brisbane St receiver	22	34
Cnr Taylor Ave and Adelaide St receiver	21	37
4 Melbourne St receiver	21	34

The maximum value at any residential receiver location is 22 dBA at 12 Brisbane St.

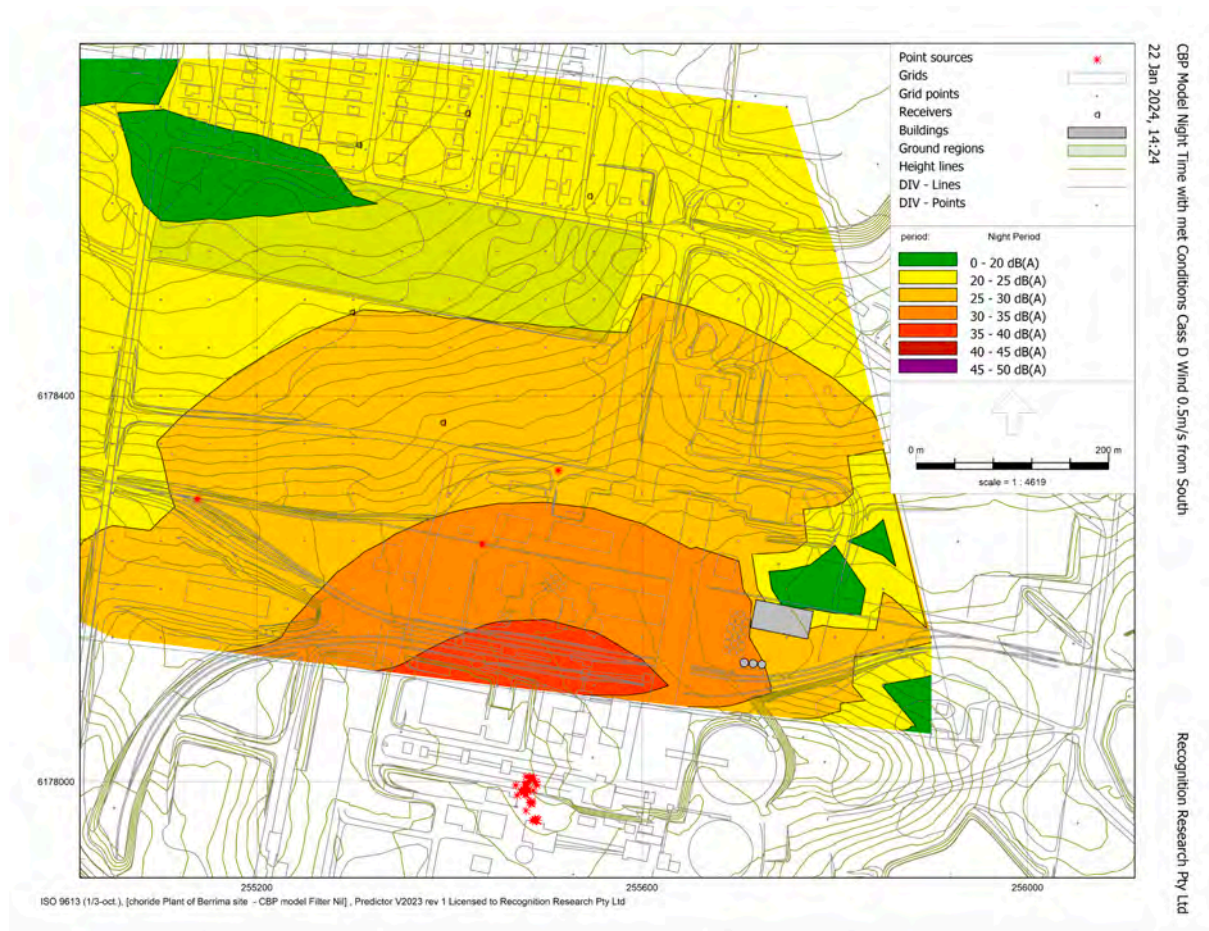


Figure 5.1.3: Sound level contour map of the Model with Class D meteorological correction added

As shown from Tables 5.1.1, 5.1.2 and Table 5.1.3 the maximum sound level contribution of the CBP received at any residential receiver location is 25 dBA at 12 Brisbane St. This is 9 dB below the noise compliance objectives for Chloride Bypass Plant set in the Preconstruction Verification Report, of 34 dBA for this receiver location. Predicted sound levels at other receiver locations are also further below the recommended compliance objective. The addition of the modelling of the Class F with 2m/s scenario is considered relevant for its inclusion to determine worst case scenario in this report; the results calculated with Class D stability and 0.5 m/s wind speed scenario has the same value as for neutral conditions. Also, it should be noted that building in the north east has a noticeable barrier effect on the area behind the building.

5.2 Prediction model using sound pressure level derived L_w sound power levels and ENM

The normal method of prediction of the contribution sound levels from a source to a receiver involves the following:

1. Measurement of sound levels with the source operating
2. Measurement of sound levels without the source operating.
3. Calculate the difference between the two conditions and obtain the source sound level in one-third octave band frequency levels. Preferably the difference between the two sound levels should be greater than 10 dB to be sure that the subject sound is from the source and not from the ambient environment (of combined other sources). If the difference is between 4 dB and 10 dB, an adjustment to the source sound level can be made by logarithmic subtraction of the **off** sound level. If the difference is less than 4 dB, methods provided in Standards do not allow use of the source sound level in calculations.
4. Calculate the sound power level from the source by adding a factor based on the size of the source and distance of the measurement. For a point source located well above ground, the addition is:

$$L_w \text{ sound power level dB} = L_p \text{ sound pressure level} + 20 \times \log \text{ Distance} = \text{SPL} + 11 \text{ dB for 1m}$$

5. Calculate the sound level at the receiver location – for distances greater than 100m, this will involve consideration of the distance, ground type and its sound absorption characteristics at different frequencies, topography of the ground surface and its barrier effects, and air-absorption based on air temperature and relative humidity. The calculation is best done using an accepted computer noise model because of the multiple frequencies and ground topographic effects involved. In this case, the Australian developed computer noise model ENM was used with the sound pressure level derived values. This program was developed in NSW in the 1980's and has been verified by many authors and accepted by the EPA as a conservative method.

Using ENM, the most enhancing meteorological conditions relevant to the source-receiver site can be used for the worst-case predictions. In this case, it is considered that the most relevant is 5°C with 95%rh to represent a high humidity cold winter morning, plus an atmospheric temperature inversion of 3°C/100m and a wind speed of 2m/s from the source towards the receiver. This is similar to Category F stability conditions, which is more enhancing than the required Category D stability conditions of the approval conditions.

Inputs required to the model include ground topography, ground absorption type and source sound power levels. Figures 5.2.1 to 5.2.3 show the ground profiles between the PHT and the receiver locations. One of each figure has an enhanced vertical scale, with a second graph having similar vertical and horizontal scales.

To simplify the calculations, a generic sound source with a flat spectrum of 92 dBA was initially used for the four different receiver locations. 10 source locations were used with ground location and elevation based on the CBP and PHT (for Fan FA276) layout, to represent all of the different sources in the CBP.

The computer noise model was run for three conditions of wind speed and lapse rate:

- Wind calm 0 m/s and neutral lapse rate 0°C/100m (W0L0)
- Wind 2 m/s and Cat F lapse rate 3°C/100m (W2L3)
- Wind 3 m/s and neutral lapse rate 0°C/100m (W3L0)

The results of the calculations are as shown in Table 5.2.1

Table 5.2.1: Calculated receiver sound levels for flat spectrum 92 dBA compared to Pre-construction noise verification report objectives (PCNVR Obj)

Receiver	Meteorological Condition Wind Speed and Lapse rate			
	W0L0	W2L3	W3L0	PCNVR Obj
Taylor Near Adelaide	31.1	36.3	35.3	37
12 Brisbane	29.1	34.5	33.5	34
4 Melbourne	29.7	35	34	34
Loc 20	37.3	40.6	40	52

The results of this initial calculation indicate that the most enhancing condition of these is 2m/s wind speed and 3°C/100m lapse rate. The most sensitive receiver location is 4 Melbourne St.

The values obtained from the modelling were used to calculate the reduction in sound level from each source location to the four receivers. This reduction can then be added to the source levels to calculate the receiver sound levels without the need to rerun the model with the measured source levels for each source to receiver case. In simple terms, the calculation of received sound level is as follows:

Point Source Sound Pressure Level L_{pA} FA276 = 84.6 dBA

Point Source Sound Power Level $L_{wA} = L_{pA} + 11$ = 95.6 dBA

Reduction in L_{wA} to L_{pA} at 4 Melbourne St for FA276 (in ENM) = 71.3 dB

Received contribution sound level at 4 Melbourne St $L_{pA} = 95.6 - 71.3$ = 24.3 dB

This calculation is made for each one-third octave band and for each source.

Figure 5.2.1: Ground Elevation profile from PHT to corner Taylor Ave and Adelaide St

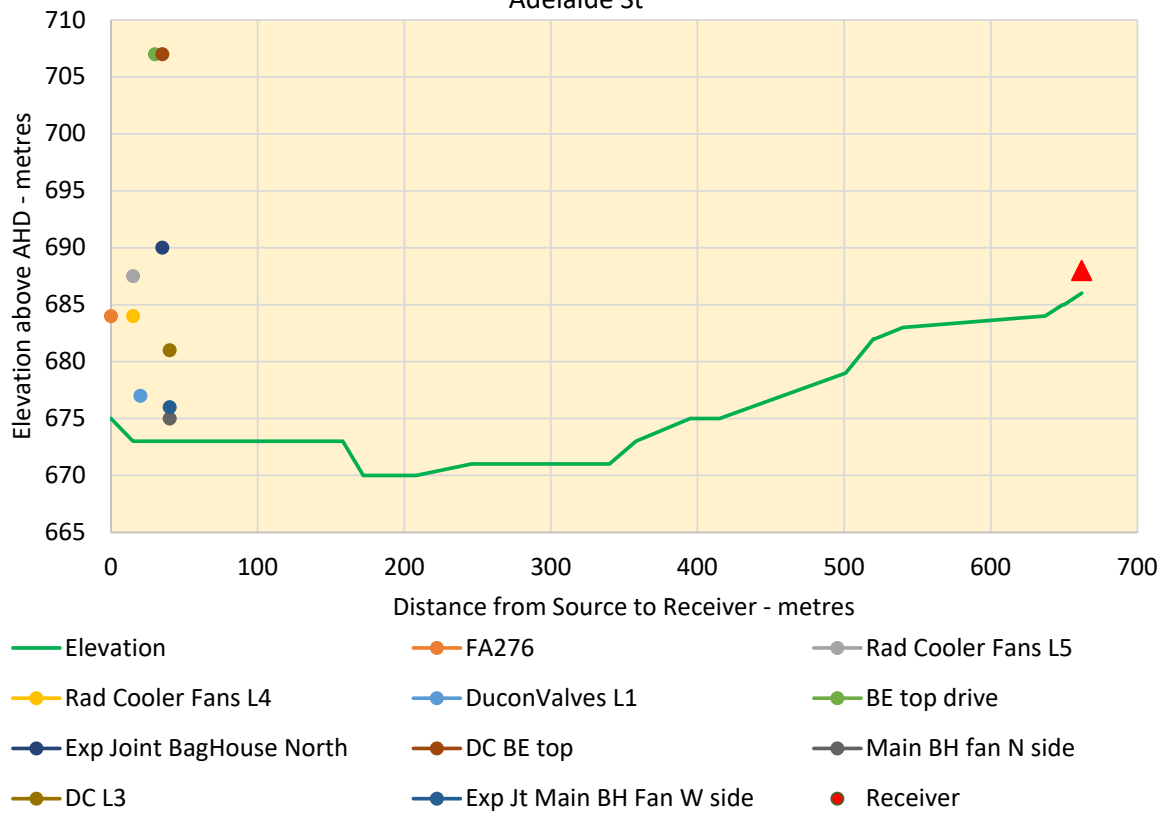


Figure 5.2.1A: Ground Elevation profile from PHT to corner Taylor Ave and Adelaide St - similar scales horizontal and vertical

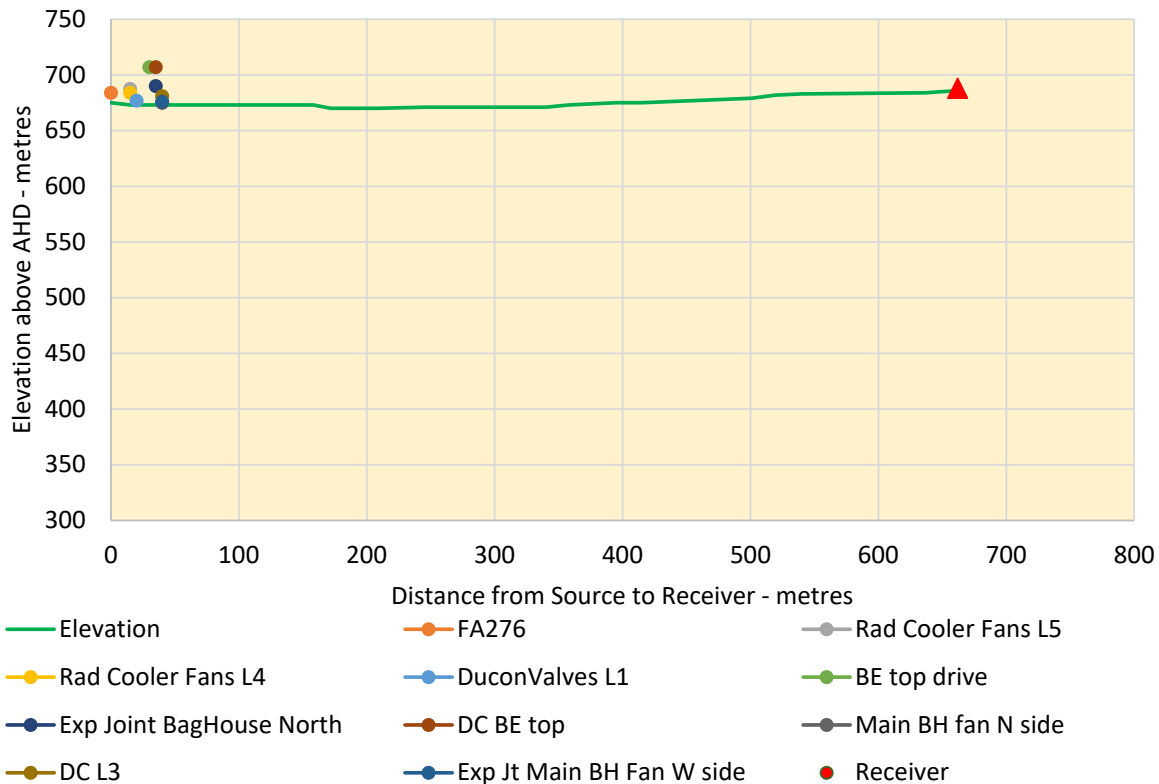


Figure 5.2.2: Ground Elevation profile from PHT to 12 Brisbane St

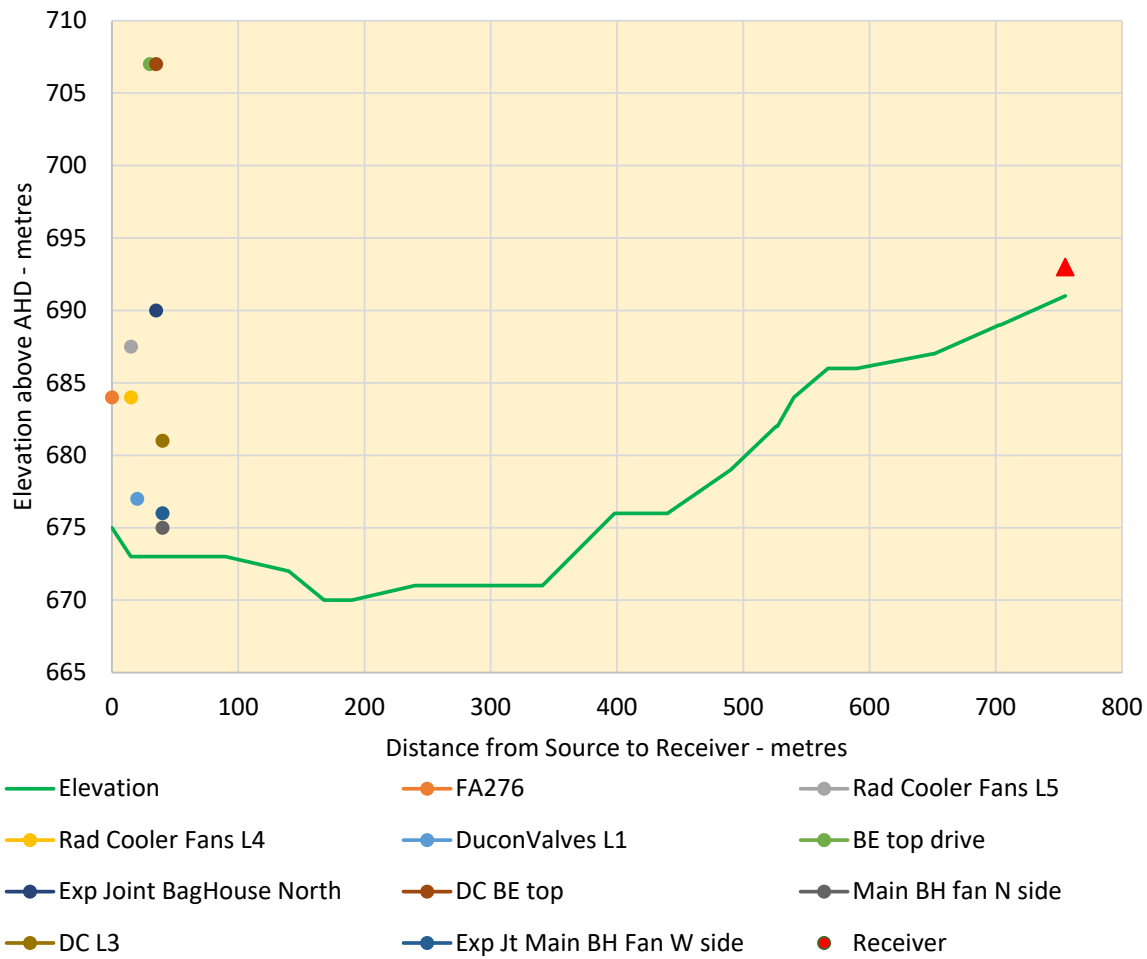


Figure 5.2.2A: Ground Elevation profile from PHT to 12 Brisbane St - similar scales horizontal and vertical

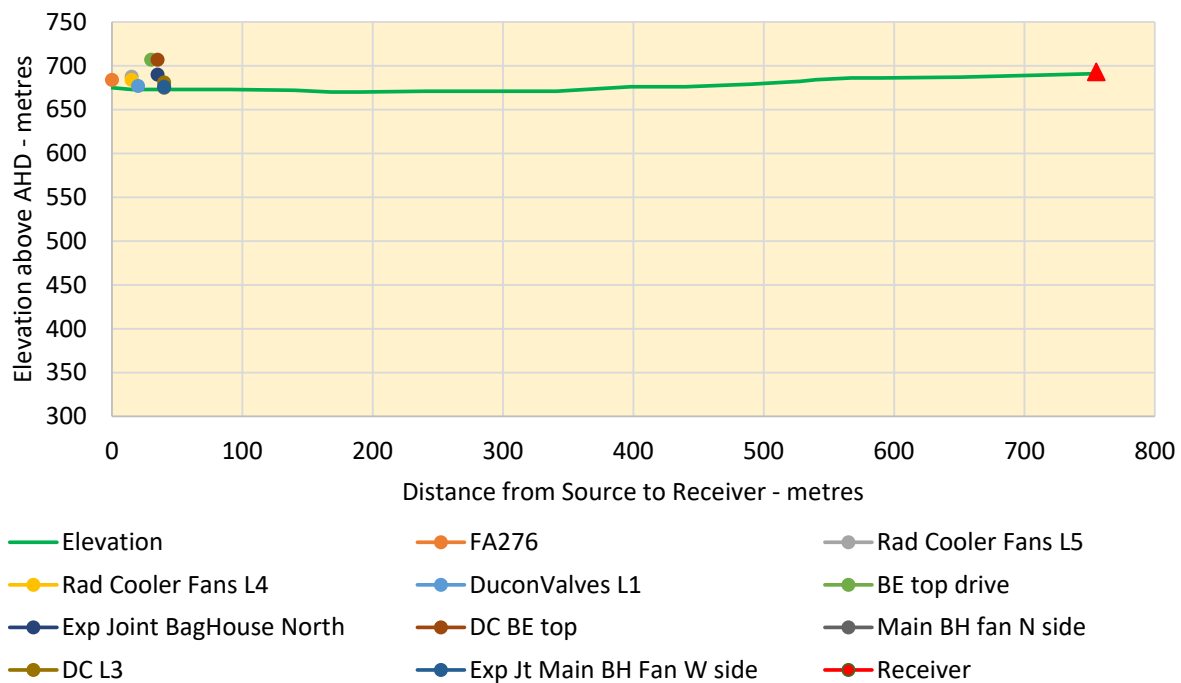


Figure 5.2.3: Ground Elevation profile from PHT to 4 Melbourne St and Location 20

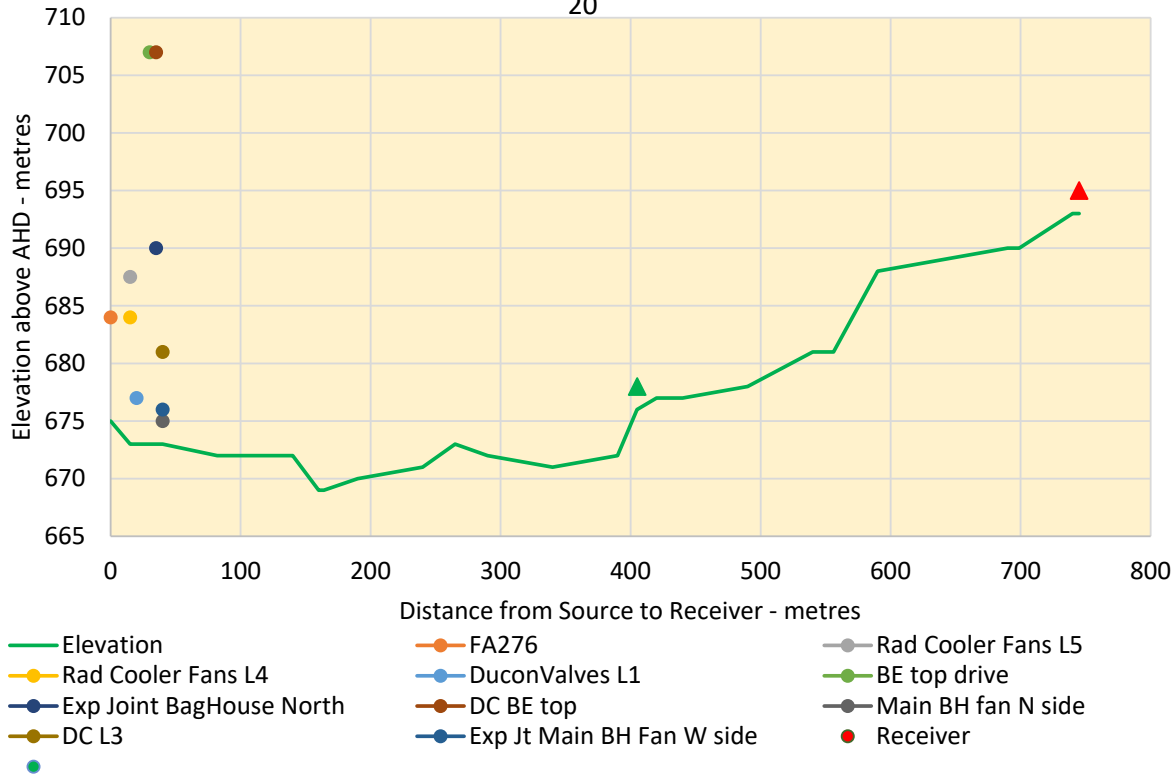
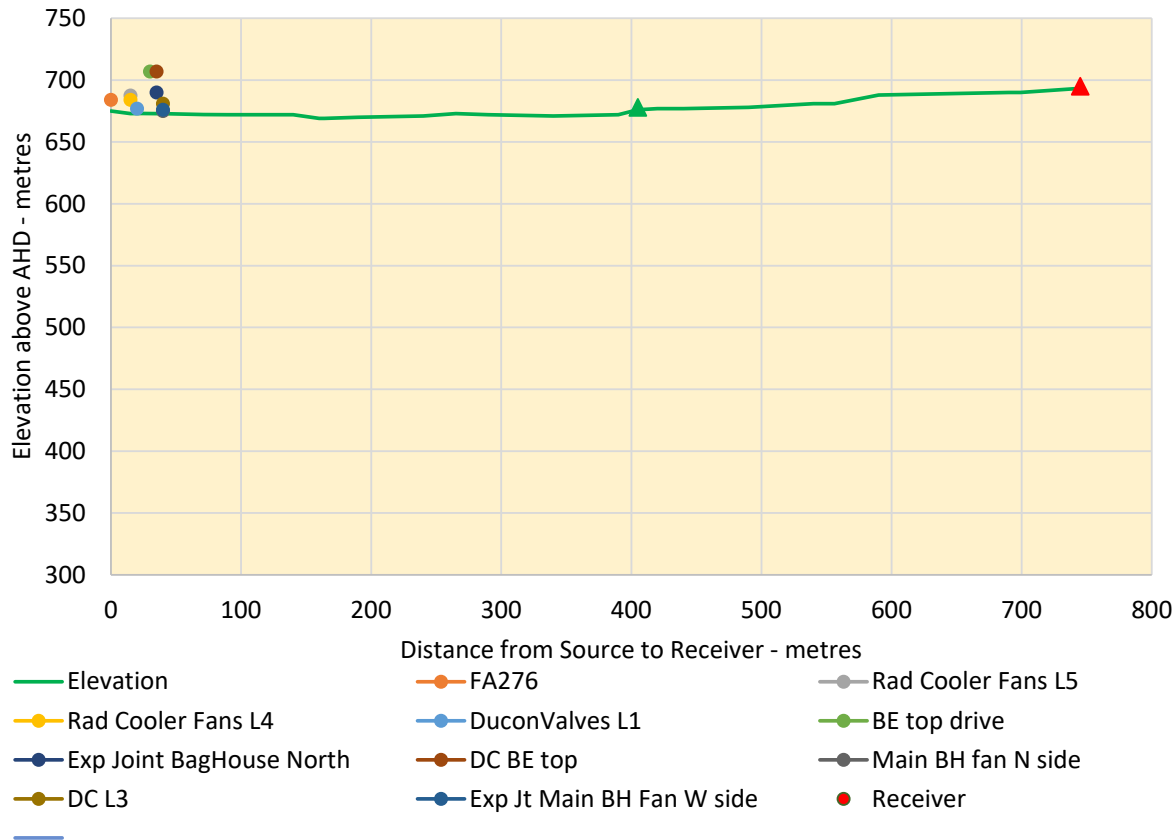


Figure 5.2.3A: Ground Elevation profile from PHT to 4 Melbourne St and Loc.20 - similar scales horizontal & vertical



5.2.1 Selection of the source sound levels

As noted in section 4 and described in step 3 above, sound levels around the CBP were affected by noise emissions from other sources at the Cement Plant. Sound levels measured in the **Off** condition were sometimes the same as or higher than those when measured in the **On** condition. For an accurate assessment of the operating noise emission, the sound levels should be more than 10 dB. Where the difference On to Off is between 4 and 10 dB, the adjusted sound level can be calculated. Theoretically other values can not be used for noise emissions can not be used. Figure 5.2.4 shows the values able to be used for the adjusted sources. All of the adjusted sources have most of the spectrum unavailable for use. The top section of Table 5.2.2 shows the Adjusted spectrum levels for sources.

To provide a conservative approach to potential source spectrum sound levels, a value was applied to the bands where the **On** – **Off** difference was less than 3.5 dB. In these cases, if the **On** band sound level was above the **Off** band sound level, the value used for the source sound was the **On** value – 10 dB. If the **Off** value was higher, the value used for the source sound was the **Off** value – 10 dB. This approach may understate some source levels but will more likely overstate most. This will give a potentially more realistic value of the source sound for calculation. This assumed source sound level was termed the Maximum Adjusted (Max Adj) level. These values are shown in the bottom section of Table 5.2.2.

Figure 5.2.5 shows the spectra for all sources obtained using this approach. Figures 5.2.6 to 5.2.17 compare the Adjusted spectrum sound power levels with the Max Adj sound power levels for each source. Figure 5.2.6 shows an additional spectrum for Fan FA276 – this was based on the area emitting the sound averaged over the whole fan and motor surface being 19m², rather than considering it as a point source.

While the Max Adj values may overstate the source sound power levels, it is considered they provide a more realistic value for comparison with the objectives.

An even more conservative approach for cases where the **On-Off** difference was less than 3.5 dB, would be to use a band sound pressure level value for the source of 3dB lower than the **On** value. This is on the assumption that two equal sound levels added together is 3dB higher than the individual source sound level. This would overstate the value of the **On** sound level – in sources in this case by 5 to 6 dB compared to the Max Adj level. This approach is not recommended because of the overstatement of source sound level; however, it has been added to the calculations for completeness. Table 5.2.3 compares the Max Adj and MaxMax Adj levels.

Table 5.2.4 shows the calculation of the contribution sound levels at 4 Melbourne Street with worst-case propagation (Category F stability) conditions for the source FA276 (average of all sound level measurements). It shows that the received sound level for the Adjusted source is 16 dBA, for the Max Adj source is 21 dBA and for the MaxMax Adj source is 28 dBA.

Table 5.2.5 shows the results of the calculations for all sources. In all cases discussed below, the calculation does not include any barrier shielding between the sources and receivers from the body of the CBP or other site buildings. This might be marginally significant for the Radicon Cooler fans and

some other sources. The model used has placed the sources in free space at their distance and elevation with only the ground conditions included.

The first three result columns show all contributions – two are used for the Bucket Elevator Drive with L_{Aeq} and L_{A90} values used for comparison because the Off measurements had significant wind conditions and it is considered that the L_{A90} results are a better indication of the source levels.

The second group of three result columns has the totals with the L_{Aeq} values removed.

The third group of result columns has directivity added to the Radicon Cooler fans – because these are at 90° or more to the direction of propagation from their eastern side towards the receivers, a reduction for the directivity loss (for 90°) as the sound travels around from the east direction towards the receivers. This is the more realistic value of contribution for these fans. The results show total received sound levels of 24 dBA for the Adjusted source levels, 29 dBA for the Max Adj sources and 34 dBA for the MaxMax Adj sources. These results can be compared with the 34 dBA night-time contribution objective in the initial verification report. This indicates that even with the source sound levels higher than the values obtained by the conservative approach used (Max Adj), the received contribution sound levels for Category F conditions are compliant with the values recommended in the Pre-construction verification report.

Figure 5.2.4: One Third octave Band Spectra - adjusted source sound power levels for model ENM

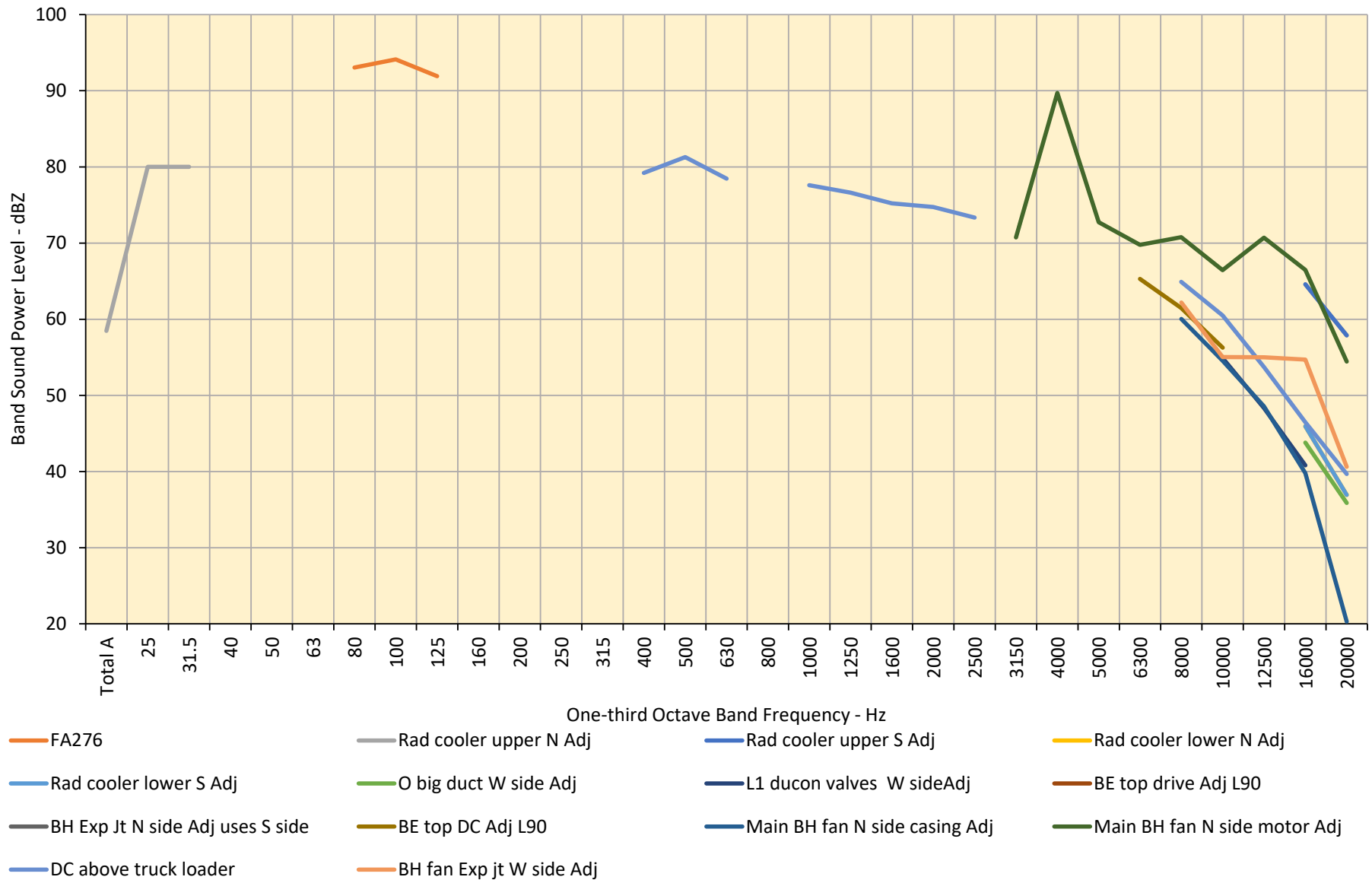


Figure 5.2.5: One Third octave Band Spectra - Max. adjusted source sound power levels for model ENM

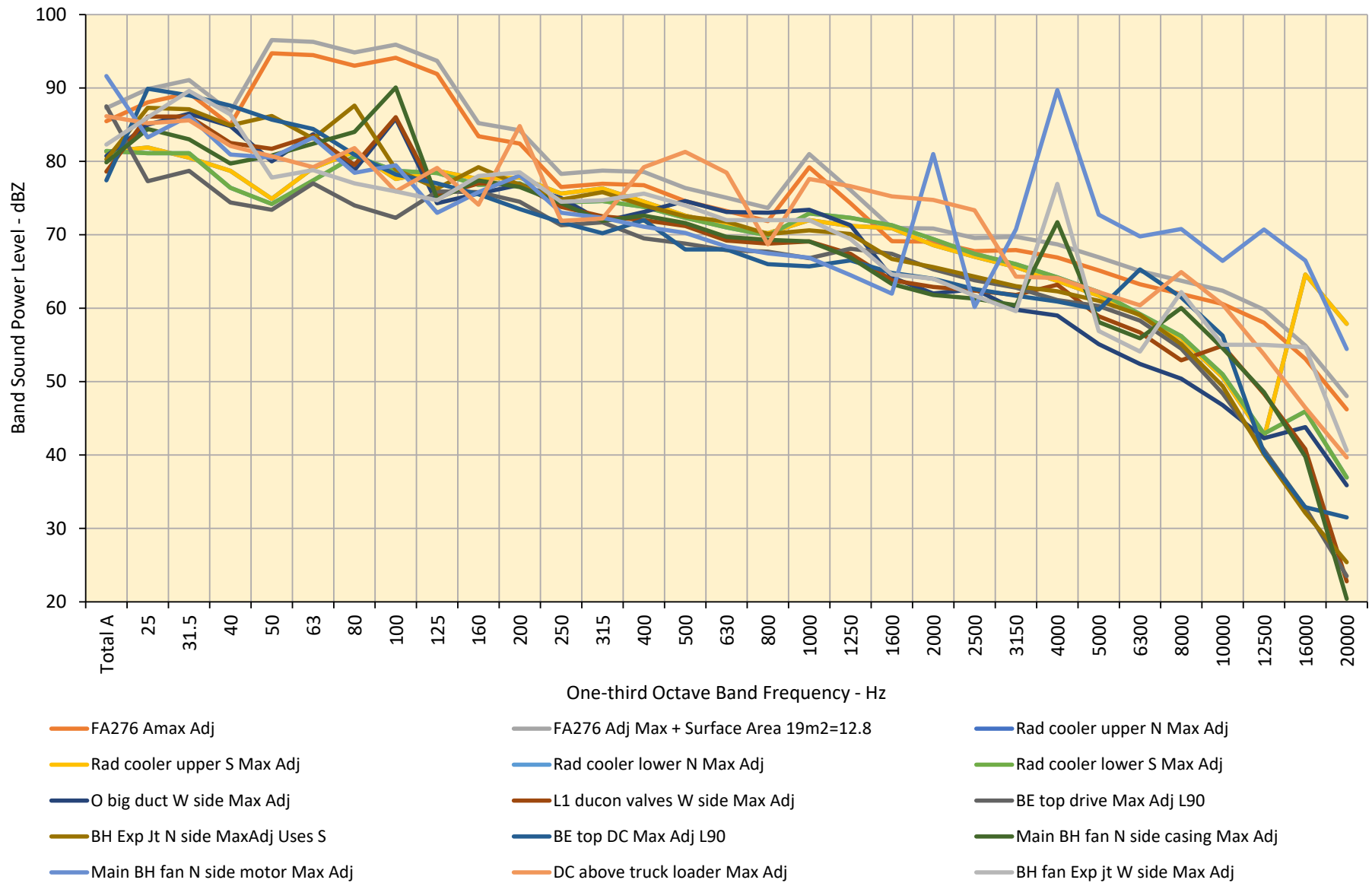


Figure 5.2.6: One Third octave Band Spectra - adjusted source sound levels for model ENM Source 1 FA276

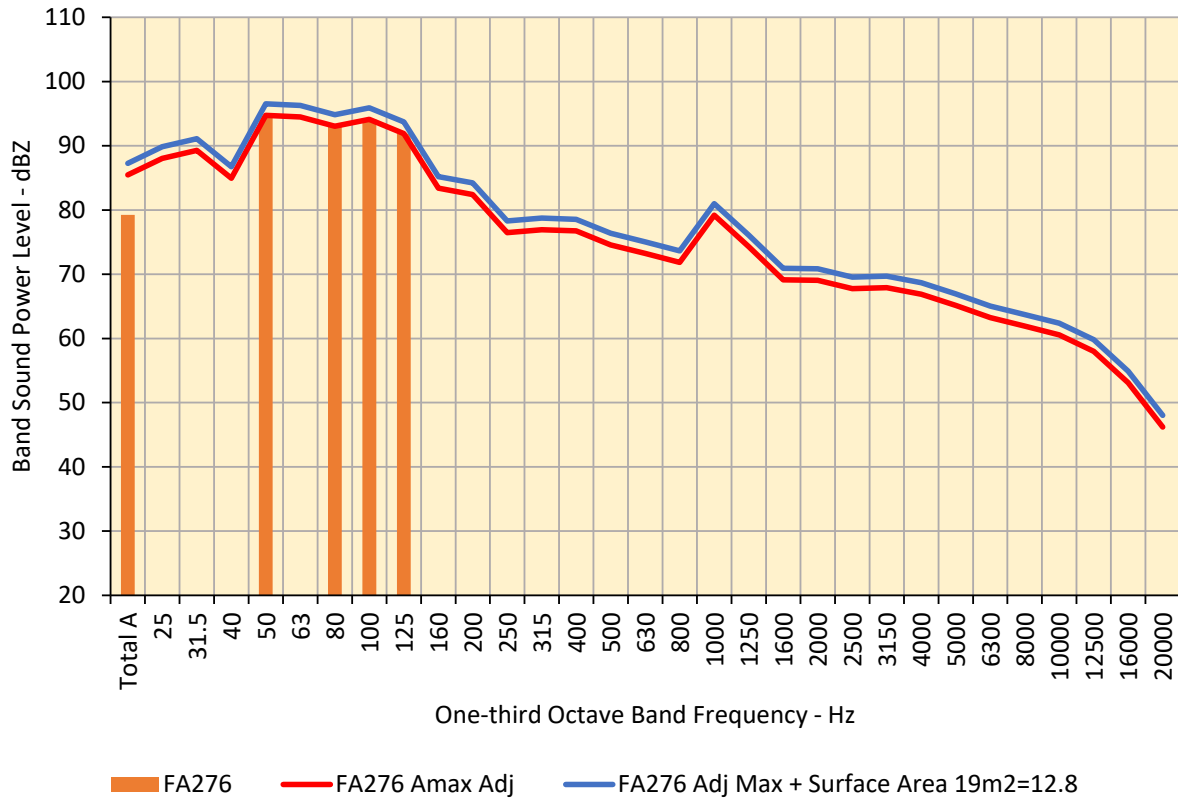


Figure 5.2.7: One Third octave Band Spectra - adjusted source sound levels for model ENM Source 2 Radicon Cooler Upper Level 5

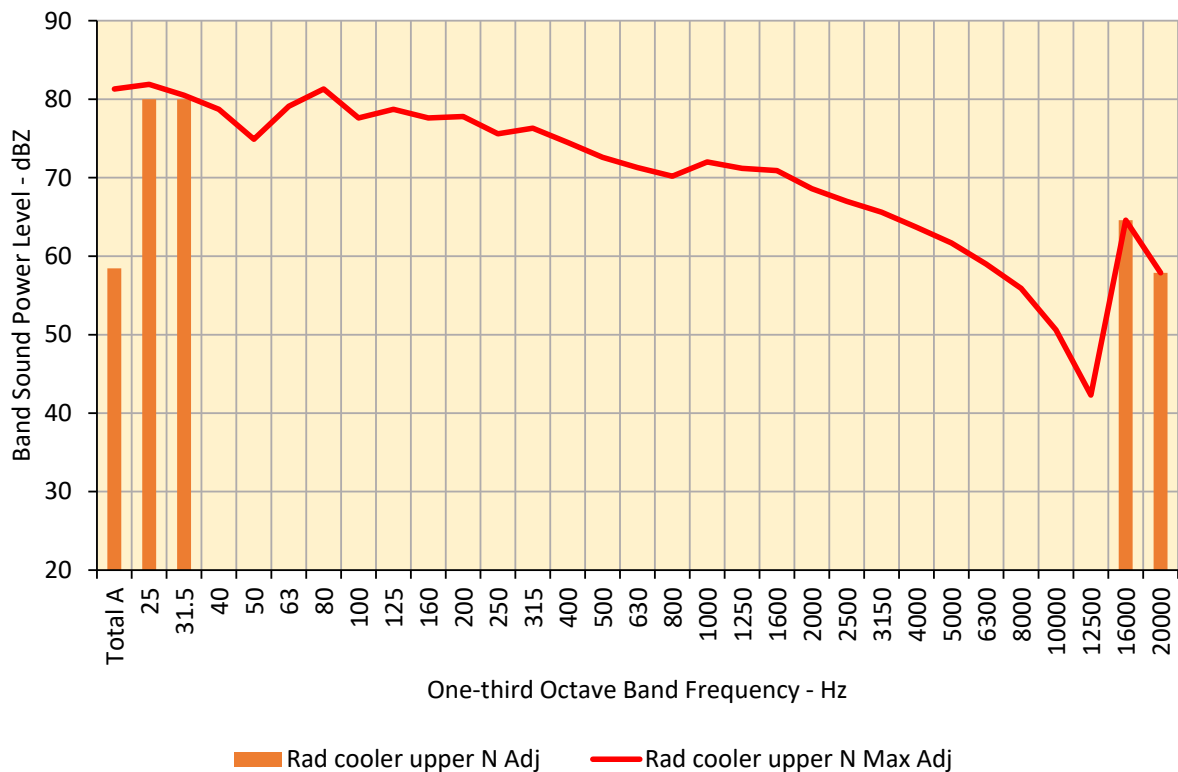


Figure 5.2.8: One Third octave Band Spectra - adjusted source sound levels for model ENM Source 3 Radicon Cooler Lower Level 4

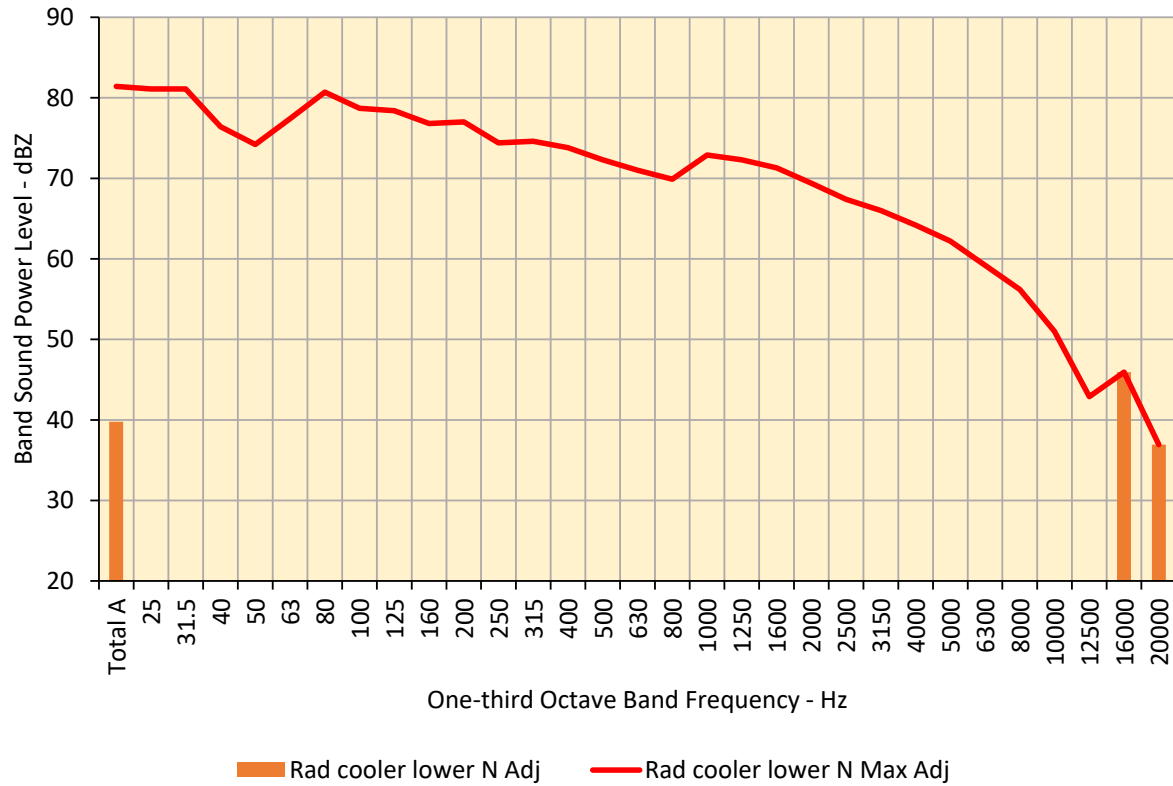


Figure 5.2.9: One Third octave Band Spectra - adjusted source sound levels for model ENM Source Source 32 Big Duct W side of Baghouse Level 4

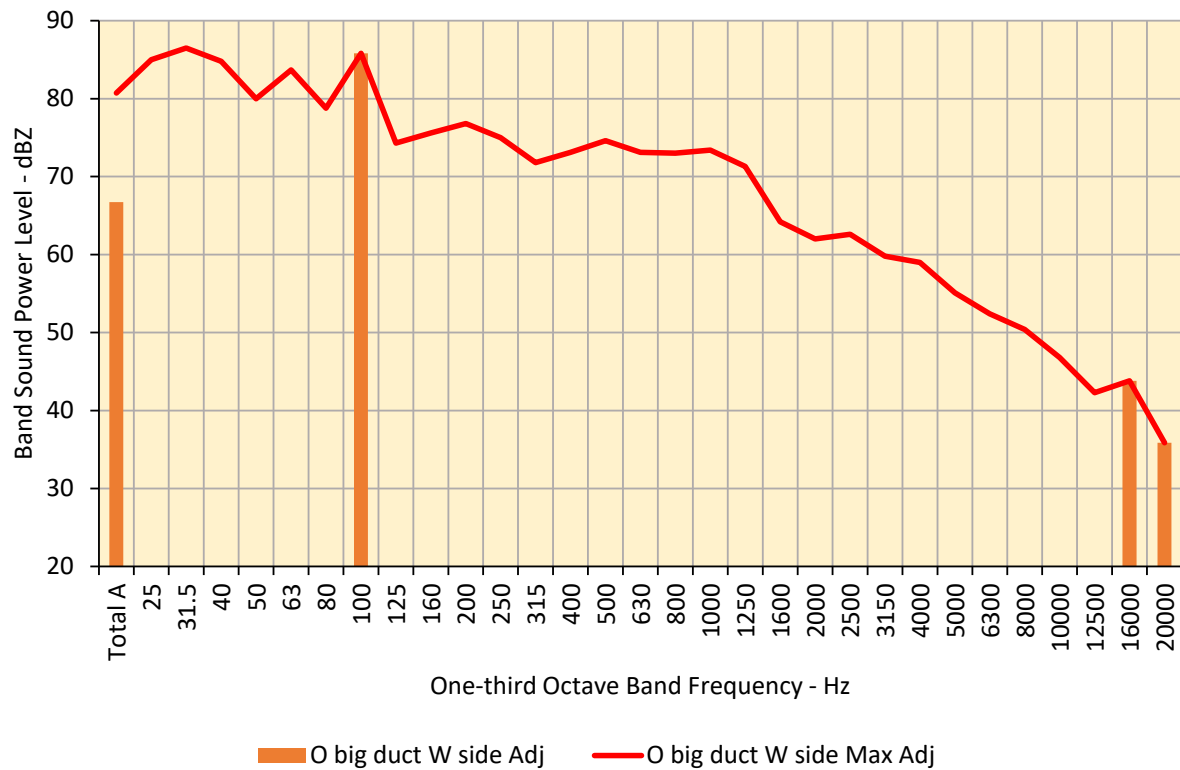


Figure 5.2.10: One Third octave Band Spectra - adjusted source sound levels for model ENM Source 4 Level 1 Ducon Valve W side

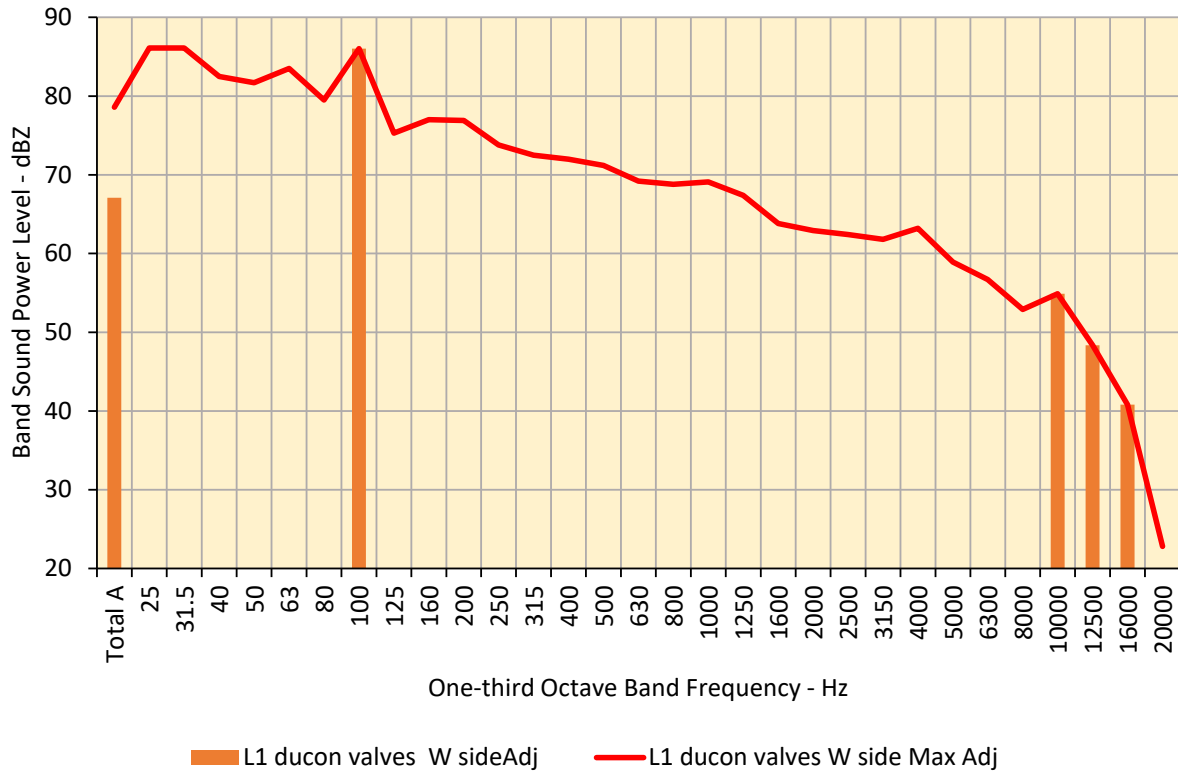


Figure 5.2.11: One Third octave Band Spectra - adjusted source sound levels for model ENM Source 5 Top Level BE Drive

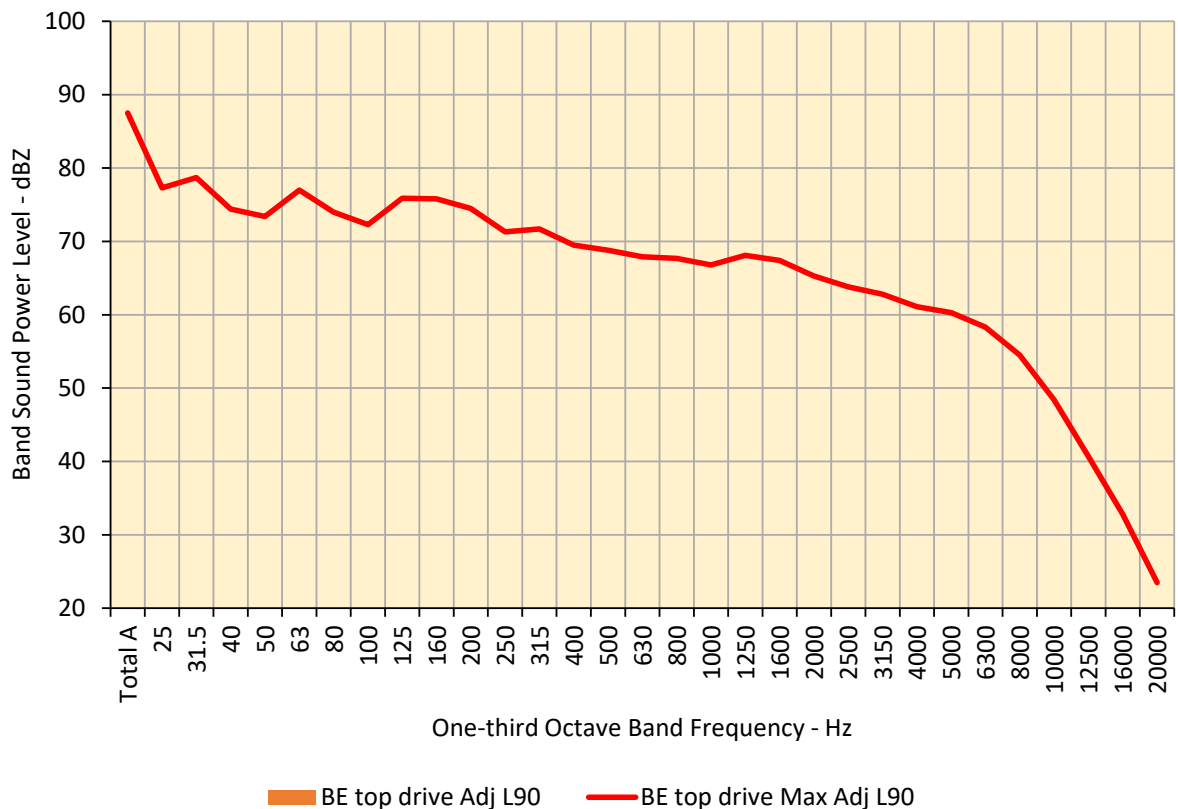


Figure 5.2.12: One Third octave Band Spectra - adjusted source sound levels for model ENM Source 6 Baghouse Expansion Joint N side

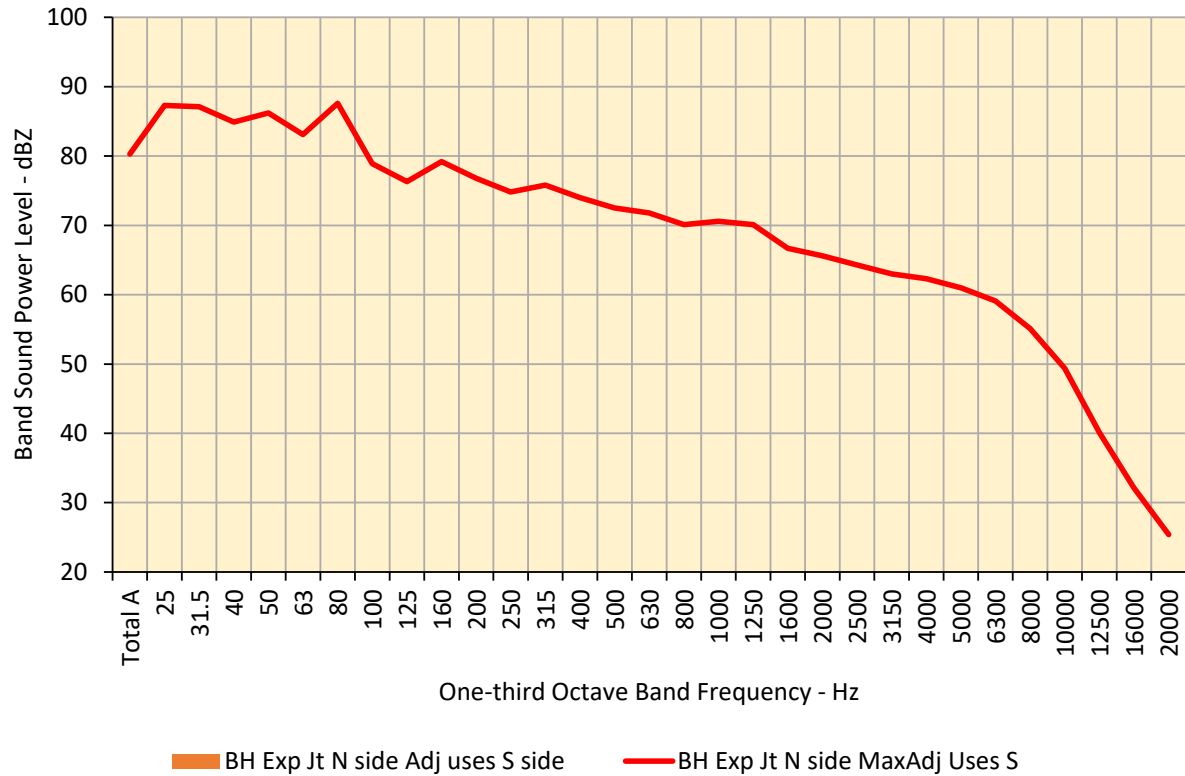


Figure 5.2.13: One Third octave Band Spectra - adjusted source sound levels for model ENM Source 7 Dust Collector at Top Level of Bucket elevator N side

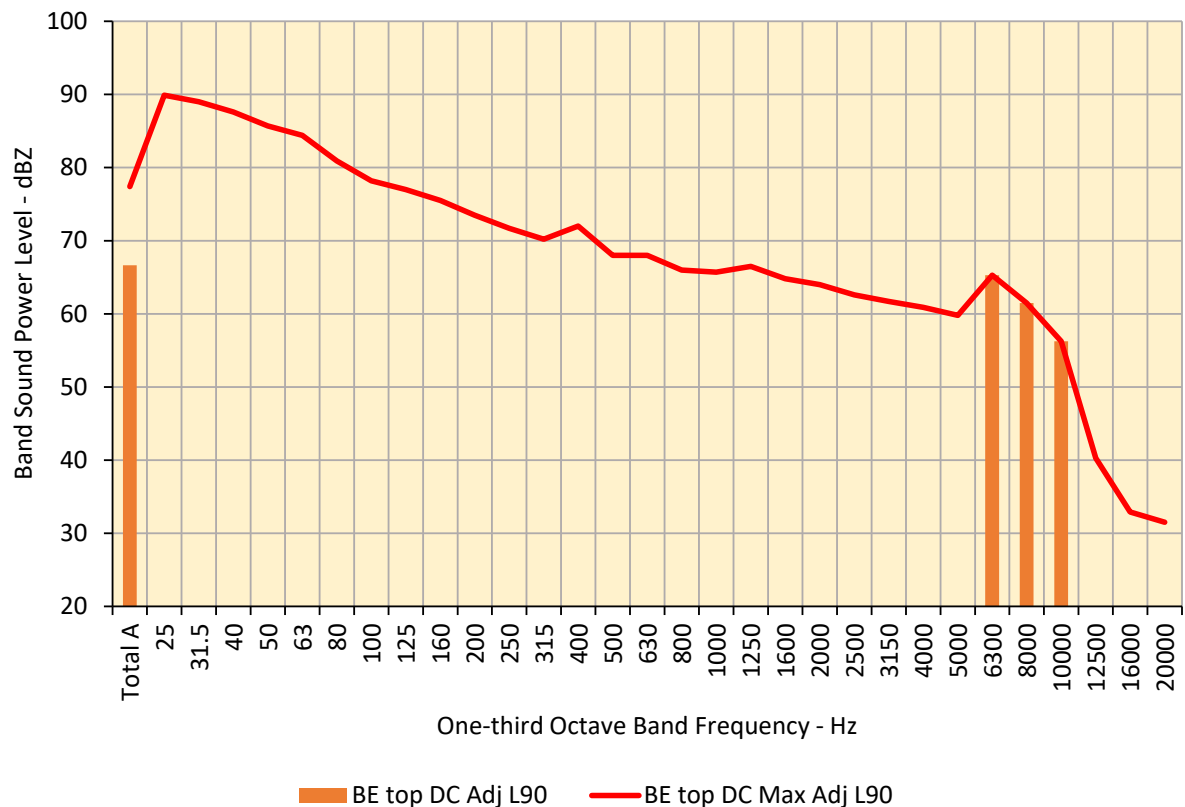


Figure 5.2.14: One Third octave Band Spectra - adjusted source sound levels for model ENM Source 8 Main baghouse fan N side casing (uses S side values)

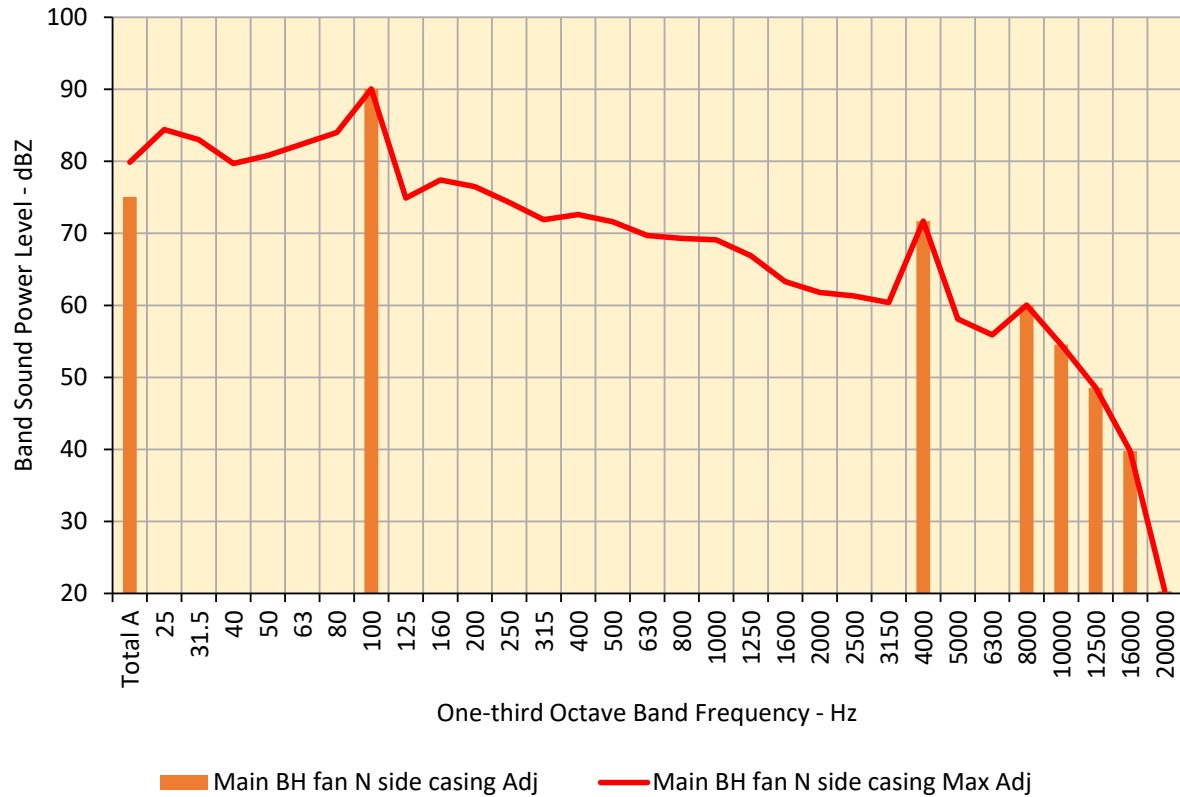


Figure 5.2.15: One Third octave Band Spectra - adjusted source sound levels for model ENM Source 8 Main baghouse fan motor N side (average all sides)

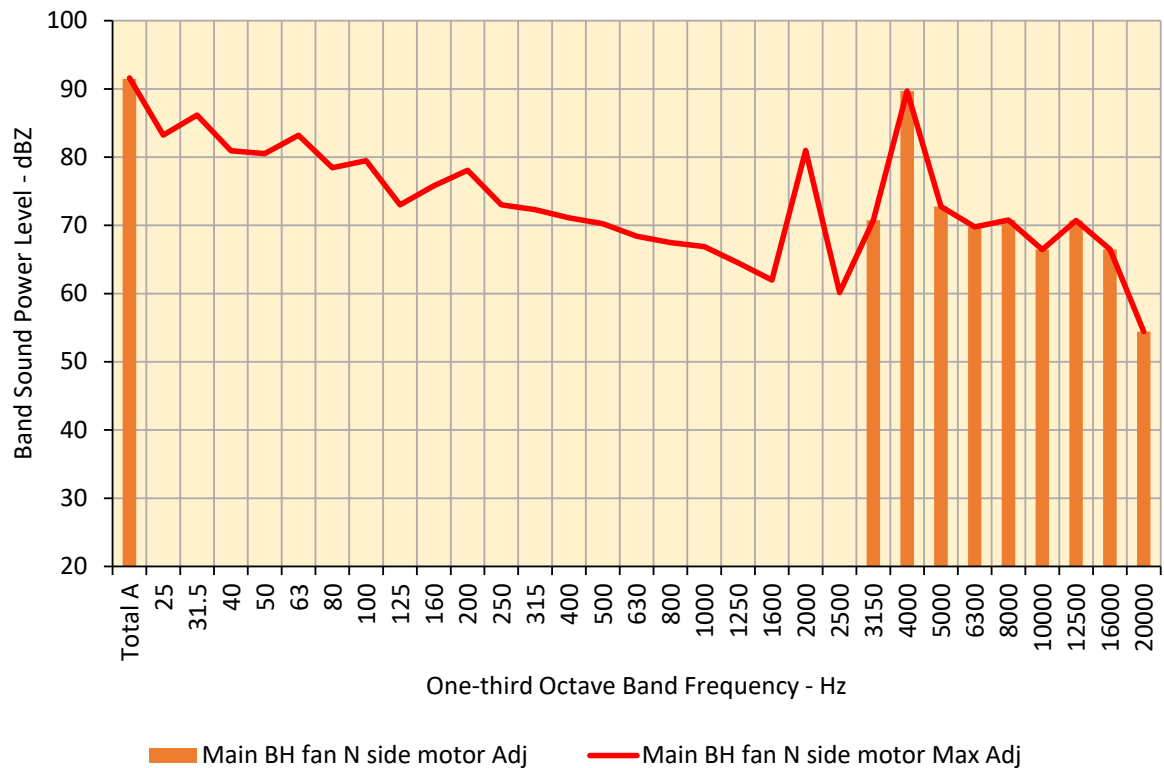


Figure 5.2.16: One Third octave Band Spectra - adjusted source sound levels for model ENM Source 9 Dust Collector Level 3 above Truck loader

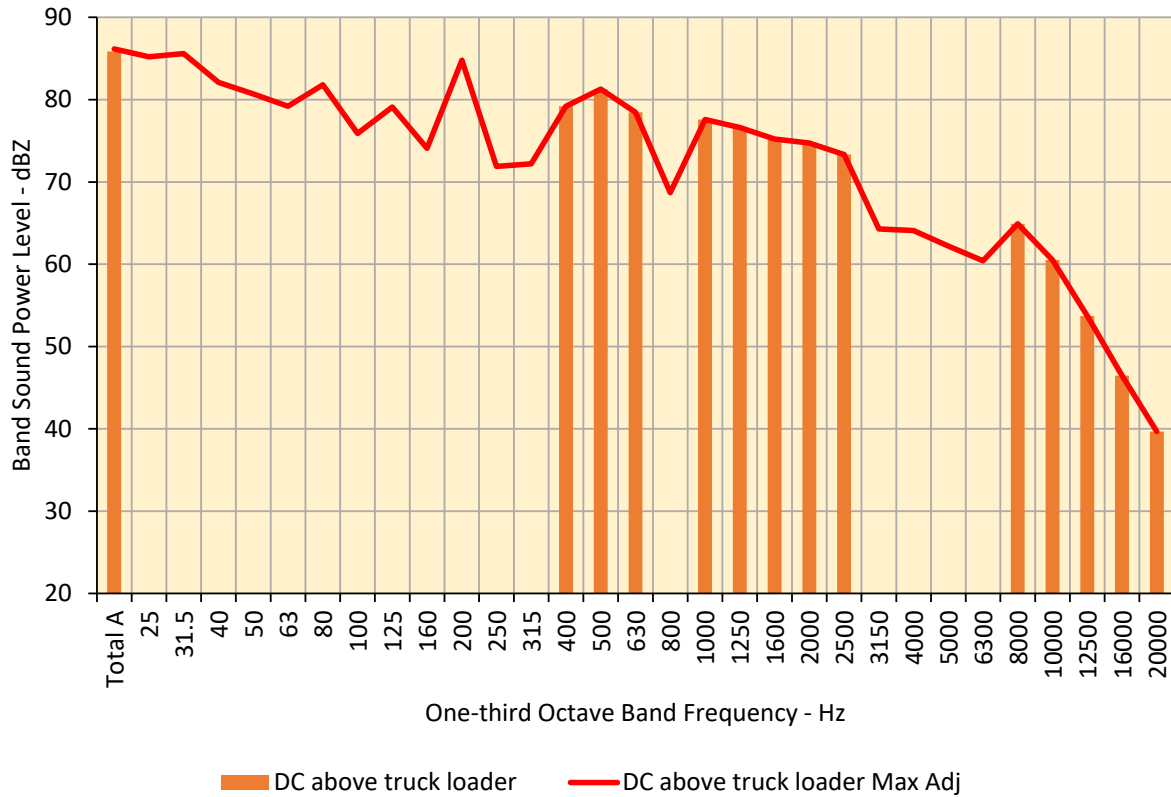


Figure 5.2.17: One Third octave Band Spectra - adjusted source sound levels for model ENM Source 10 Main Baghouse fan discharge expansion joint W side

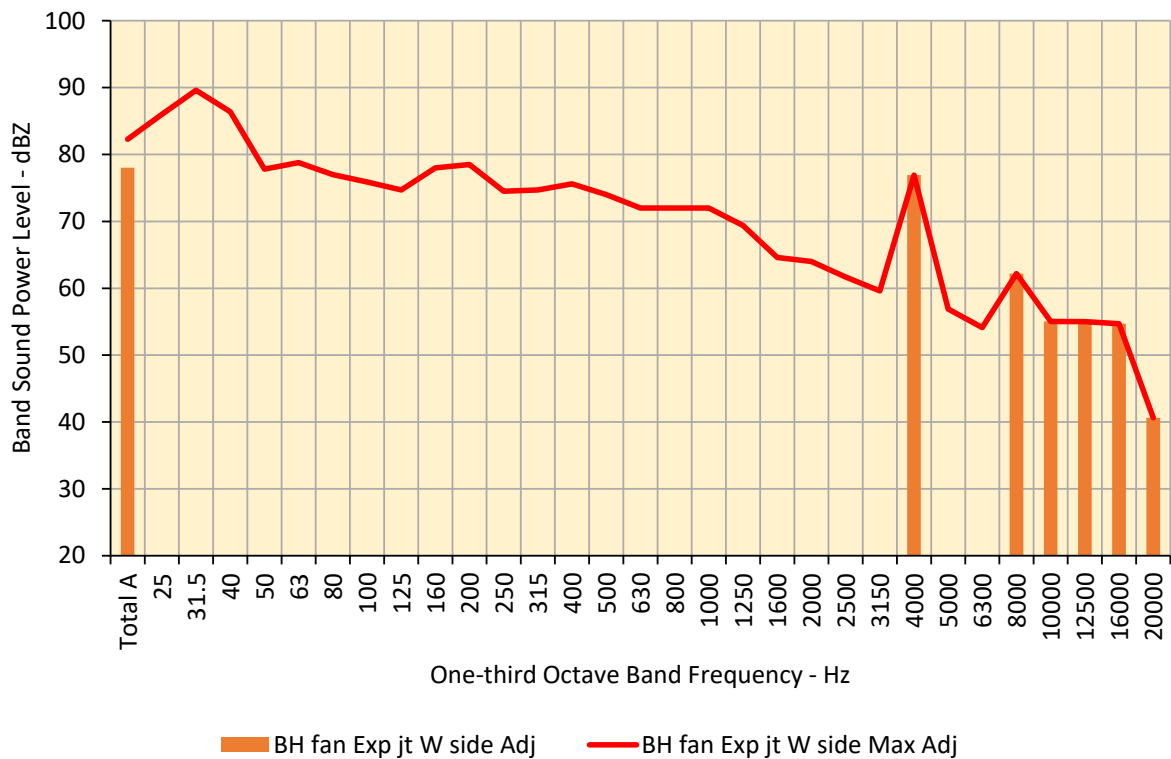


Table 5.2.2: Boral Cement Berrima CBP Plant Operational Noise Verification - One-third Octave Band Sound power level values for the second stage of ENM calculations - Adj and Max Adj values and Directivity added to Radicon Cooler Fans

	Sources for ENM Adj	Total A	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000	20000	Total Z
1	FA276	79.2				95		93	94	92																							99.6
2	Rad cooler upper N Adj	58.5	80	80																											65	58	65.4
21	Rad cooler upper S Adj	58.5																													65	58	65.4
3	Rad cooler lower N Adj	39.8																													46	37	46.5
31	Rad cooler lower S Adj	39.8																													46	37	46.5
32	O big duct W side Adj	66.7							86																						44	36	85.8
4	L1 ducon valves W side Adj	67.1							86																				55	48	41		86.0
5	BE top drive Adj L90																																
6	BH Exp Jt N side Adj uses S side																																
7	BE top DC Adj L90	66.7																									65	61	56				67.2
8	Main BH fan N side casing Adj	75.1							90																72			60	55	49	40	20	90.1
81	Main BH fan N side motor Adj	91.5																						71	90	73	70	71	66	71	66	54	90.0
9	DC above truck loader	85.9													79	81	78		78	77	75	75	73					65	61	54	46	40	86.8
10	BH fan Exp jt W side Adj	78.0																							77			62	55	55	55	41	77.1
	Sources for ENM Max Adj																																
1	FA276 Amax Adj	85.5	88	89	85	95	94	93	94	92	83	82	76	77	77	75	73	72	79	74	69	69	68	68	67	65	63	62	61	58	53	46	101.6
11	FA276 Adj Max + Surface Area 19m2=12.8	87.3	90	91	87	97	96	95	96	94	85	84	78	79	79	76	75	74	81	76	71	71	70	70	69	67	65	64	62	60	55	48	103.4
2	Rad cooler upper N Max Adj	81.3	82	81	79	75	79	81	78	79	78	78	76	76	75	73	71	70	72	71	71	69	67	66	64	62	59	56	51	42	65	58	90.2
21	Rad cooler upper S Max Adj	81.3	82	81	79	75	79	81	78	79	78	78	76	76	75	73	71	70	72	71	71	69	67	66	64	62	59	56	51	42	65	58	90.2
3	Rad cooler lower N Max Adj	81.4	81	81	76	74	77	81	79	78	77	77	74	75	74	72	71	70	73	72	71	69	67	66	64	62	59	56	51	43	46	37	89.7
31	Rad cooler lower S Max Adj	81.4	81	81	76	74	77	81	79	78	77	77	74	75	74	72	71	70	73	72	71	69	67	66	64	62	59	56	51	43	46	37	89.7
32	O big duct W side Max Adj	80.7	85	87	85	80	84	79	86	74	76	77	75	72	73	75	73	73	73	71	64	62	63	60	59	55	52	50	47	42	44	36	93.3
4	L1 ducon valves W side Max Adj	78.6	86	86	83	82	84	80	86	75	77	77	74	73	72	71	69	69	69	67	64	63	62	62	63	59	57	53	55	48	41	23	93.2
5	BE top drive Max Adj L90	87.5	77	79	74	73	77	74	72	76	76	75	71	72	70	69	68	68	67	68	67	65	64	63	61	60	58	55	48	41	33	24	86.6
6	BH Exp Jt N side MaxAdj Uses S	80.3	87	87	85	86	83	88	79	76	79	77	75	76	74	73	72	70	71	70	67	66	64	63	62	61	59	55	49	40	32	25	94.7
7	BE top DC Max Adj L90	77.4	90	89	88	86	84	81	78	77	76	74	72	70	72	68	68	66	66	67	65	64	63	62	61	60	65	61	56	40	33	32	95.3
8	Main BH fan N side casing Max Adj	79.9	84	83	80	81	82	84	90	75	77	77	74	72	73	72	70	69	69	67	63	62	61	60	72	58	56	60	55	49	40	20	93.8
81	Main BH fan N side motor Max Adj	91.6	83	86	81	81	83	78	79	73	76	78	73	72	71	70	68	67	67	65	62	81	60	71	90	73	70	71	66	71	66	54	94.1
9	DC above truck loader Max Adj	86.1	85	86	82	81	79	82	76	79	74	85	72	72	79	81	78	69	78	77	75	75	73	64	64	62	60	65	61	54	46	40	93.4
10	BH fan Exp jt W side Max Adj	82.3	86	90	86	78	79	77	76	75	78	79	75	75	76	74	72	72	72	69	65	64	62	60	77	57	54	62	55	55	55	41	93.7
Directivity	Loss for Radicon fans to 90°		0.0	0.0	0.0	0.5	0.7	1.0	1.5	2.0	2.3	2.7	3.0	3.7	4.3	5.0	5.7	6.4	7.0	8.0	9.0	10.0	11.2	12.5	14.0	15.5	16.8	18.0	19.5	51.0	23.0	25.0	
2 & 21	Rad cooler upper Max Adj DIR	75.2	81.9	80.5	78.7	74.4	78.4	80.3	76.1	76.7	75.3	75.1	72.6	72.5	70.2	67.6	65.6	63.8	65.0	63.2	61.9	58.6	55.8	53.1	49.7	46.2	42.2	37.9	31.1	-8.7	41.6	32.9	88.8
3 & 31	Rad cooler lower Max Adj DIR	75.0	81.1	81.1	76.4	73.7	76.7	79.7	77.2	76.4	74.5	74.3	71.4	70.9	69.5	67.3	65.3	63.5	65.9	64.3	62.3	59.4	56.2	53.5	50.2	46.7	42.4	38.2	31.5	-8.1	22.9	11.9	88.3

	Sources for ENM Max Adj	Total A	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000	20000	Total Z
1	FA276 Amax Adj	85	88	89	85	95	94	93	94	92	83	82	76	77	77	75	73	72	79	74	69	69	68	68	67	65	63	62	61	58	53	46	102
11	FA276 Adj Max + Surface Area 19m2=12.8	87	90	91	87	97	96	95	96	94	85	84	78	79	79	76	75	74	81	76	71	71	70	70	69	67	65	64	62	60	55	48	103
2	Rad cooler upper N Max Adj	81	82	81	79	75	79	81	78	79	78	78	76	76	75	73	71	70	72	71	71	69	67	66	64	62	59	56	51	42	65	58	90
21	Rad cooler upper S Max Adj	81	82	81	79	75	79	81	78	79	78	78	76	76	75	73	71	70	72	71	71	69	67	66	64	62	59	56	51	42	65	58	90
3	Rad cooler lower N Max Adj	81	81	81	76	74	77	81	79	78	77	77	74	75	74	72	71	70	73	72	71	69	67	66	64	62	59	56	51	43	46	37	90
31	Rad cooler lower S Max Adj	81	81	81	76	74	77	81	79	78	77	77	74	75	74	72	71	70	73	72	71	69	67	66	64	62	59	56	51	43	46	37	90
32	O big duct W side Max Adj	81	85	87	85	80	84	79	86	74	76	77	75	72	73	75	73	73	73	71	64	62	63	60	59	55	52	50	47	42	44	36	93
4	L1 ducon valves W side Max Adj	79	86	86	83	82	84	80	86	75	77	77	74	73	72	71	69	69	69	67	64	63	62	62	63	59	57	53	55	48	41	23	93
5	BE top drive Max Adj L90	88	77	79	74	73	77	74	72	76	76	75	71	72	70	69	68	68	67	68	67	65	64	63	61	60	58	55	48	41	33	24	87
6	BH Exp Jt N side MaxAdj Uses S	80	87	87	85	86	83	88	79	76	79	77	75	76	74	73	72	70	71	70	67	66	64	63	62	61	59	55	49	40	32	25	95
7	BE top DC Max Adj L90	77	90	89	88	86	84	81	78	77	76	74	72	70	72	68	68	66	66	67	65	64	63	62	61	60	65	61	56	40	33	32	95
8	Main BH fan N side casing Max Adj	80	84	83	80	81	82	84	90	75	77	77	74	72	73	72	70	69	69	67	63	62	61	60	72	58	56	60	55	49	40	20	94
81	Main BH fan N side motor Max Adj	92	83	86	81	81	83	78	79	73	76	78	73	72	71	70	68	67	67	65	62	81	60	71	90	73	70	71	66	71	66	54	94
9	DC above truck loader Max Adj	86	85	86	82	81	79	82	76	79	74	85	72	72	79	81	78	69	78	77	75	75	73	64	64	62	60	65	61	54	46	40	93
10	BH fan Exp jt W side Max Adj	82	86	90	86	78	79	77	76	75	78	79	75	75	76	74	72	72	72	69	65	64	62	60	77	57	54	62	55	55	55	41	94
Directivity	Loss for Radicon fans to 90°		0.0	0.0	0.0	0.5	0.7	1.0	1.5	2.0	2.3	2.7	3.0	3.7	4.3	5.0	5.7	6.4	7.0	8.0	9.0	10.0	11.2	12.5	14.0	15.5	16.8	18.0	19.5	51.0	23.0	25.0	
2 & 21	Rad cooler upper Max Adj DIR	75	82	81	79	74	78	80	76	77	75	75	73	73	70	68	66	64	65	63	62	59	56	53	50	46	42	38	31	-9	42	33	89
3 & 31	Rad cooler lower Max Adj DIR	75	81	81	76	74	77	80	77	76	75	74	71	71	70	67	65	64	66	64	62	59	56	54	50	47	42	38	32	-8	23	12	88
	MaxMax Adj Values																																
11	FA276 MaxMaxAdj	94	97	98	95	95	104	94	94	93	94	93	87	86	86	85	84	83	87	83	78	77	76	76	77	73	71	70	69	68	63	56	108
2 & 21	L5 Rad Cooler MaxMaxAdj	87	88	88	86	82	85	85	85	85	85	83	83	83	81	79	78	77	79	77	73	71	69	68	66	63	60	57	55	50	65	58	97
3 & 31	VL4 Rad Cooler Fan N MaxMax Adj	86	88	88	83	81	82	85	86	85	84	84	81	82	80	79	78	76	78	76	73	70	69	67	65	63	62	60	55	50	46	37	96
32	O L3 Big Duct Max MaxAdj	87	92	94	92	87	91	86	86	81	82	83	81	79	79	82	80	80	79	77	70	68	69	66	66	62	59	57	54	49	44	36	100
4	J'W side Ducon Valve N side Max MaxAdj	85	91	87	88	83	90	83	85	79	82	84	79	78	79	78	76	76	76	74	70	70	69	69	70	66	64	60	54	47	39	30	97
5	S: Top level of BE tower S side of platform MaxMax Adj L90	84	84	83	81	80	84	81	79	82	83	79	78	79	77	76	75	74	74	73	71	71	71	70	68	67	65	62	55	48	37	28	93
6	N' Exp Jt Sth Side BH MaxMaxAdj	86	91	90	88	87	86	86	81	81	83	83	79	80	79	78	77	77	76	77	73	71	71	70	69	68	66	62	56	47	37	27	97
7	Top of BE Tower DC MaxMaxAdj L90	84	92	90	88	86	87	84	83	82	82	79	78	77	79	75	75	73	73	73	71	70	69	69	68	67	65	61	56	47	40	39	97
8	G' Inlet platform S side scan 3m2 Max MaxAdj	85	90	90	87	84	89	87	89	82	83	84	79	78	79	79	77	76	76	74	70	69	68	67	72	65	63	60	55	49	40	27	98
81	Motor Max Max	92	88	90	86	83	85	81	85	77	78	81	76	76	75	75	73	72	71	69	68	81	67	71	90	73	70	71	66	71	66	54	97
9	M L3 DC Fan & Motor Adj MaxMax	87	92	90	88	85	85	83	83	80	81	85	79	79	79	81	78	76	78	77	75	75	73	71	71	69	67	65	61	54	46	40	97
10	C Main BH Fan Exp Joint W side Max Max Adj	88	93	96	93	84	86	82	82	82	82	83	81	82	83	81	79	79	79	76	72	71	69	67	77	64	61	62	55	55	55	41	100
2 & 21	L5 Rad Cooler MaxMaxAdj DIR	82	88	88	86	81	84	84	84	83	82	82	80	80	77	74	73	71	72	69	64	61	58	55	52	48	43	39	35	-1	42	33	95
3 & 31	VL4 Rad Cooler Fan N MaxMax Adj DIR	81	88	88	83	81	82	84	84	83	82	81	78	78	76	74	72	70	71	68	64	60	57	54	51	47	45	42	36	-1	23	12	95

Table 5.2.4: Calculation of Band Sound Level Received for Fan FA276 at 4 Melbourne St for Different Source Levels

Band Frequency Hz	Source On LpA	Source Off LpA	On-Off Difference	Adjusted LpA	Max Adjusted LpA	MaxMax Adjusted LpA	PWL Lw Adj	PWL Lw Max Adj	PWL Lw MaxMax Adj	Reduction to 4 Melbourne St	Contribution Adj	Contribution Max Adj	Contribution MaxMax Adj
Total A	84.6	83.5	1.1	68.2	74.5	81.6	79.2	85.5	92.6	67.5	15.6	20.5	28.3
25	42.8	42.3	0.5		32.3	39.8		43.3	50.8	62.9		-19.6	-12.1
31.5	49.8	48.9	0.9		38.9	46.8		49.9	57.8	62.6		-12.7	-4.8
40	51.2	49.3	1.9		39.3	48.2		50.3	59.2	62.4		-12.1	-3.2
50	55.5	51.1	4.4	53.5	53.5	53.5	64.5	64.5	64.5	62.6	1.9	1.9	1.9
63	68.4	67.3	1.1		57.3	65.4		68.3	76.4	63.6		4.7	12.8
80	62.0	58.4	3.6	59.5	59.5	59.5	70.5	70.5	70.5	64.5	6.0	6.0	6.0
100	65.3	59.5	5.8	64.0	64.0	64.0	75.0	75.0	75.0	68.9	6.1	6.1	6.1
125	67.2	63.6	3.7	64.8	64.8	64.8	75.8	75.8	75.8	80.3	-4.5	-4.5	-4.5
160	71.7	69.0	2.7		59.0	68.7		70.0	79.7	70.6		-0.6	9.1
200	73.0	70.5	2.5		60.5	70.0		71.5	81.0	65.9		5.6	15.1
250	69.6	66.9	2.7		56.9	66.6		67.9	77.6	64		3.9	13.6
315	70.7	69.3	1.3		59.3	67.7		70.3	78.7	65.4		4.9	13.3
400	72.0	70.9	1.1		60.9	69.0		71.9	80.0	69.3		2.6	10.7
500	72.5	70.4	2.1		60.4	69.5		71.4	80.5	59.3		12.1	21.2
630	72.9	70.3	2.5		60.3	69.9		71.3	80.9	63.5		7.8	17.4
800	72.6	70.1	2.6		60.1	69.6		71.1	80.6	61.9		9.2	18.7
1000	78.2	78.2	-0.1		68.2	75.2		79.2	86.2	62.6		16.6	23.6
1250	74.8	73.9	0.9		63.9	71.8		74.9	82.8	65.5		9.4	17.3
1600	69.6	69.1	0.5		59.1	66.6		70.1	77.6	69.7		0.4	7.9
2000	69.3	69.4	-0.1		59.3	66.3		70.3	77.3	70.4		-0.1	6.9
2500	68.1	68.7	-0.6		58.1	65.1		69.1	76.1	75.5		-6.4	0.6
3150	68.1	69.0	-0.8		58.1	65.1		69.1	76.1	79		-9.9	-2.9
4000	69.2	66.9	2.3		56.9	66.2		67.9	77.2	86.1		-18.2	-8.9
5000	64.6	65.5	-0.9		54.6	61.6		65.6	72.6	99.2		-33.6	-26.6
6300	62.2	63.4	-1.2		52.2	59.2		63.2	70.2	116.2		-53.0	-46.0
8000	59.8	61.7	-1.9		49.8	56.8		60.8	67.8	140.4		-79.6	-72.6
10000	57.1	57.3	-0.2		47.1	54.1		58.1	65.1	179.6		-121.5	-114.5
12500	54.1	52.7	1.4		42.7	51.1		53.7	62.1	180		-126.3	-117.9
16000	47.0	45.5	1.5		35.5	44.0		46.5	55.0	180		-133.5	-125.0
20000	37.6	35.9	1.7		25.9	34.6		36.9	45.6	180		-143.1	-134.4

Table 5.2.5: Calculation of Contribution Sound Levels at 4 Melbourne St using Adjusted, Maximum Adjusted and MaxMax Source Sound power Level Values - results sorted for Max Adj values

Sort No.	Sources Location & Name	Contribution Adj	Contribution Max	Contribution MaxMax	Contribution Adj	Contribution Max	Contribution MaxMax	Contribution Adj DIR	Contribution Max DIR	Contribution MaxMax DIR
		dBA at 4 Melbourne St			dBA at 4 Melbourne St			dBA at 4 Melbourne St with each Rad Cooler Fans Directivity		
					Not including 34 BE Top Leg			Not including 34 BE Top Leg		
27	M L3 DC Fan & Motor	22.4	22.6	23.2	22.4	22.6	23.2	22.4	22.6	23.2
50	FA276 Average	15.6	20.5	28.3	15.6	20.5	28.3	15.6	20.5	28.3
31	O L3 Big Duct W side	7.3	18.9	25.2	7.3	18.9	25.2	7.3	18.9	25.2
5	BH Fan Disch Exp Jt.	0.0	17.5	24.5	0.0	17.5	24.5	0.0	17.5	24.5
28	Exp Jt N side BH Top	0	17.5	22.8	0	17.5	22.8	0	17.5	22.8
41	V L4 Rad Cooler Fan S	0	17.2	22.4	0	17.2	22.4	0	11.5	18.2
38	L5 Rad Cooler Fan N	0	17.0	23.5	0	17.0	23.5	10.4	11.4	18.1
38	U L5 Rad Cooler Fan S	0	17.0	23.5	0	17.0	23.5	10.4	11.4	18.1
40	V L4 Rad Cooler Fan N	0.0	16.8	22.4	0.0	16.8	22.4	0.0	11.5	18.2
33	Q Top of BE	0	16.8	21.3	0	16.8	21.3	0	16.8	21.3
34	R Top BE Tower DC Leg	0.0	16.4	21.7	0.0			0.0		
8 to 13	BH Fan Motor Average	12.7	16.1	19.1	12.7	16.1	19.1	12.7	16.1	19.1
15	BH Fan casing	8.9	16.0	21.9	8.9	16.0	21.9	8.9	16.0	21.9
21	Ducon Valve W side	3.9	14.3	20.7	3.9	14.3	20.7	3.9	14.3	20.7
34	R Top BE Tower DC L90	0	13.4	20.0	0	13.4	20.0	0	13.4	20.0
Total All Sources added		24.0	29.6	35.1	24.0	29.3	34.9	24.3	28.6	34.1

Comparison with Approval Meteorological Conditions

The calculations provided and described above have been for the expected typical worst-case sound propagation conditions from the Cement Plant to the residential and Location 20 receivers. This is considered to be 5°C, 95% rh 2m/s wind speed and 3°C/100m lapse rate, equivalent to a Category F Pasquil stability condition according to the NSW EPA Noise Policy for Industry Fact Sheet D and the National Oceanographic and Atmospheric Administration of the US Department of Commerce. The approval meteorological conditions are for Categories A to D with a maximum wind speed of 0.5m/s at 10m elevation.

The noise model ENM was re-run for all receiver locations to provide a comparison with the different stability conditions. The measured source sound levels based on the Max Adj values were used and different meteorological conditions equivalent to Pasquil Categories D to F. These are shown in Table 5.2.6 below.

Table 5.2.6: Boral Cement Berrima CBP Verification

Comparison of ENM Model Results for Max Adj Sources with Cat D and Cat F Stability Conditions for all receivers with both Radicon cooler Fans on each level with Directivity

Parameter	Received Total Sound Level - dBA							
	PCNVR Obj	Met. Condition Wind Speed Towards Receiver Lapse Rate for 5°C 95%rh						
Wind Speed m/s		0	0.5	0.5	0.5	2	1	3
Lapse Rate °C/100m		0	0	-0.5	-1.5	3	-1.5	0
Stability Class		D	D	D	D	F	D	D-E
4 Melbourne St	34	23.0	23.9	23.5	22.5	28.6	23.4	27.6
12 Brisbane St	34	22.8	23.7	23.2	22.2	28.5	23.1	27.5
Corner Taylor Adelaide	37	24.7	25.4	25.0	24.3	30.0	24.9	29.0
Location 20	52	31.1	31.5	31.2	30.8	34.3	31.2	33.6

The results of this comparison indicate that the predicted results at all receiver locations are at least 5 dB below the Pre-construction noise verification report objectives for Category F conditions and at least 10 dB lower than the objectives when the approval meteorological conditions are used. Category F conditions are close to 5 dB higher than those obtained for the maximum Category D values for Melbourne Street.

Based on these calculations using the ENM model and measured sound pressure levels for source conditions, it is considered that the operational Chloride Bypass Plant is compliant with its recommended contribution sound levels.

6 Summary and Conclusions

The Chloride Bypass Plant at Berrima Cement has been measured for sound levels in normal operations **On** and in the **Off** condition. Sound levels around the CBP were found to be affected significantly by emissions from the other parts of the cement plant. This is to be expected because the noise specification sound levels for the new CBP were intended to be relatively low. Sound levels measured at many locations around the CBP were not significantly different (i.e. within 3 dB of each other) for the **On** and **Off** cases. In some locations, the **Off** condition sound level was higher, probably due to minor changes in process conditions in the rest of the Cement plant at the time. For this reason, sound levels measured at residential receiver locations and Location 20 did not change for the two CBP operational conditions and it was not discernible.

In order to demonstrate compliance with the recommended sound level contribution objectives given in the Preconstruction Verification Report, the Noise Policy for Industry allows use of prediction modelling. Two different methods of predictions and models were used because of the difficulty of accurately measuring the sound levels of emissions from the different sources in the CBP. One method used sound intensity with *Predictor* computer noise model, the other used sound pressure level measurements and ENM computer noise model, both of which are considered suitable and accurate for the purpose. Using the two different methods provides greater assurance of the results indicating compliance. Both methods used predictions for typical worst-case meteorological conditions used for the Berrima Cement Plant in the past and these were for Category F stability conditions. The ENM model was also used to predict results with Category D stability and 0.5m/s wind speed, as noted in the approval conditions.

For the *Predictor* model predictions with sound intensity results, the predicted sound levels for Class F stability were a minimum of 9 dB below the compliance objective. For Class D conditions they were a minimum of 12 dB below the objectives.

For the ENM model predictions with sound pressure level measurements, the results depend on which approach is taken to adjusting the measured **On** sound levels when they are within 3.5 dB of the **Off** sound levels. Methods according to Australian and International standards require ignoring values when the differences are less than 3.5 dB and adjusting the sound levels for those values with greater differences, and results were calculated with this approach. A modified method was also used to present a more realistic or expected emission condition calculation. Additionally, a third method using the maximum possible **On** condition sound level, not recommended by Standards, was also used to provide a comparison. The results calculated showed for the more realistic emission condition calculation, sound levels predicted for residential receivers for Class D stability and 0.5 m/s wind speed were more than 10 dB below the compliance objectives of the Pre-construction Noise Verification Report. For the compliance Location 20, the predicted contribution was 20 dB below the objective.

For Class F conditions used in the calculations, the predicted contribution sound levels were at least 5 dB below the objectives. Even with the maximum possible noise emission and Class F conditions, the predicted sound levels did not exceed the recommended compliance objectives.

Based on these two calculation methods, it is the assessment of this report that the noise emissions from the operational CBP are in compliance with the recommended objectives of the Pre-construction Verification Report.

Appendices

Appendix A: One-third octave band frequency spectra of sound pressure level measurements of CBP

Appendix B: Sound Power results using the Sound Intensity Method and Measurement locations

Appendix A: One-third octave band frequency spectra of sound pressure level measurements of CBP

Table 4.2: Berrima Cement - CBP Assessment 14 December 2023 - On and off Measurements for One-third Octave Band LAeq,t Spectra

Location	CBP	File	Wtg	Statistical Sound Pressure Level - dBA							One-third Octave Band LAeq,t A-weighted Sound Level - dBA																																		
	On/Off			L _{Aeq,t}	L _{Ceq,t}	L _{AMax}	L _{A01,t}	L _{A10,t}	L _{A90,t}	L _{A99,t}	12.5 Hz	16 Hz	20 Hz	25 Hz	31.5 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz	12.5 kHz	16 kHz	20 kHz		
A: N side opp. Fan motor @ 6.4m to motor end	On	4	A	75	87	77	76	76	75	75	14.3	24.1	29.5	36.2	46.7	44.7	42.9	48.1	47.6	51.5	53.8	57.8	61	58.7	64.3	63.1	63.7	62.7	63.7	64.9	63.9	61.7	65.5	60.3	60.2	66.6	59	57	52.6	45.4	37.3	35.2	18.8		
A: N side opp. Fan motor @ 6.4m to motor end	Off	63	A	74	86	76	75	74	74	73	12.5	22.5	28.4	34.6	45.7	44.1	45.8	49.2	49.1	51.8	54.7	58.4	61.4	60.1	64.6	62.2	63.8	63.2	63.5	64.8	63.4	60.8	60.5	59.5	58.2	56.6	54.6	51.3	45.4	36.8	26.1	15	7		
A: Difference On to Off	Δ			1.2	0.4	1.1	1.2	1.2	1.2	1.3	1.8	1.6	1.1	1.6	1.0	0.6	-2.9	-1.1	-1.5	-0.3	-0.9	-0.6	-0.4	-1.4	-0.3	0.9	-0.1	-0.5	0.2	0.1	0.5	0.9	5.0	0.8	2.0	10.0	4.4	5.7	7.2	8.6	11.2	20.2	11.8		
B: N side, Edge concrete between N columns opp. Pump	On	5	A	75	87	81	77	76	75	75	13.1	23	28.3	34.8	47.4	43.4	41.8	50.8	49.7	53.6	54.5	57.7	60	60	62.8	62.7	64.1	64	64.6	65.3	64.6	63.4	63.8	61.3	61.1	66.1	59.6	57	53.1	46.6	37.7	31.1	15.1		
B: N side, Edge concrete between N columns opp. Pump	Off	64	A	75	88	78	77	76	75	75	16.5	23.9	29.7	35.2	47.5	44	45	51.6	56.1	55.3	55.9	60.4	64.7	62.1	63	62.1	64.8	64.6	64.6	65.1	64.2	63.3	63.2	62.1	61.4	60.4	58.8	56.2	51	42.9	31.2	17.1	7		
B: Difference On to Off	Δ			-0.1	-1.2	2.8	-0.1	-0.1	-0.1	-0.1	-3.4	-0.9	-1.4	-0.4	-0.1	-0.6	-3.2	-0.8	-6.4	-1.7	-1.4	-2.7	-4.7	-2.1	-0.2	0.6	-0.7	-0.6	0.0	0.2	0.4	0.1	0.6	-0.8	-0.3	5.7	0.8	0.8	2.1	3.7	6.5	14.0	8.1		
C': Motor Platform discharge casing exp. Joint N side 0.5m	On	19	A	79	92	81	81	80	79	78	13.3	20.4	29.2	38.3	48.7	51.3	50.4	58	57.3	65.5	56.9	62.6	67.8	63.8	64.9	66.9	67.9	67.3	67.6	67.8	66.1	63.3	68.7	60.7	61.1	73.7	59	56.2	61	48.8	47.7	40.8	25.3		
C': Motor Platform discharge casing exp. Joint N side 0.5m	Off	70	A	77	91	78	78	78	77	77	17.9	23.6	30.8	38.5	49	50.9	51.7	58.3	55.9	59.9	56.5	62.2	66.3	64.2	66.3	66.1	68.8	66.7	67.3	67.7	65.9	62.2	60.9	60.2	58.3	55.9	53.5	50	43.7	35.7	28.3	22.6	13		
C': Difference On to Off	Δ			2.2	0.7	3.1	2.8	2.5	2.1	1.6	-4.6	-3.2	-1.6	-0.2	-0.3	0.4	-1.3	-0.3	1.4	5.6	0.4	0.4	1.5	-0.4	-1.4	0.8	-0.9	0.6	0.3	0.1	0.2	1.1	7.8	0.5	2.8	17.8	5.5	6.2	17.3	13.1	19.4	18.2	12.3		
C': Casing discharge W side 0.5m	On	20	A	79	90	80	80	80	79	79	13	21	28.9	39.8	48.7	50.4	44.7	52.2	52.5	56.2	57.5	61.6	65.9	64.3	67	70.6	70.4	70	69.9	69.7	68.6	64.1	62.7	61.2	59	64.7	55.3	51.7	49.1	40	38	27.7	13.2		
C': Motor Platform discharge casing exp. Joint N side 0.5m	Off	70	A	77	91	78	78	78	77	77	17.9	23.6	30.8	38.5	49	50.9	51.7	58.3	55.9	59.9	56.5	62.2	66.3	64.2	66.3	66.1	68.8	66.7	67.3	67.7	65.9	62.2	60.9	60.2	58.3	55.9	53.5	50	43.7	35.7	28.3	22.6	13		
C': Difference on to off	Δ			2.0	-1.2	1.9	1.9	2.0	2.0	2.0	-4.9	-2.6	-1.9	1.3	-0.3	-0.5	-7.0	-6.1	-3.4	-3.7	1.0	-0.6	-0.4	0.1	0.7	4.5	1.6	3.3	2.6	2.0	2.7	1.9	1.8	1.0	0.7	8.8	1.8	1.7	5.4	4.3	9.7	5.1	0.2		
C: W side near fan, between duct support and fan discharge expansion joint @ 0.79m	On	6	A	79	90	80	80	80	79	78	14.7	21.3	28.7	40.1	48.9	50.8	45.4	51.3	51.3	54.5	57.6	60.8	64.3	64	67.1	69.8	69.8	69.1	70.2	71	69	64.6	64.2	62	59.8	67.3	56.4	53	50.9	42.4	39.8	37.1	20.4		
C: W side near fan, between duct support and fan discharge expansion joint @ 0.79m	Off	65	A	79	90	80	80	79	79	78	18.7	24.2	30.6	40.3	49.2	50.8	46.6	51.6	53.5	55.8	57.6	63.6	66.6	64.9	65.8	69.1	69.6	68.8	70	71	68.7	64	61.9	61.7	59.4	56.5	53.4	49.6	43.2	35	23.4	11.8	3.3		
C Difference On to Off	Δ			0.4	-0.5	0.3	0.3	0.4	0.4	0.1	-4.0	-2.9	-1.9	-0.2	-0.3	0.0	-1.2	-0.3	-2.2	-1.3	0.0	-2.8	-2.3	-0.9	1.3	0.7	0.2	0.3	0.2	0.0	0.3	0.6	2.3	0.3	0.4	10.8	3.0	3.4	7.7	7.4	16.4	25.3	17.1		
C: W side near fan, between duct support and fan discharge expansion joint @ 0.79m	On	103	A	79	91	80	80	79	79	78	15.2	22.9	29.9	39.5	49.3	52	46.9	52.3	54.1	56.5	58	63.7	65.5	66	67.7	69.2	70.3	68.7	69.6	70.6	68.8	64.8	62.6	61.5	58.6	55	51.5	47.2	41.8	34.7	24.6	12.9	3.6		
C: W side near fan, between duct support and fan discharge expansion joint @ 0.79m	Off	65	A	79	90	80	80	79	79	78	18.7	24.2	30.6	40.3	49.2	50.8	46.6	51.6	53.5	55.8	57.6	63.6	66.6	64.9	65.8	69.1	69.6	68.8	70	71	68.7	64	61.9	61.7	59.4	56.5	53.4	49.6	43.2	35	23.4	11.8	3.3		
C Difference On to Off - 2nd On	Δ			0.1	0.2	-0.1	-0.1	0.0	0.1	0.0	-3.5	-1.3	-0.7	-0.8	0.1	1.2	0.3	0.7	0.6	0.7	0.4	0.1	-1.1	1.1	1.9	0.1	0.7	-0.1	-0.4	-0.4	0.1	0.8	0.7	-0.2	-0.8	-1.5	-1.9	-2.4	-1.4	-0.3	1.2	1.1	0.3		
D': Motor platform Casing N on W side 0.5m	On	14	A	83	91	84	84	84	82	81	13.4	20.6	28.8	39.5	48.9	49.7	50	54.9	52.3	57.2	55.8	63.6	69.1	63.3	65.4	70.8	68.2	67.4	67.6																

Table 4.2: Berrima Cement - CBP Assessment 14 December 2023 - On and off Measurements for One-third Octave Band LAeq,t Spectra

Location	CBP	File	Wtg	Statistical Sound Pressure Level - dBA								One-third Octave Band LAeq,t A-weighted Sound Level - dBA																															
				L _{Aeq,t}	L _{Ceq,t}	L _{AMax}	L _{A01,t}	L _{A10,t}	L _{A90,t}	L _{A99,t}	12.5 Hz	16 Hz	20 Hz	25 Hz	31.5 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz	12.5 kHz	16 kHz	20 kHz
I: Level 1, S of fan inlet @ 2.1m	On	27	A	78	88	80	80	78	77	77	13.7	17.4	25.2	36.4	39.3	44.6	43.1	52.5	57.2	61.7	57.2	61	63.4	61.3	63.5	66.1	67.5	66.9	67.7	68.6	66.9	64.6	64.3	62.6	62.2	61.8	60.7	58.2	54.1	46.9	36.2	27.4	12.4
I: Level 1, S of fan inlet @ 2.1m	Off	74	A	77	91	78	78	77	77	76	26.2	33	37.2	41.8	45.5	46.3	49.9	54.5	61.4	58.8	59.6	63.7	65.3	64.7	63.1	65.3	67.1	65.8	66.8	66.8	66.2	64	63.2	62.7	61.8	60	57.1	53.1	46.9	39.1	29.3	19.7	9.8
I: Difference On to off	Δ			0.7	-3.8	1.9	1.5	0.6	0.7	0.7	-12.5	-15.6	-12.0	-5.4	-6.2	-1.7	-6.8	-2.0	-4.2	2.9	-2.4	-2.7	-1.9	-3.4	0.4	0.8	0.4	1.1	0.9	1.8	0.7	0.6	1.1	-0.1	0.4	7.3	3.6	5.1	7.2	7.8	6.9	7.7	2.6
J ^{'''} . Centre Ducon valve on itsa N side @ 1m	On	30	A	77	87	79	78	77	77	76	13.5	17.5	28	38.2	39.9	45.5	43.8	55.5	52.8	55	56.3	59.8	62.3	61.3	63.4	65.3	66.6	66.2	66.9	67.9	66.8	64.4	63.9	62.7	62.2	64.2	59.6	57.1	52.3	45	34.9	25.5	13.2
J ^{'''} . Centre Ducon valve on itsa N side @ 1m	Off	77	A	77	89	79	78	77	76	76	15.7	22.5	30.5	37.3	45.2	44.2	52.1	58.4	54.9	54	57.9	62.2	63.6	64.4	64.1	65.3	66	66.1	66.4	66.8	66.5	64.1	63.5	63.1	62.1	60.4	58	54.4	48.7	40.8	30.5	18.4	7.3
J ^{'''} . Centre Ducon valve Difference On to off	Δ			0.1	-2.2	-0.5	0.1	0.1	0.2	0.2	-2.2	-5.0	-2.5	0.9	-5.3	1.3	-8.3	-2.9	-2.1	1.0	-1.6	-2.4	-1.3	-3.1	-0.7	0.0	0.6	0.1	0.5	1.1	0.3	0.3	0.4	-0.4	0.1	3.8	1.6	2.7	3.6	4.2	4.4	7.1	5.9
J ^{''} . W side Ducon vlve on its N side @ 1m	On	29	A	77	87	78	78	77	77	76	15	17.9	26.5	38.7	39.5	45.2	44.5	55.5	52	58	55	60.7	64.6	62.1	63.4	66.2	67	66.1	67	68.1	66.8	63.3	63.1	62.3	62	63.2	58.4	55.6	50.8	43.8	34.6	24.5	12.5
J ^{''} . W side Ducon vlve on its N side @ 1m	Off	76	A	77	90	78	78	77	76	76	22.3	27.5	33.4	40.4	45.7	46.9	50.5	56.3	56	53.8	58.2	62.6	65	64.2	64.9	65.7	66.1	66.3	66.2	67	67	63.8	62.5	62.7	61.6	59.9	57.3	53.6	47.7	40.1	29.4	18.6	9.3
J ^{''} . W side Ducon valve difference on to off	Δ			0.2	-2.6	0.4	0.4	0.2	0.2	0.1	-7.3	-9.6	-6.9	-1.7	-6.2	-1.7	-6.0	-0.8	-4.0	4.2	-3.2	-1.9	-0.4	-2.1	-1.5	0.5	0.9	-0.2	0.8	1.1	-0.2	-0.5	0.6	-0.4	0.4	3.3	1.1	2.0	3.1	3.7	5.2	5.9	3.2
J ^{''} . W side Ducon vlve on its W side @ 1m & above SC drive	On	31	A	77	86	79	78	77	77	76	16.4	19.4	25.9	36.7	38.7	45.6	43.2	52	50.5	53.2	54.9	59.7	62.6	61.4	63.2	66	67	66.5	67.1	68.1	66.9	63.3	63.2	62.8	63.1	62.9	58	54.7	49.7	43.3	34	24.6	13.6
J ^{''} . W side Ducon vlve on its N side @ 1m	Off	76	A	77	90	78	78	77	76	76	22.3	27.5	33.4	40.4	45.7	46.9	50.5	56.3	56	53.8	58.2	62.6	65	64.2	64.9	65.7	66.1	66.3	66.2	67	67	63.8	62.5	62.7	61.6	59.9	57.3	53.6	47.7	40.1	29.4	18.6	9.3
J ^{''} Difference On to off	Δ			0.0	-3.9	1.0	0.1	-0.1	0.1	0.1	-5.9	-8.1	-7.5	-3.7	-7.0	-1.3	-7.3	-4.3	-5.5	-0.6	-3.3	-2.9	-2.4	-2.8	-1.7	0.3	0.9	0.2	0.9	1.1	-0.1	-0.5	0.7	0.1	1.5	3.0	0.7	1.1	2.0	3.2	4.6	6.0	4.3
J: Level 1, 1m S of Ducon valve	On	28	A	77	88	79	78	78	77	77	14.6	19.4	31.5	39.1	41.6	45.4	43.2	56.6	53.8	56.3	55.6	59.8	62.4	62.1	63.3	64.9	66.9	66.4	67.6	68.4	68.4	65.5	64.5	63.6	63.3	64.5	60.7	58.1	53.5	46.3	36.4	29.3	22.1
J: Level 1, 1m S of Ducon valve	Off	75	A	78	90	80	79	78	77	77	22.5	27.5	34.4	40.5	44.1	44.7	51.7	57.9	55.8	54.3	59	64.1	64.8	65.1	65.7	66.1	66.9	67.5	67.5	68	68.3	65.8	65	64.9	63.8	61.9	59.2	55.3	49.4	41.9	32.9	22.7	12.7
J Difference On to off	Δ			-0.6	-2.3	-0.7	-0.8	-0.6	-0.3	-0.2	-7.9	-8.1	-2.9	-1.4	-2.5	0.7	-8.5	-1.3	-2.0	2.0	-3.4	-4.3	-2.4	-3.0	-2.4	-1.2	0.0	-1.1	0.1	0.4	0.1	-0.3	-0.5	-1.3	-0.5	2.6	1.5	2.8	4.1	4.4	3.5	6.6	9.4
K: Level 2 opp fan inlet duct by column @ 2.5m	On	32	A	77	87	79	78	78	77	77	12.5	18.3	27.4	39.9	40.1	44.2	41.8	47	49.3	52.6	56.1	62.3	68.2	62.2	63.2	65.4	66.9	66.2	66.8	67.6	66.8	64.1	64.1	62.5	62.3	65.6	60.7	58.2	53.7	46.7	36.7	28.6	13.7
K: Level 2 opp fan inlet duct by column @ 2.5m	Off	78	A	77	89	78	78	77	77	76	18.9	26	32	38.5	45.6	42.8	44.8	49.5	60.5	55.3	58.7	60.7	62.5	63.8	65.2	65	66.1	66	66.5	67	66.8	64.2	63.7	63.3	62.8	61.8	59.7	56.6	51	42.9	31.7	20	10.2
K Difference On to off	Δ			0.6	-1.9	1.2	0.7	0.6	0.5	0.6	-6.4	-7.7	-4.6	1.4	-5.5	1.4	-3.0	-2.5	-11.2	-2.7	-2.6	1.6	5.7	-1.6	-2.0	0.4	0.8	0.2	0.3	0.6	0.0	-0.1	0.4	-0.8	-0.5	3.8	1.0	1.6	2.7	3.8	5.0	8.6	3.5
L:Level 3 N side of fan discharge on E side by pipe @ 1.8m	On	3																																									

Table 4.2: Berrima Cement - CBP Assessment 14 December 2023 - On and off Measurements for One-third Octave Band LAeq,t Spectra

Location	CBP	File	Wtg	Statistical Sound Pressure Level - dBA							One-third Octave Band LAeq,t A-weighted Sound Level - dBA																																
				L _{Aeq,t}	L _{Ceq,t}	L _{AMax}	L _{A01,t}	L _{A10,t}	L _{A90,t}	L _{A99,t}	12.5 Hz	16 Hz	20 Hz	25 Hz	31.5 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz	12.5 kHz	16 kHz	20 kHz
V: Level 4 Rad cooler S fan @ 1.4m	Off	92	A	80	88	82	82	81	80	79	11.6	21.1	32.5	35.4	40.6	40.5	42.3	50.2	57.2	57.7	61.3	62.4	64.6	64.6	66.9	68	68.1	68.1	71.9	71.9	71.3	69.6	67.7	66.2	64.2	61.7	58.1	54.1	47.5	37.6	24	11.1	
V Difference On to Off	Δ			-0.9	0.4	4.4	1.8	-0.9	-1.2	-1.3	-0.4	-0.9	-0.1	-1.3	0.8	3.5	2.0	0.9	-2.4	0.6	0.6	1.5	2.1	1.7	1.6	0.0	0.2	0.7	1.3	-0.5	-1.6	-4.9	-4.7	-3.9	-4.1	-3.9	-4.7	-3.5	-3.8	-1.8	1.8	6.6	6.7
W: Bottom level Rad cooler S side valve @ 1m	On	50	A	78	91	81	79	79	78	77	21.7	28.3	35.5	38.4	43.6	46.5	49.6	58.3	62.9	61.4	59.1	64.4	66.6	63.6	65.3	65.9	67.2	67.8	68.3	69.2	69.5	65.7	64.1	62.7	60.3	58.3	53.2	49.8	44.3	41	37	30.8	21.3
W: Bottom level Rad cooler S side valve @ 1m	Off	93	A	80	92	86	84	81	79	79	25	31.1	37.3	41.6	45.4	48.6	51	59	57.9	57.1	60.5	62.6	65.7	64.1	65.7	67.2	67.5	67.4	68.8	69.5	72.9	71.8	69.2	67.5	65.7	63.3	60.4	56.5	51.7	44.5	35.1	23.7	12.9
W Difference On to off	Δ			-1.9	-0.4	-4.2	-5.2	-2.0	-1.7	-1.5	-3.3	-2.8	-1.8	-3.2	-1.8	-2.1	-1.4	-0.7	5.0	4.3	-1.4	1.8	0.9	-0.5	-0.4	-1.3	-0.3	0.4	-0.5	-0.3	-3.4	-6.1	-5.1	-4.8	-5.4	-5.0	-7.2	-6.7	-7.4	-3.5	1.9	7.1	8.4
FA276#1 S side of casing @ 2m	On	51	A	86	97	97	92	87	83	83	16.8	26.9	43.3	44.4	51.1	51.4	52.1	66.8	60.5	63.3	66.2	70.7	71.8	68.4	71.7	73	72.4	72.8	73.2	79.2	77.9	70.7	70.3	70.1	69.9	69.7	68.5	66.6	64	61.6	59.3	51	41.8
FA 276 #1	Off	94	A	85	96	89	87	86	84	83	17.5	25.4	41.5	43.9	51.4	50.6	50.9	65.4	58.3	59.5	64.9	69.9	71	67.6	70.9	72.4	71.9	72.2	71.6	80.1	76	70.3	70.7	69.5	70.4	67.9	66.1	63.5	61.2	55.9	49.9	41.7	31.5
FA 276 #1 Difference On to Off	Δ			0.6	1.0	7.6	4.9	0.8	-0.2	-0.3	-0.7	1.5	1.8	0.5	-0.3	0.8	1.2	1.4	2.2	3.8	1.3	0.8	0.8	0.8	0.8	0.6	0.5	0.6	1.6	-0.9	1.9	0.4	-0.4	0.6	-0.5	1.8	2.4	3.1	2.8	5.7	9.4	9.3	10.3
#2 S side motor @ 1m	On	52	A	85	98	95	90	86	84	83	23	29.6	42.7	44.5	51.8	50.9	52.7	69.1	60.1	63.2	64.8	71.4	74	69	72	73.2	72.2	74.4	73.4	77.7	75.3	69.9	70.4	68.9	69.1	71.4	67.8	65.3	64.1	61.2	58.2	52.5	42.4
FA 276 #1	Off	94	A	85	96	89	87	86	84	83	17.5	25.4	41.5	43.9	51.4	50.6	50.9	65.4	58.3	59.5	64.9	69.9	71	67.6	70.9	72.4	71.9	72.2	71.6	80.1	76	70.3	70.7	69.5	70.4	67.9	66.1	63.5	61.2	55.9	49.9	41.7	31.5
FA276 #2 Difference On to Off	Δ			0.2	2.0	5.3	2.4	-0.1	0.1	0.2	5.5	4.2	1.2	0.6	0.4	0.3	1.8	3.7	1.8	3.7	-0.1	1.5	3.0	1.4	1.1	0.8	0.3	2.2	1.8	-2.4	-0.7	-0.4	-0.3	-0.6	-1.3	3.5	1.7	1.8	2.9	5.3	8.3	10.8	10.9
#3 Motor end @ 1m	On	53	A	84	95	87	86	85	83	83	17.3	26.3	40.2	43.6	48.9	49.4	50.6	63.7	59.4	61.4	64.1	71.1	71.8	69.7	71.1	73.1	72.3	72.4	72.1	77.4	74.4	68.9	68.6	66.9	66.7	68.2	60.7	58.3	55	53.8	49	40.3	32.4
FA 276 #3	Off	95	A	85	94	97	93	86	84	83	17	25.8	38.7	42.7	48.6	49.1	49.6	63.8	56.6	58.8	63.5	70.8	72	69.1	71.4	73.3	72.6	71.5	71.9	79.7	75.2	71.1	71.9	71.8	72.1	70.6	69.6	67.6	66.1	62.3	58	51.4	42.1
FA 276 #3 Difference On to off	Δ			-1.4	0.3	-10.0	-7.2	-0.9	-0.7	-0.4	0.3	0.5	1.5	0.9	0.3	0.3	1.0	-0.1	2.8	2.6	0.6	0.3	-0.2	0.6	-0.3	-0.2	-0.3	0.9	0.2	-2.3	-0.8	-2.2	-3.3	-4.9	-5.4	-2.4	-8.9	-9.3	-11.1	-8.5	-9.0	-11.1	-9.7
FA 276 #4 Motor N side @ 1m	On	54	A	85	96	88	87	86	84	83	20.8	28.3	39.3	42.2	48	49	52.2	67.8	61.2	63.5	65	70.8	70.8	68.6	70.8	72.4	71.7	72.1	72.9	80.4	74.8	69.9	69.6	66.8	69	71.9	62.4	59.5	54.8	52.9	48.3	40.7	33.1
FA 276 #5	Off	96	A	82	96	89	88	82	81	80	28.3	34.3	40.6	44.6	48.8	50.3	53.3	68	60	60.9	63.4	68.7	70.1	66.5	68.5	70.9	68.2	68	68.6	74.8	72.5	68.1	67.6	67	66.4	64.3	62.3	60.9	59.1	54.8	50.4	41.2	30.5
FA 276 #4 Motor N side Difference On to Off	Δ			3.2	-0.3	-1.1	-1.0	4.0	3.2	3.1	-7.5	-6.0	-1.3	-2.4	-0.8	-1.3	-1.1	-0.2	1.2	2.6	1.6	2.1	0.7	2.1	2.3	1.5	3.5	4.1	4.3	5.6	2.3	1.8	2.0	-0.2	2.6	7.6	0.1	-1.4	-4.3	-1.9	-2.1	-0.5	2.6
#5 Discharge N side @ 0.5m	On	55	A	84	96	86	86	84	83	82	16.2	26.3	36.5	38.4	46.2	48.8	53.2	68.2	61.5	65.2	65.3	72.6	73.4	67.7	69.5	71	71.7	72.5	72.3	77.9	72.1	67.2	66.8	64.3	66.3	66.6	58.7	54.7	51.1	47.4	41.5	29.9	21.3
FA 276 #5	Off	96	A	82	96	89	88	82	81	80	28.3	34.3	40.6	44.6	48.8	50.3	53.3	68	60	60.9	63.4	68.7	70.1	66.5	68.5	70.9	68.2	68	68.6	74.8	72.5	68.1	67.6	67	66.4	64.3	62.3	60.9	59.1	54.8	50.4	41.2	30.5
FA 276 #5 Difference On to Off	Δ			1.9	-0.2	-2.5	-2.6	2.2	2.2	2.2	-12.1	-8.0	-4.1	-6.2	-2.6	-1.5	-0.1	0.2	1.5	4.3	1.9	3.9	3.3	1.2	1.0	0.1	3.5	4.5	3.7	3.1	-0.4	-0.9	-0.8	-2.7	-0.1	2.3	-3.6	-6.2	-8.0	-7.4	-8.9	-11.3	-9.2
#6 Inlet N side & discharge casing @ 1m	On	56	A	83	98	84	83	83	82	82	14.9	26.7	38.5	39.3	47.1	50.6	57.2	71.1	62.3	62.4	64.8	70.6	71.3	67.5	67.9	68.9	71.2	72.1	72.2	74.8	72.3	67.9	67.3	65.4	65.5	65.4	60.5	57.1	54.2	49.4	43	33.6	24.2
FA 276 #6	Off	97	A	81	95	88	85	82	80	79	16.5	21.2	31.4	37.3	46.1	46.2	50.3	69.1	58.3	59.2	63.7	67.2	68.1	64.7	66.2	67.5	68.9	69.4	67.9	74.3	71.2	67.3	67.1	66.3	65.7	63.4	62.3	59.8	57.4	52.6	47.8	39	27.3
FA 276 #6 Difference On to off	Δ			1.7	2.6	-4.1	-1.8	1.0	2.5	2.5	-1.6	5.5	7.1	2.0	1.0	4.4	6.9	2.0	4.0	3.2	1.1	3.4	3.2	2.8	1.7	1.4	2.3	2.7	4.3	0.5	1.1	0.6	0.2	-0.9	-0.2	2.0	-1.8	-2.7	-3.2	-3.2	-4.8	-5.4	-3.1
FA 276 #7 Inlet @1m	On	57	A	86	99	88	87	86	85	84	19	30.1	44	43.7	51.8	54.9	60.5	69	65.7	70.4	72.5	73.6	75.8	73.1	70.5	70.9	74.8	73.4	72.2	78	74.1	71.3	70.3	70.4	68.5	66.5	64	60.7	58.1	53.7	50.4	43.4	35.4
FA 276 #7	Off	98	A	83	95	86	85	84	81	80	16.9	20.9	33.9	39.3	47.8	49.3	50.5	68.1	58.2	58.7	61.8	67.3	70.5	65	67.5	67.4	68.1	69.2	68.6</														

Table 4.2: Berrima Cement - CBP Assessment 14 December 2023 - On and off Measurements for One-third Octave Band LAeq,t Spectra

Location	CBP	File	Wtg	Statistical Sound Pressure Level - dBA								One-third Octave Band LAeq,t A-weighted Sound Level - dBA																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
				L _{Aeq,t}	L _{Ceq,t}	L _{AMax}	L _{A01,t}	L _{A10,t}	L _{A90,t}	L _{A99,t}	12.5 Hz	16 Hz	20 Hz	25 Hz	31.5 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz	12.5 kHz	16 kHz	20 kHz																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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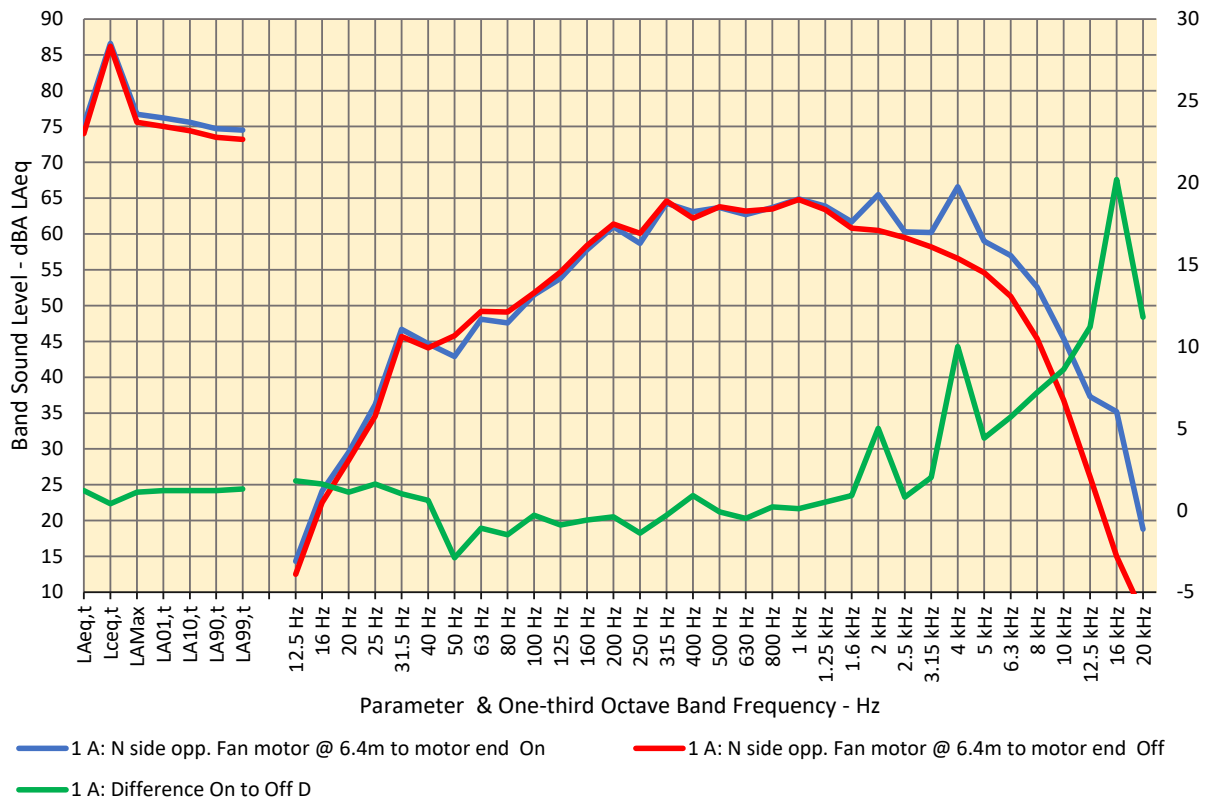
Table 4.2: Berrima Cement - CBP Assessment 14 December 2023 - On and off Measurements for One-third Octave Band LAeq,t Spectra

Location	CBP	File	Wtg	Statistical Sound Pressure Level - dBA							One-third Octave Band LAeq,t A-weighted Sound Level - dBA																																
				L _{Aeq,t}	L _{Ceq,t}	L _{AMax}	L _{A01,t}	L _{A10,t}	L _{A90,t}	L _{A99,t}	12.5 Hz	16 Hz	20 Hz	25 Hz	31.5 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz	12.5 kHz	16 kHz	20 kHz
I: Level 1, S of fan inlet @ 2.1m	On	27	A	78	88	80	80	78	77	77	13.7	17.4	25.2	36.4	39.3	44.6	43.1	52.5	57.2	61.7	57.2	61	63.4	61.3	63.5	66.1	67.5	66.9	67.7	68.6	66.9	64.6	64.3	62.6	62.2	61.8	60.7	58.2	54.1	46.9	36.2	27.4	12.4
I: Level 1, S of fan inlet @ 2.1m	Off	74	A	77	91	78	78	77	77	76	26.2	33	37.2	41.8	45.5	46.3	49.9	54.5	61.4	58.8	59.6	63.7	65.3	64.7	63.1	65.3	67.1	65.8	66.8	66.8	66.2	64	63.2	62.7	61.8	60	57.1	53.1	46.9	39.1	29.3	19.7	9.8
I: Difference On to off	Δ			0.7	-3.8	1.9	1.5	0.6	0.7	0.7	-12.5	-15.6	-12.0	-5.4	-6.2	-1.7	-6.8	-2.0	-4.2	2.9	-2.4	-2.7	-1.9	-3.4	0.4	0.8	0.4	1.1	0.9	1.8	0.7	0.6	1.1	-0.1	0.4	7.3	3.6	5.1	7.2	7.8	6.9	7.7	2.6
J ^{'''} . Centre Ducon valve on itsa N side @ 1m	On	30	A	77	87	79	78	77	77	76	13.5	17.5	28	38.2	39.9	45.5	43.8	55.5	52.8	55	56.3	59.8	62.3	61.3	63.4	65.3	66.6	66.2	66.9	67.9	66.8	64.4	63.9	62.7	62.2	64.2	59.6	57.1	52.3	45	34.9	25.5	13.2
J ^{'''} . Centre Ducon valve on itsa N side @ 1m	Off	77	A	77	89	79	78	77	76	76	15.7	22.5	30.5	37.3	45.2	44.2	52.1	58.4	54.9	54	57.9	62.2	63.6	64.3	64.1	65.3	66	66.1	66.4	66.8	66.5	64.1	63.5	63.1	62.1	60.4	58	54.4	48.7	40.8	30.5	18.4	7.3
J ^{'''} . Centre Ducon valve Difference On to off	Δ			0.1	-2.2	-0.5	0.1	0.1	0.2	0.2	-2.2	-5.0	-2.5	0.9	-5.3	1.3	-8.3	-2.9	-2.1	1.0	-1.6	-2.4	-1.3	-3.1	-0.7	0.0	0.6	0.1	0.5	1.1	0.3	0.3	0.4	-0.4	0.1	3.8	1.6	2.7	3.6	4.2	4.4	7.1	5.9
J ['] . W side Ducon vlve on its N side @ 1m	On	29	A	77	87	78	78	77	77	76	15	17.9	26.5	38.7	39.5	45.2	44.5	55.5	52	58	55	60.7	64.6	62.1	63.4	66.2	67	66.1	67	68.1	66.8	63.3	63.1	62.3	62	63.2	58.4	55.6	50.8	43.8	34.6	24.5	12.5
J ['] . W side Ducon vlve on its N side @ 1m	Off	76	A	77	90	78	78	77	76	76	22.3	27.5	33.4	40.4	45.7	46.9	50.5	56.3	56	53.8	58.2	62.6	65	64.2	64.9	65.7	66.1	66.3	66.2	67	67	63.8	62.5	62.7	61.6	59.9	57.3	53.6	47.7	40.1	29.4	18.6	9.3
J ['] : W side Ducon valve difference on to off	Δ			0.2	-2.6	0.4	0.4	0.2	0.2	0.1	-7.3	-9.6	-6.9	-1.7	-6.2	-1.7	-6.0	-0.8	-4.0	4.2	-3.2	-1.9	-0.4	-2.1	-1.5	0.5	0.9	-0.2	0.8	1.1	-0.2	-0.5	0.6	-0.4	0.4	3.3	1.1	2.0	3.1	3.7	5.2	5.9	3.2
J ['] . W side Ducon vlve on its W side @ 1m & above SC drive	On	31	A	77	86	79	78	77	77	76	16.4	19.4	25.9	36.7	38.7	45.6	43.2	52	50.5	53.2	54.9	59.7	62.6	61.4	63.2	66	67	66.5	67.1	68.1	66.9	63.3	63.2	62.8	63.1	62.9	58	54.7	49.7	43.3	34	24.6	13.6
J ['] . W side Ducon vlve on its N side @ 1m	Off	76	A	77	90	78	78	77	76	76	22.3	27.5	33.4	40.4	45.7	46.9	50.5	56.3	56	53.8	58.2	62.6	65	64.2	64.9	65.7	66.1	66.3	66.2	67	67	63.8	62.5	62.7	61.6	59.9	57.3	53.6	47.7	40.1	29.4	18.6	9.3
J ['] Difference On to off	Δ			0.0	-3.9	1.0	0.1	-0.1	0.1	0.1	-5.9	-8.1	-7.5	-3.7	-7.0	-1.3	-7.3	-4.3	-5.5	-0.6	-3.3	-2.9	-2.4	-2.8	-1.7	0.3	0.9	0.2	0.9	1.1	-0.1	-0.5	0.7	0.1	1.5	3.0	0.7	1.1	2.0	3.2	4.6	6.0	4.3
J: Level 1, 1m S of Ducon valve	On	28	A	77	88	79	78	78	77	77	14.6	19.4	31.5	39.1	41.6	45.4	43.2	56.6	53.8	56.3	55.6	59.8	62.4	62.1	63.3	64.9	66.9	66.4	67.6	68.4	68.4	65.5	64.5	63.6	63.3	64.5	60.7	58.1	53.5	46.3	36.4	29.3	22.1
J: Level 1, 1m S of Ducon valve	Off	75	A	78	90	80	79	78	77	77	22.5	27.5	34.4	40.5	44.1	44.7	51.7	57.9	55.8	54.3	59	64.1	64.8	65.1	65.7	66.1	66.9	67.5	67.5	68	68.3	65.8	65	64.9	63.8	61.9	59.2	55.3	49.4	41.9	32.9	22.7	12.7
J Difference On to off	Δ			-0.6	-2.3	-0.7	-0.8	-0.6	-0.3	-0.2	-7.9	-8.1	-2.9	-1.4	-2.5	0.7	-8.5	-1.3	-2.0	2.0	-3.4	-4.3	-2.4	-3.0	-2.4	-1.2	0.0	-1.1	0.1	0.4	0.1	-0.3	-0.5	-1.3	-0.5	2.6	1.5	2.8	4.1	4.4	3.5	6.6	9.4
K: Level 2 opp fan inlet duct by column @ 2.5m	On	32	A	77	87	79	78	78	77	77	12.5	18.3	27.4	39.9	40.1	44.2	41.8	47	49.3	52.6	56.1	62.3	68.2	62.2	63.2	65.4	66.9	66.2	66.8	67.6	66.8	64.1	64.1	62.5	62.3	65.6	60.7	58.2	53.7	46.7	36.7	28.6	13.7
K: Level 2 opp fan inlet duct by column @ 2.5m	Off	78	A	77	89	78	78	77	77	76	18.9	26	32	38.5	45.6	42.8	44.8	49.5	60.5	55.3	58.7	60.7	62.5	63.8	65.2	65	66.1	66	66.5	67	66.8	64.2	63.7	63.3	62.8	61.8	59.7	56.6	51	42.9	31.7	20	10.2
K Difference On to off	Δ			0.6	-1.9	1.2	0.7	0.6	0.5	0.6	-6.4	-7.7	-4.6	1.4	-5.5	1.4	-3.0	-2.5	-11.2	-2.7	-2.6	1.6	5.7	-1.6	-2.0	0.4	0.8	0.2	0.3	0.6	0.0	-0.1	0.4	-0.8	-0.5	3.8	1.0	1.6	2.7	3.8	5.0	8.6	3.5
L:Level 3 N side of fan discharge on E side by pipe @ 1.8m	On	33	A	78	90	80	79	79																																			

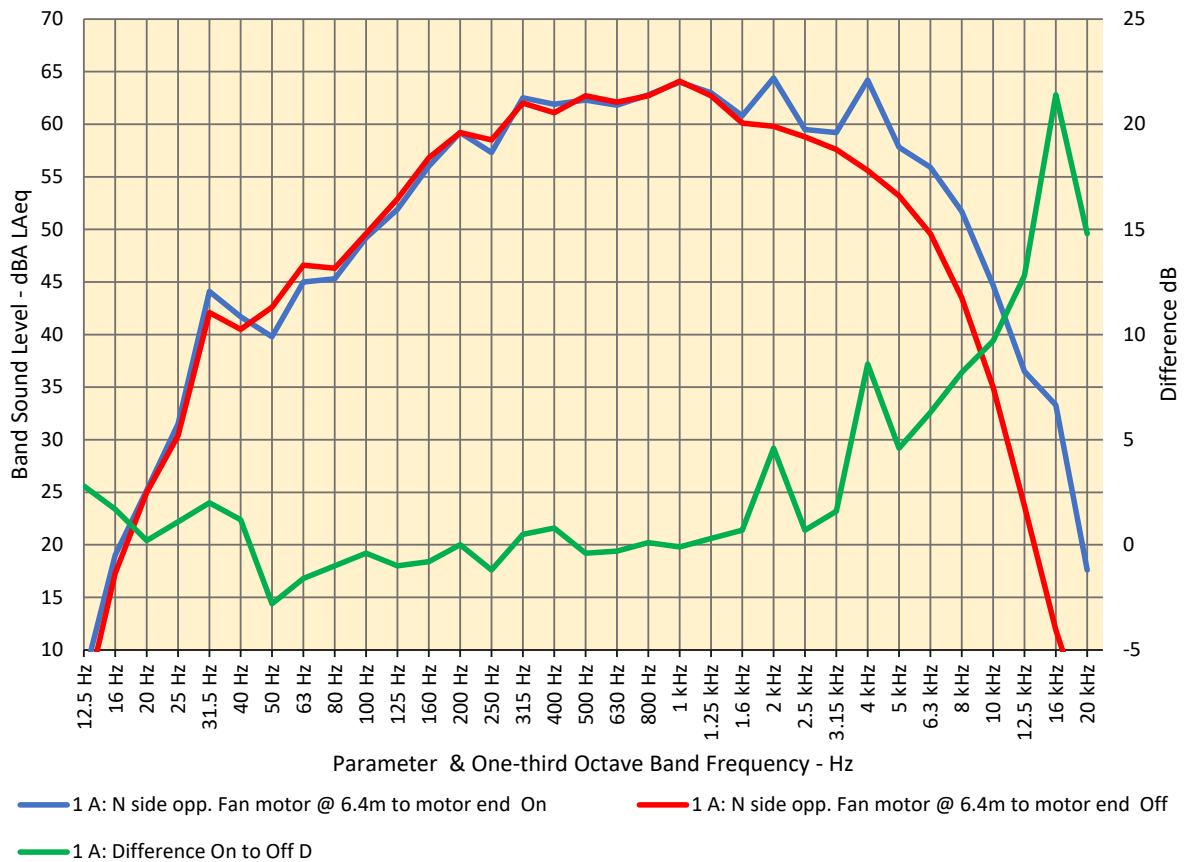
Table 4.2: Berrima Cement - CBP Assessment 14 December 2023 - On and off Measurements for One-third Octave Band LAeq,t Spectra

Location	CBP	File	Wtg	Statistical Sound Pressure Level - dBA								One-third Octave Band LAeq,t A-weighted Sound Level - dBA																															
				L _{Aeq,t}	L _{Ceq,t}	L _{AMax}	L _{A01,t}	L _{A10,t}	L _{A90,t}	L _{A99,t}	12.5 Hz	16 Hz	20 Hz	25 Hz	31.5 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz	12.5 kHz	16 kHz	20 kHz
V: Level 4 Rad cooler S fan @ 1.4m	Off	92	A	80	88	82	82	81	80	79	11.6	21.1	32.5	35.4	40.6	40.5	42.3	50.2	57.2	57.7	61.3	62.4	64.6	64.6	66.9	68	68.1	68.1	68.1	71.9	71.9	71.3	69.6	67.7	66.2	64.2	61.7	58.1	54.1	47.5	37.6	24	11.1
V Difference On to Off	Δ			-0.9	0.4	4.4	1.8	-0.9	-1.2	-1.3	-0.4	-0.9	-0.1	-1.3	0.8	3.5	2.0	0.9	-2.4	0.6	0.6	1.5	2.1	1.7	1.6	0.0	0.2	0.7	1.3	-0.5	-1.6	-4.9	-4.7	-3.9	-4.1	-3.9	-4.7	-3.5	-3.8	-1.8	1.8	6.6	6.7
W: Bottom level Rad cooler S side valve @ 1m	On	50	A	78	91	81	79	79	78	77	21.7	28.3	35.5	38.4	43.6	46.5	49.6	58.3	62.9	61.4	59.1	64.4	66.6	63.6	65.3	65.9	67.2	67.8	68.3	69.2	69.5	65.7	64.1	62.7	60.3	58.3	53.2	49.8	44.3	41	37	30.8	21.3
W: Bottom level Rad cooler S side valve @ 1m	Off	93	A	80	92	86	84	81	79	79	25	31.1	37.3	41.6	45.4	48.6	51	59	57.9	57.1	60.5	62.6	65.7	64.1	65.7	67.2	67.5	67.4	68.8	69.5	72.9	71.8	69.2	67.5	65.7	63.3	60.4	56.5	51.7	44.5	35.1	23.7	12.9
W Difference On to off	Δ			-1.9	-0.4	-4.2	-5.2	-2.0	-1.7	-1.5	-3.3	-2.8	-1.8	-3.2	-1.8	-2.1	-1.4	-0.7	5.0	4.3	-1.4	1.8	0.9	-0.5	-0.4	-1.3	-0.3	0.4	-0.5	-0.3	-3.4	-6.1	-5.1	-4.8	-5.4	-5.0	-7.2	-6.7	-7.4	-3.5	1.9	7.1	8.4
FA276#1 S side of casing @ 2m	On	51	A	86	97	97	92	87	83	83	16.8	26.9	43.3	44.4	51.1	51.4	52.1	66.8	60.5	63.3	66.2	70.7	71.8	68.4	71.7	73	72.4	72.8	73.2	79.2	77.9	70.7	70.3	70.1	69.9	69.7	68.5	66.6	64	61.6	59.3	51	41.8
FA 276 #1	Off	94	A	85	96	89	87	86	84	83	17.5	25.4	41.5	43.9	51.4	50.6	50.9	65.4	58.3	59.5	64.9	69.9	71	67.6	70.9	72.4	71.9	72.2	71.6	80.1	76	70.3	70.7	69.5	70.4	67.9	66.1	63.5	61.2	55.9	49.9	41.7	31.5
FA 276 #1 Difference On to Off	Δ			0.6	1.0	7.6	4.9	0.8	-0.2	-0.3	-0.7	1.5	1.8	0.5	-0.3	0.8	1.2	1.4	2.2	3.8	1.3	0.8	0.8	0.8	0.8	0.6	0.5	0.6	1.6	-0.9	1.9	0.4	-0.4	0.6	-0.5	1.8	2.4	3.1	2.8	5.7	9.4	9.3	10.3
#2 S side motor @ 1m	On	52	A	85	98	95	90	86	84	83	23	29.6	42.7	44.5	51.8	50.9	52.7	69.1	60.1	63.2	64.8	71.4	74	69	72	73.2	72.2	74.4	73.4	77.7	75.3	69.9	70.4	68.9	69.1	71.4	67.8	65.3	64.1	61.2	58.2	52.5	42.4
FA 276 #1	Off	94	A	85	96	89	87	86	84	83	17.5	25.4	41.5	43.9	51.4	50.6	50.9	65.4	58.3	59.5	64.9	69.9	71	67.6	70.9	72.4	71.9	72.2	71.6	80.1	76	70.3	70.7	69.5	70.4	67.9	66.1	63.5	61.2	55.9	49.9	41.7	31.5
FA276 #2 Difference On to Off	Δ			0.2	2.0	5.3	2.4	-0.1	0.1	0.2	5.5	4.2	1.2	0.6	0.4	0.3	1.8	3.7	1.8	3.7	-0.1	1.5	3.0	1.4	1.1	0.8	0.3	2.2	1.8	-2.4	-0.7	-0.4	-0.3	-0.6	-1.3	3.5	1.7	1.8	2.9	5.3	8.3	10.8	10.9
#3 Motor end @ 1m	On	53	A	84	95	87	86	85	83	83	17.3	26.3	40.2	43.6	48.9	49.4	50.6	63.7	59.4	61.4	64.1	71.1	71.8	69.7	71.1	73.1	72.3	72.4	72.1	77.4	74.4	68.9	68.6	66.9	66.7	68.2	60.7	58.3	55	53.8	49	40.3	32.4
FA 276 #3	Off	95	A	85	94	97	93	86	84	83	17	25.8	38.7	42.7	48.6	49.1	49.6	63.8	56.6	58.8	63.5	70.8	72	69.1	71.4	73.3	72.6	71.5	71.9	79.7	75.2	71.1	71.9	71.8	72.1	70.6	69.6	67.6	66.1	62.3	58	51.4	42.1
FA 276 #3 Difference On to off	Δ			-1.4	0.3	-10.0	-7.2	-0.9	-0.7	-0.4	0.3	0.5	1.5	0.9	0.3	0.3	1.0	-0.1	2.8	2.6	0.6	0.3	-0.2	0.6	-0.3	-0.2	-0.3	0.9	0.2	-2.3	-0.8	-2.2	-3.3	-4.9	-5.4	-2.4	-8.9	-9.3	-11.1	-8.5	-9.0	-11.1	-9.7
FA 276 #4 Motor N side @ 1m	On	54	A	85	96	88	87	86	84	83	20.8	28.3	39.3	42.2	48	49	52.2	67.8	61.2	63.5	65	70.8	70.8	68.6	70.8	72.4	71.7	72.1	72.9	80.4	74.8	69.9	69.6	66.8	69	71.9	62.4	59.5	54.8	52.9	48.3	40.7	33.1
FA 276 #5	Off	96	A	82	96	89	88	82	81	80	28.3	34.3	40.6	44.6	48.8	50.3	53.3	68	60	60.9	63.4	68.7	70.1	66.5	68.5	70.9	68.2	68	68.6	74.8	72.5	68.1	67.6	67	66.4	64.3	62.3	60.9	59.1	54.8	50.4	41.2	30.5
FA 276 #4 Motor N side Difference On to Off	Δ			3.2	-0.3	-1.1	-1.0	4.0	3.2	3.1	-7.5	-6.0	-1.3	-2.4	-0.8	-1.3	-1.1	-0.2	1.2	2.6	1.6	2.1	0.7	2.1	2.3	1.5	3.5	4.1	4.3	5.6	2.3	1.8	2.0	-0.2	2.6	7.6	0.1	-1.4	-4.3	-1.9	-2.1	-0.5	2.6
#5 Discharge N side @ 0.5m	On	55	A	84	96	86	86	84	83	82	16.2	26.3	36.5	38.4	46.2	48.8	53.2	68.2	61.5	65.2	65.3	72.6	73.4	67.7	69.5	71	71.7	72.5	72.3	77.9	72.1	67.2	66.8	64.3	66.3	66.6	58.7	54.7	51.1	47.4	41.5	29.9	21.3
FA 276 #5	Off	96	A	82	96	89	88	82	81	80	28.3	34.3	40.6	44.6	48.8	50.3	53.3	68	60	60.9	63.4	68.7	70.1	66.5	68.5	70.9	68.2	68	68.6	74.8	72.5	68.1	67.6	67	66.4	64.3	62.3	60.9	59.1	54.8	50.4	41.2	30.5
FA 276 #5 Difference On to Off	Δ			1.9	-0.2	-2.5	-2.6	2.2	2.2	2.2	-12.1	-8.0	-4.1	-6.2	-2.6	-1.5	-0.1	0.2	1.5	4.3	1.9	3.9	3.3	1.2	1.0	0.1	3.5	4.5	3.7	3.1	-0.4	-0.9	-0.8	-2.7	-0.1	2.3	-3.6	-6.2	-8.0	-7.4	-8.9	-11.3	-9.2
#6 Inlet N side & discharge casing @ 1m	On	56	A	83	98	84	83	83	82	82	14.9	26.7	38.5	39.3	47.1	50.6	57.2	71.1	62.3	62.4	64.8	70.6	71.3	67.5	67.9	68.9	71.2	72.1	72.2	74.8	72.3	67.9	67.3	65.4	65.5	65.4	60.5	57.1	54.2	49.4	43	33.6	24.2
FA 276 #6	Off	97	A	81	95	88	85	82	80	79	16.5	21.2	31.4	37.3	46.1	46.2	50.3	69.1	58.3	59.2	63.7	67.2	68.1	64.7	66.2	67.5	68.9	69.4	67.9	74.3	71.2	67.3	67.1	66.3	65.7	63.4	62.3	59.8	57.4	52.6	47.8	39	27.3
FA 276 #6 Difference On to off	Δ			1.7	2.6	-4.1	-1.8	1.0	2.5	2.5	-1.6	5.5	7.1	2.0	1.0	4.4	6.9	2.0	4.0	3.2	1.1	3.4	3.2	2.8	1.7	1.4	2.3	2.7	4.3	0.5	1.1	0.6	0.2	-0.9	-0.2	2.0	-1.8	-2.7	-3.2	-3.2	-4.8	-5.4	-3.1
FA 276 #7 Inlet @1m	On	57	A	86	99	88	87	86	85	84	19	30.1	44	43.7	51.8	54.9	60.5	69	65.7	70.4	72.5	73.6	75.8	73.1	70.5	70.9	74.8	73.4	72.2	78	74.1	71.3	70.3	70.4	68.5	66.5	64	60.7	58.1	53.7	50.4	43.4	35.4
FA 276 #7	Off	98	A	83	95	86	85	84	81	80	16.9	20.9	33.9	39.3	47.8	49.3	50.5	68.1	58.2	58.7	61.8	67.3	70.5	65	67.5	67.4	68.1	69.2	68.6	79.1	72.7	67.4											

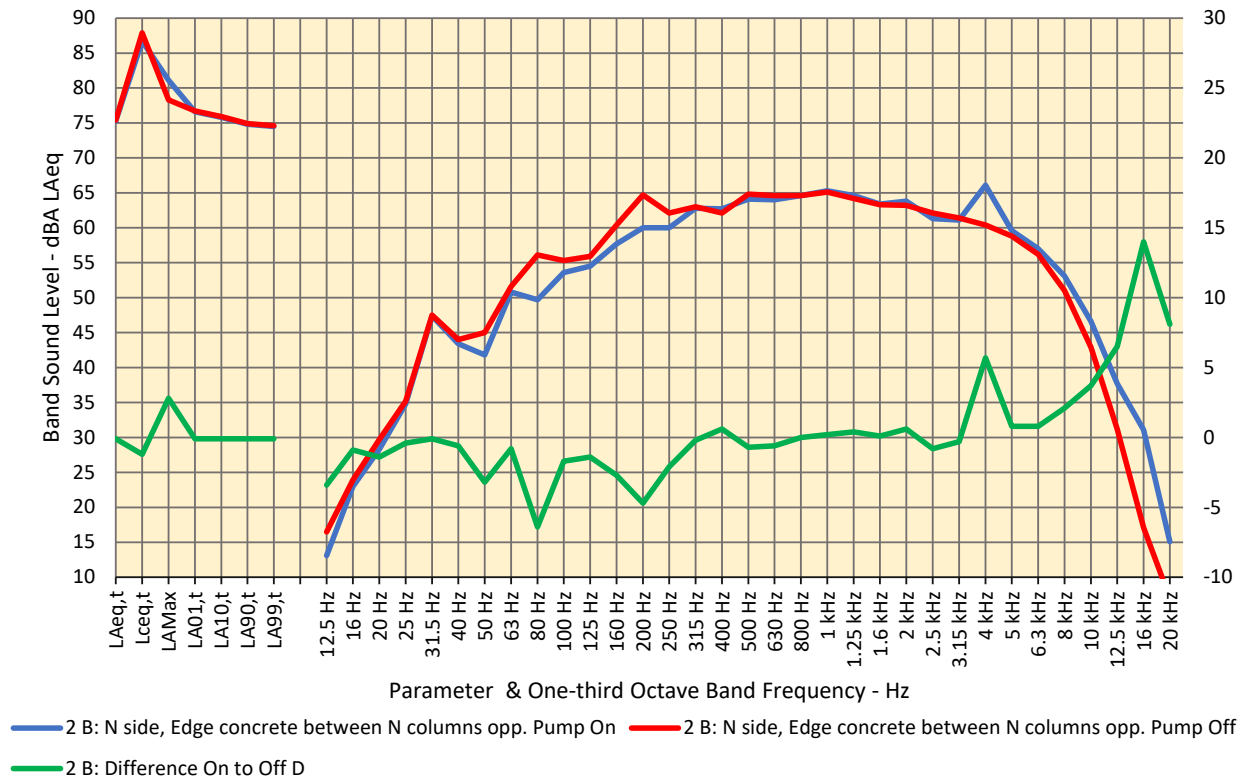
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.A $L_{Aeq,t}$



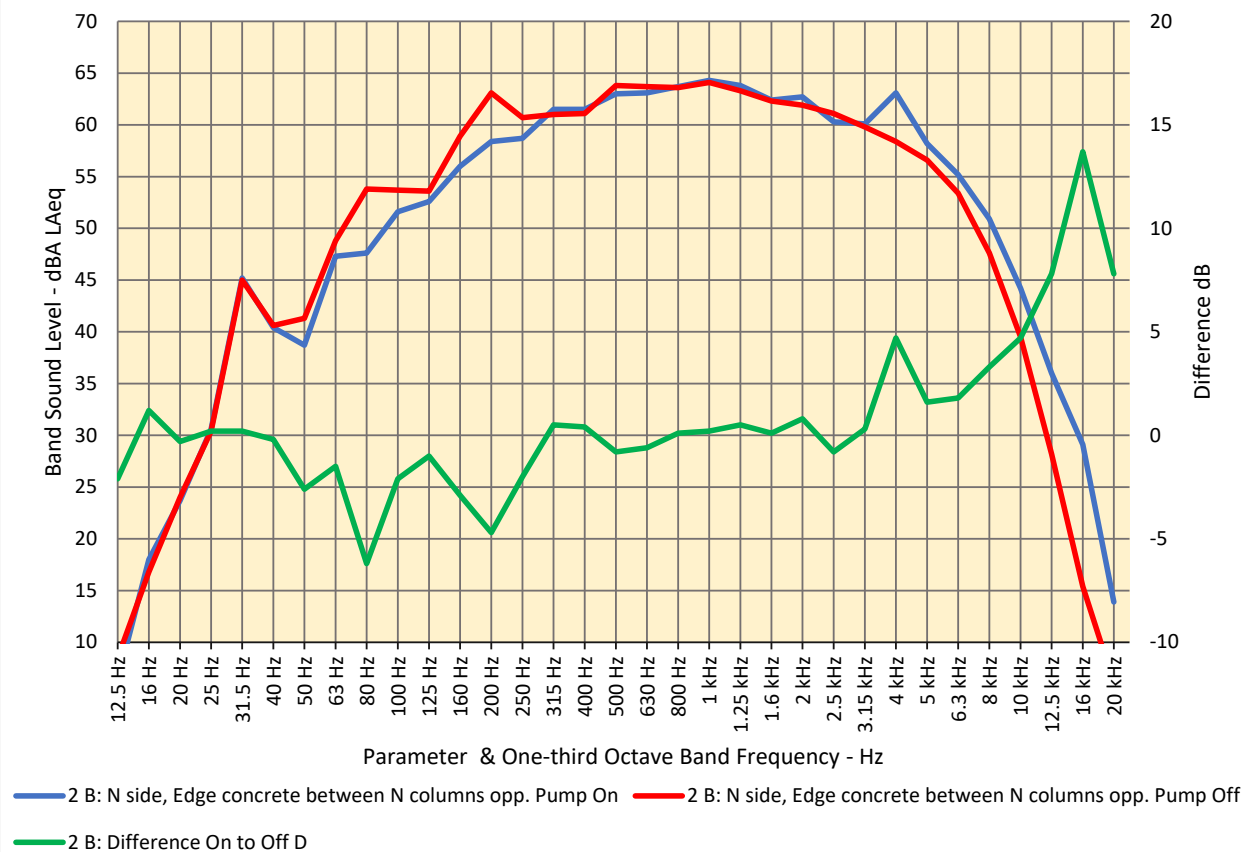
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc. A - $L_{A90,t}$



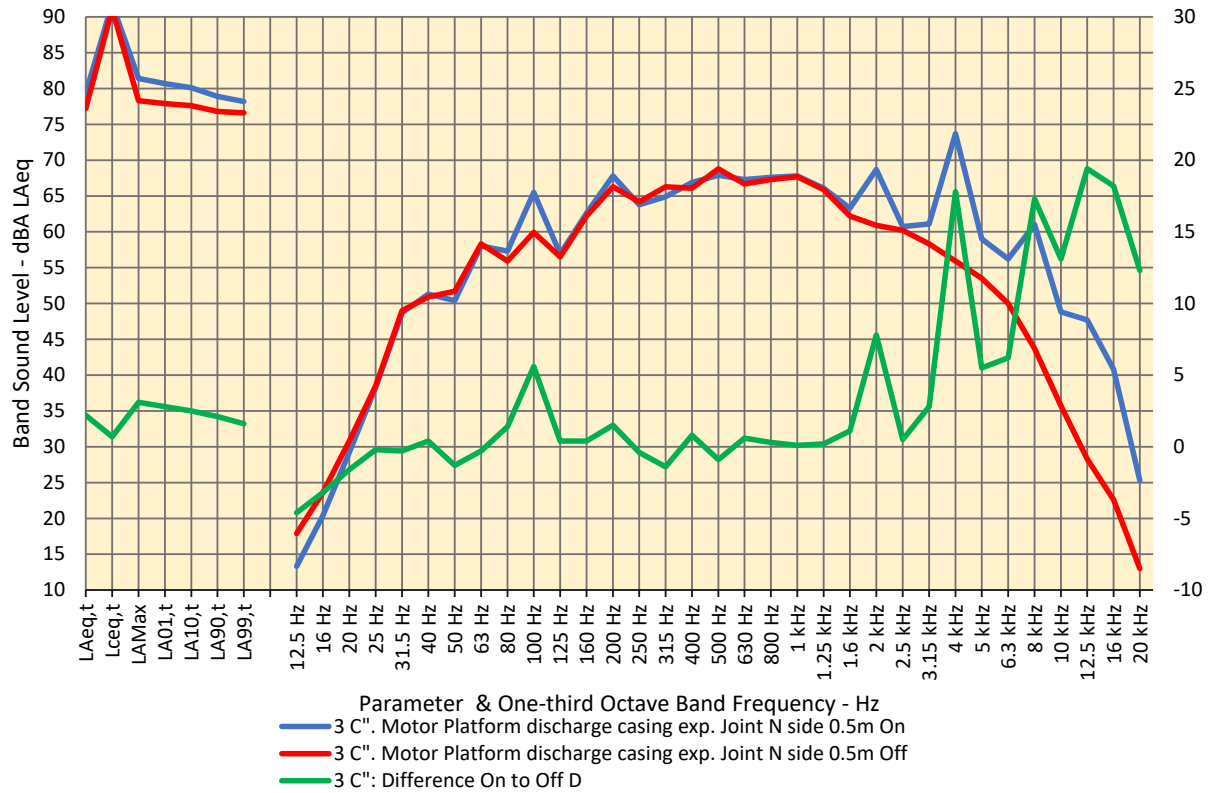
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.B $L_{Aeq,t}$



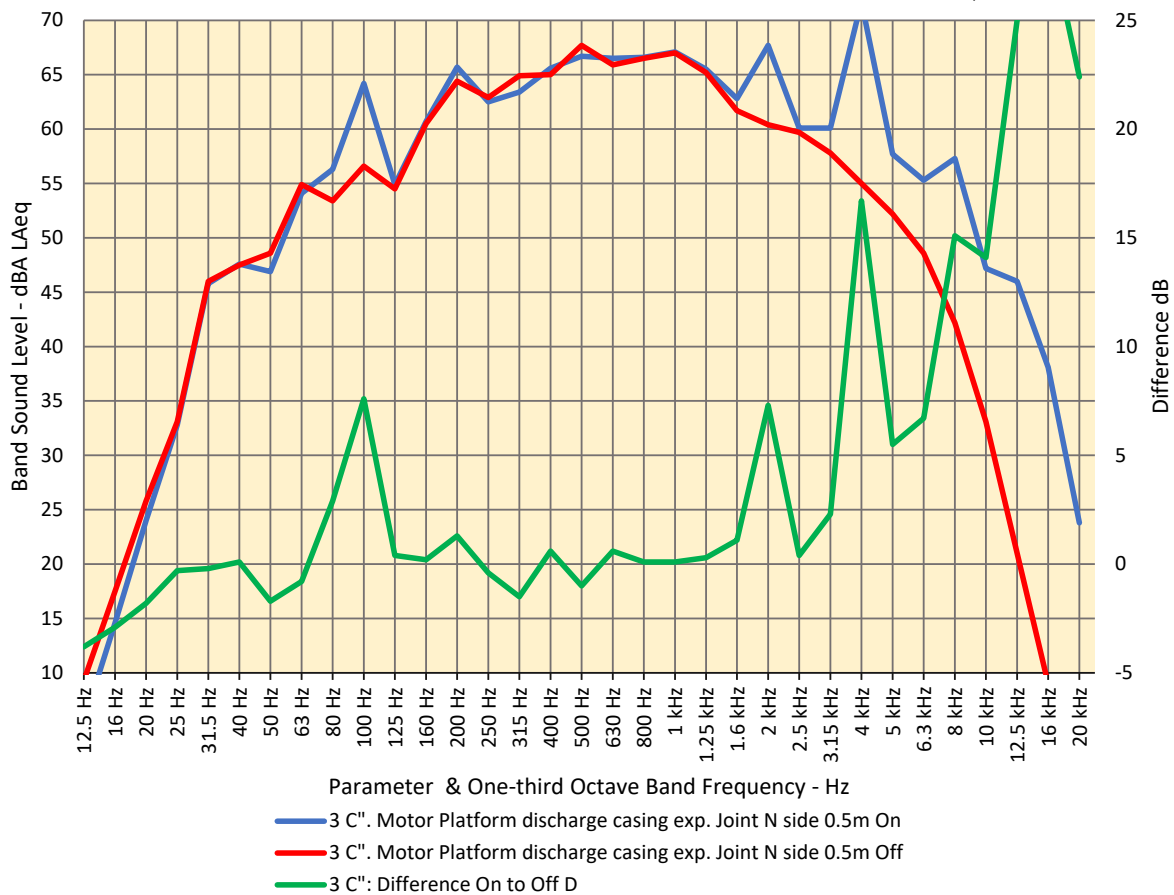
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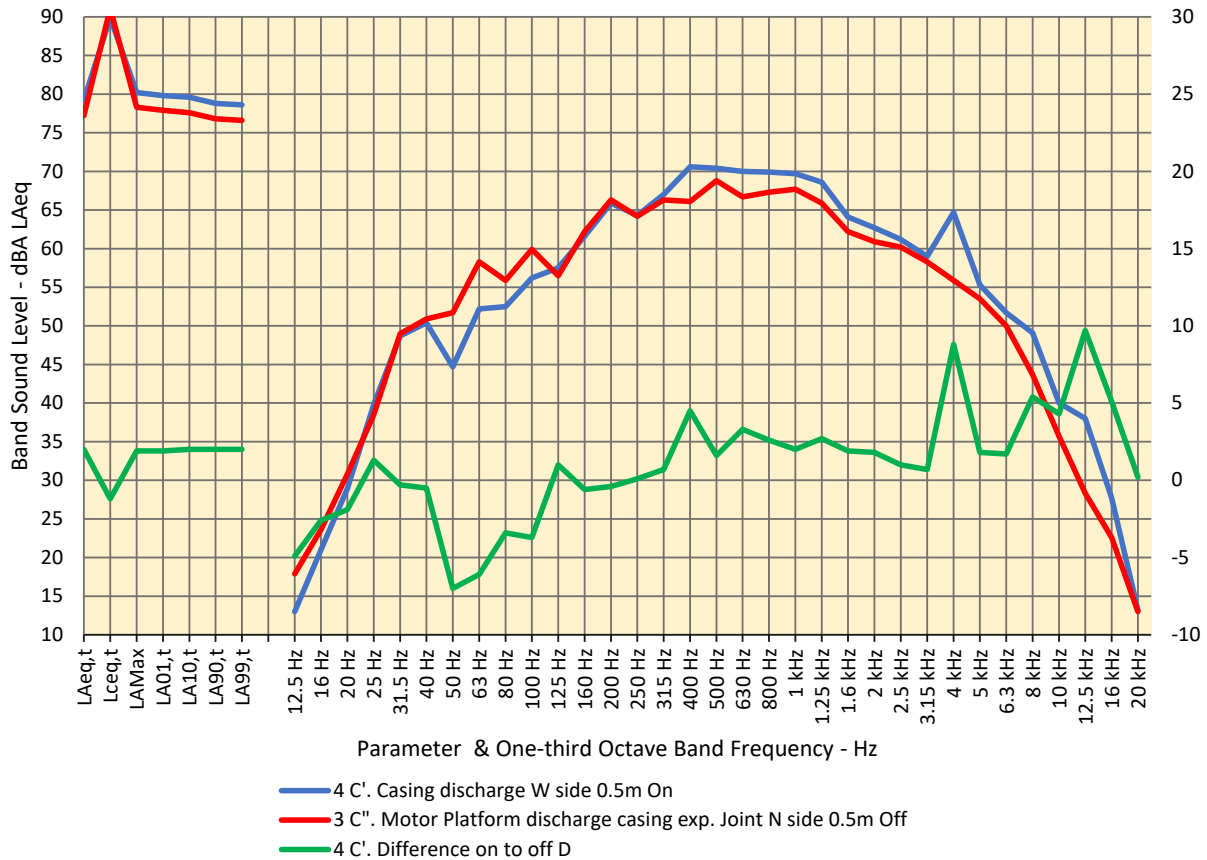
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.C" L_{Aeq,t}



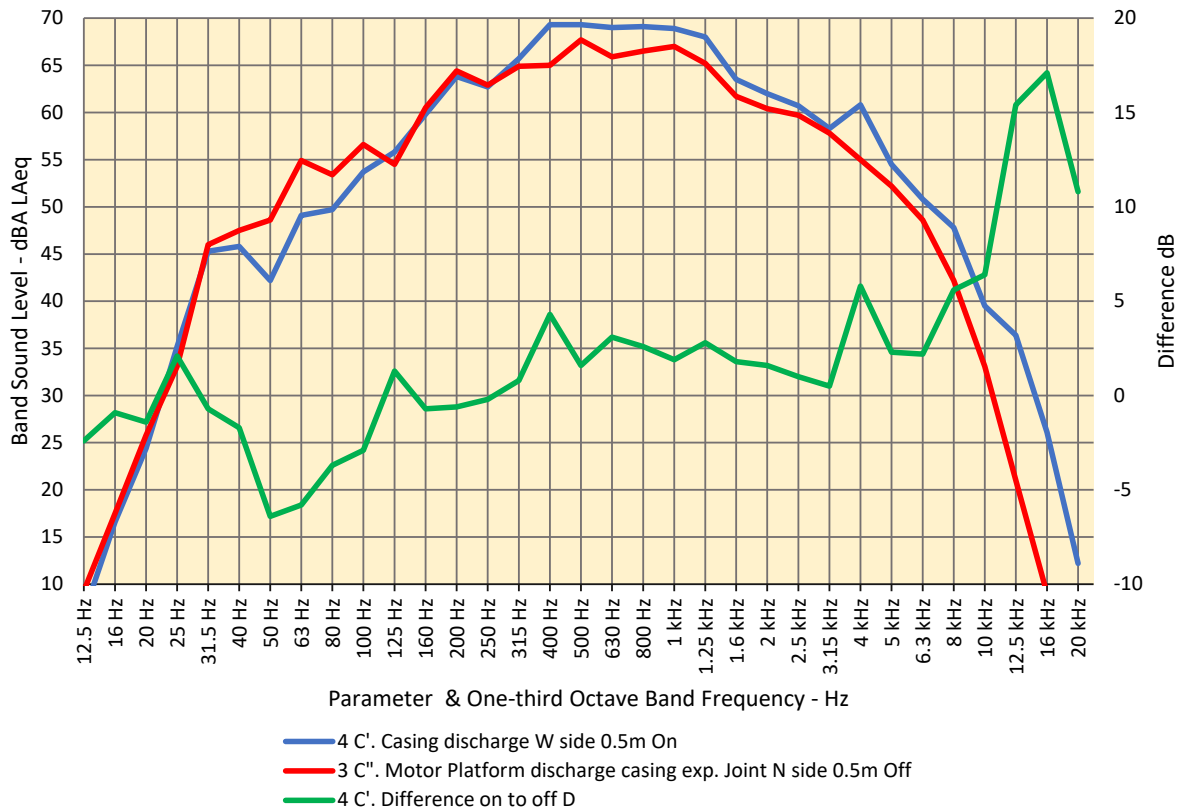
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc. C"- L_{A90,t}



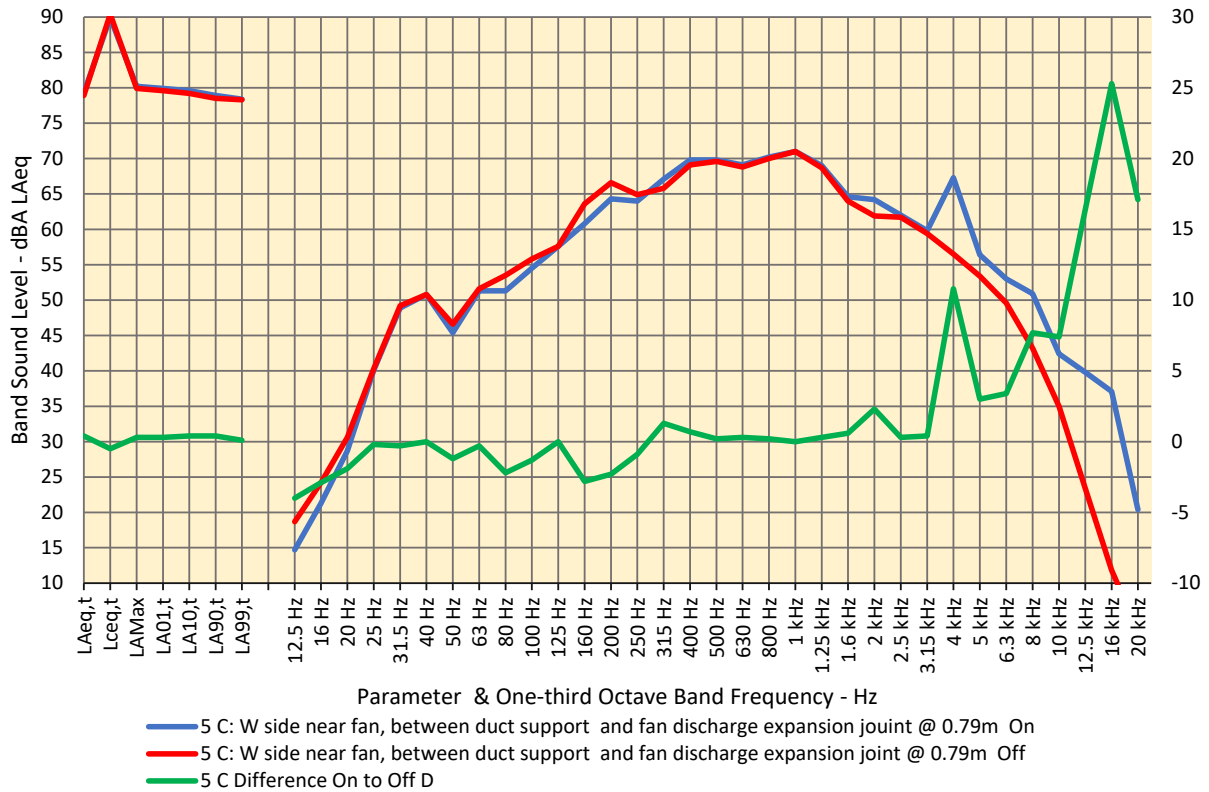
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.C' $L_{Aeq,t}$



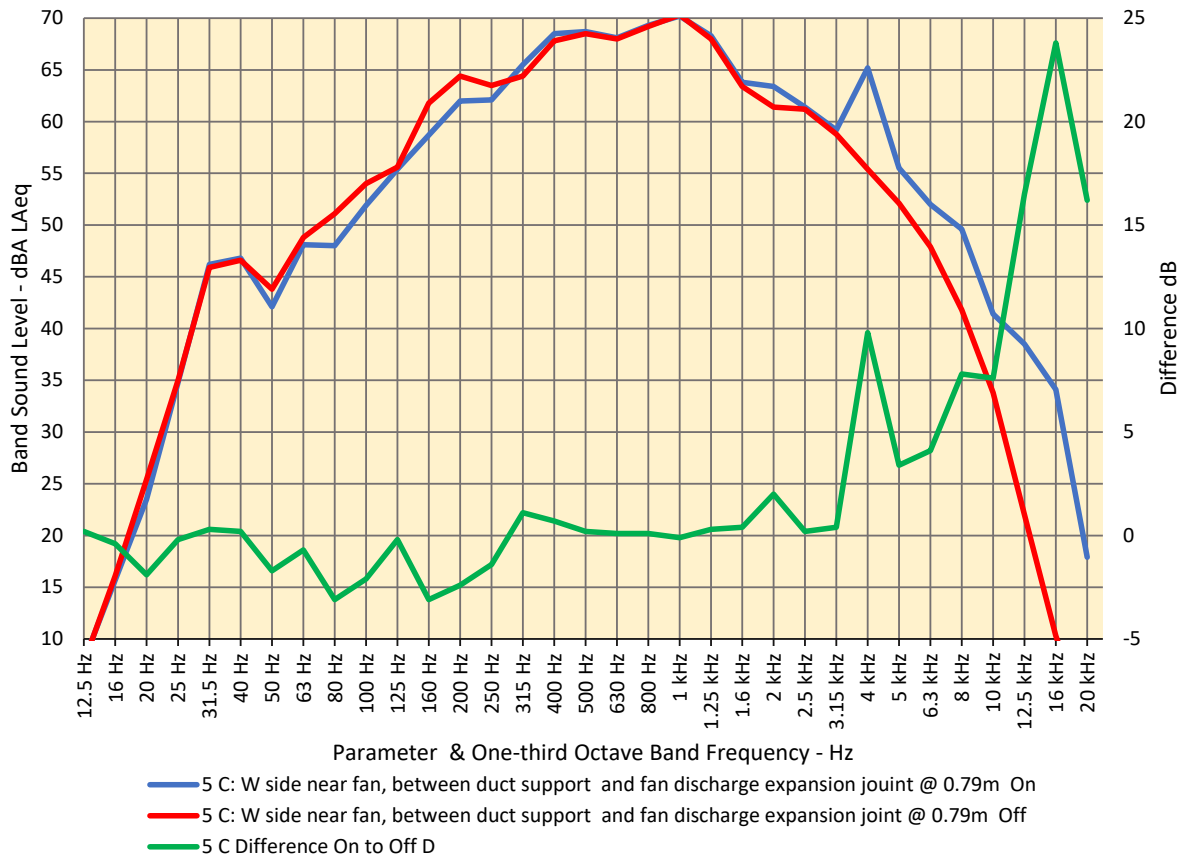
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc. C' - $L_{A90,t}$



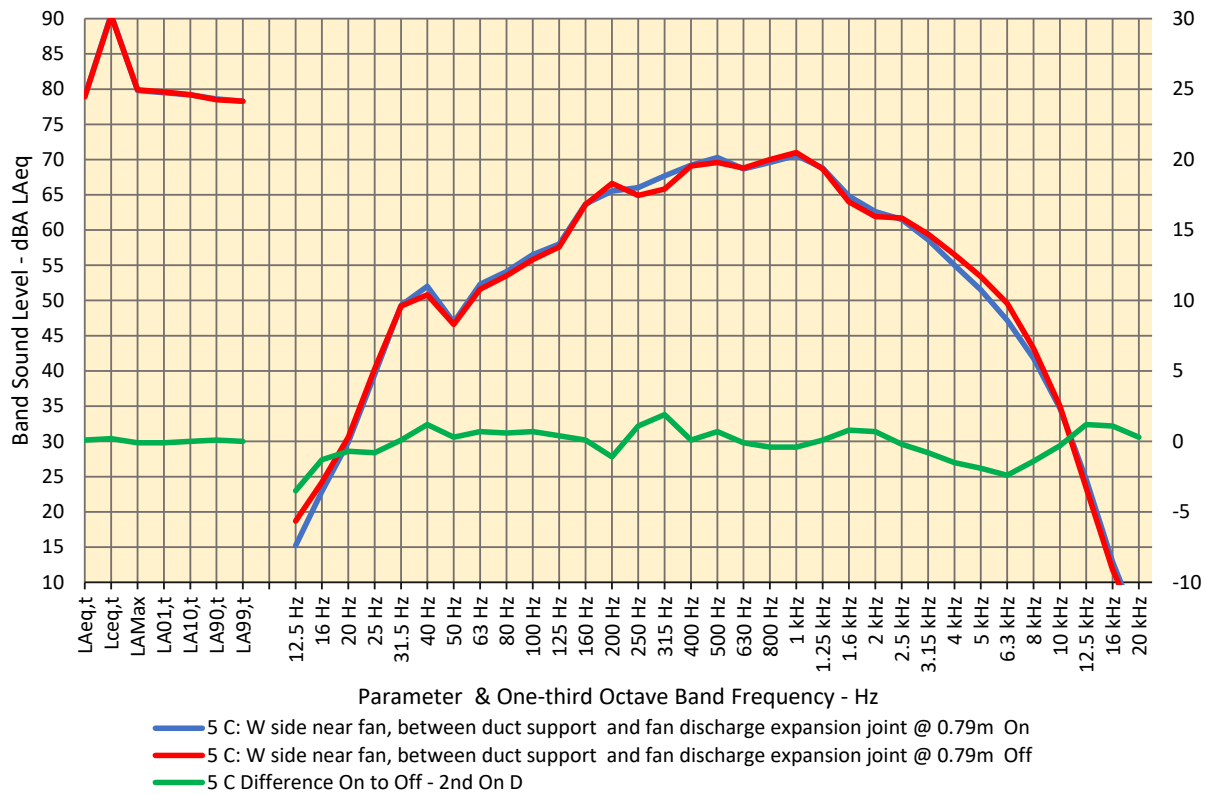
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.C $L_{Aeq,t}$



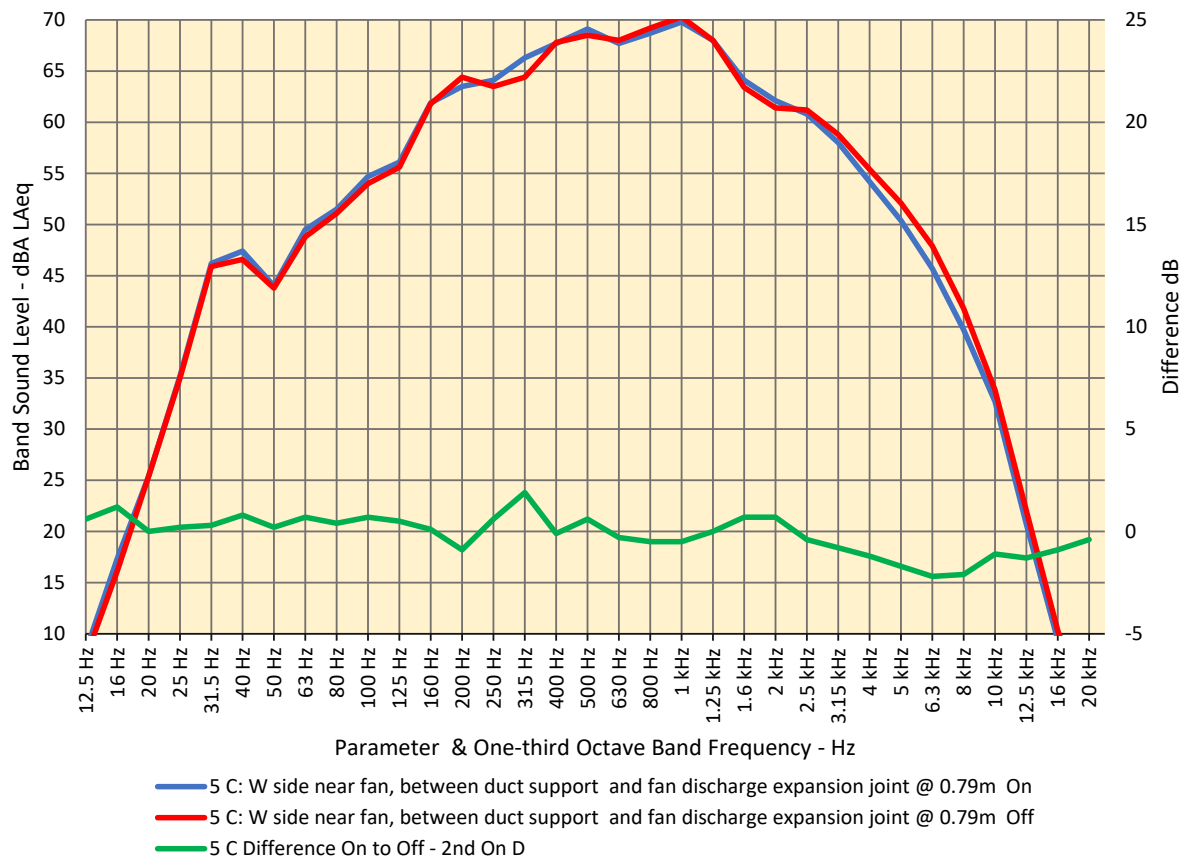
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc. C- $L_{A90,t}$



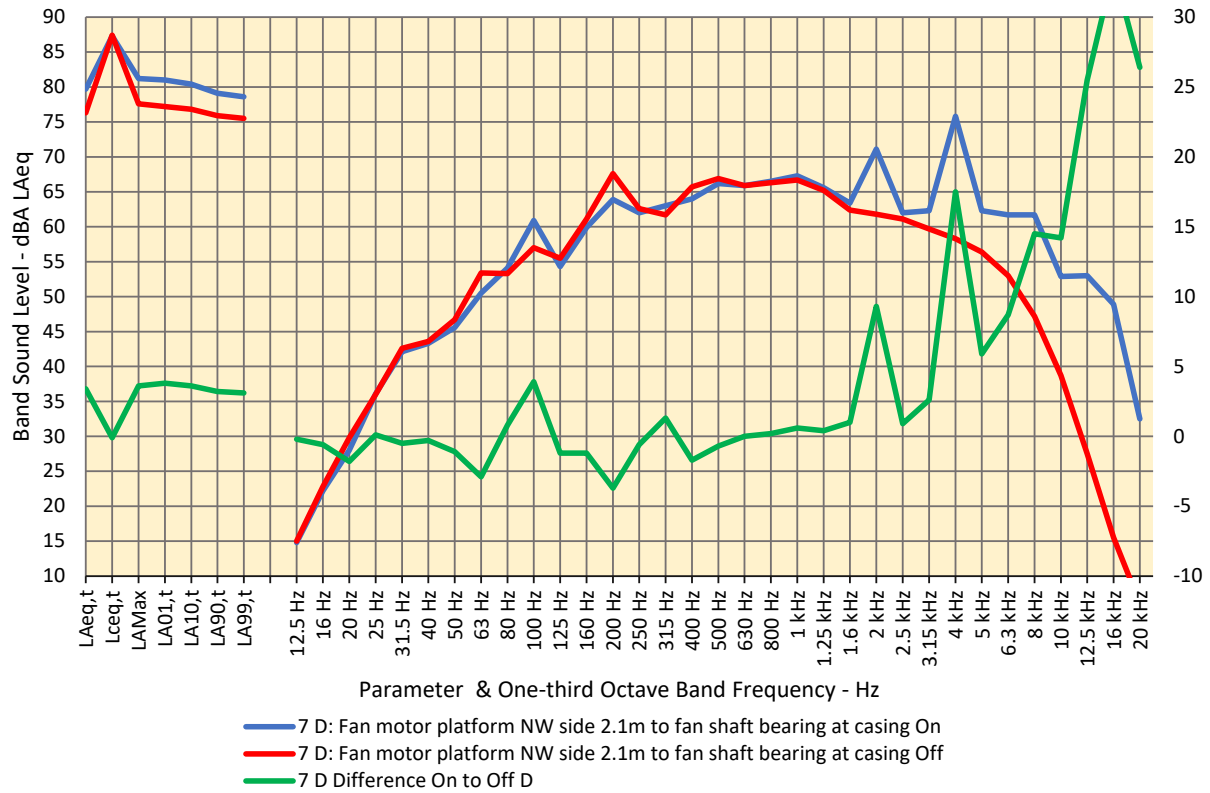
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.C $L_{Aeq,t}$



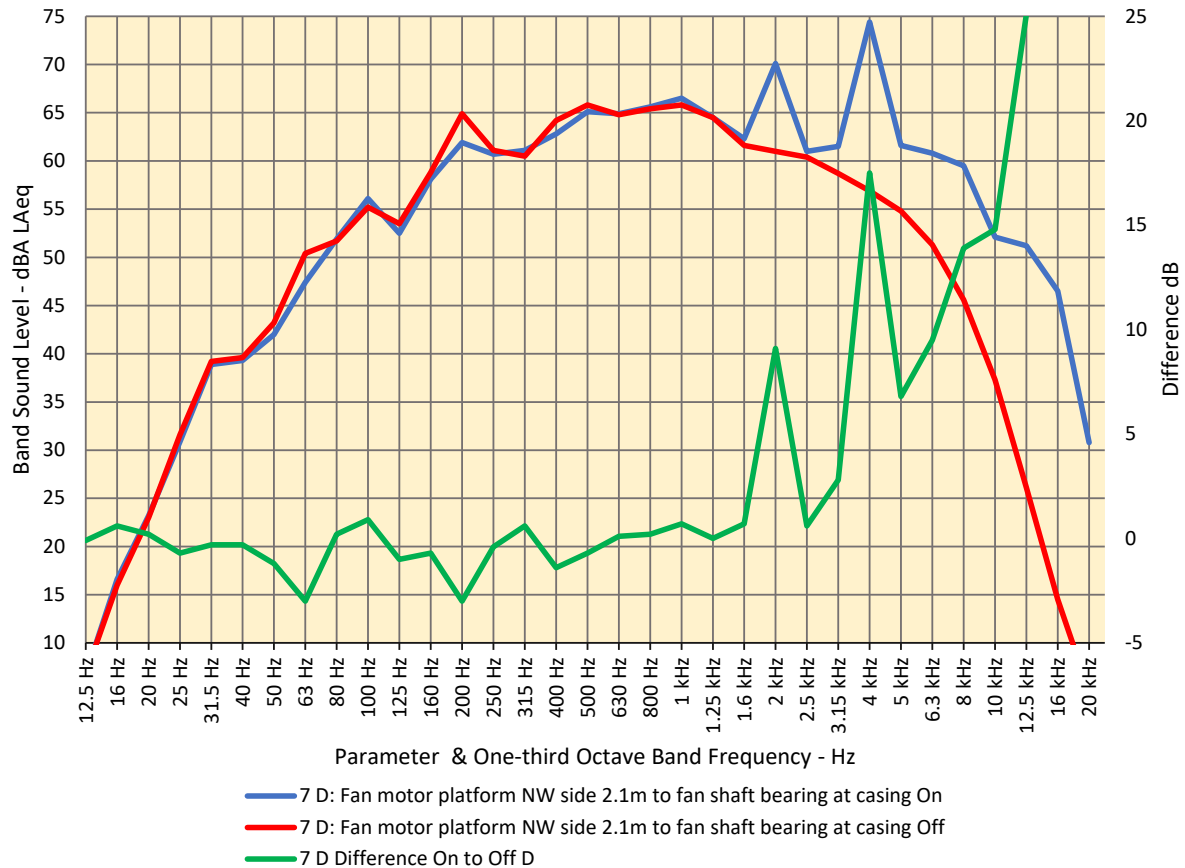
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc. C- $L_{A90,t}$



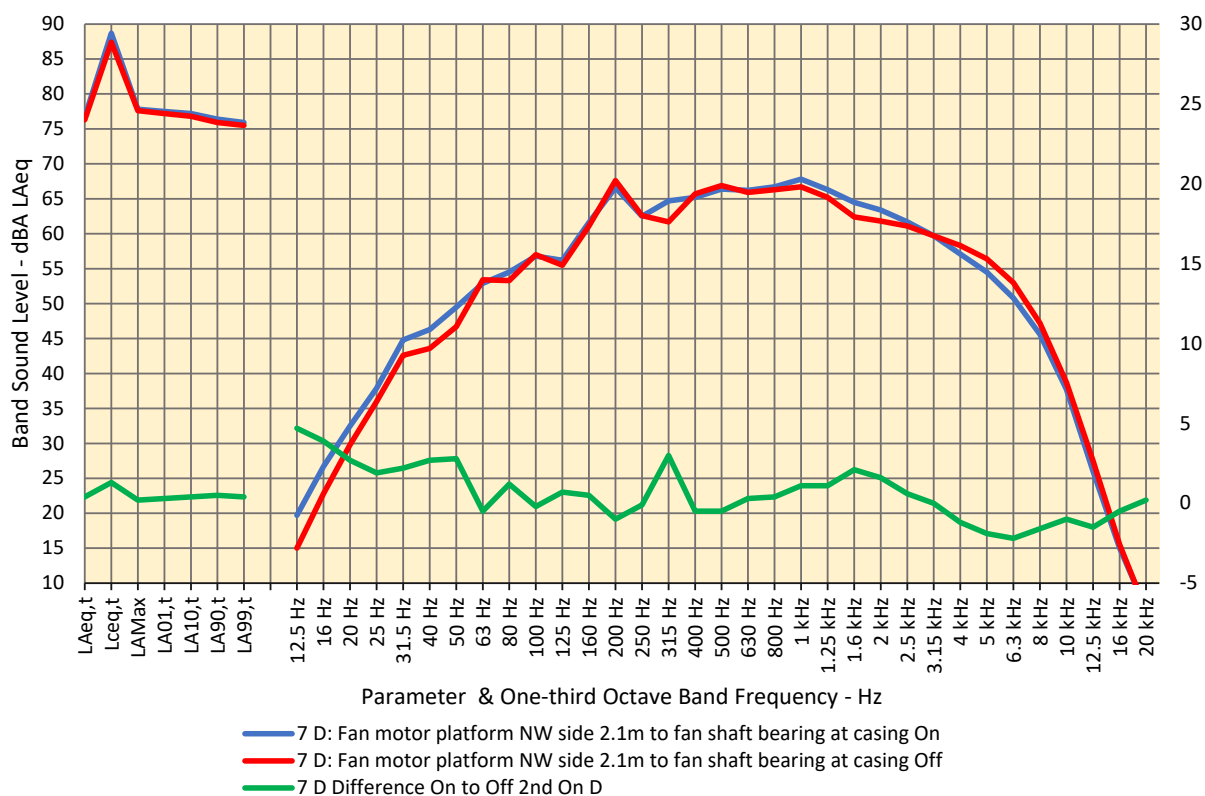
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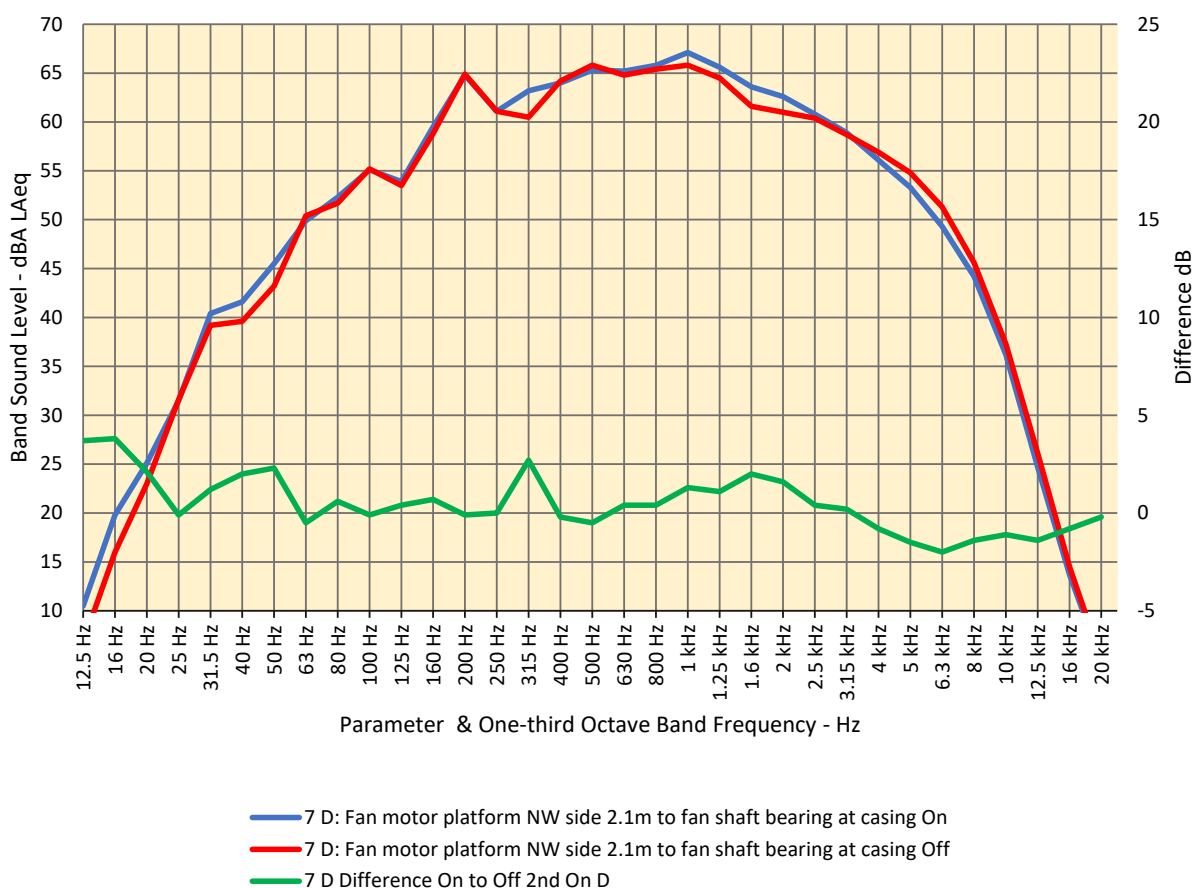
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc. D- $L_{A90,t}$



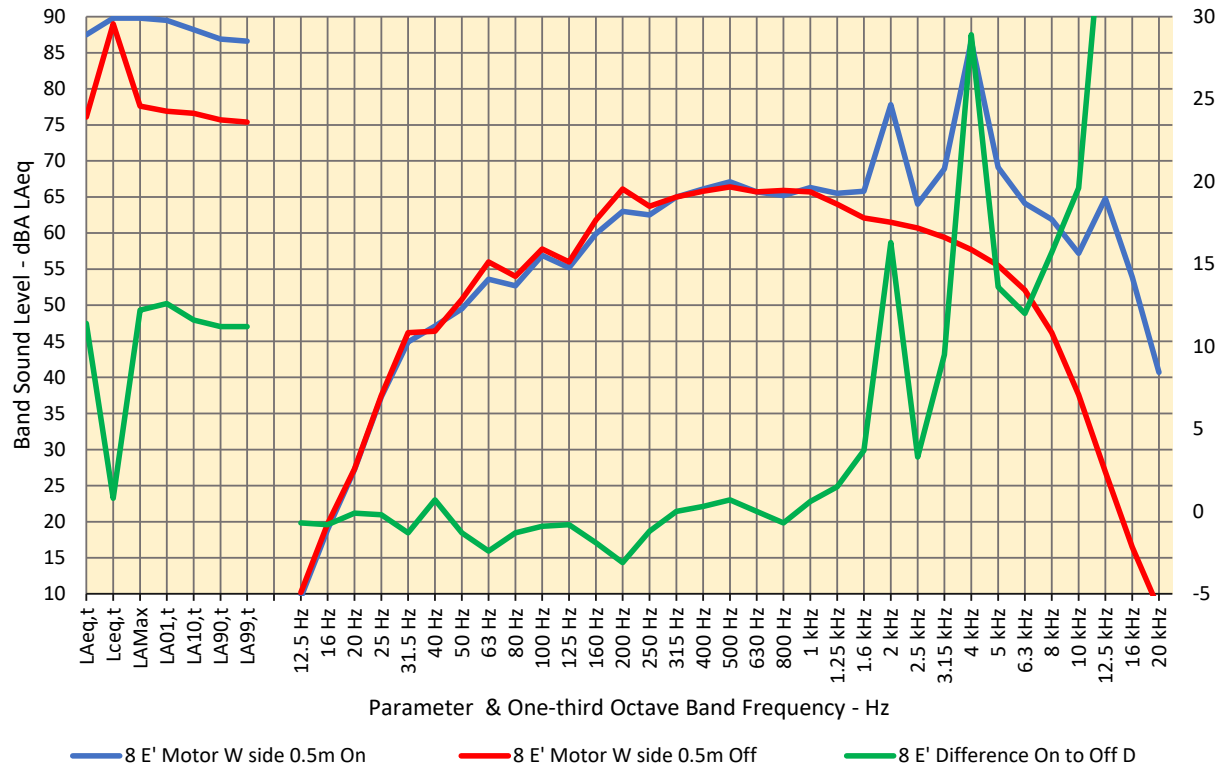
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.D $L_{Aeq,t}$



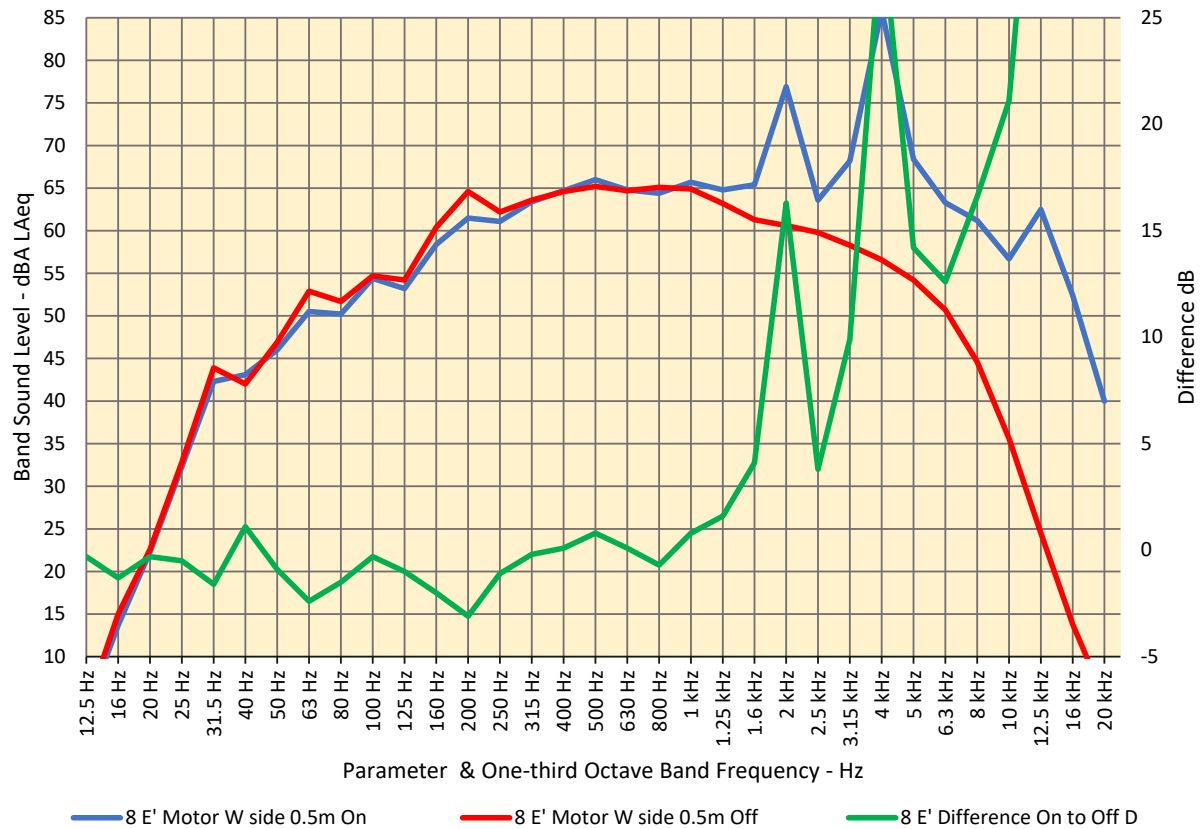
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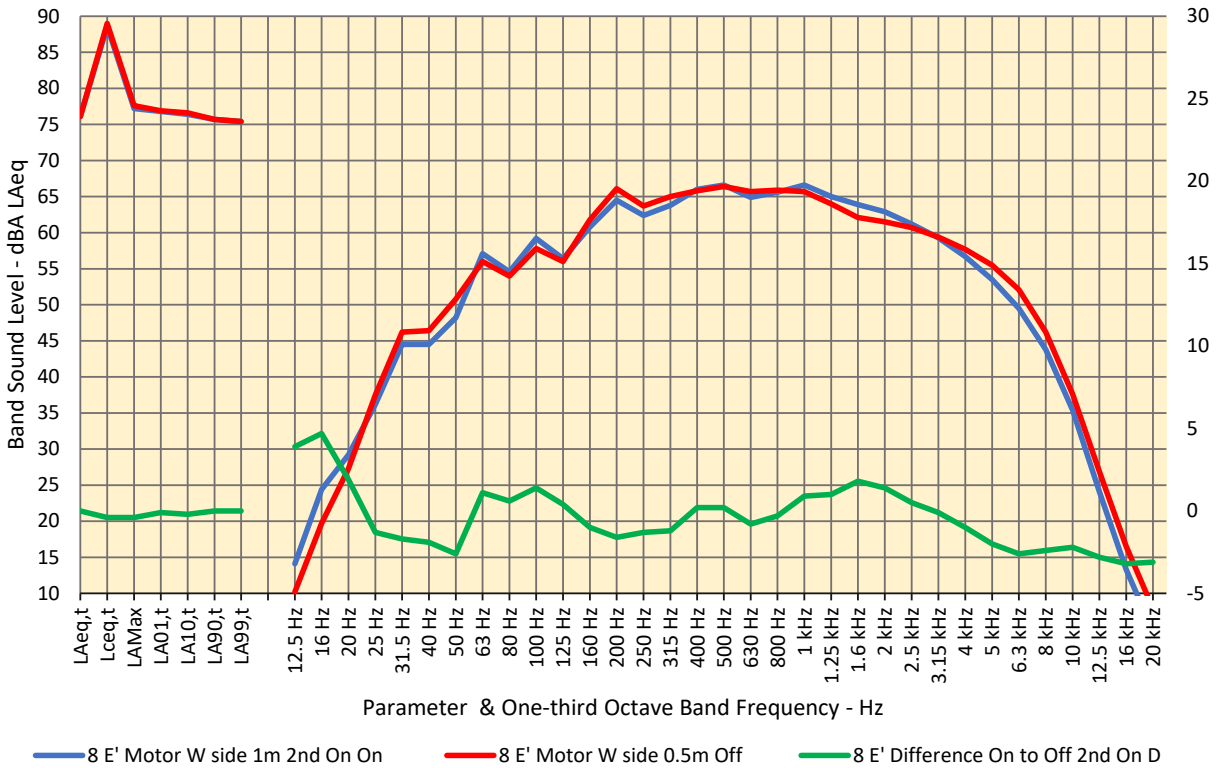
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.E' $L_{Aeq,t}$



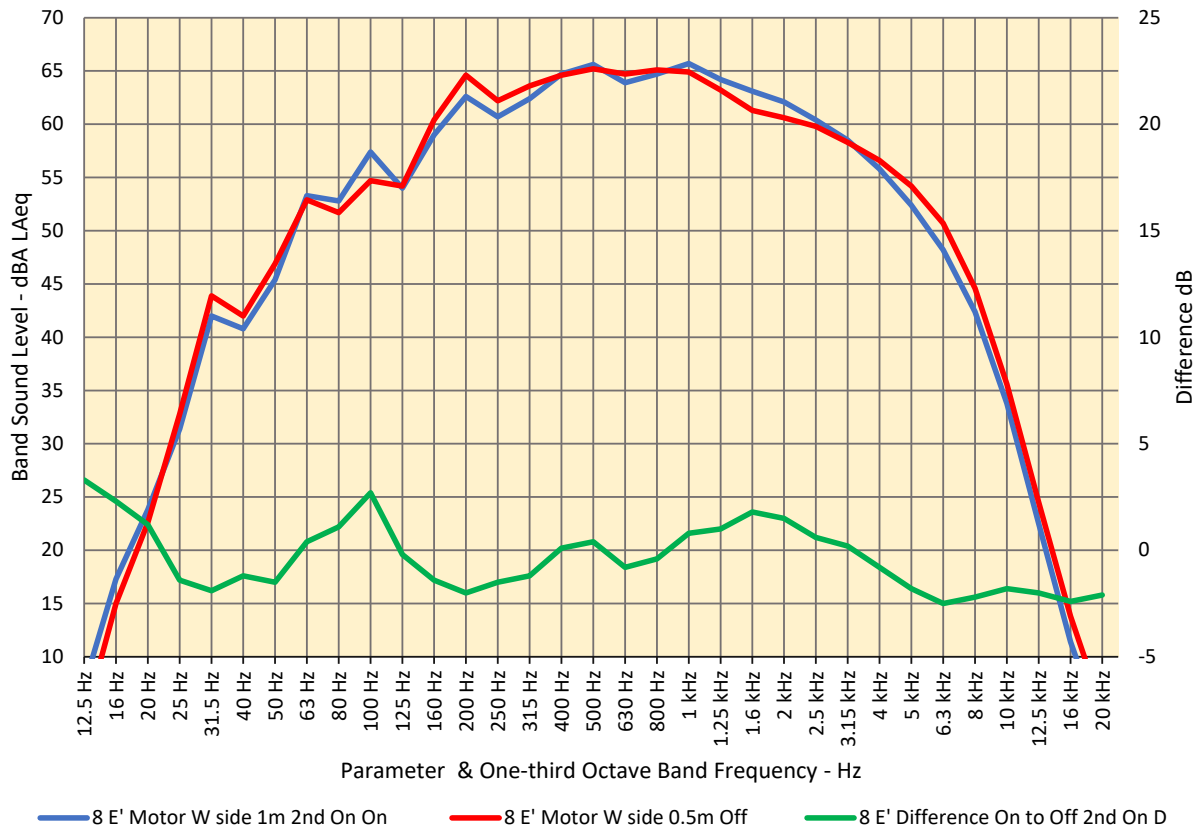
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc. E' - $L_{A90,t}$



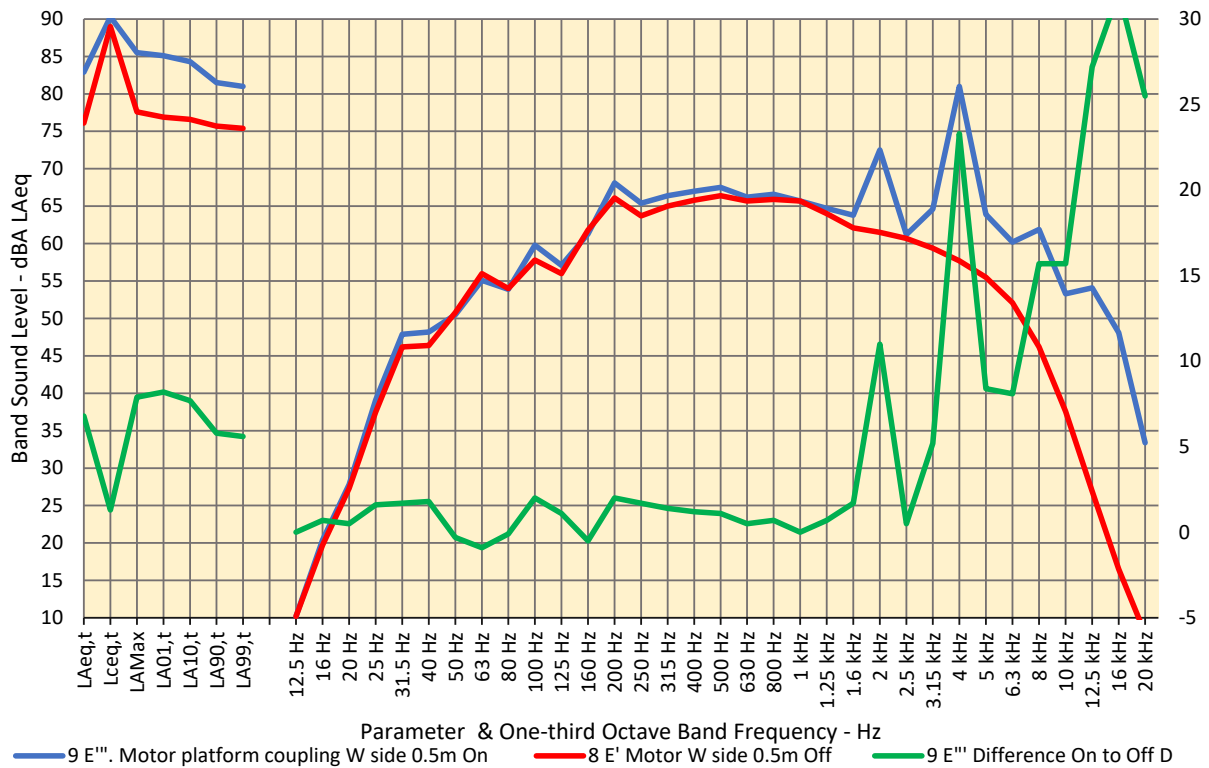
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.E' $L_{Aeq,t}$



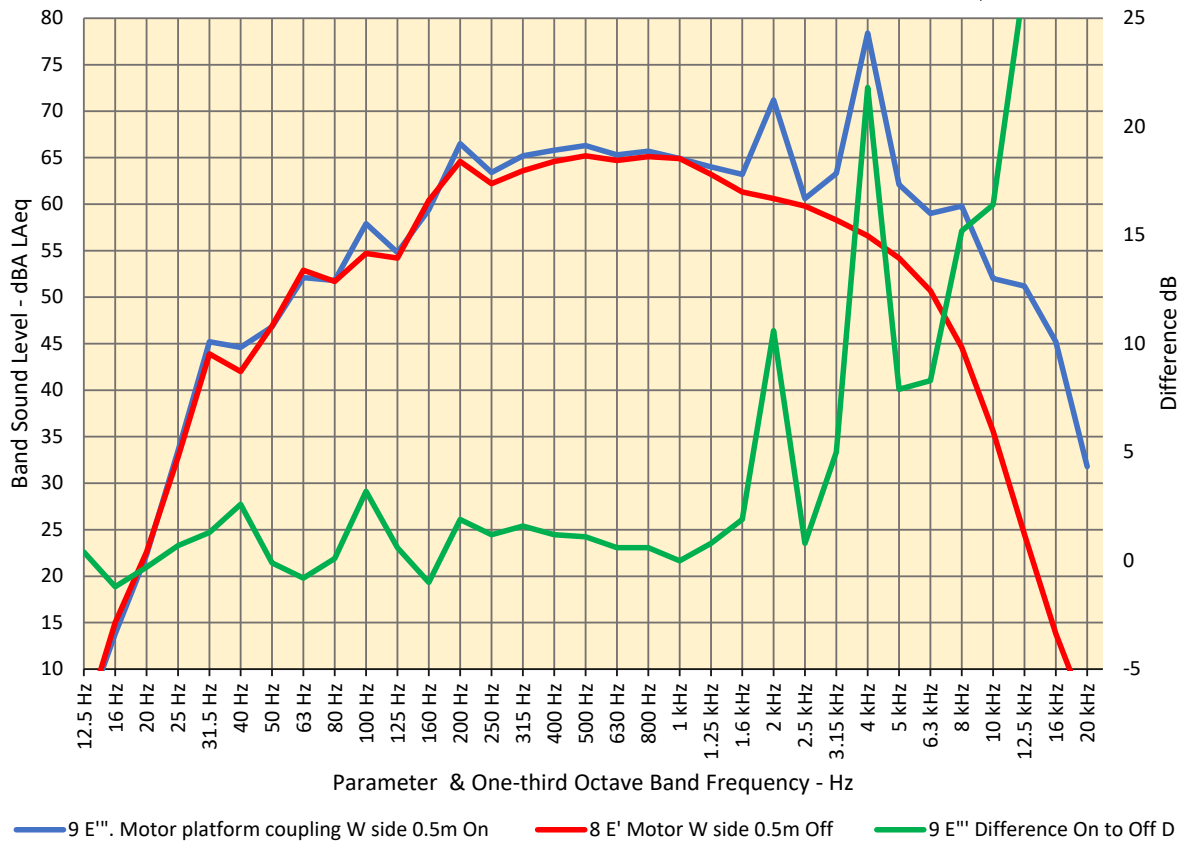
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc. E' - $L_{A90,t}$



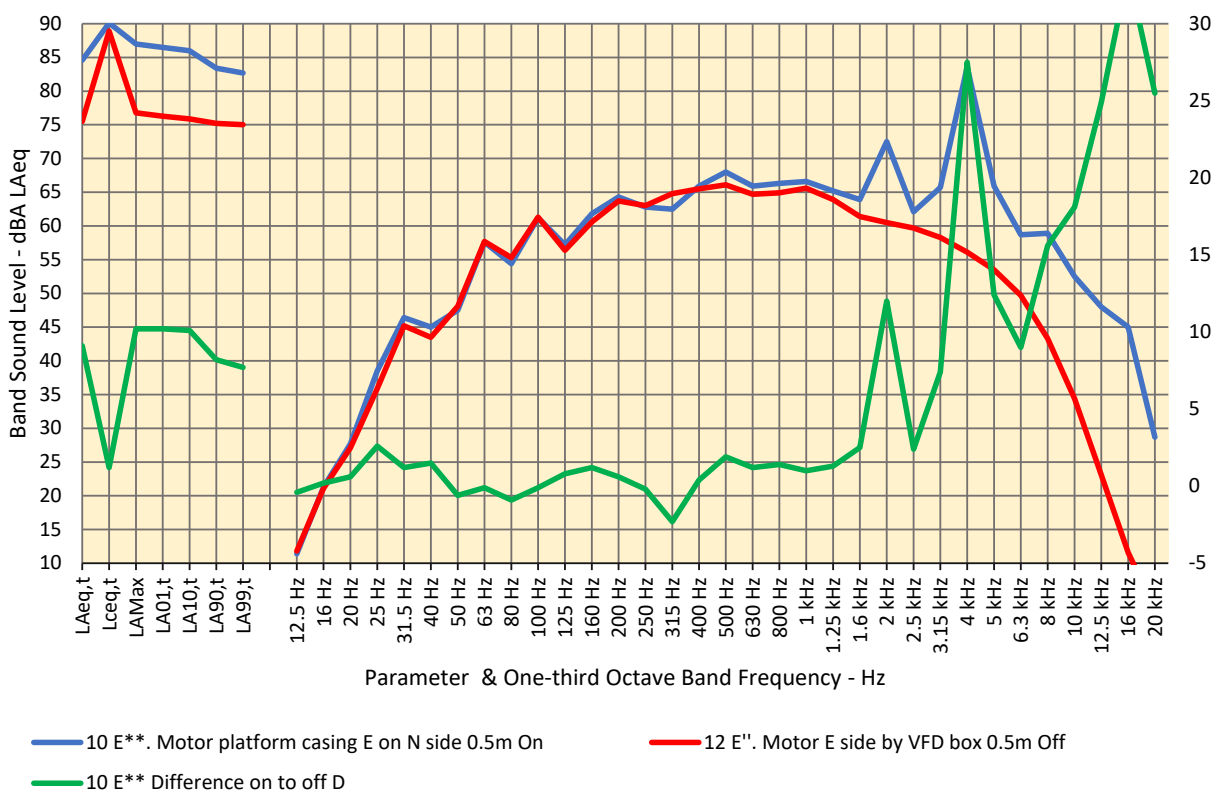
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc. E''' L_{Aeq,t}



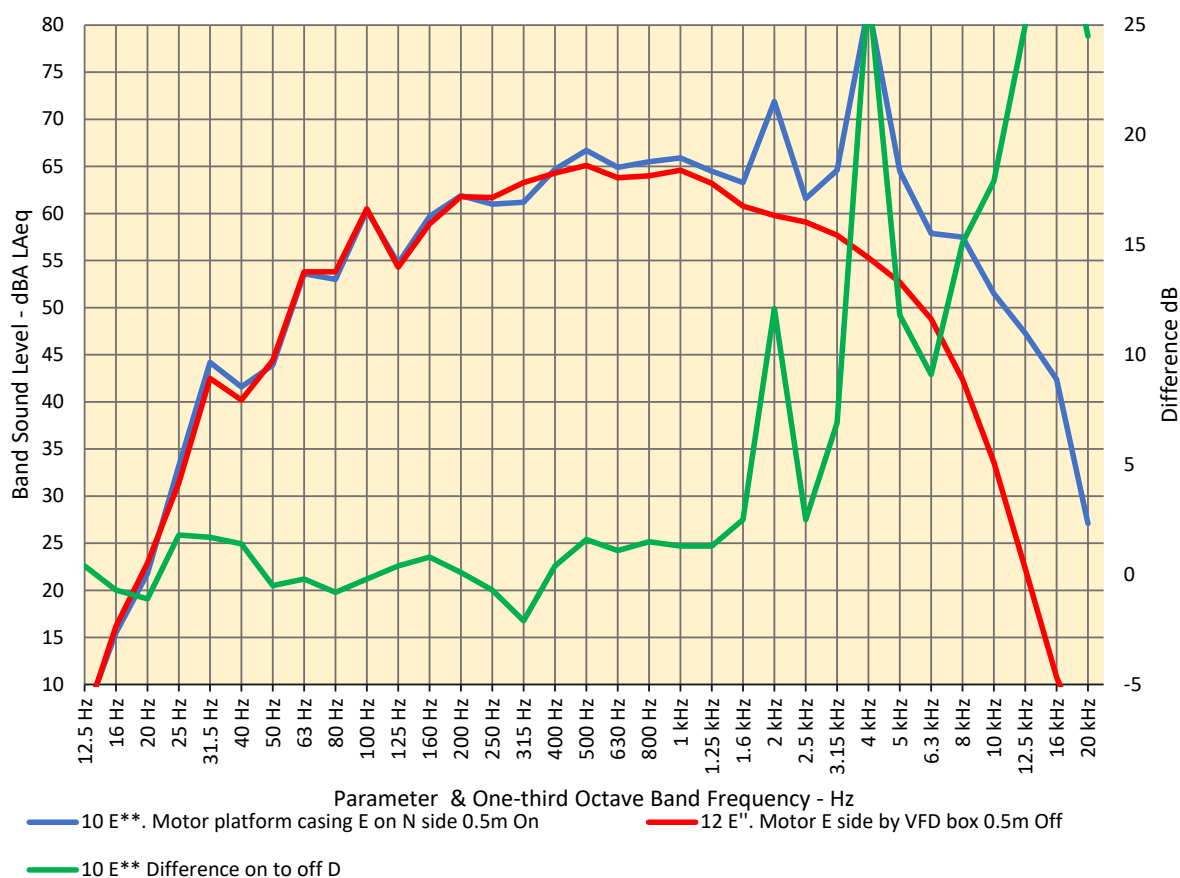
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc. E''' L_{A90,t}



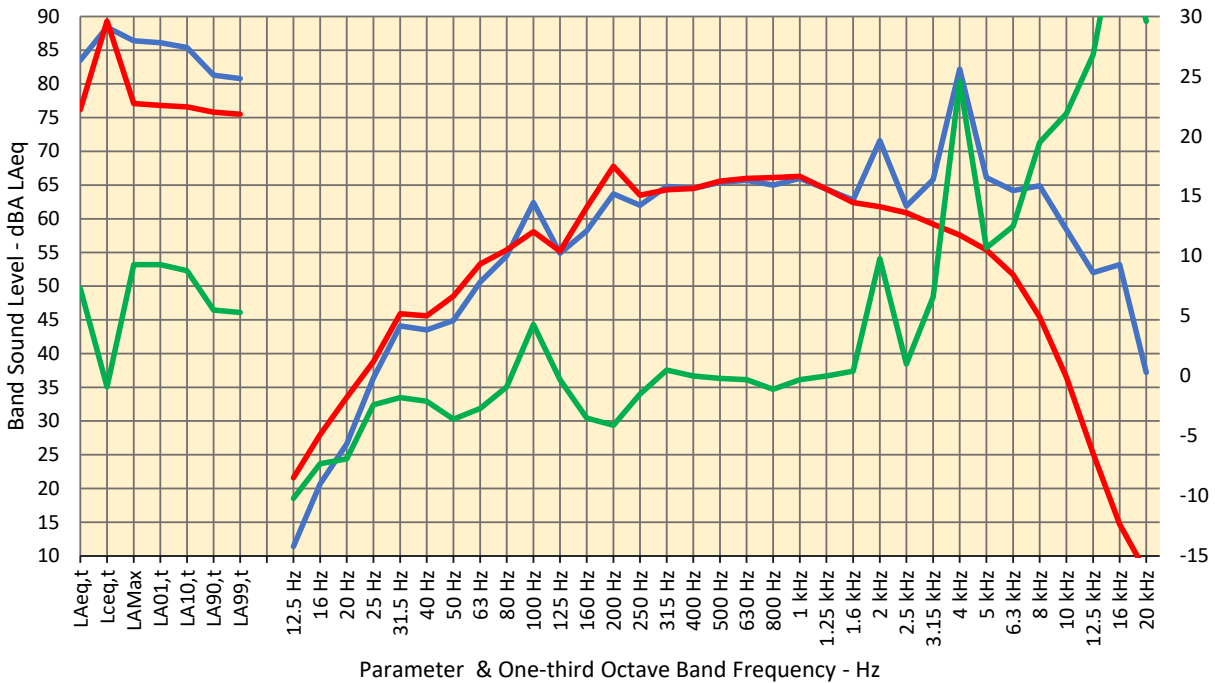
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.E** $L_{Aeq,t}$



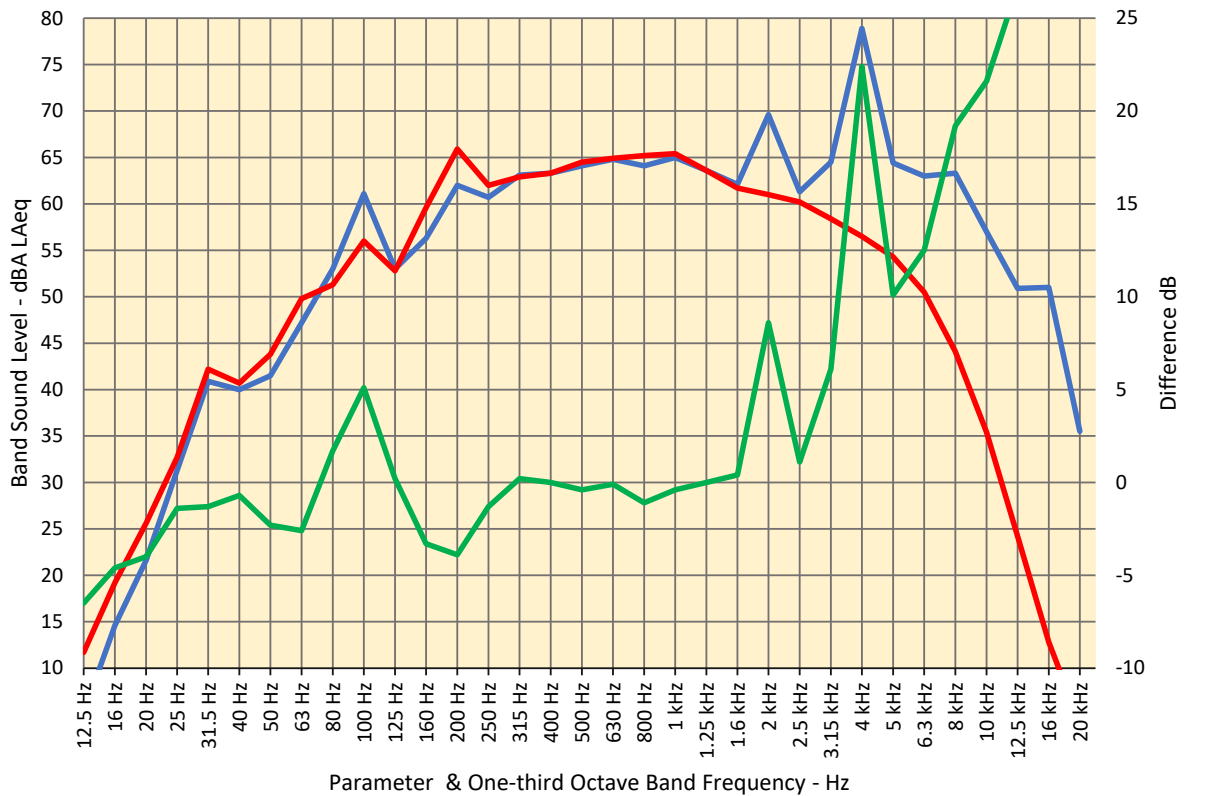
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc. E** - $L_{A90,t}$



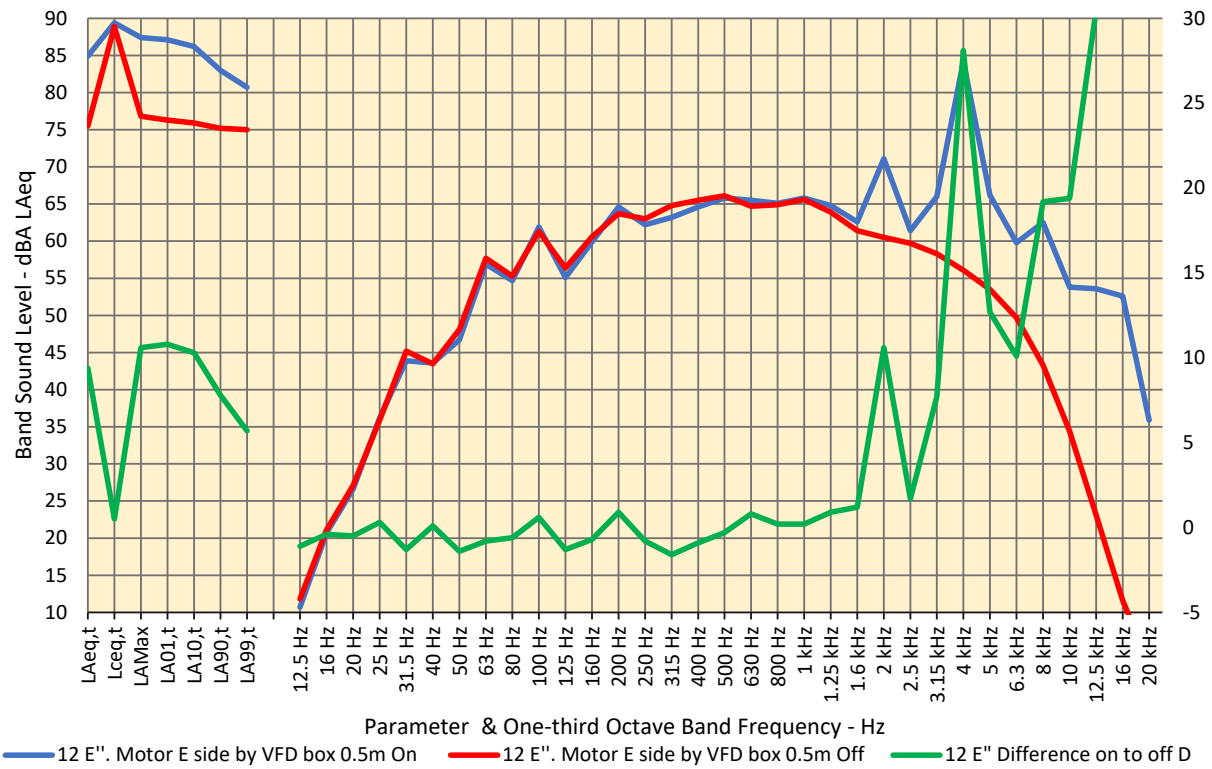
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.E* $L_{Aeq,t}$



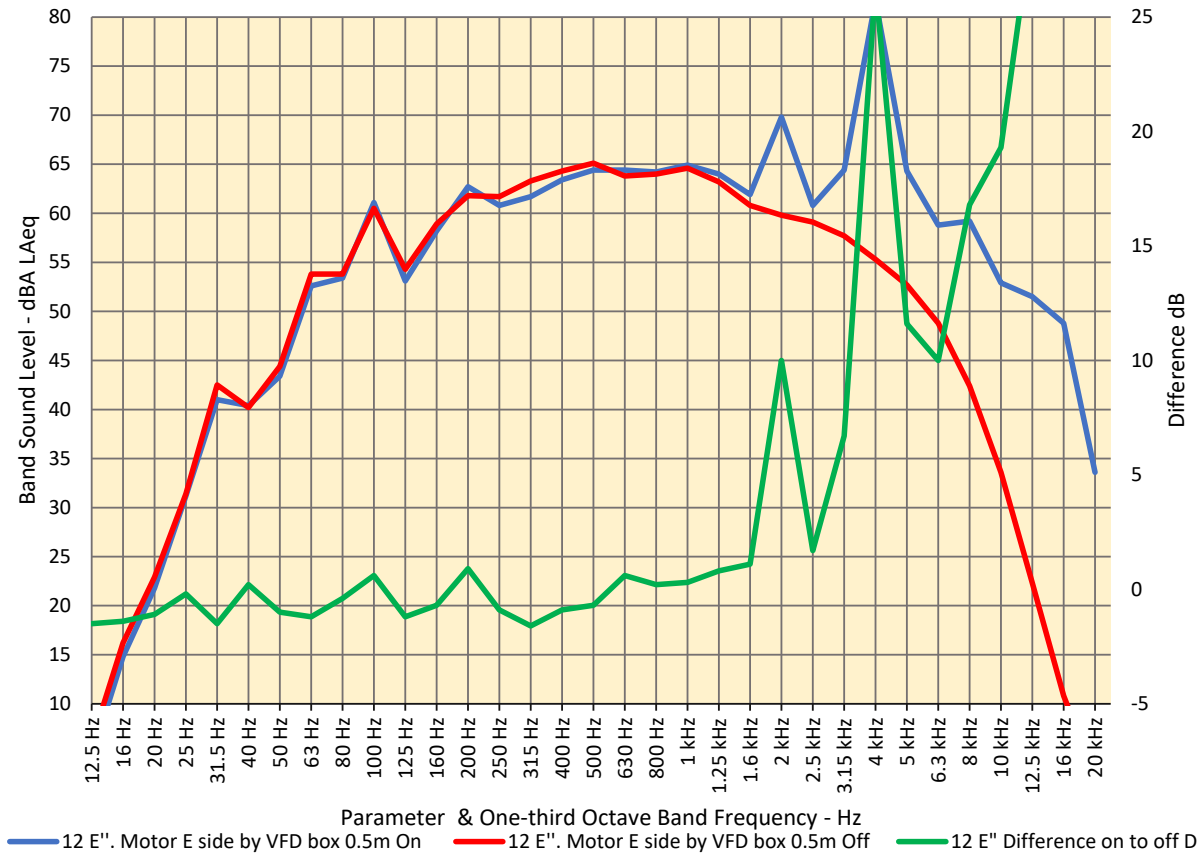
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc. E* - $L_{A90,t}$



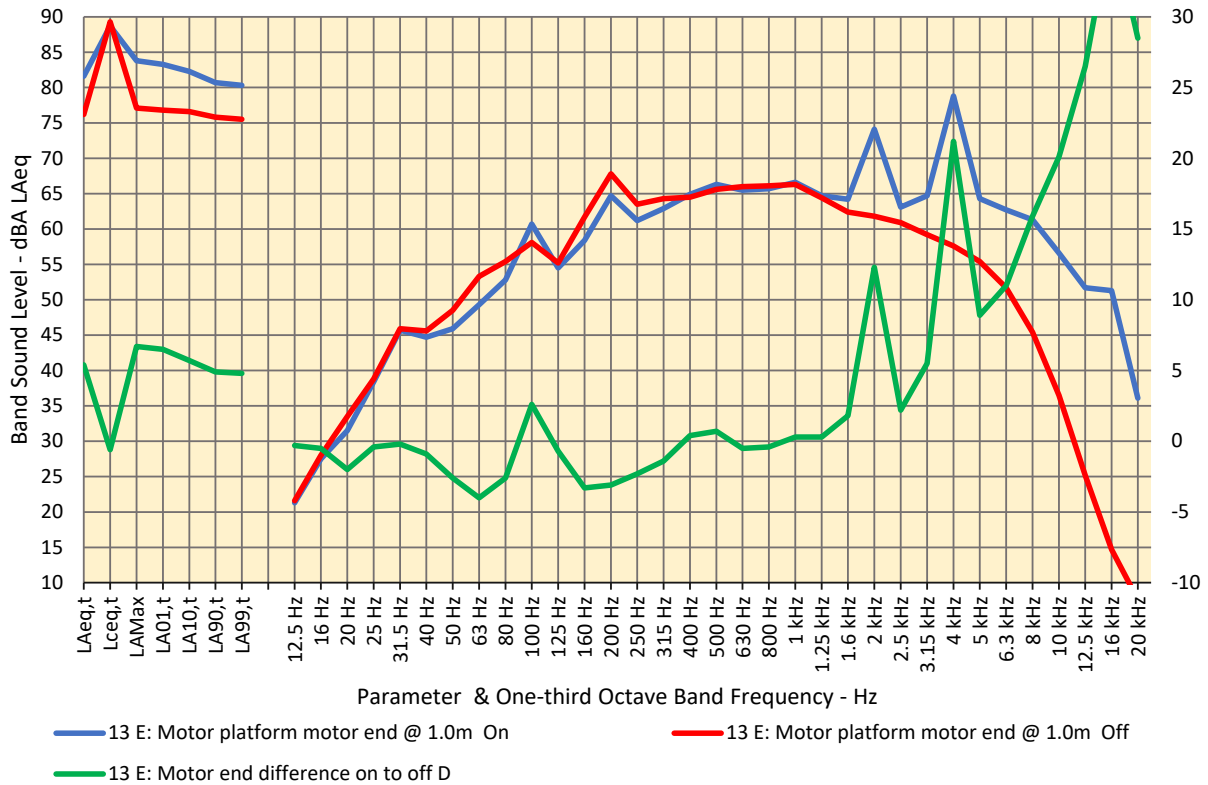
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.E" $L_{Aeq,t}$



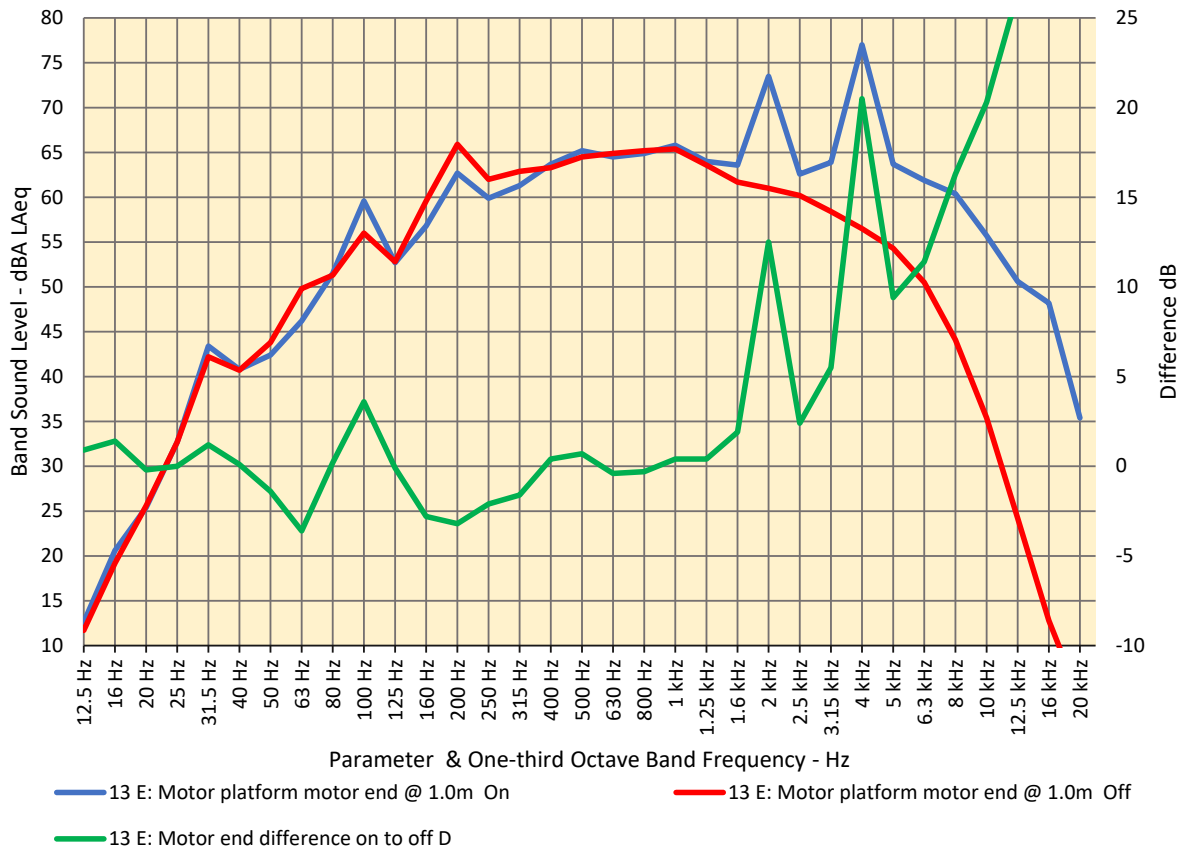
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc. E" - $L_{A90,t}$



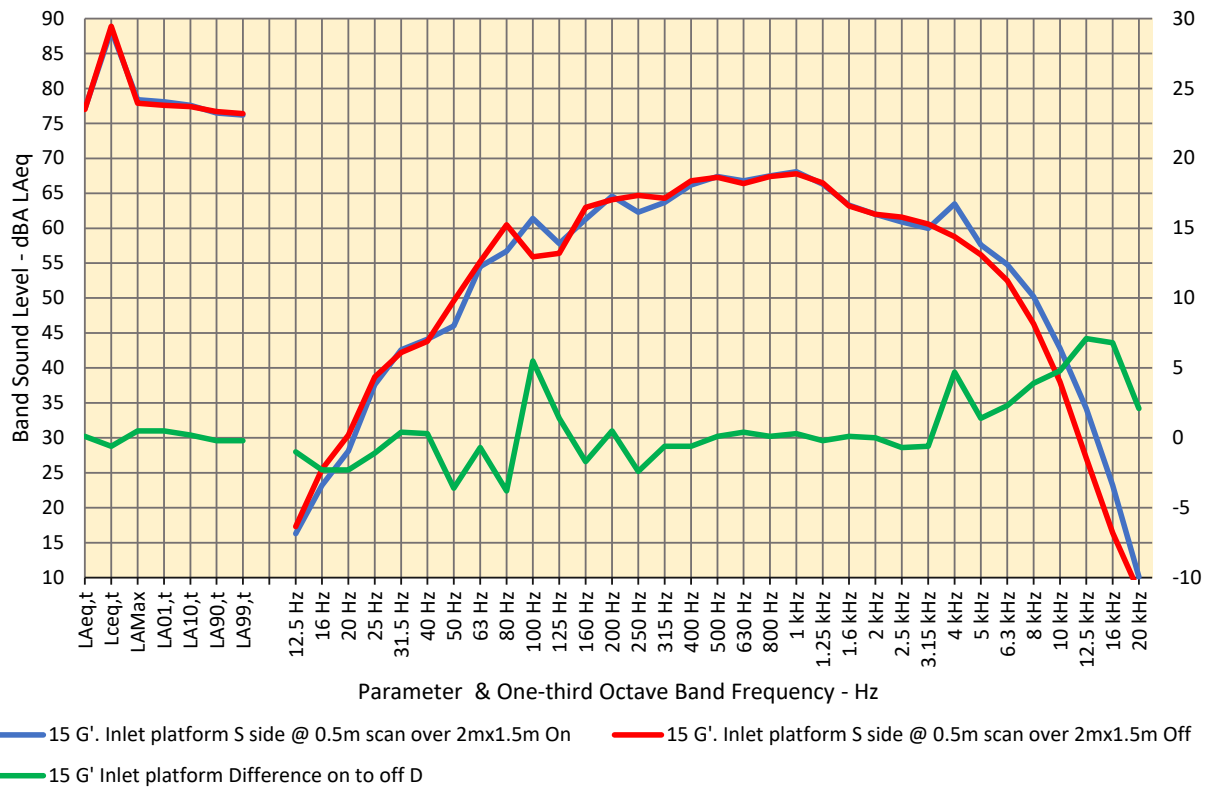
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.E $L_{Aeq,t}$



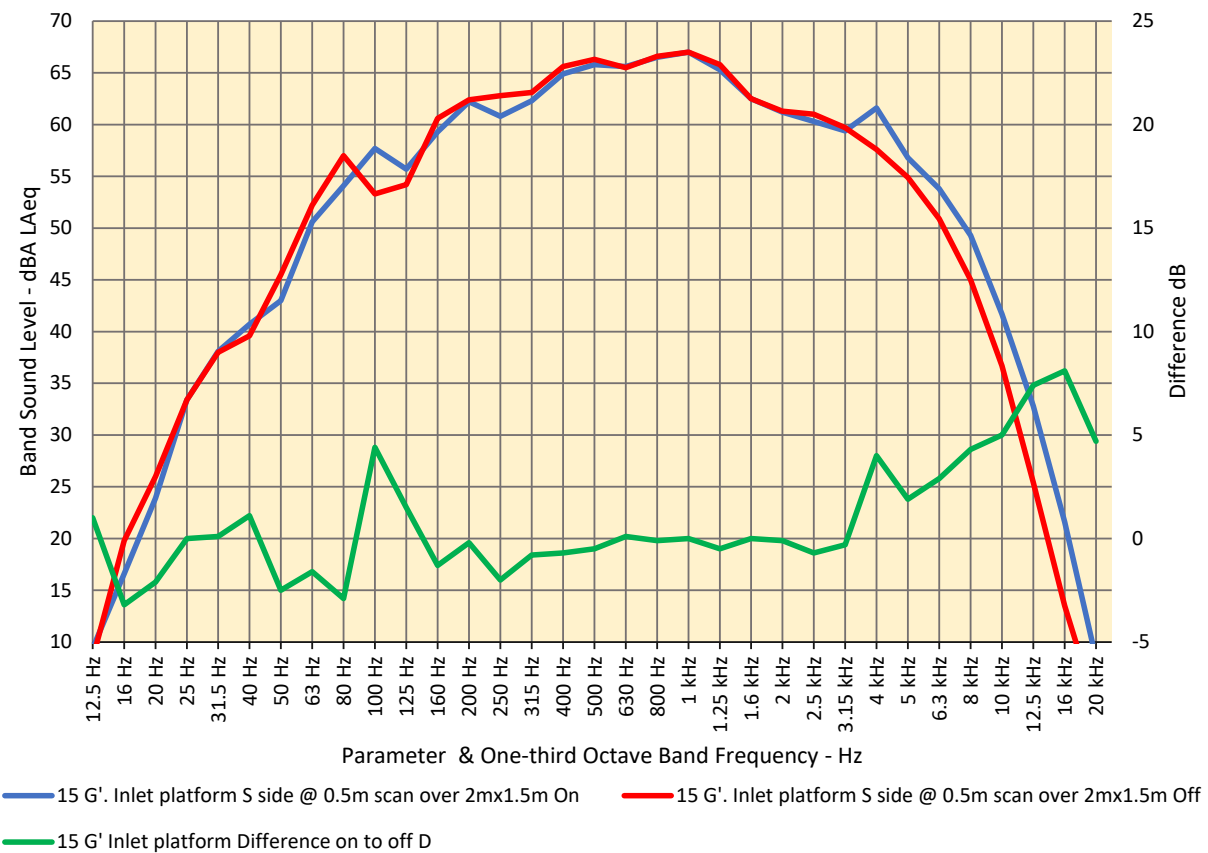
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc. E $L_{A90,t}$



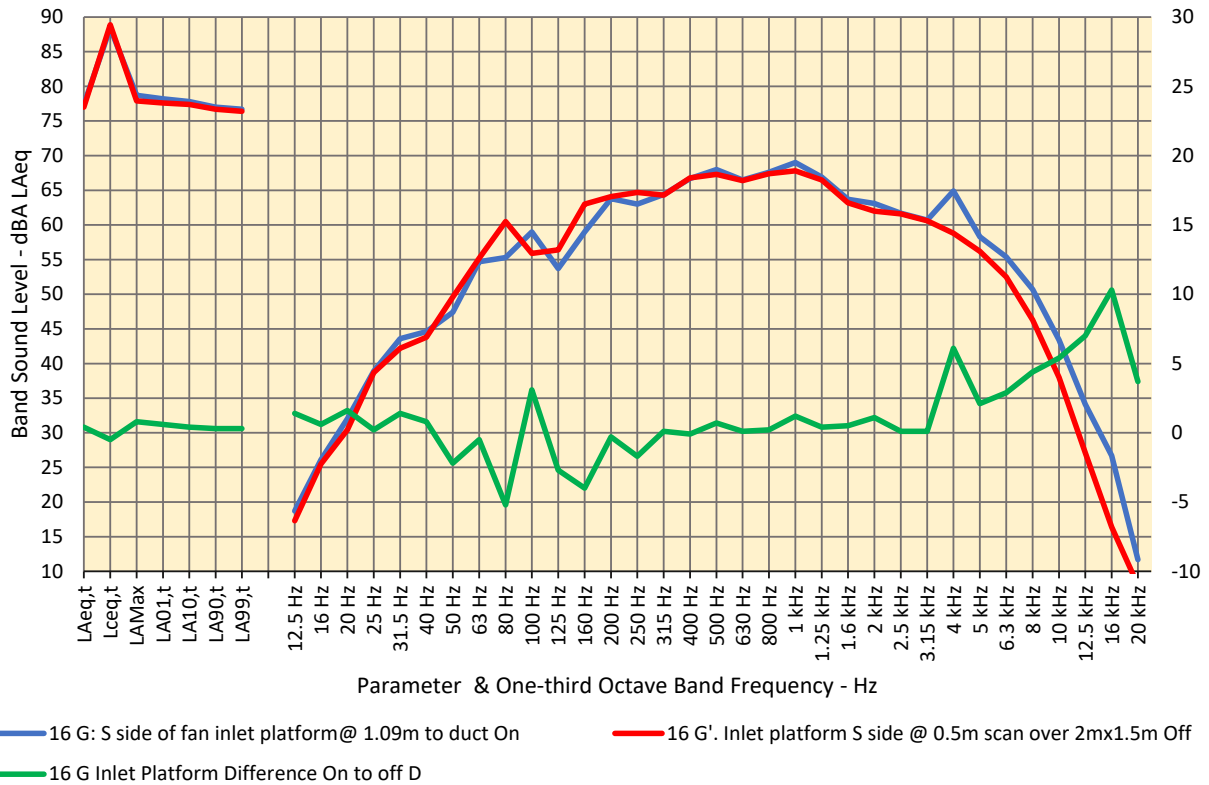
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.G' $L_{Aeq,t}$



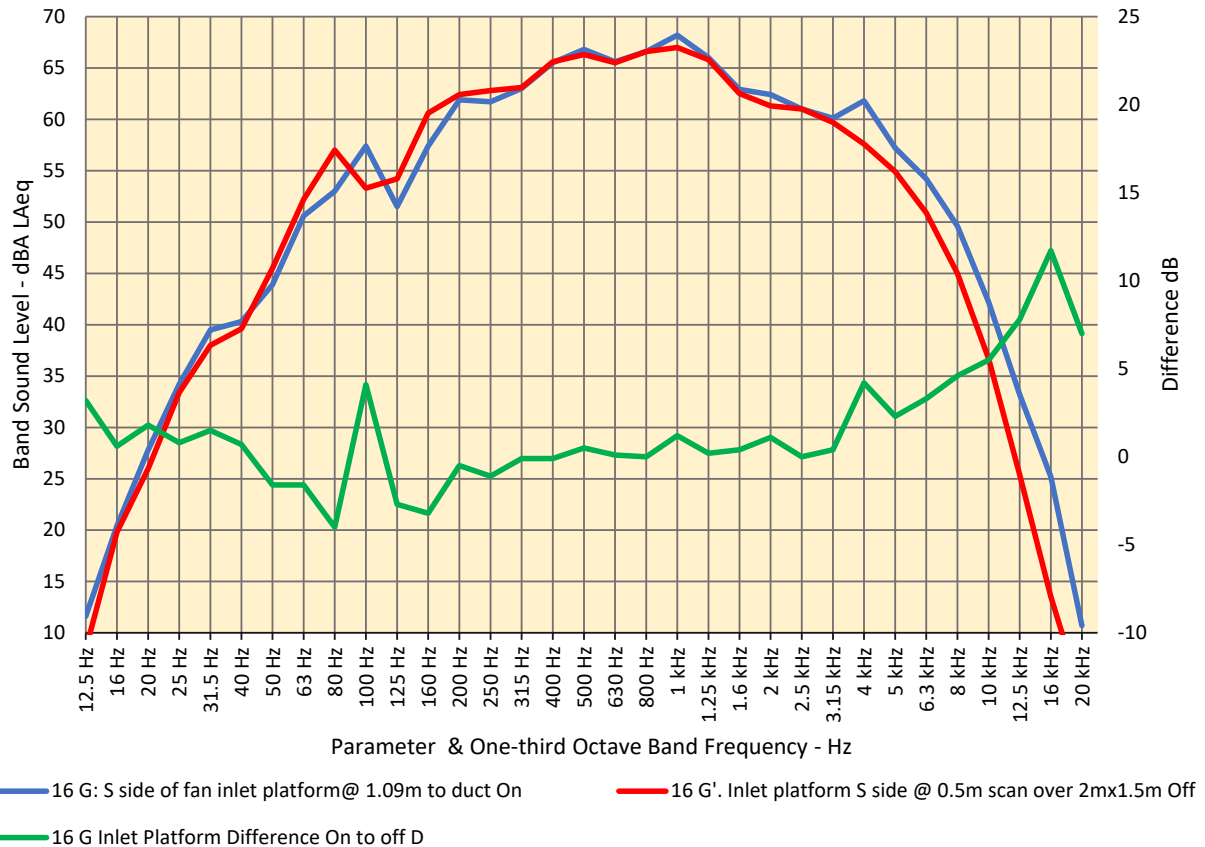
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc. G' $L_{A90,t}$



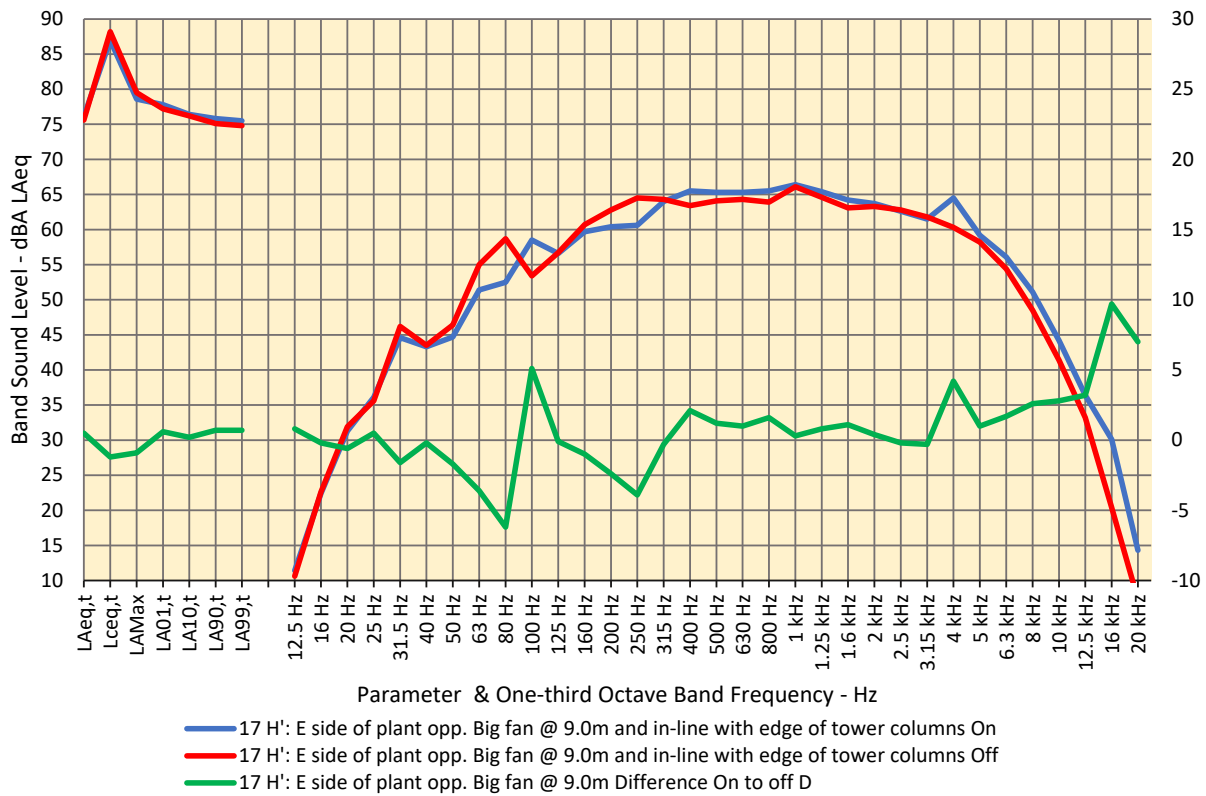
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.G $L_{Aeq,t}$



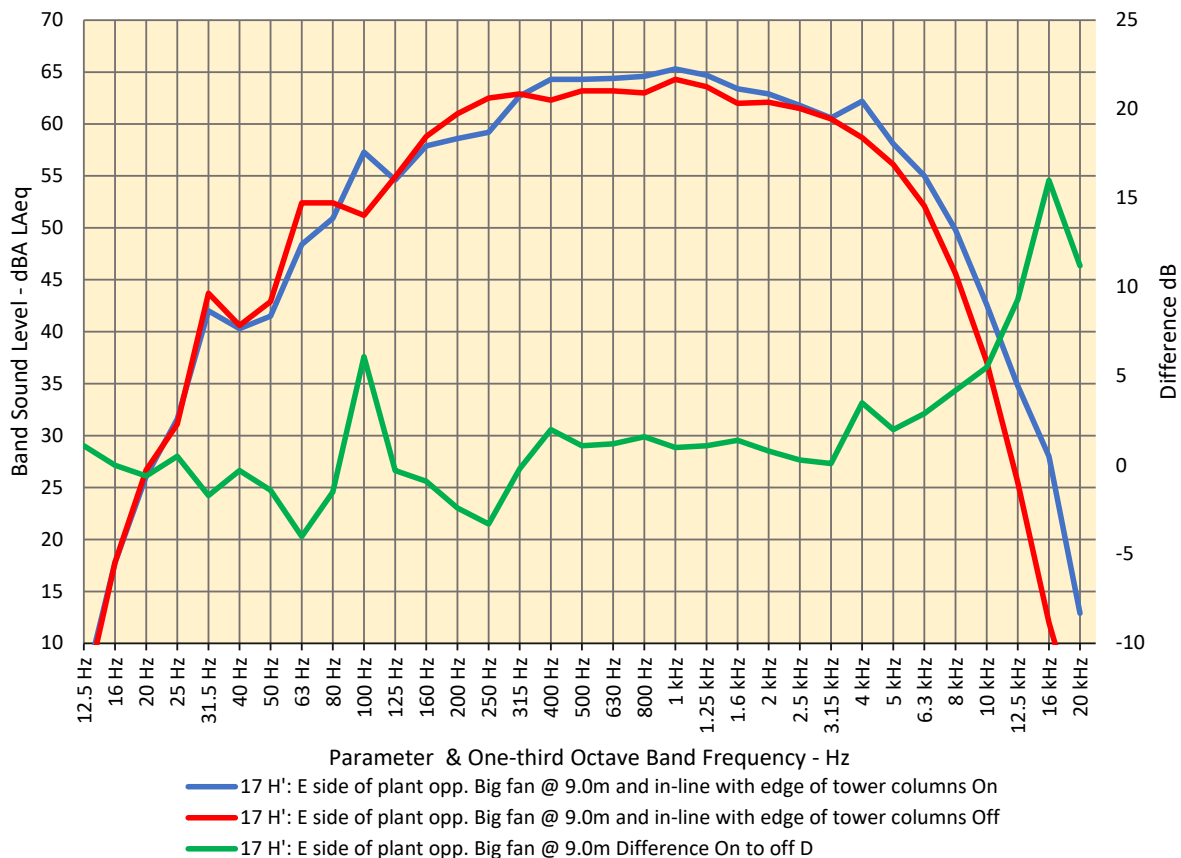
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc. G $L_{A90,t}$



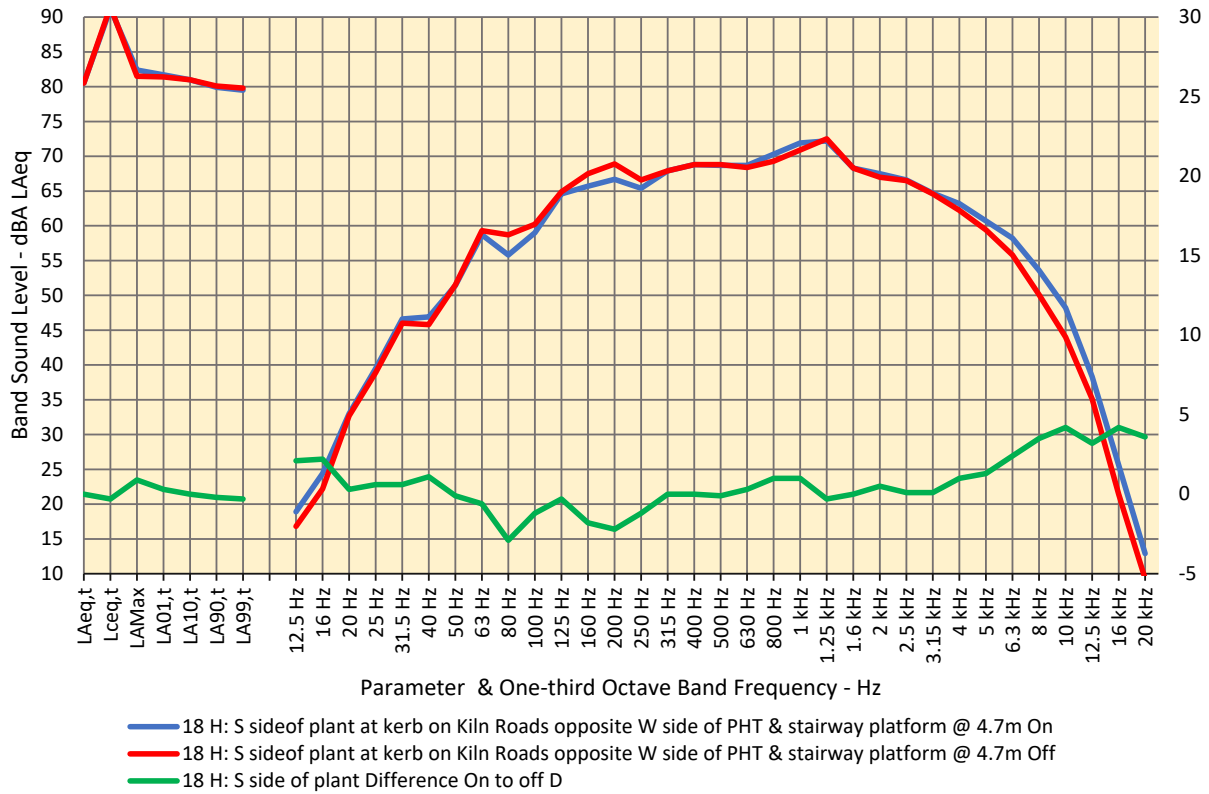
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.H' $L_{Aeq,t}$



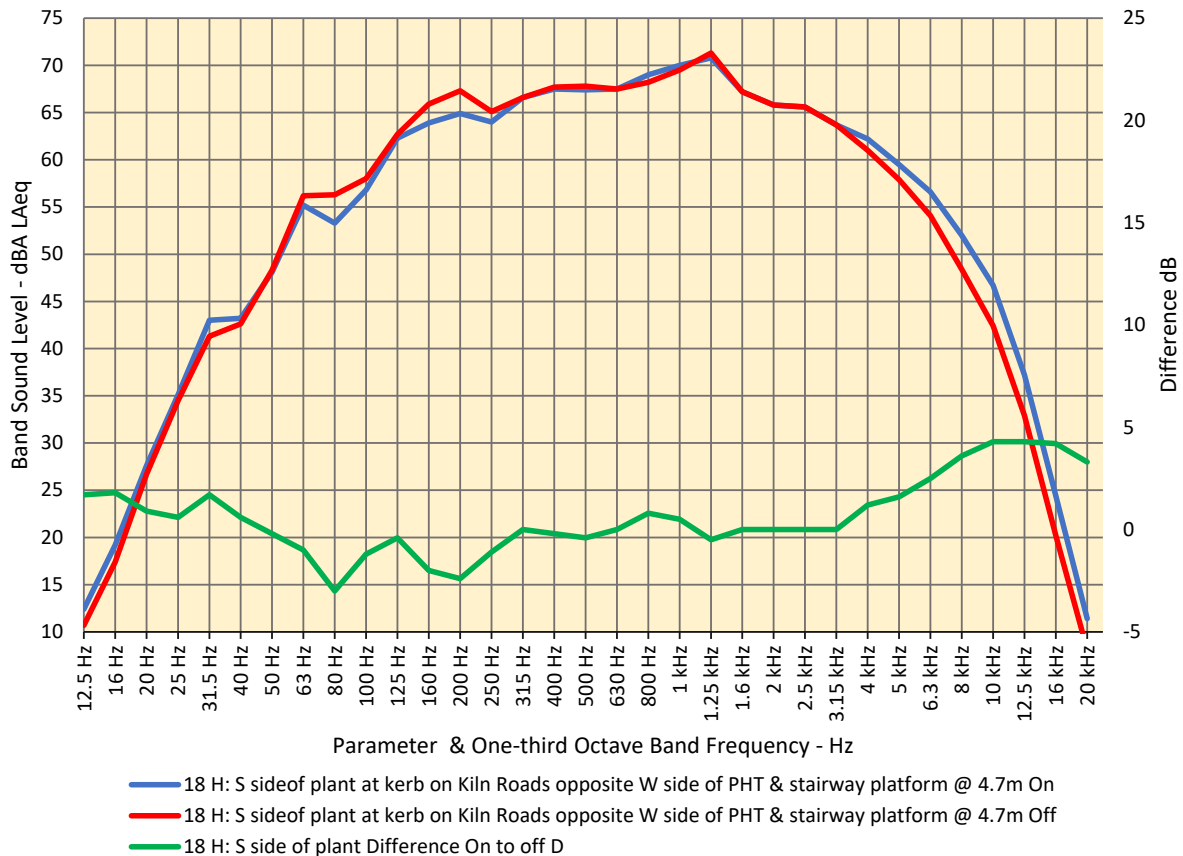
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc. H' $L_{A90,t}$



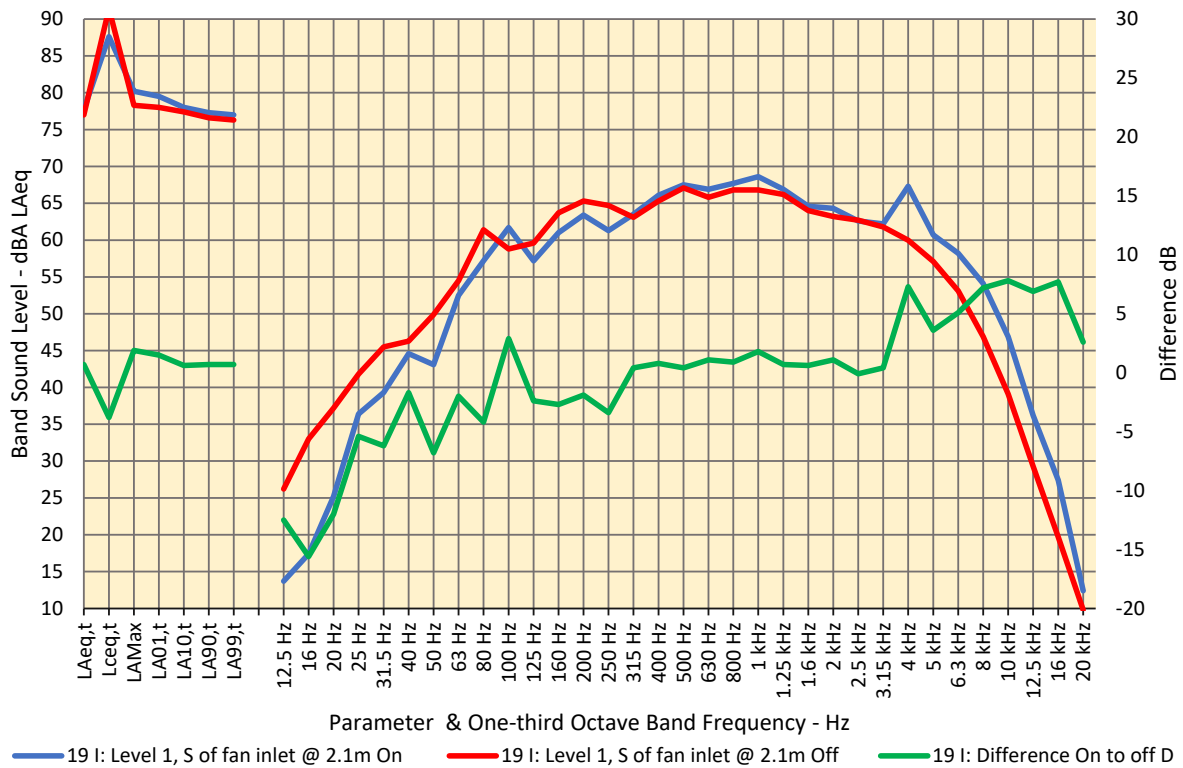
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.H $L_{Aeq,t}$



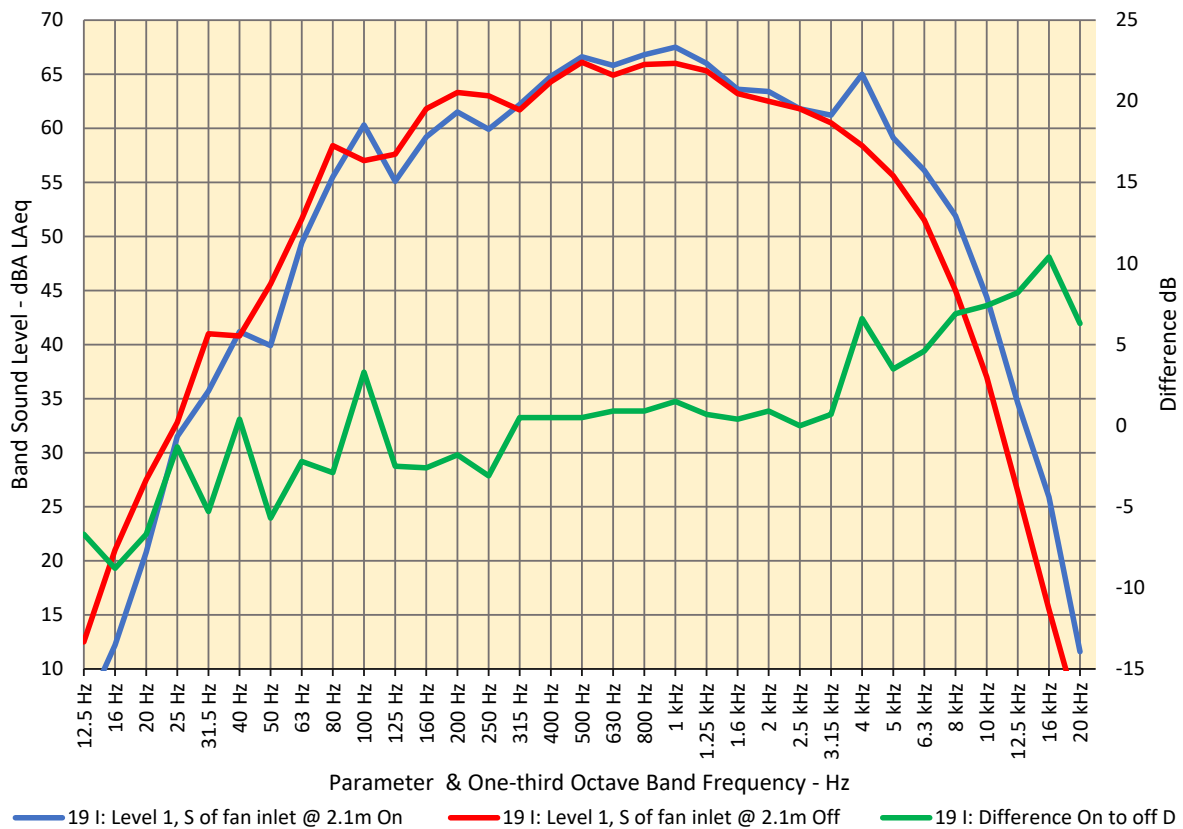
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc. H $L_{A90,t}$



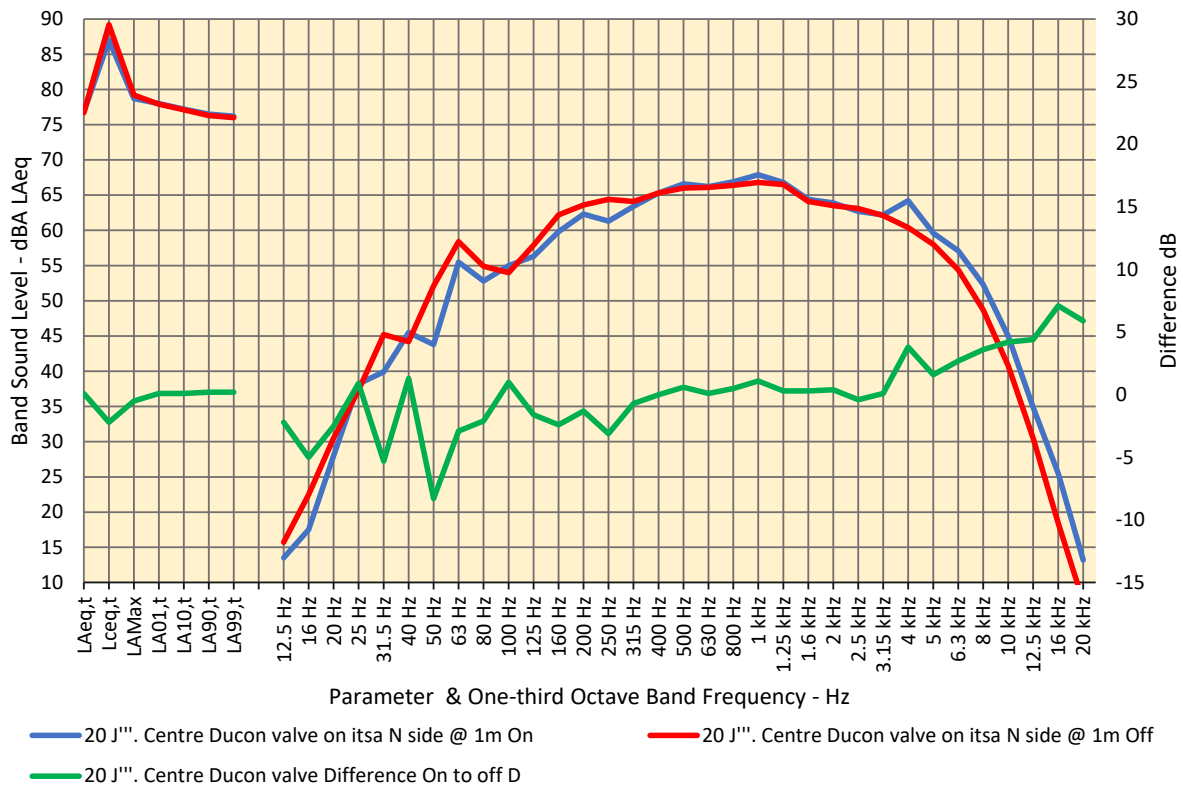
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc. I $L_{Aeq,t}$



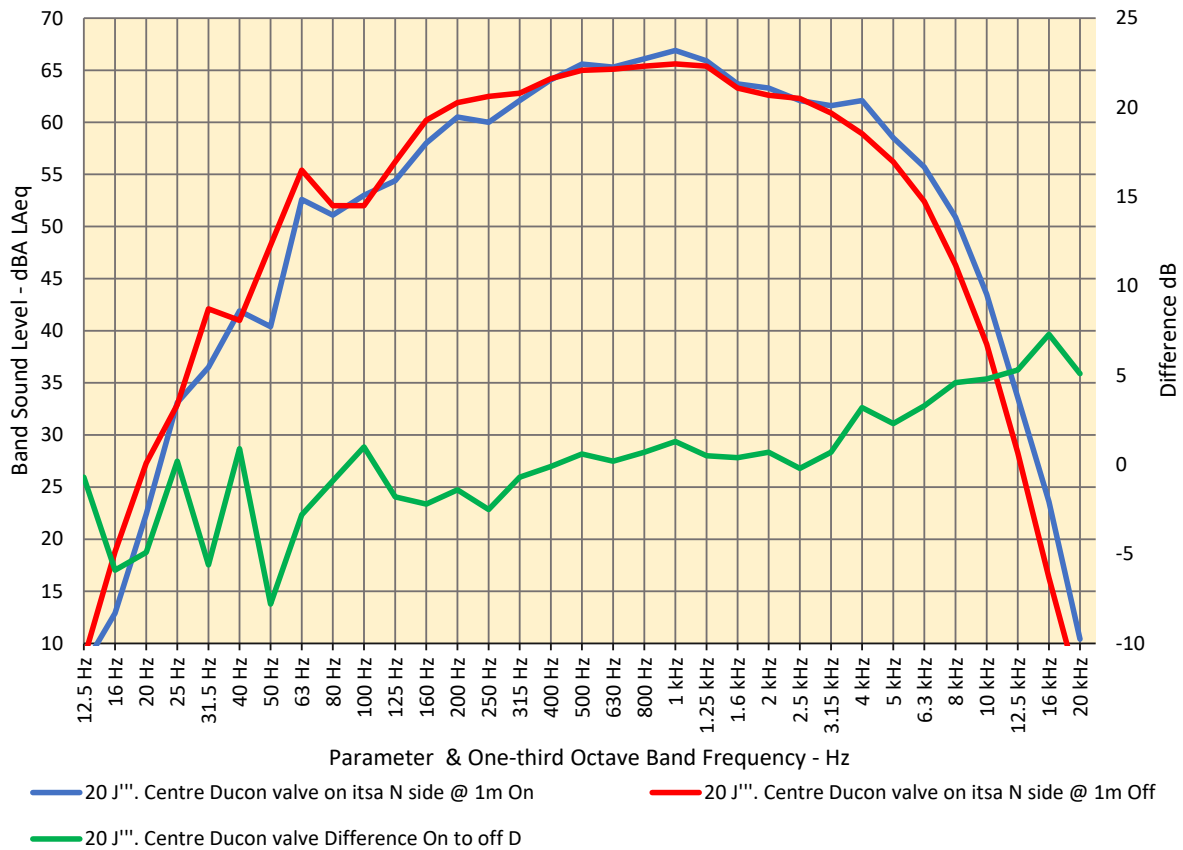
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc. I $L_{A90,t}$



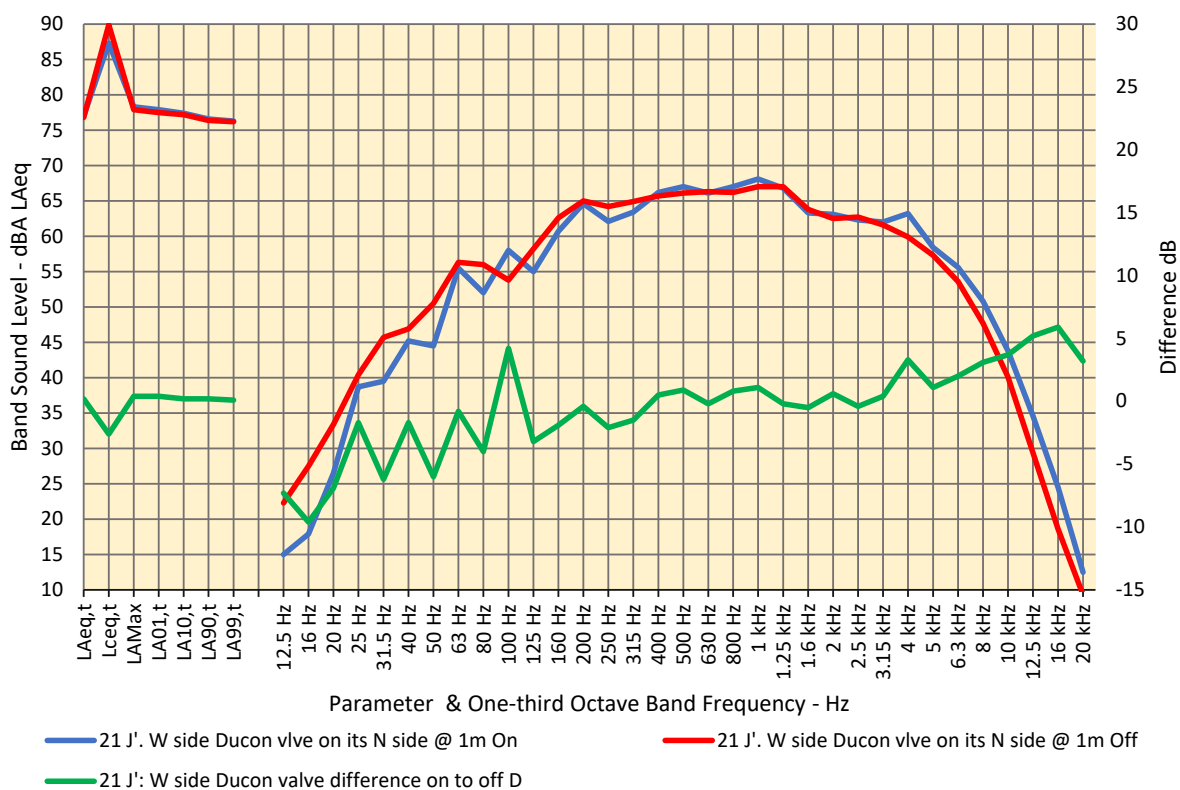
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.J''' $L_{Aeq,t}$



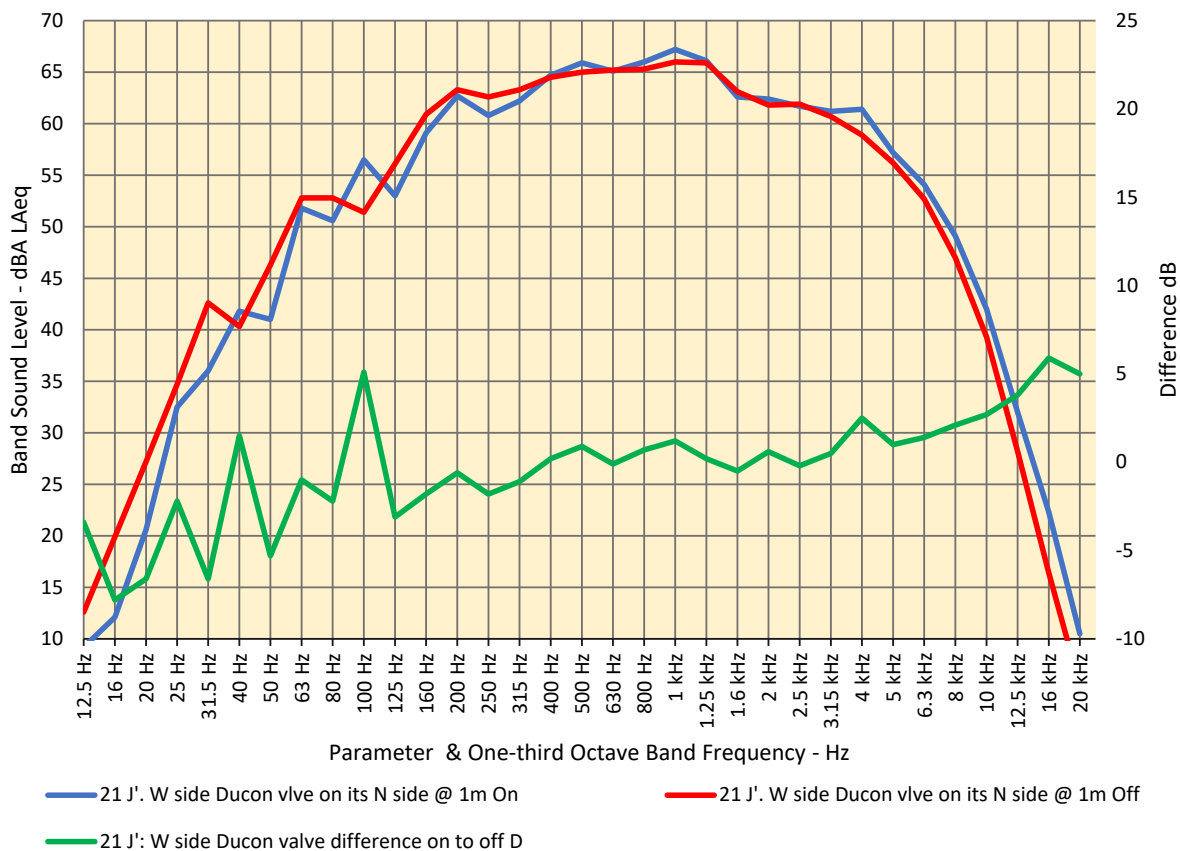
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.J''' $L_{A90,t}$



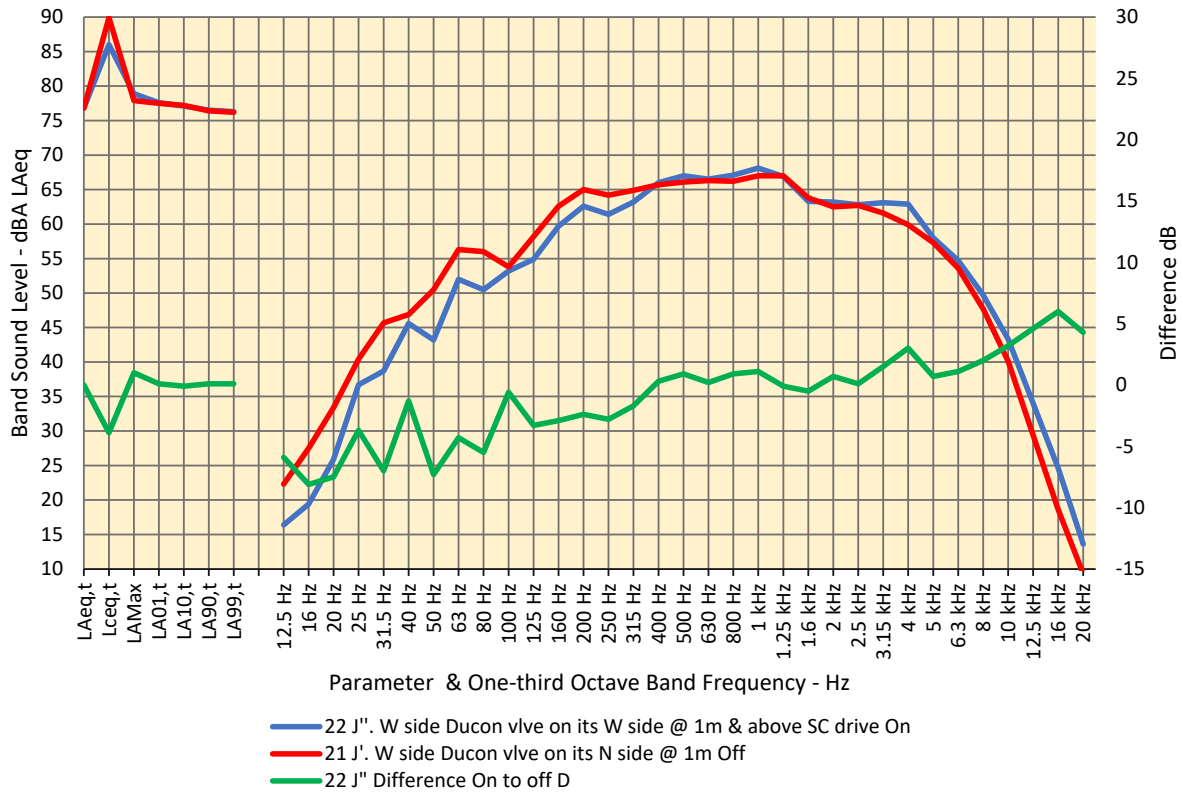
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.J' $L_{Aeq,t}$



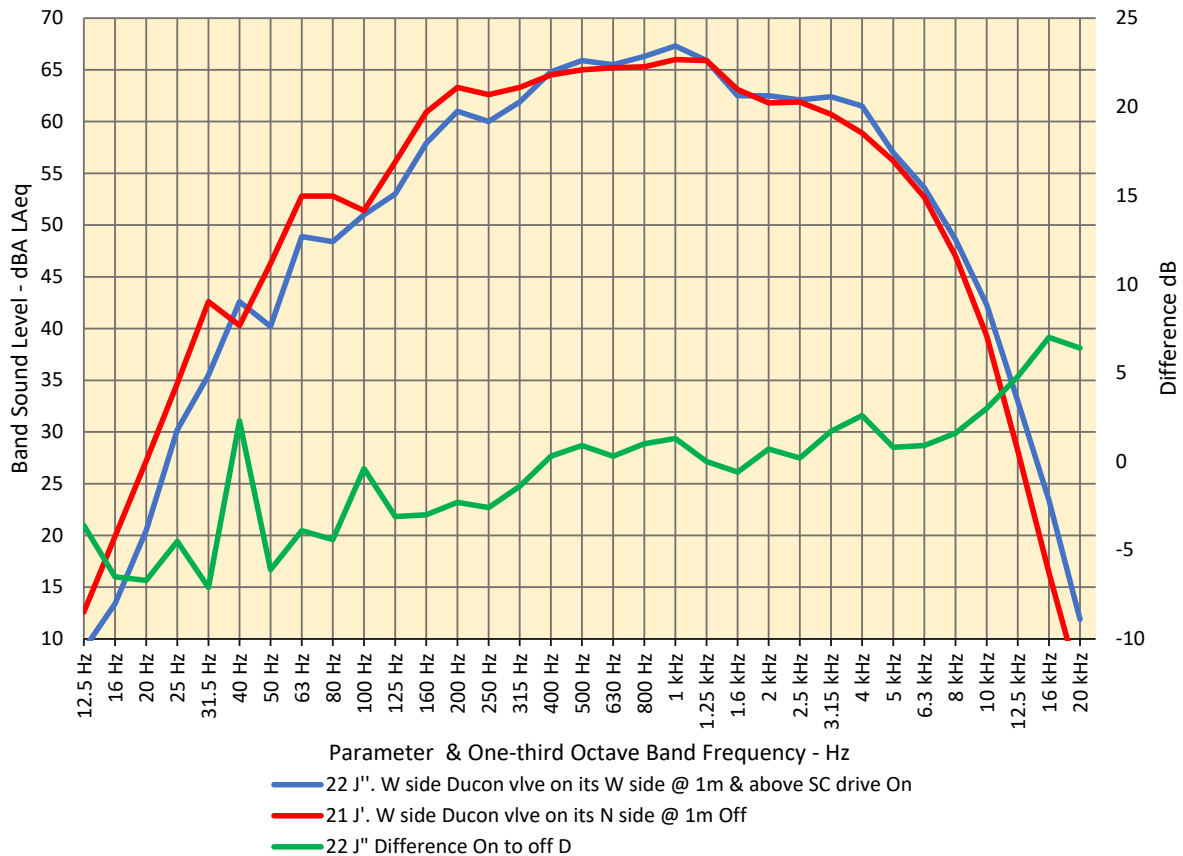
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.J' $L_{A90,t}$



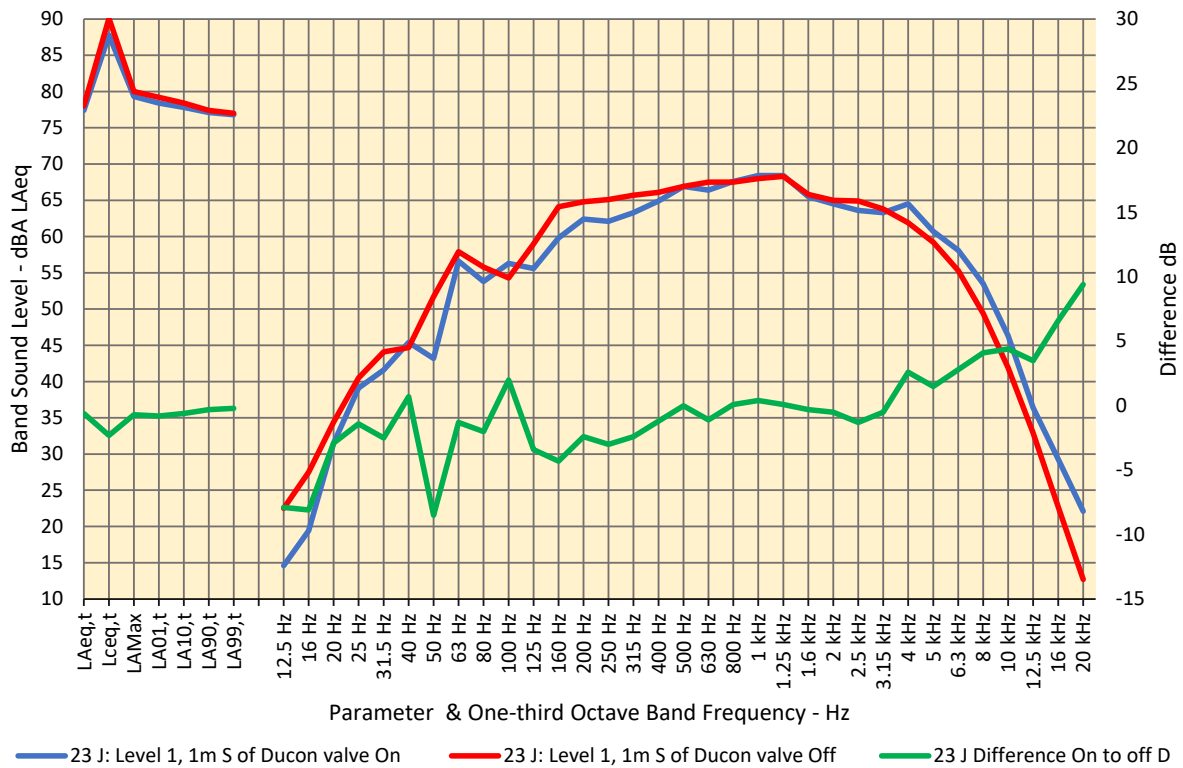
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.J" $L_{Aeq,t}$



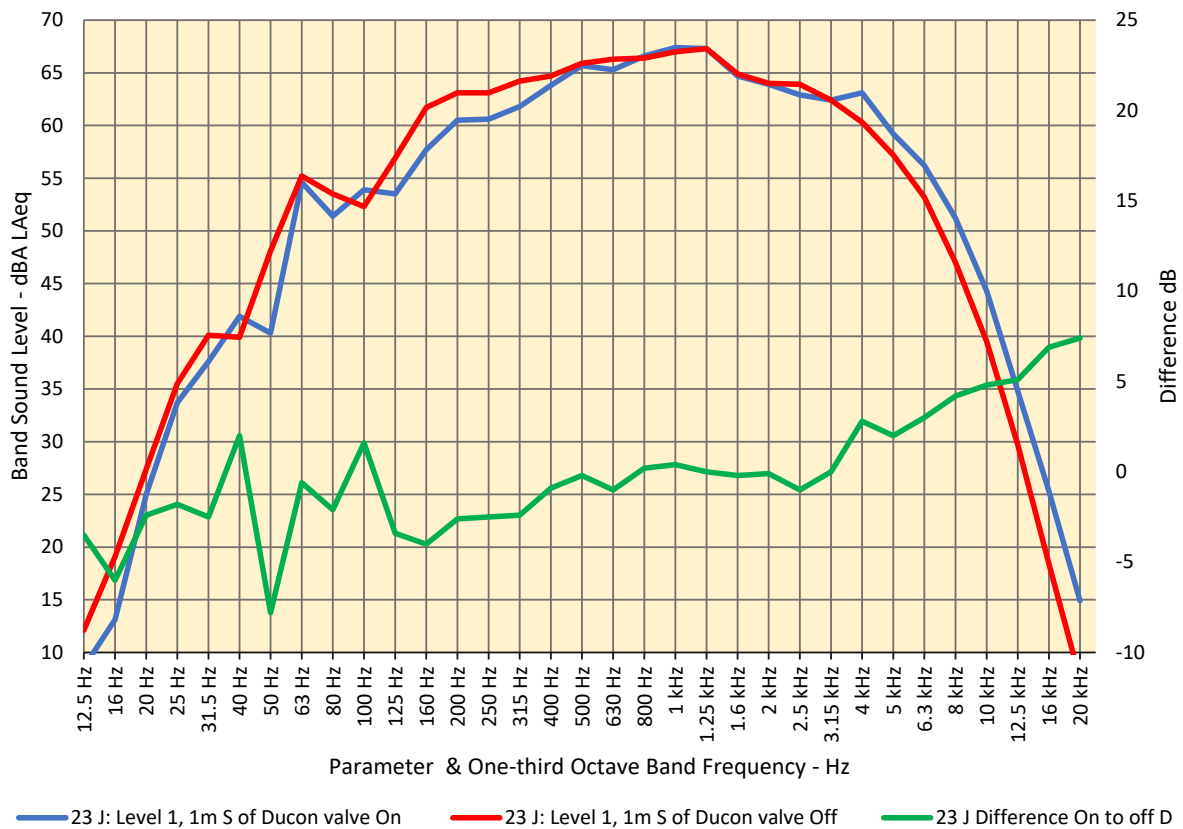
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.J" $L_{A90,t}$



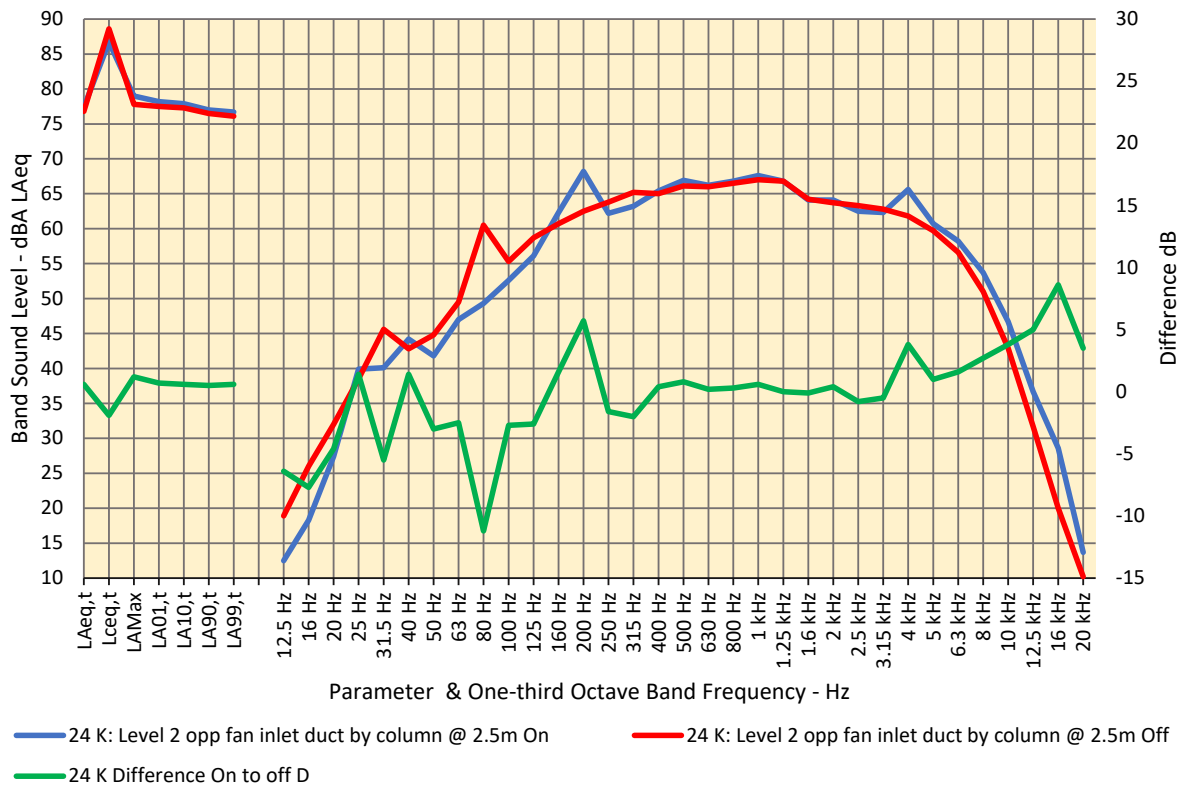
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.J $L_{Aeq,t}$



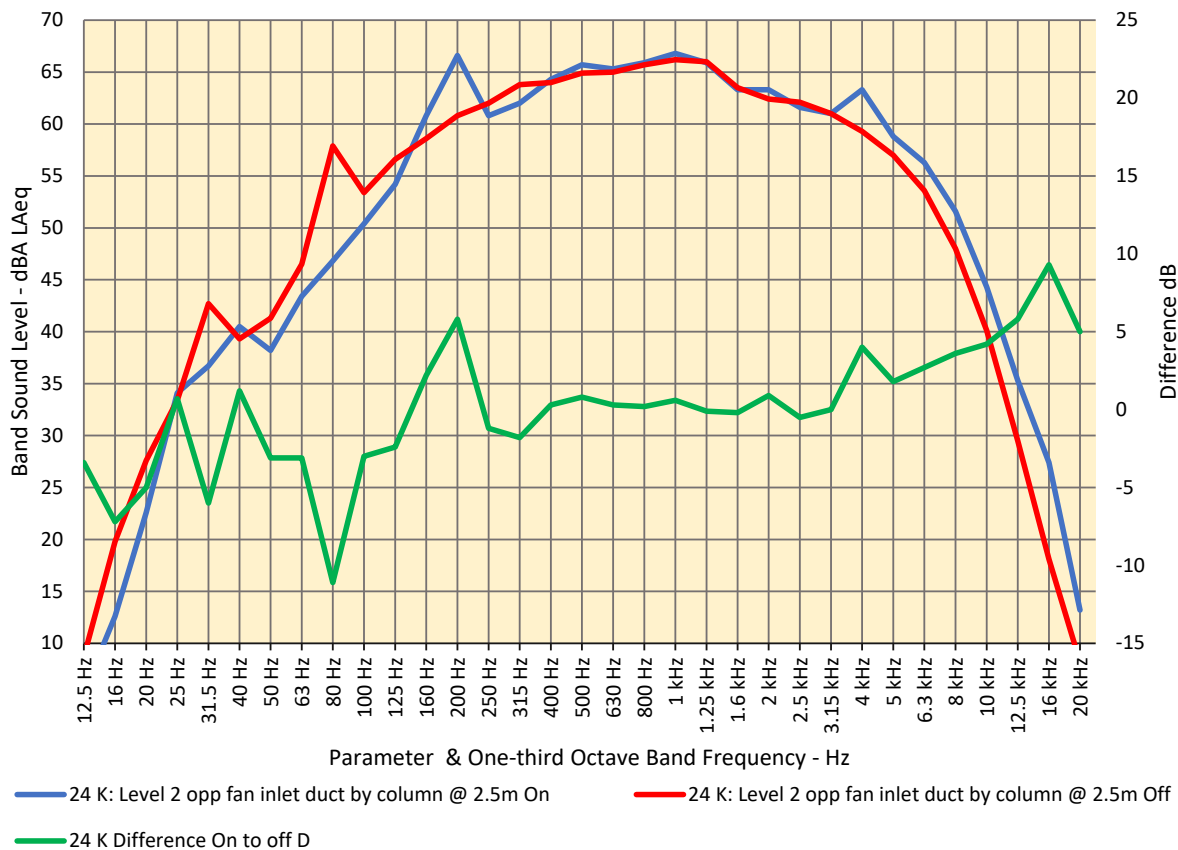
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.J $L_{A90,t}$



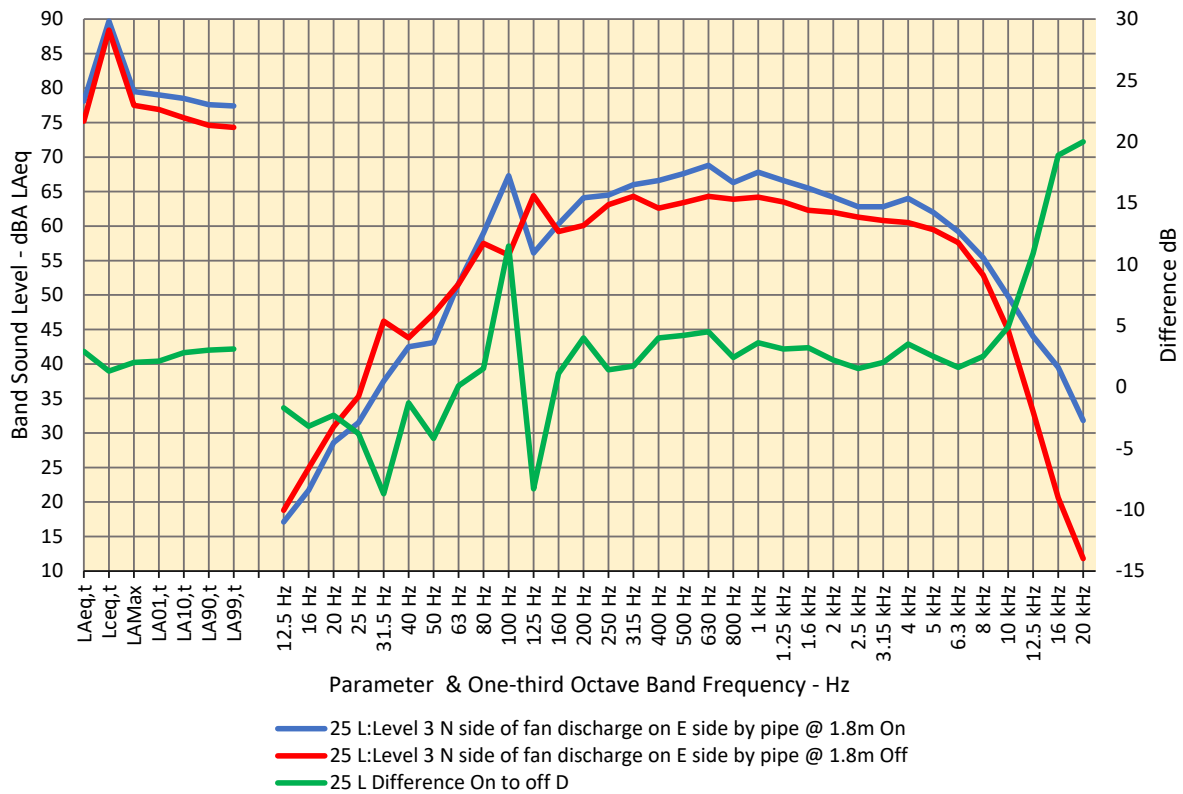
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.K $L_{Aeq,t}$



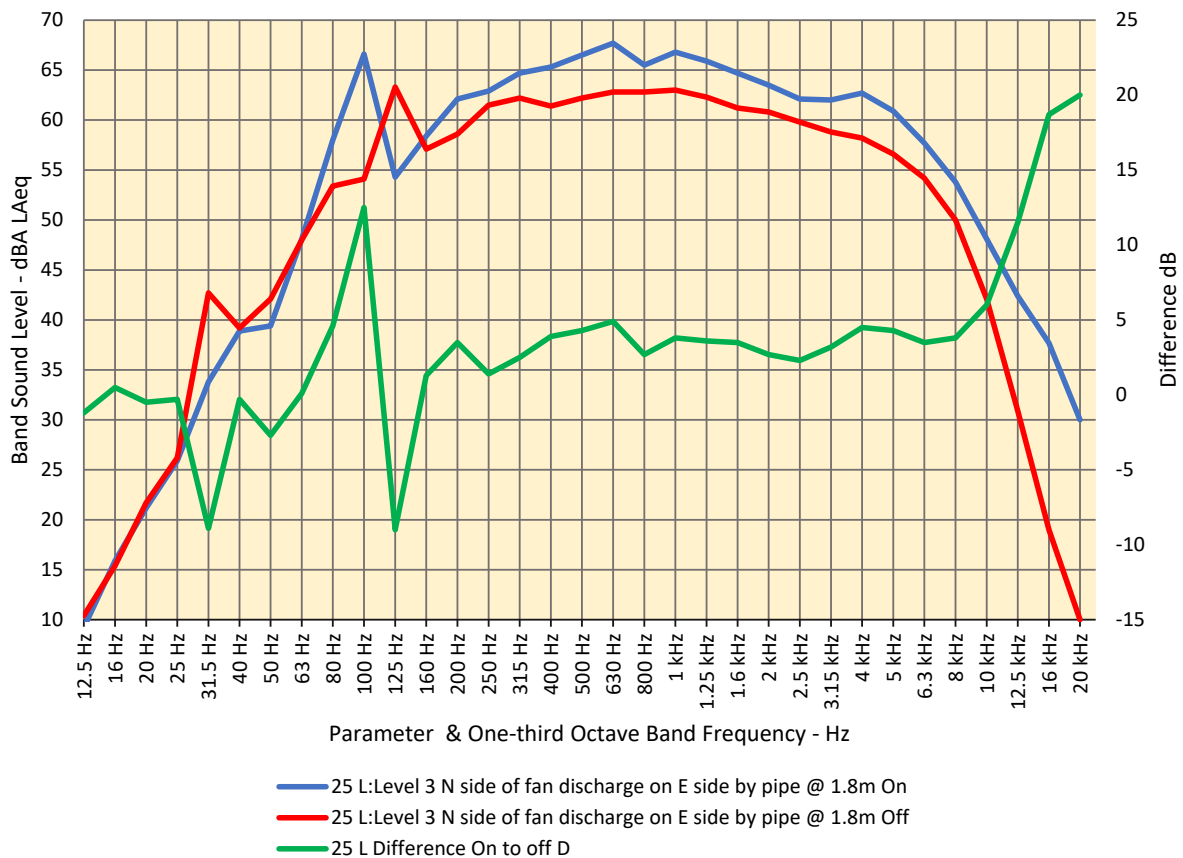
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.K $L_{A90,t}$



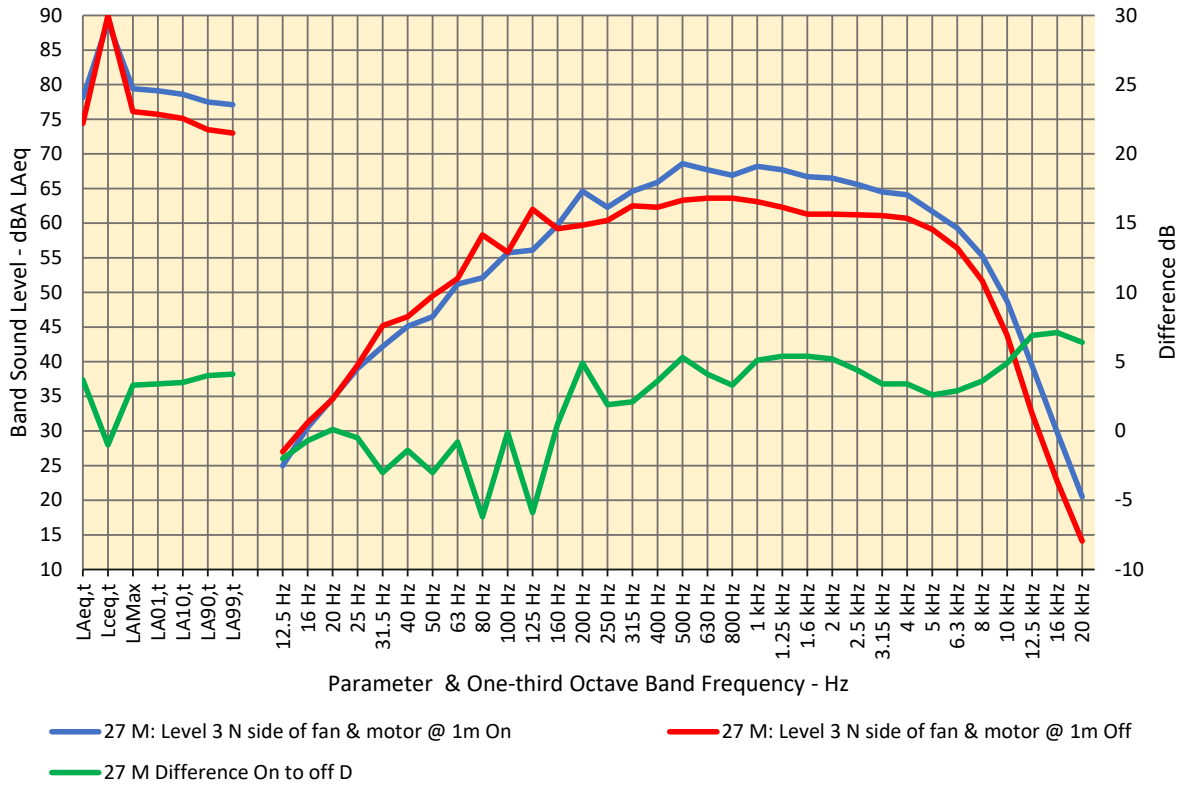
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.L $L_{Aeq,t}$



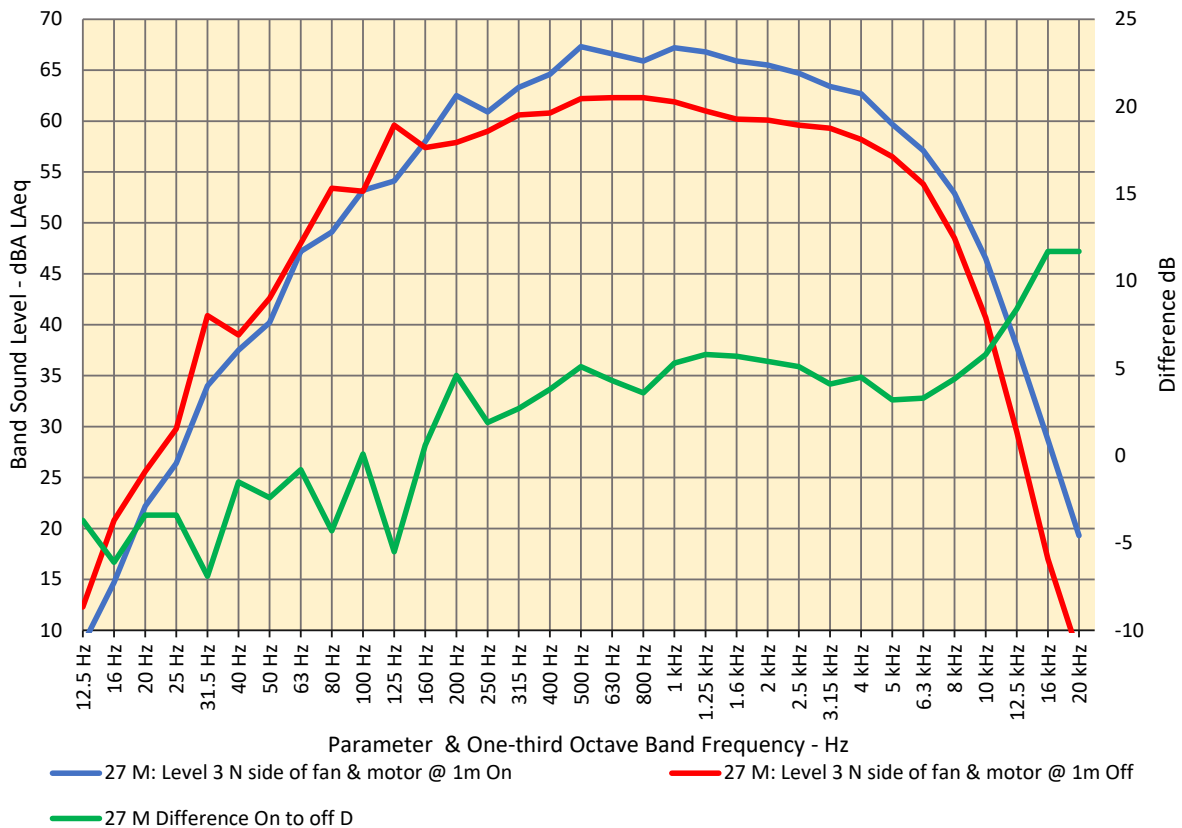
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.L $L_{A90,t}$



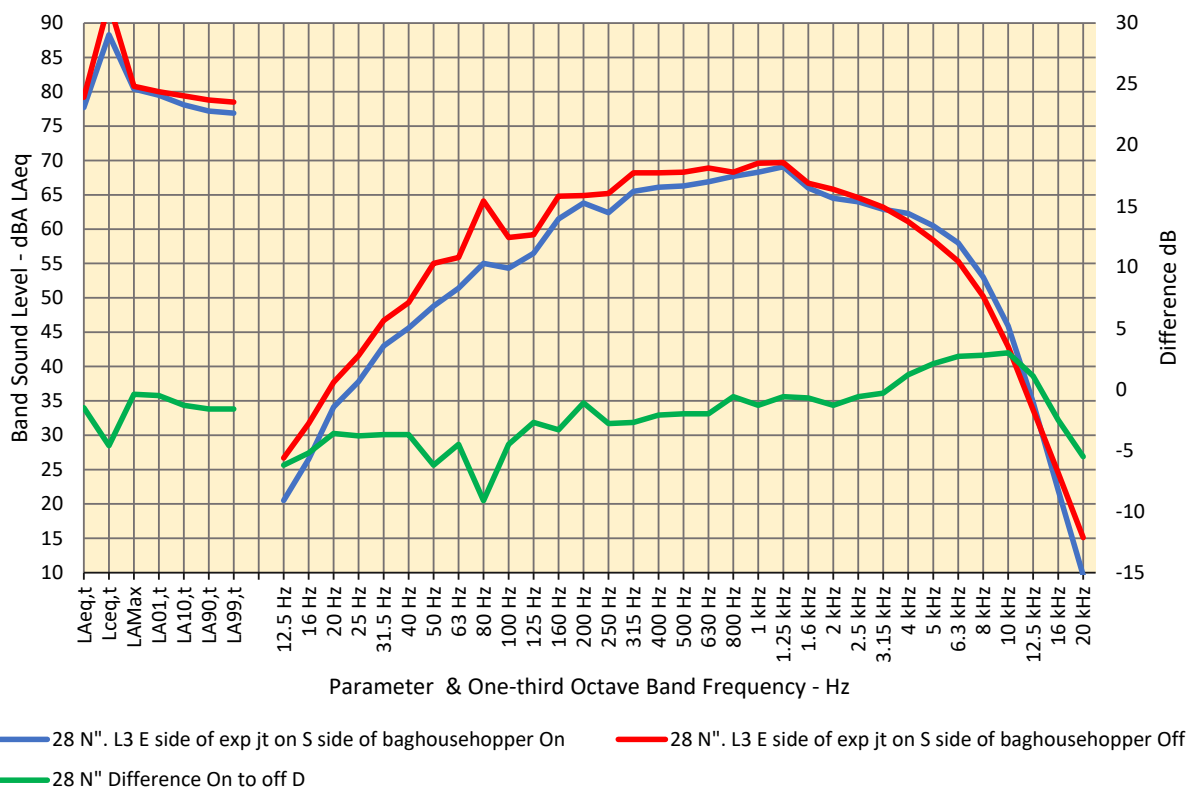
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.M $L_{Aeq,t}$



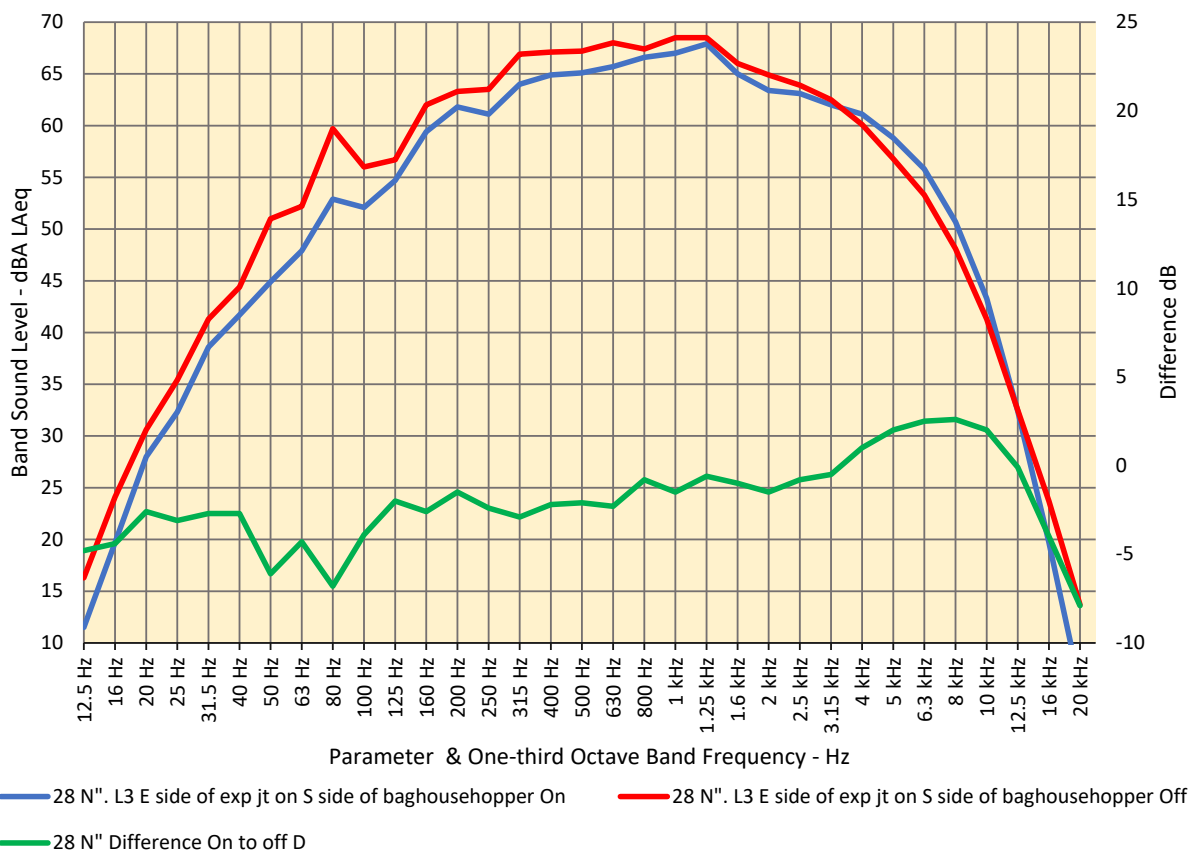
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.M $L_{A90,t}$



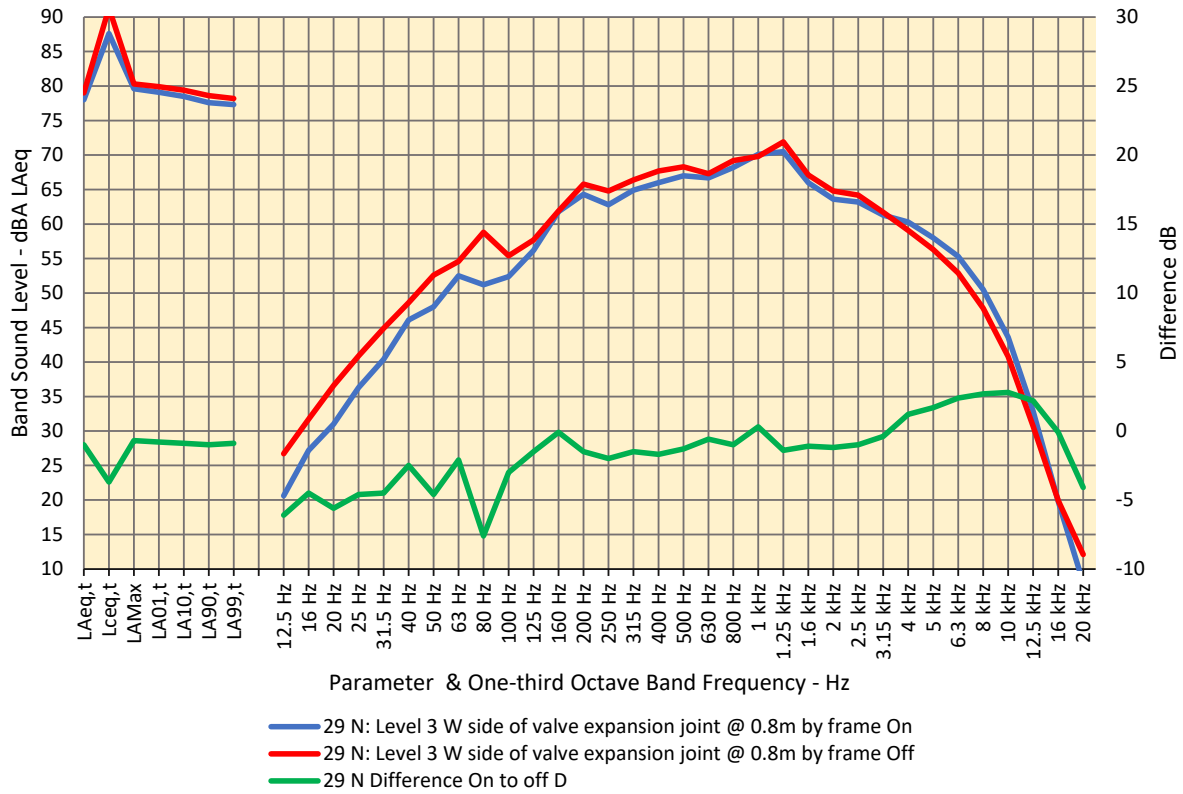
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.N" $L_{Aeq,t}$



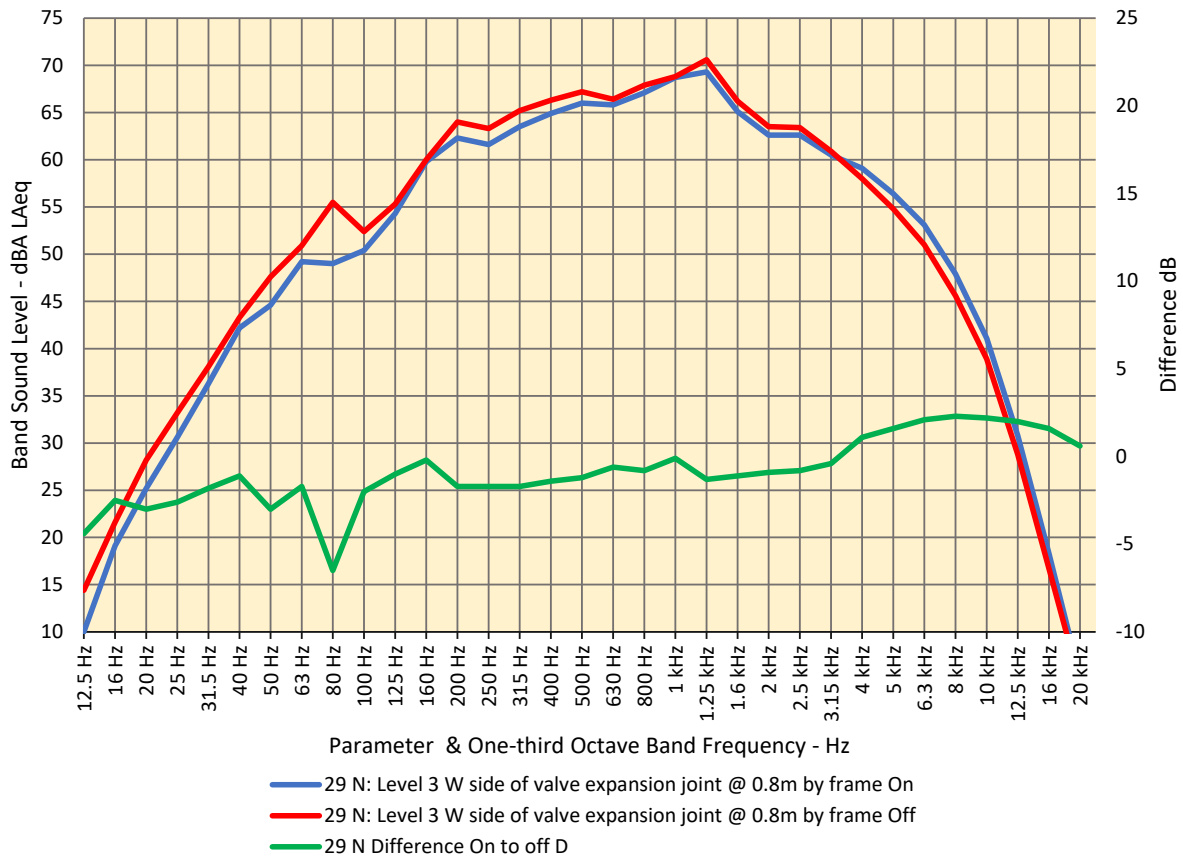
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.N" $L_{A90,t}$



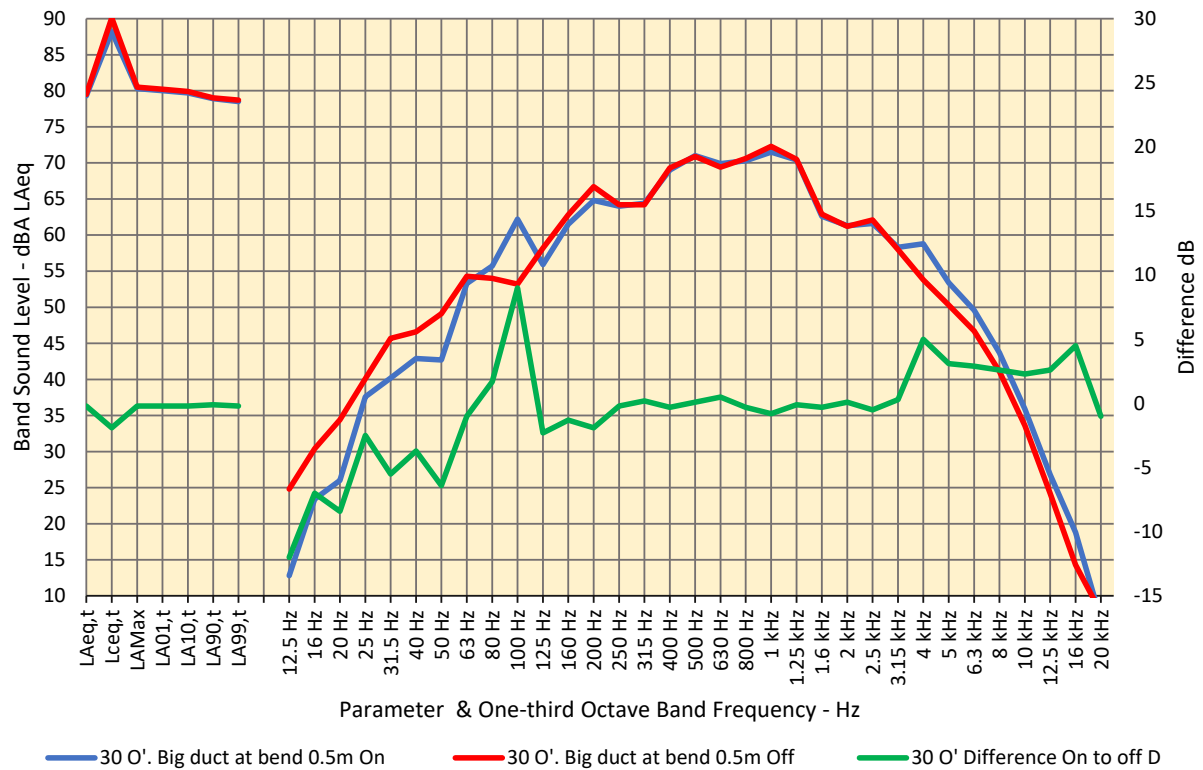
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.N $L_{Aeq,t}$



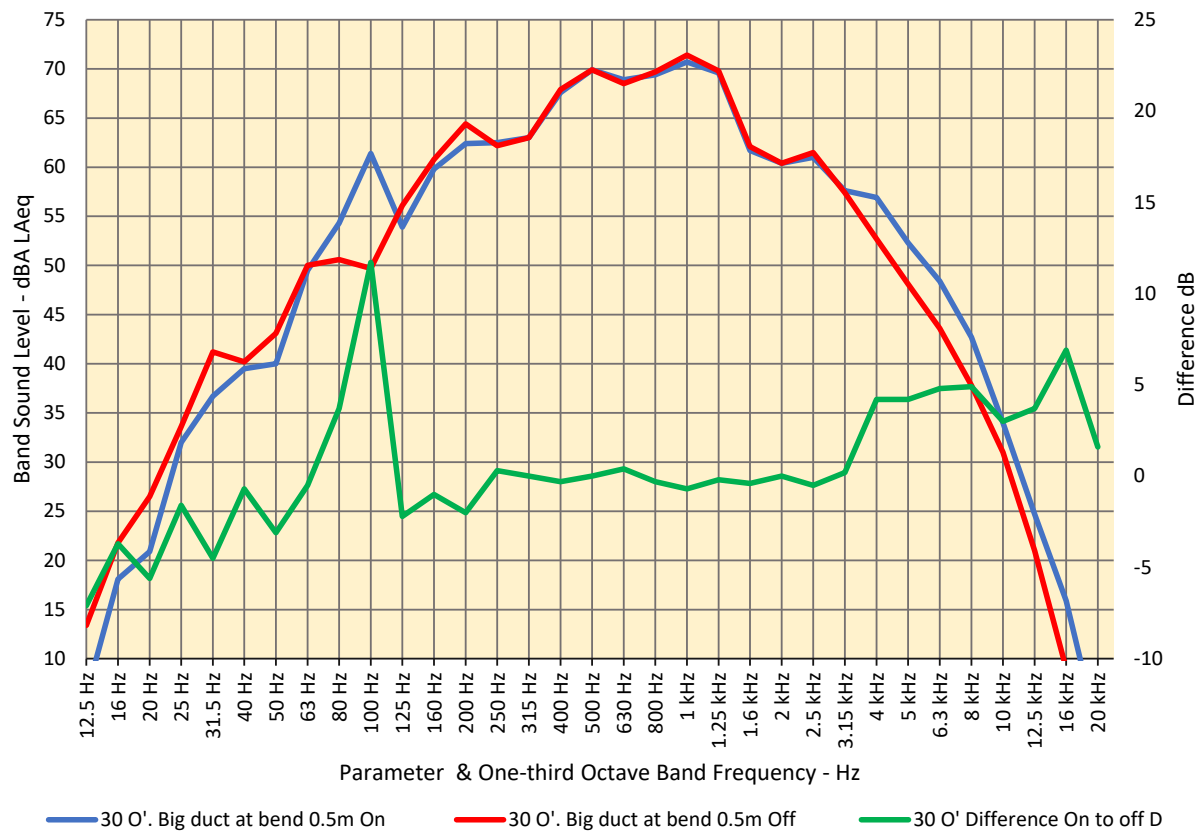
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.N $L_{A90,t}$



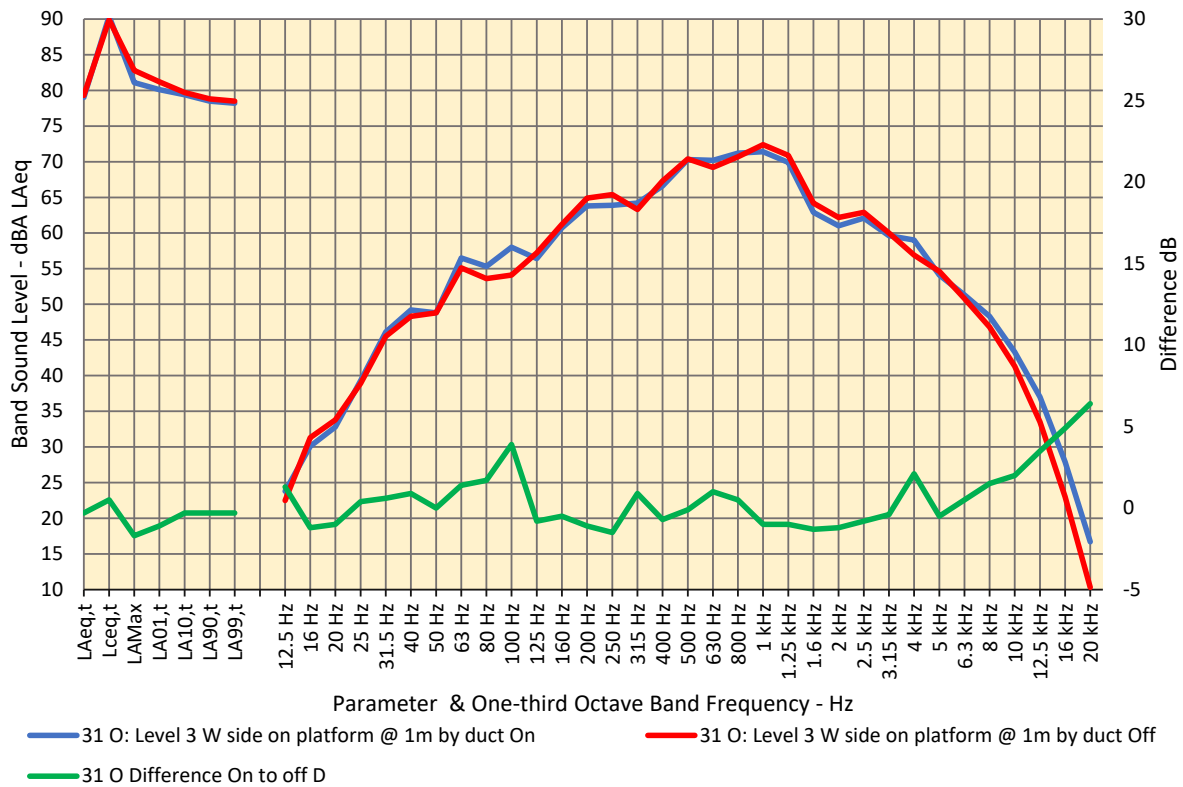
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.O' $L_{Aeq,t}$



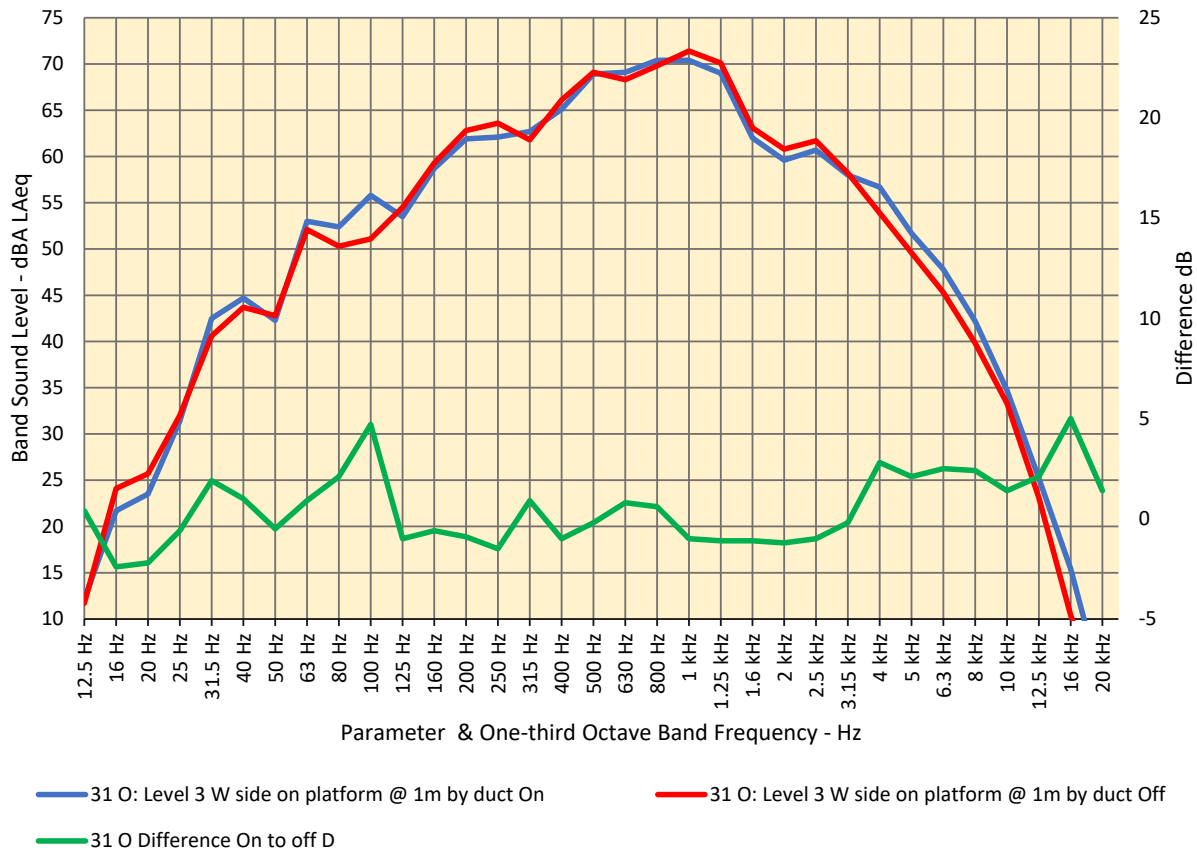
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.O' $L_{A90,t}$



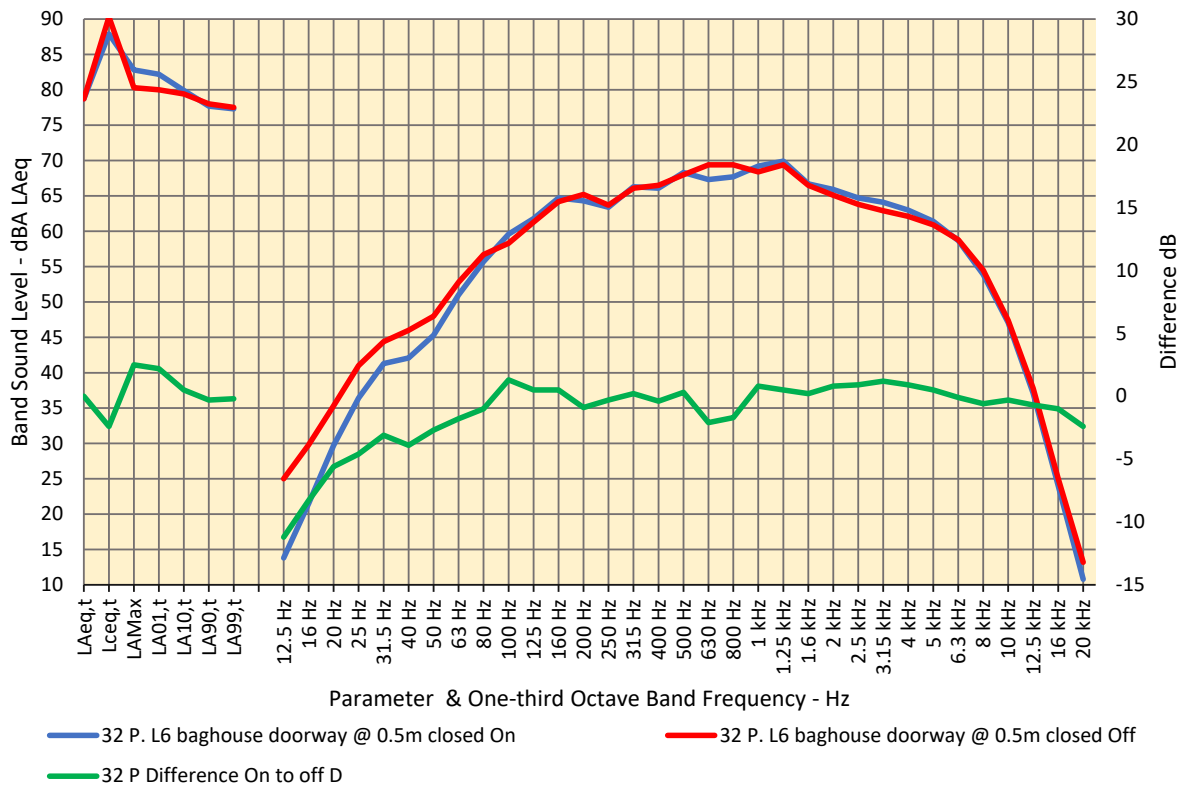
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.O $L_{Aeq,t}$



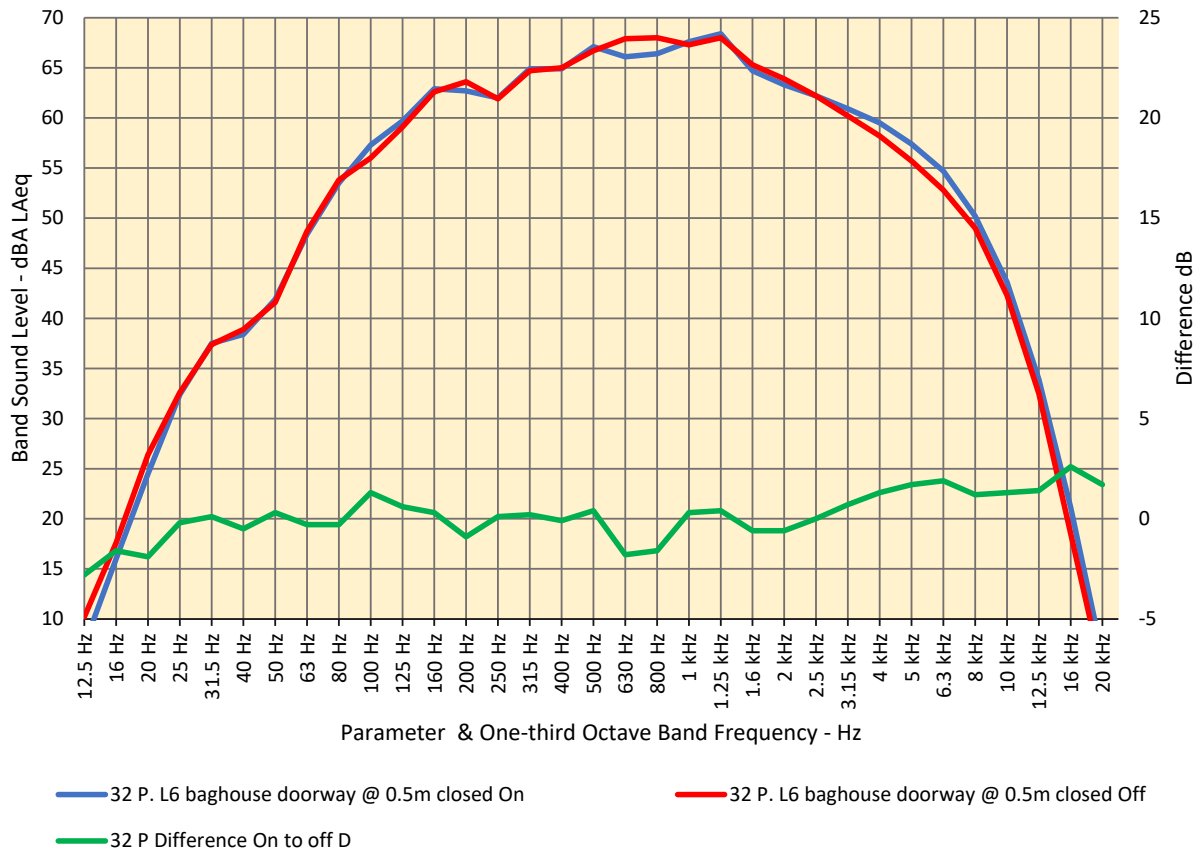
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.O $L_{A90,t}$



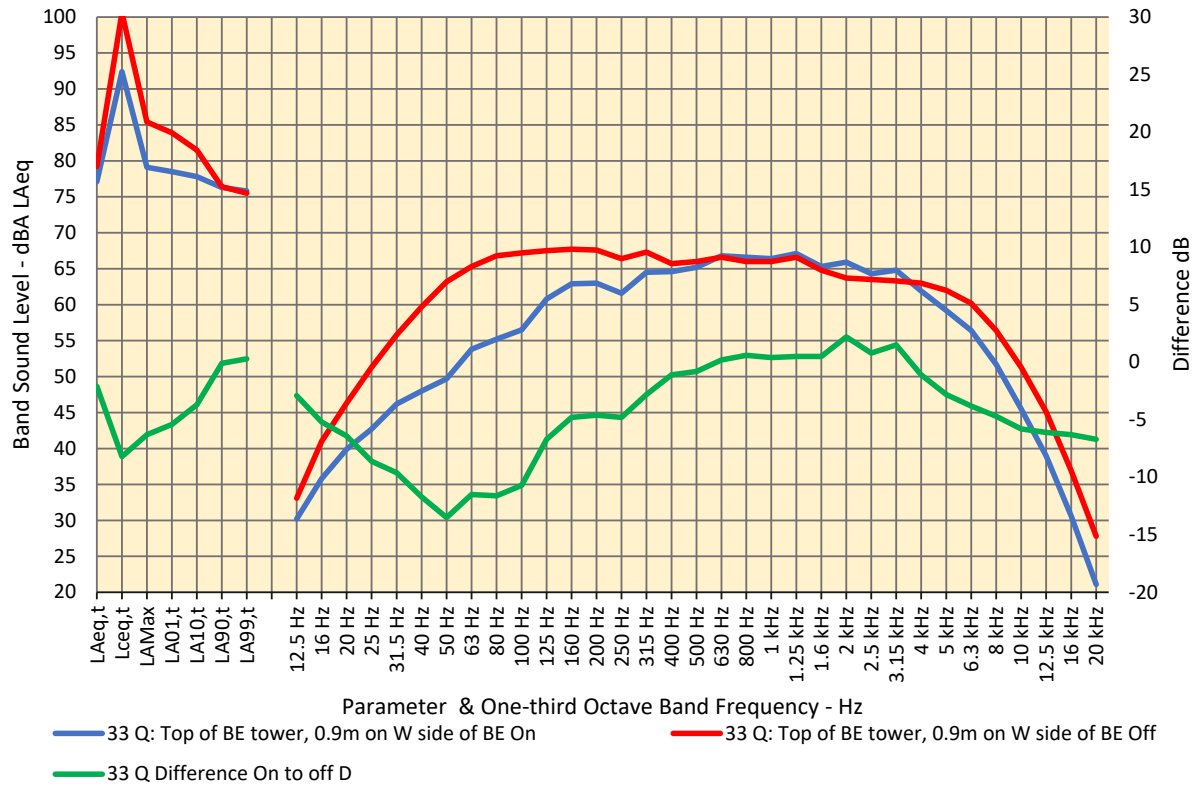
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.P $L_{Aeq,t}$



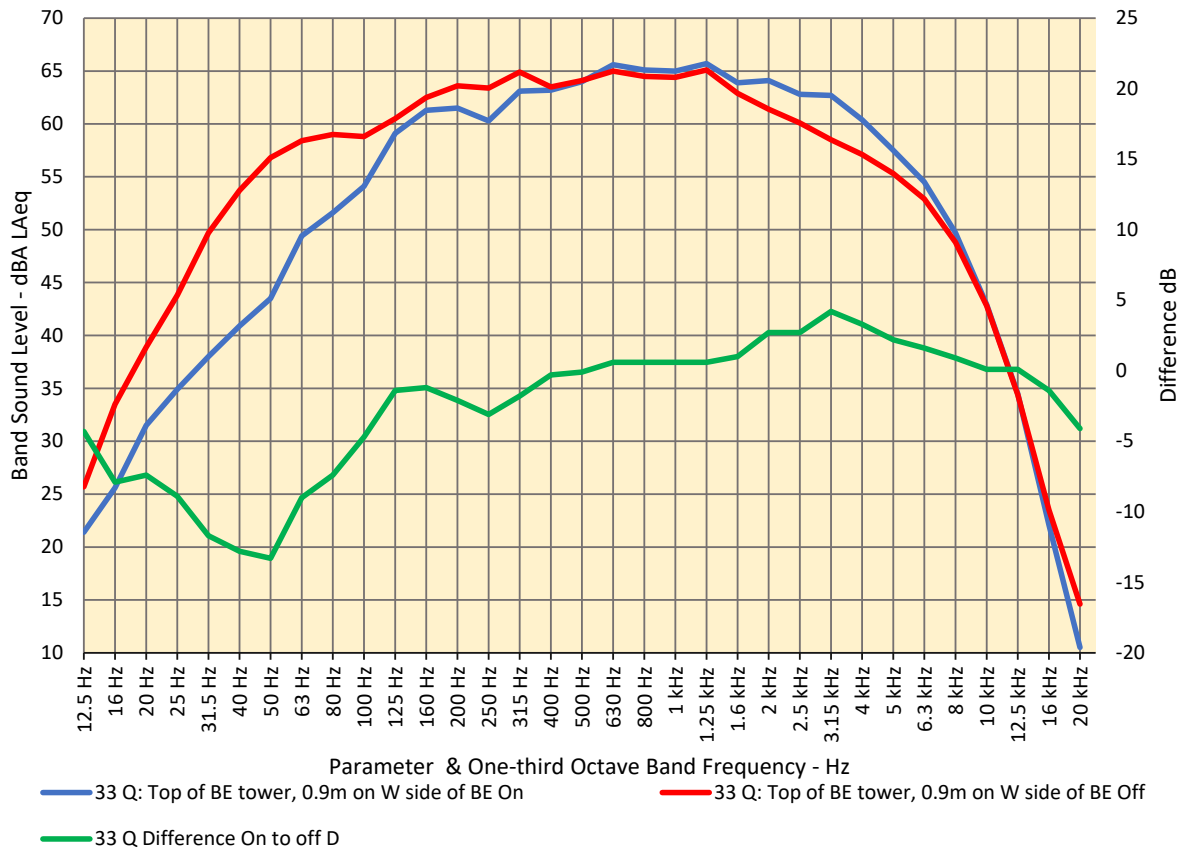
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.P $L_{A90,t}$

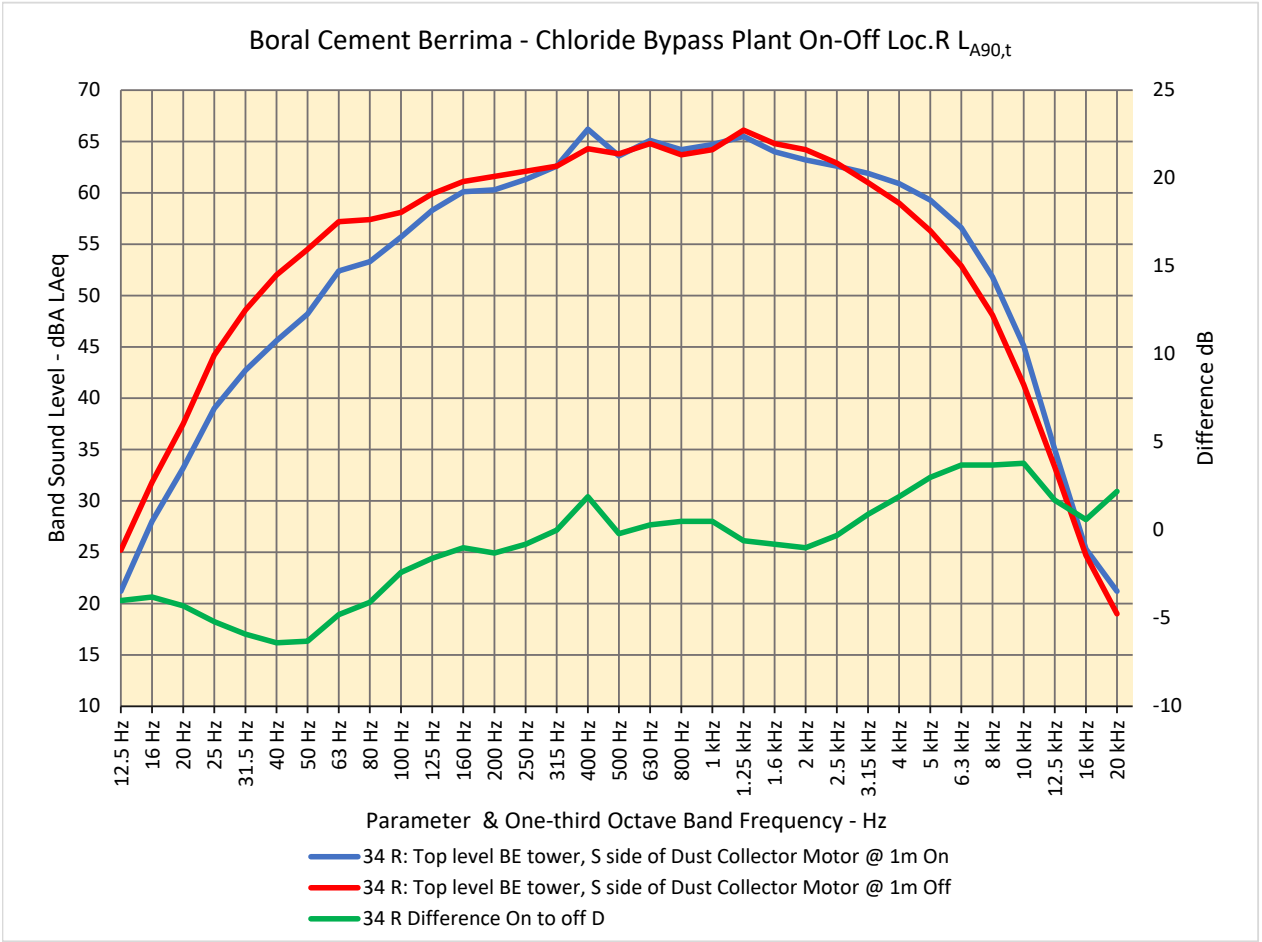
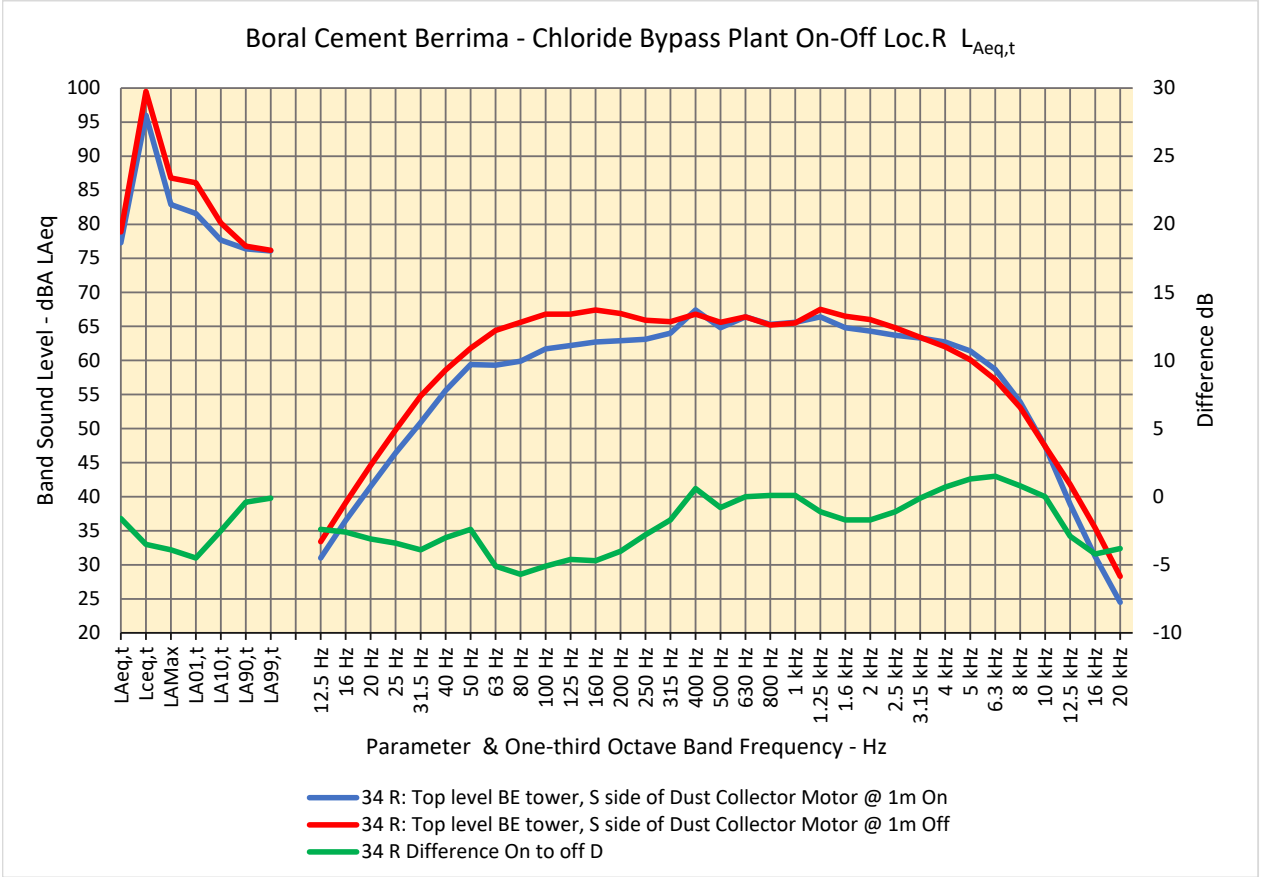


Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.Q $L_{Aeq,t}$

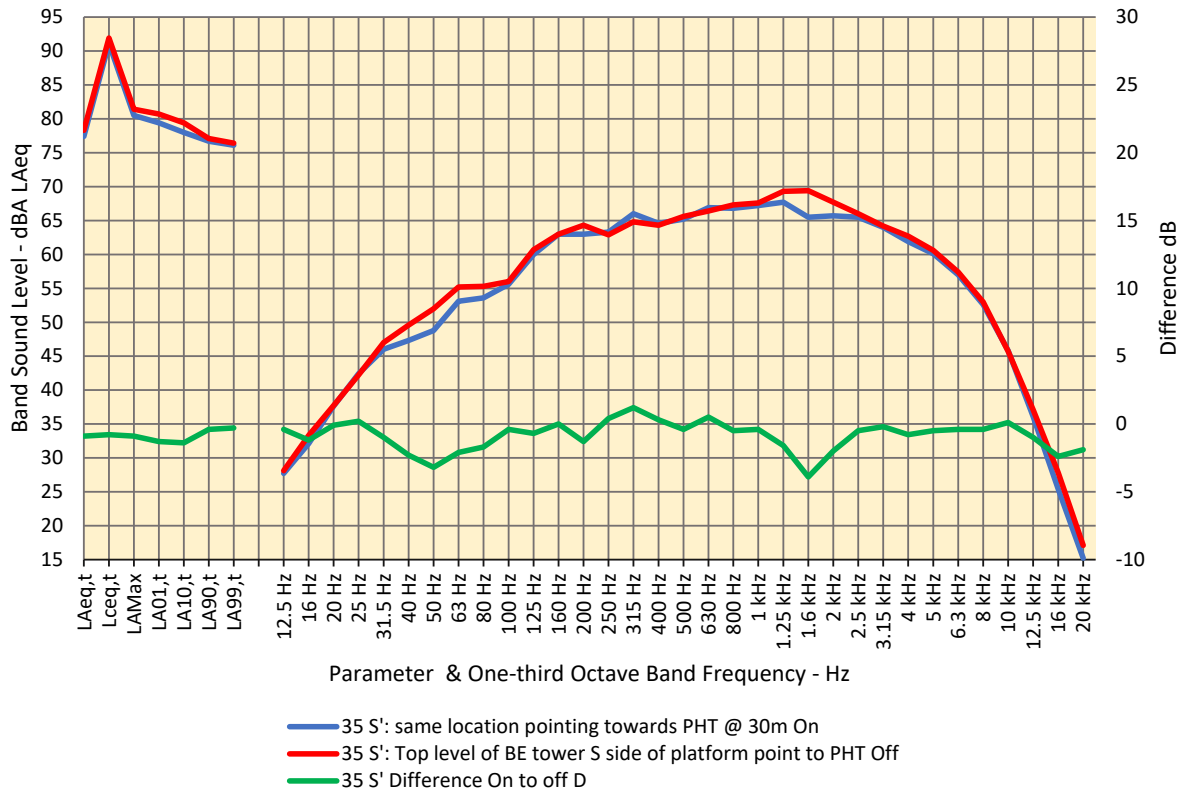


Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.Q $L_{A90,t}$

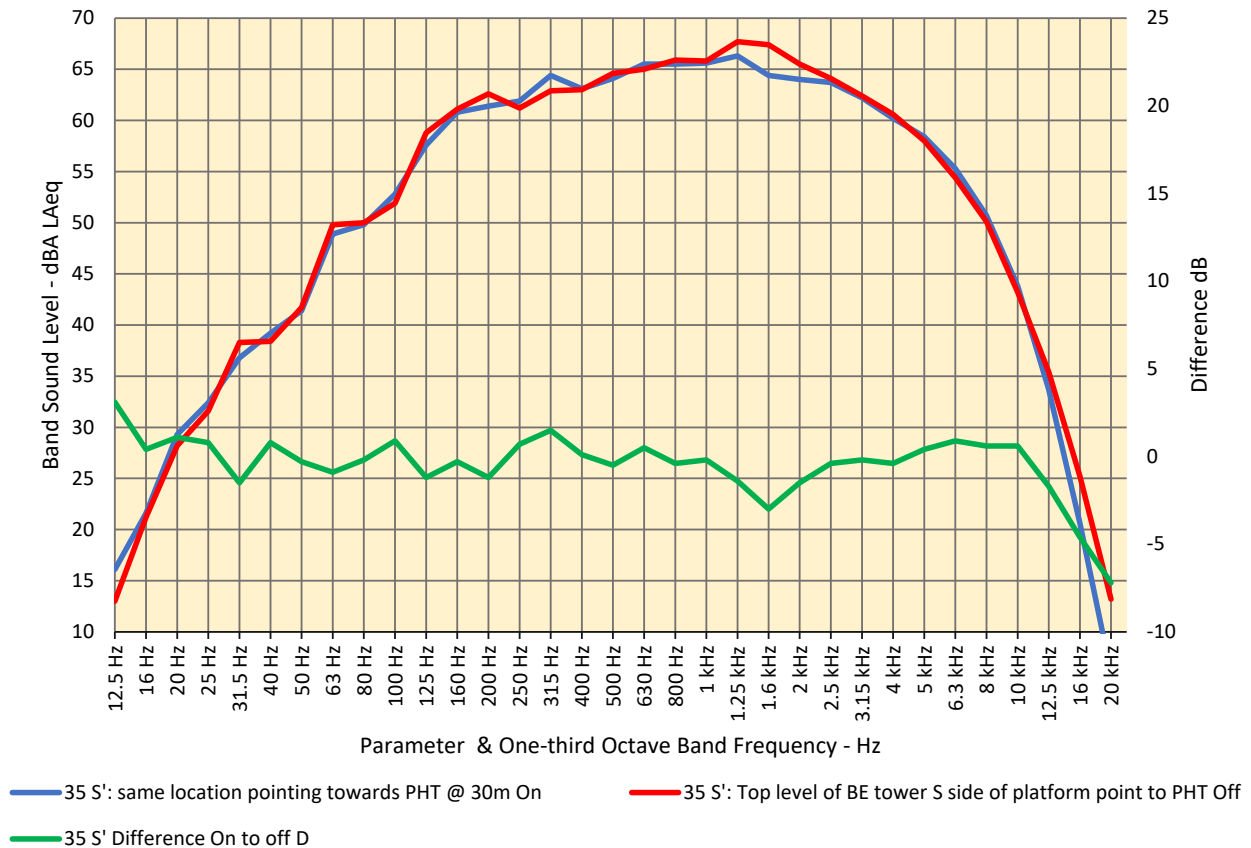




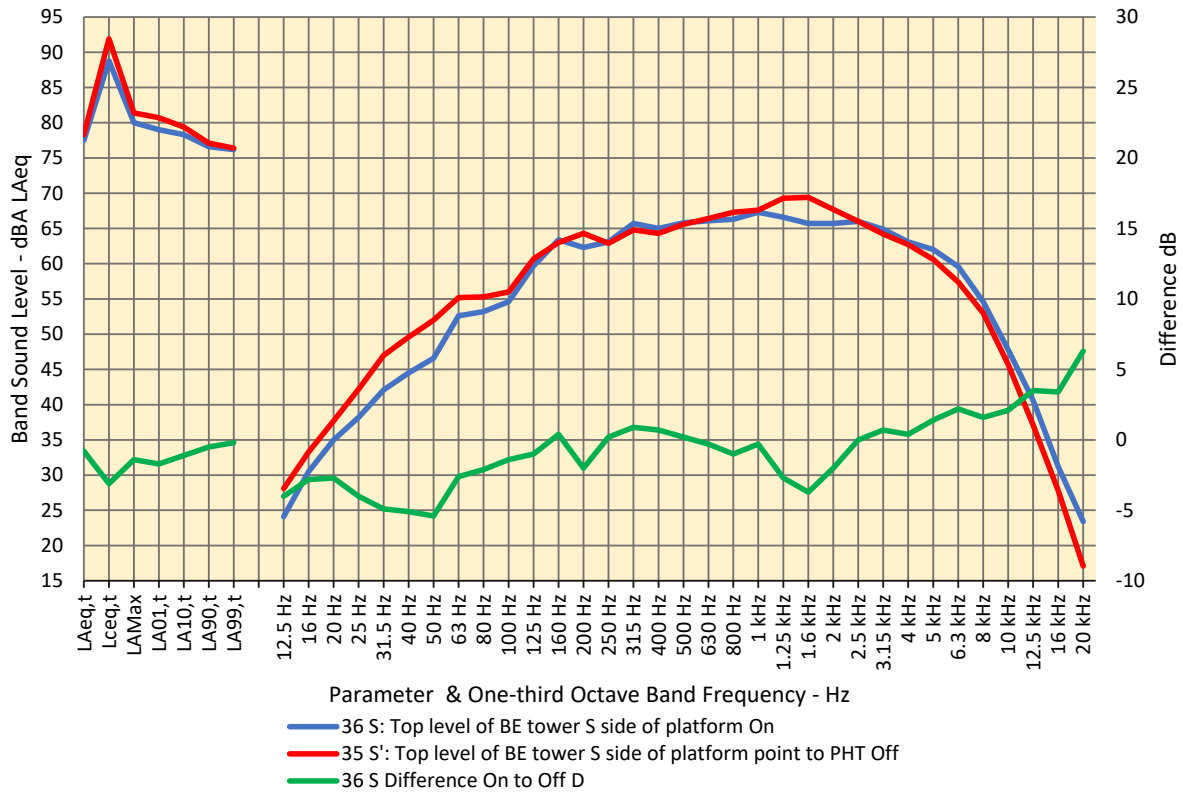
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.S' $L_{Aeq,t}$



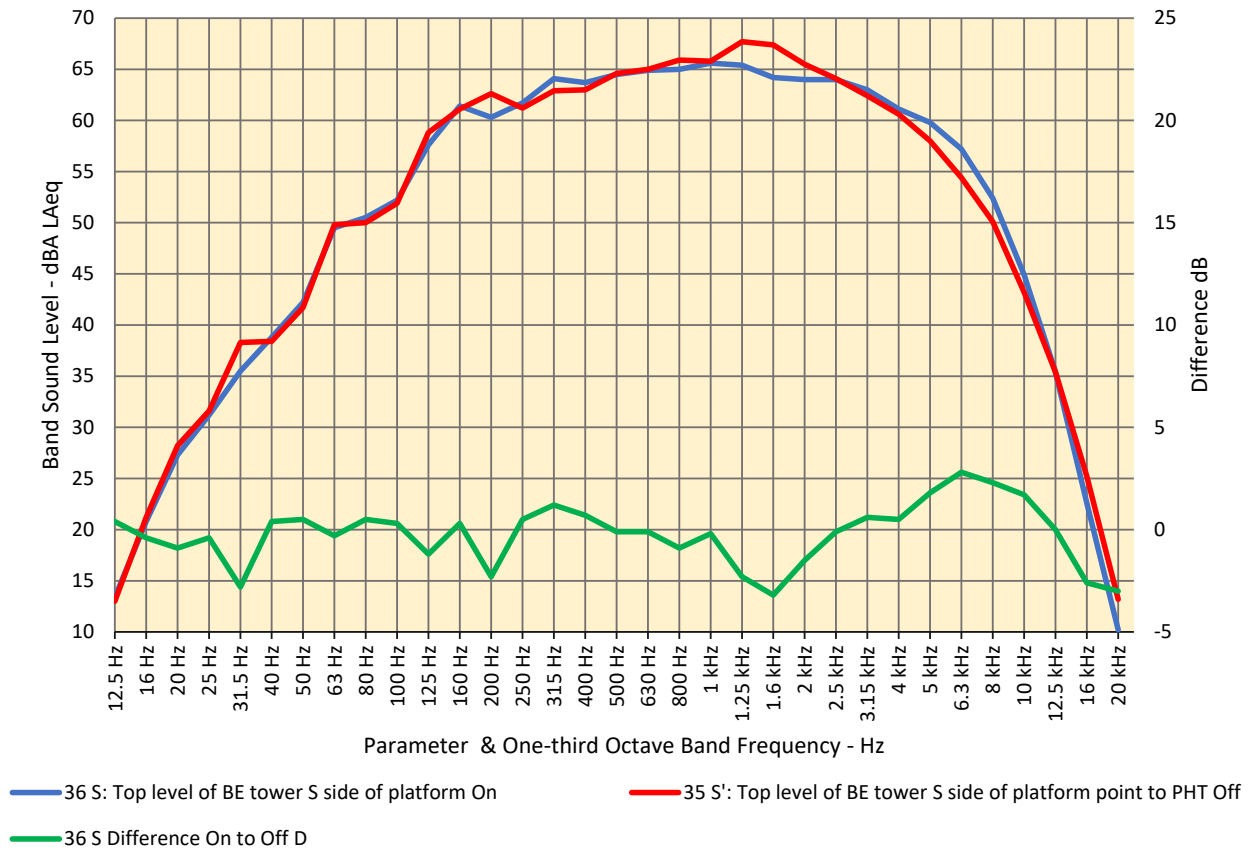
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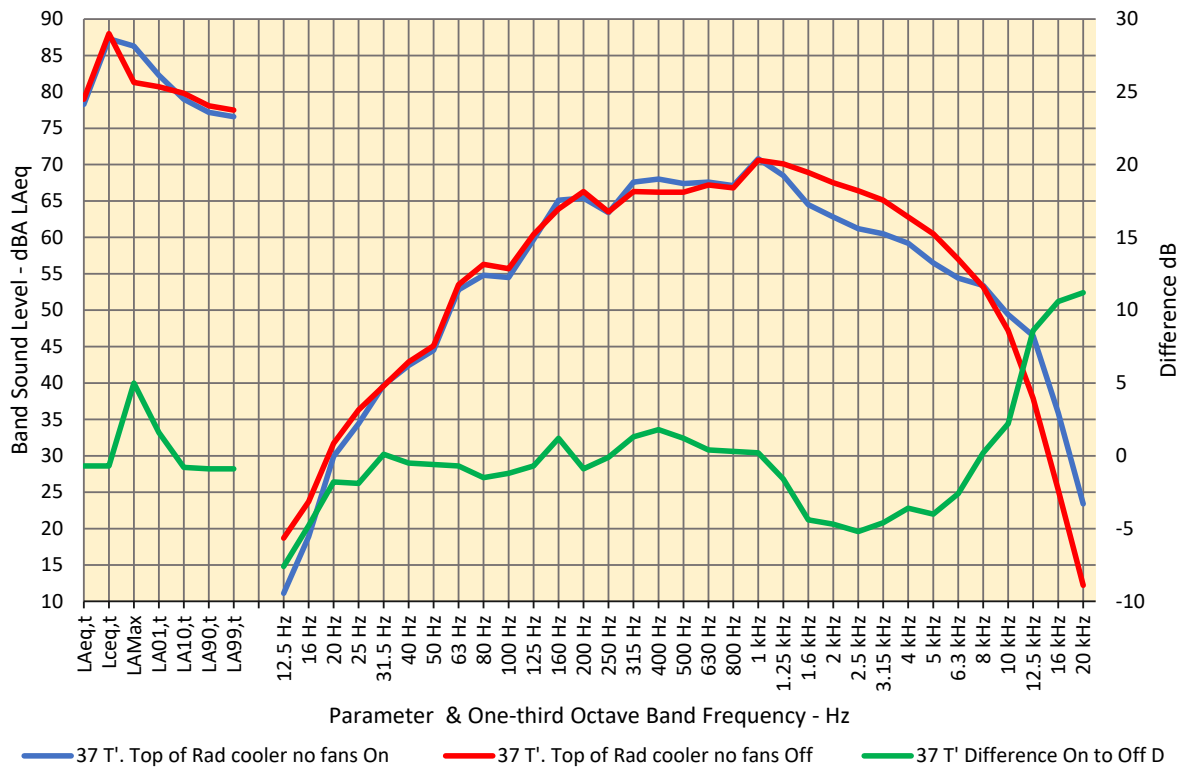
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.S $L_{Aeq,t}$



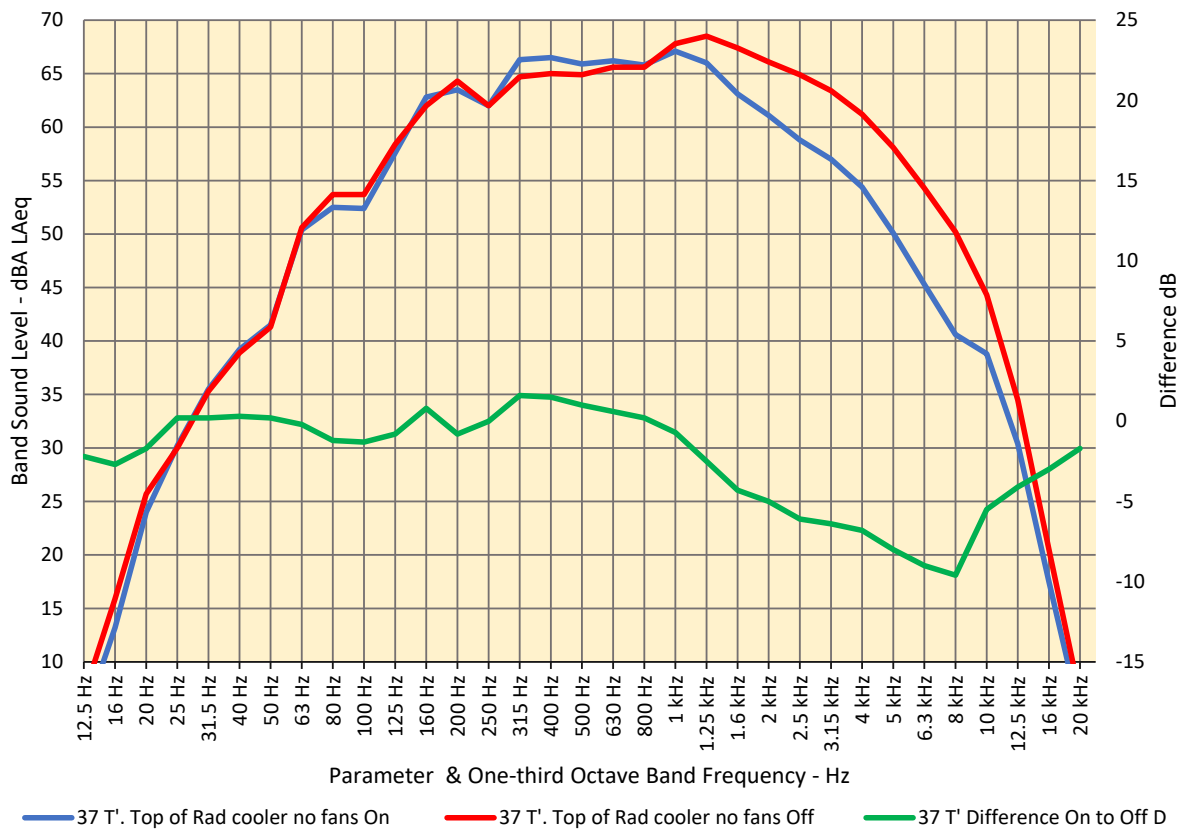
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.S $L_{A90,t}$



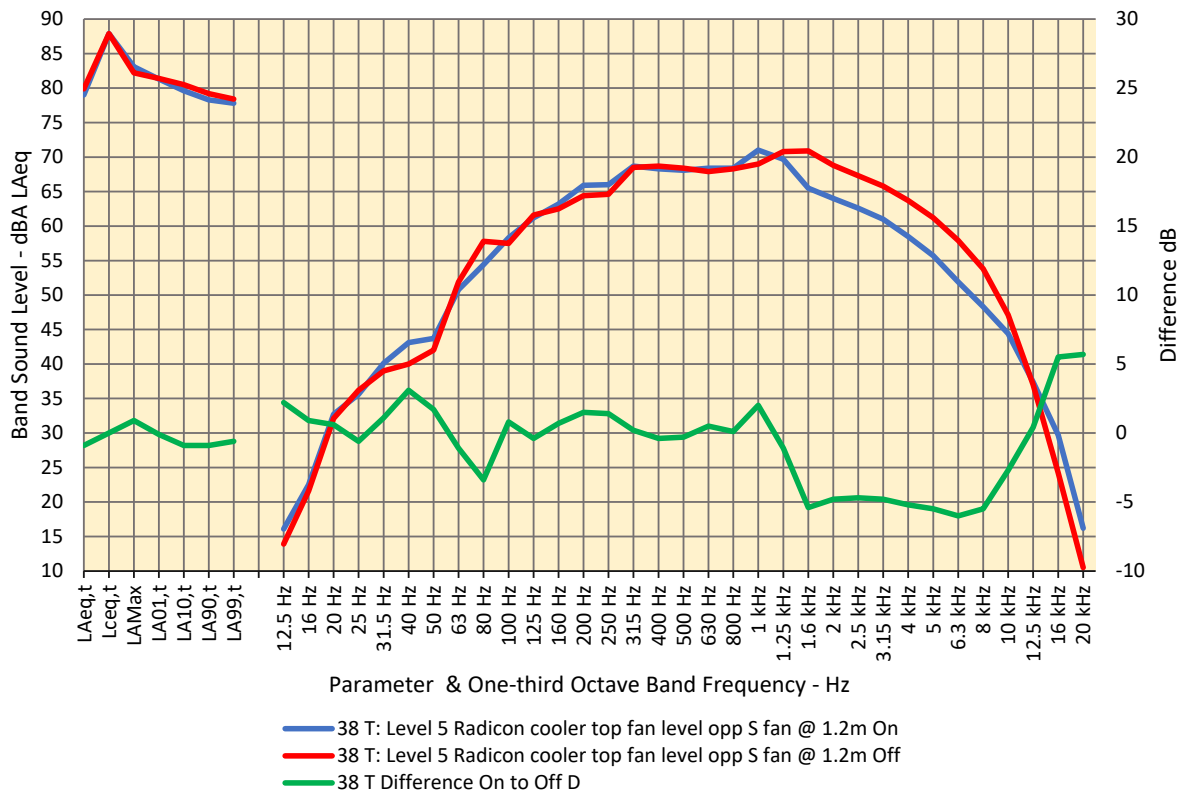
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.T' $L_{Aeq,t}$



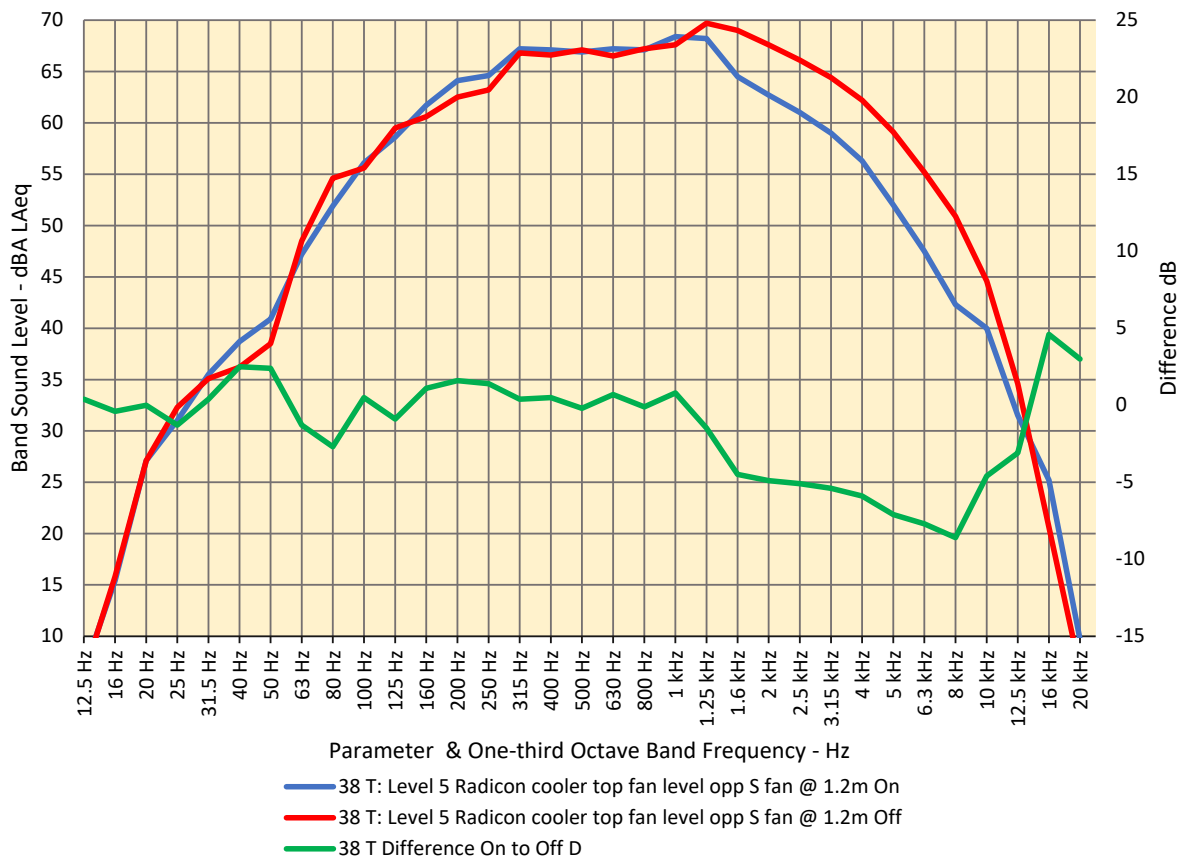
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.T' $L_{A90,t}$

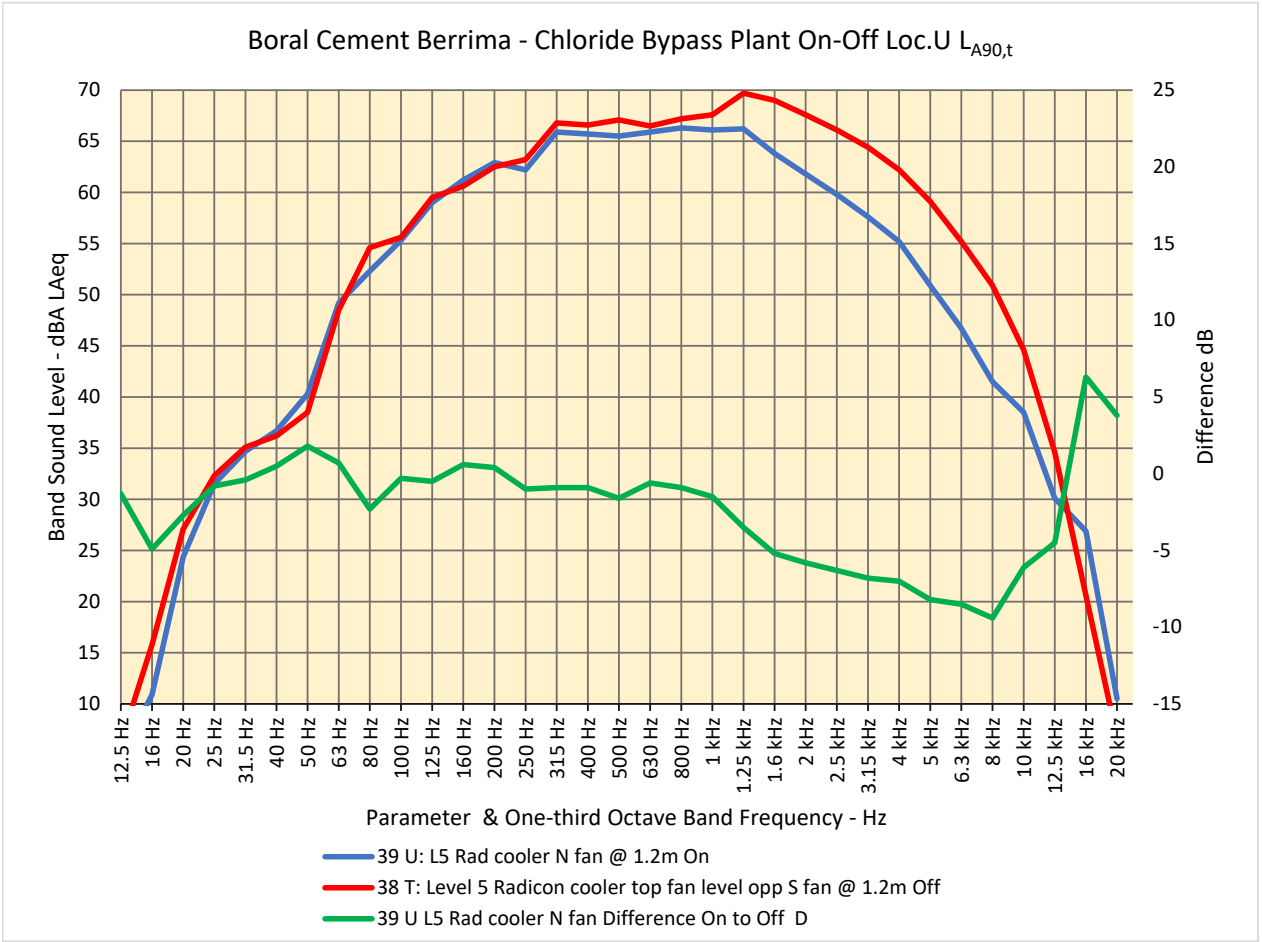
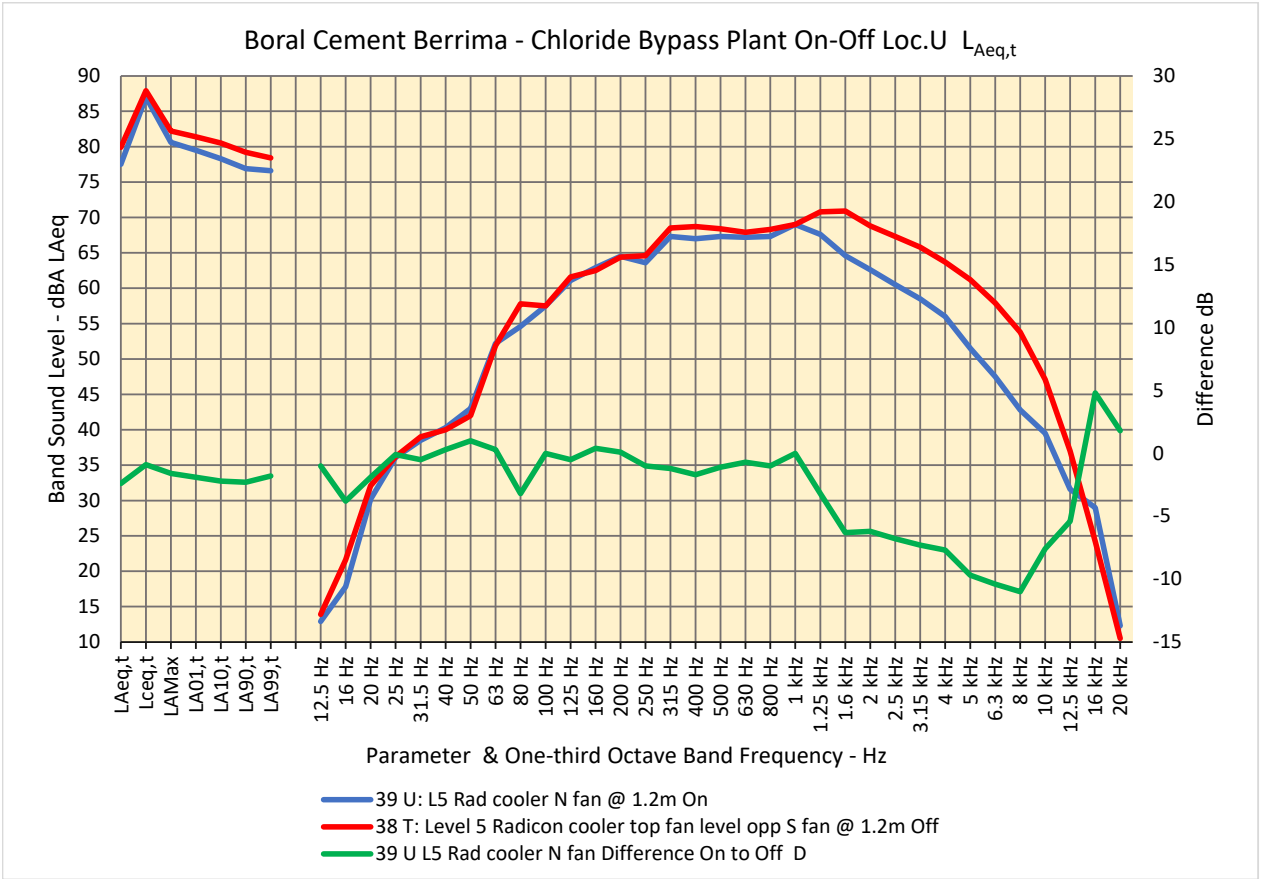


Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.T $L_{Aeq,t}$

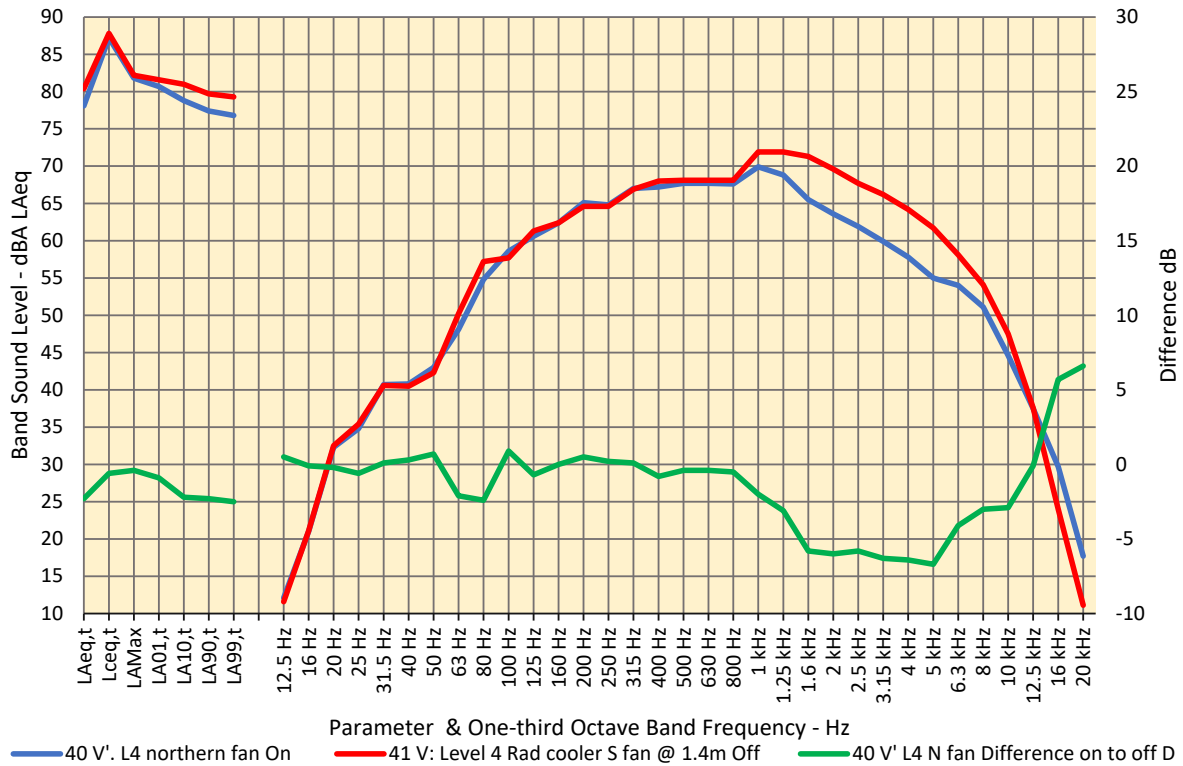


Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.T $L_{A90,t}$

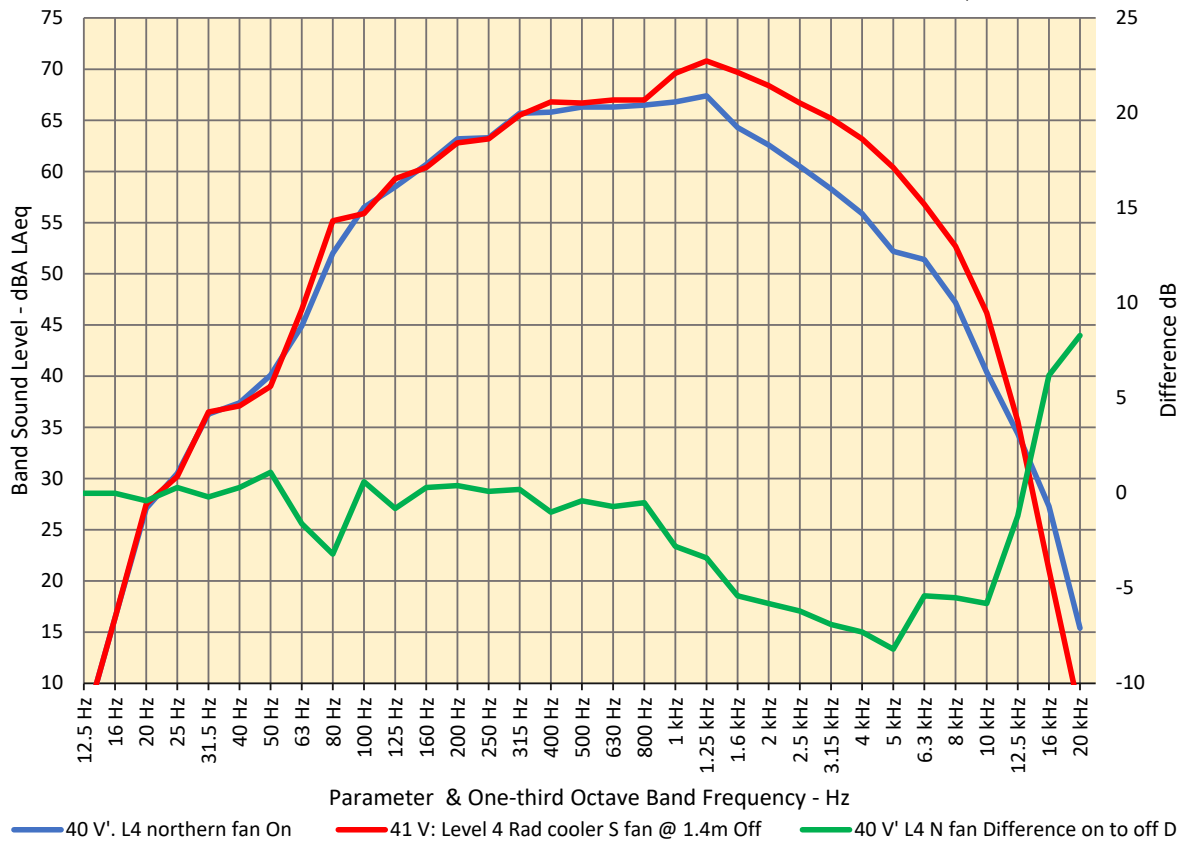




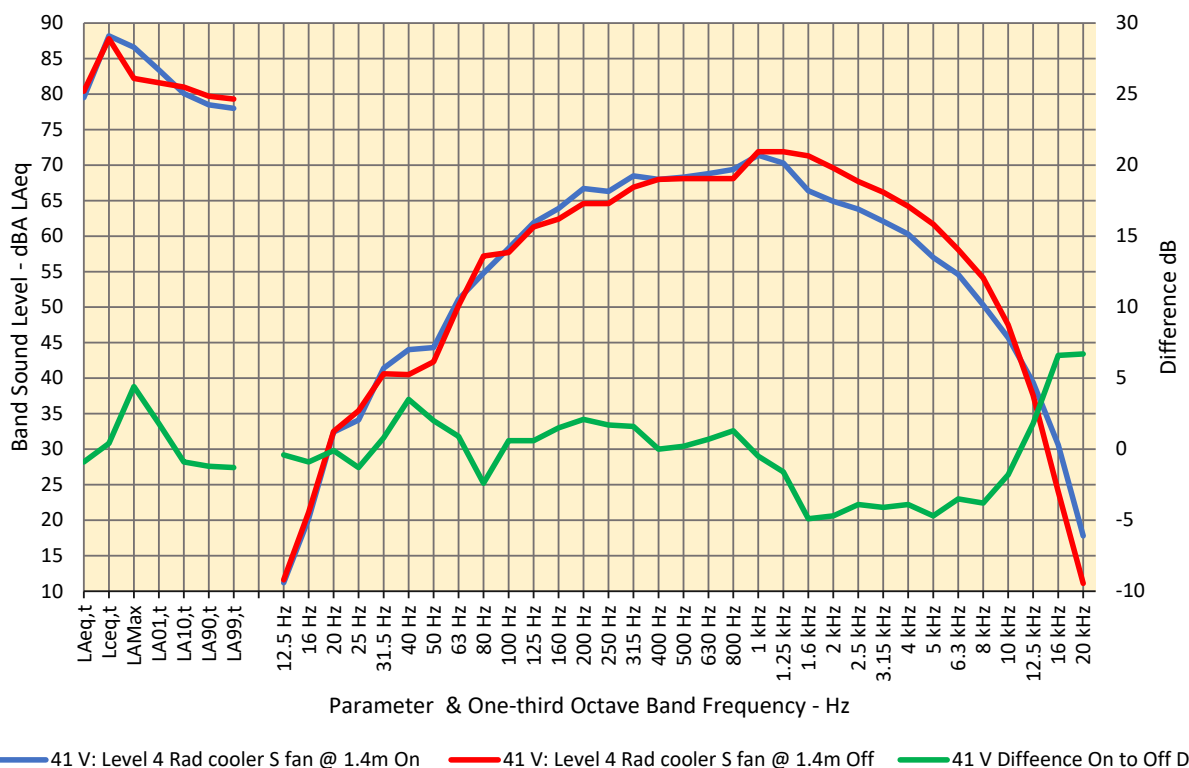
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.V' $L_{Aeq,t}$



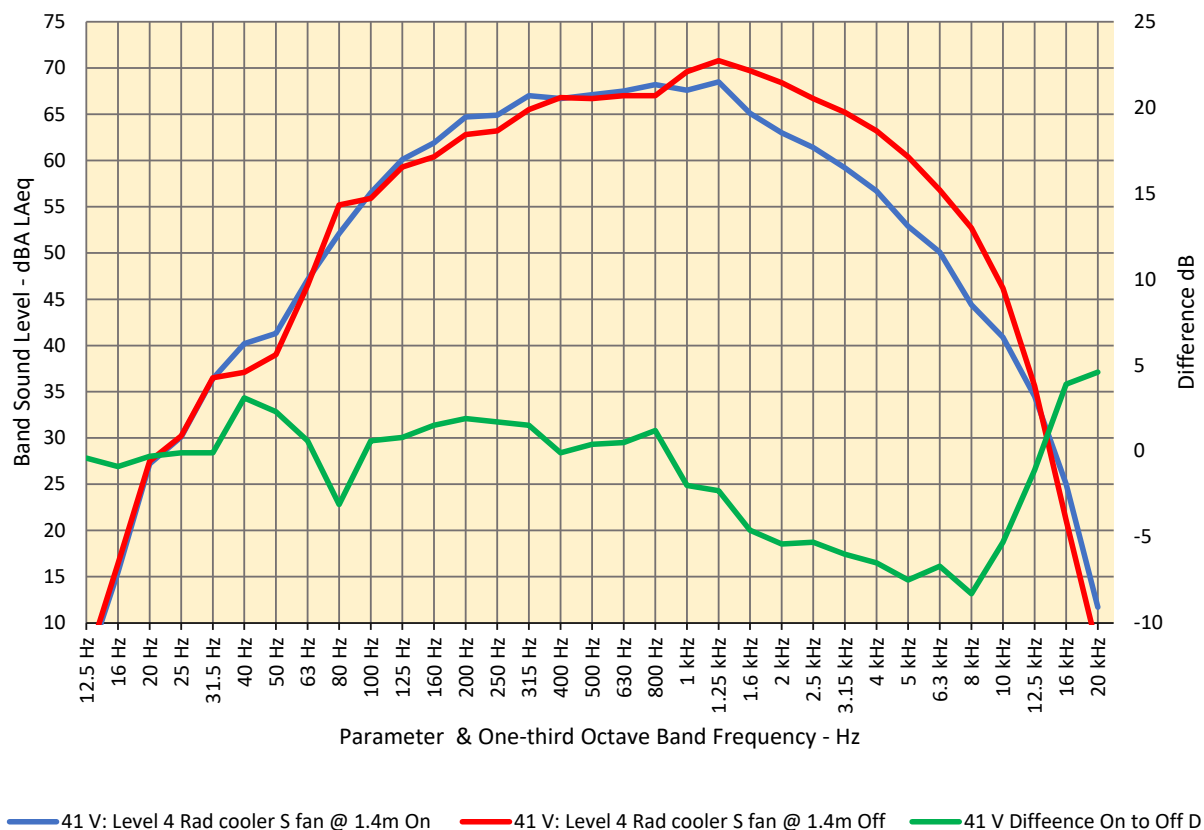
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.V' $L_{A90,t}$

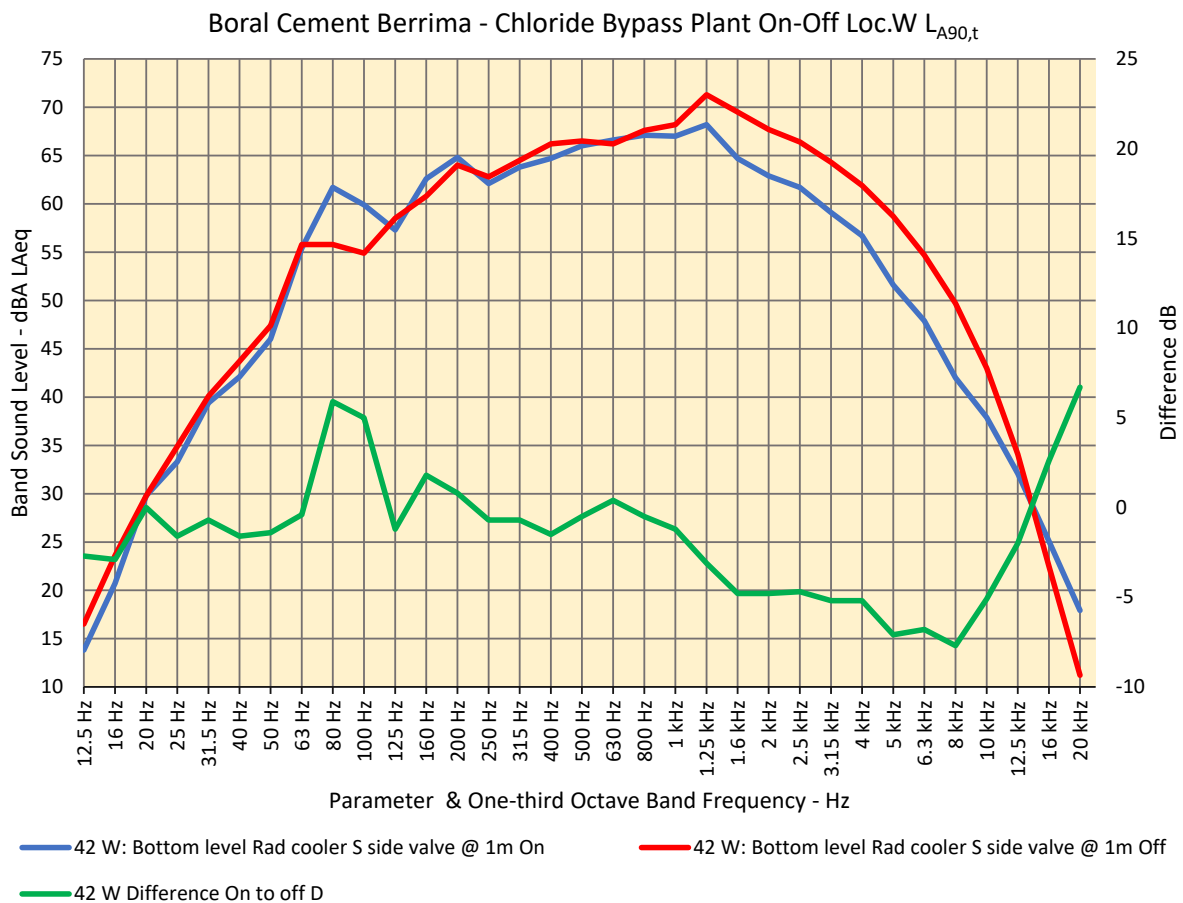
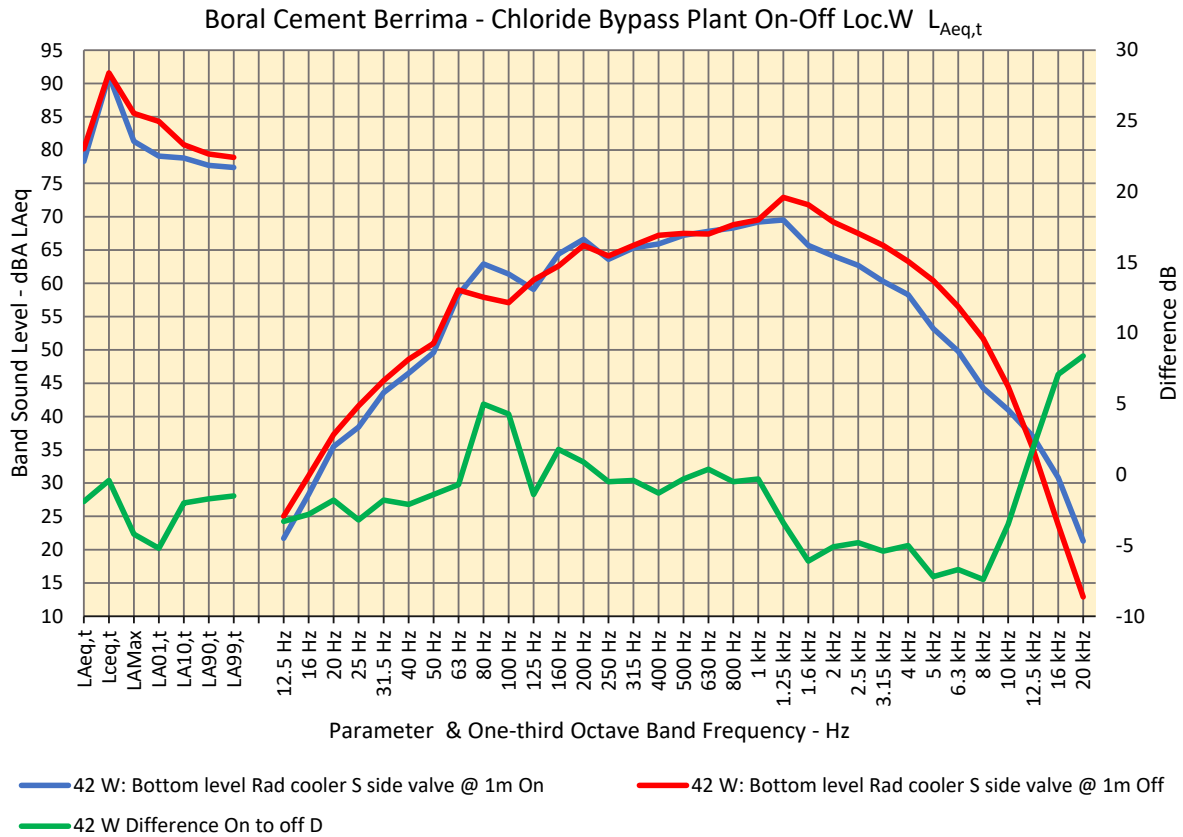


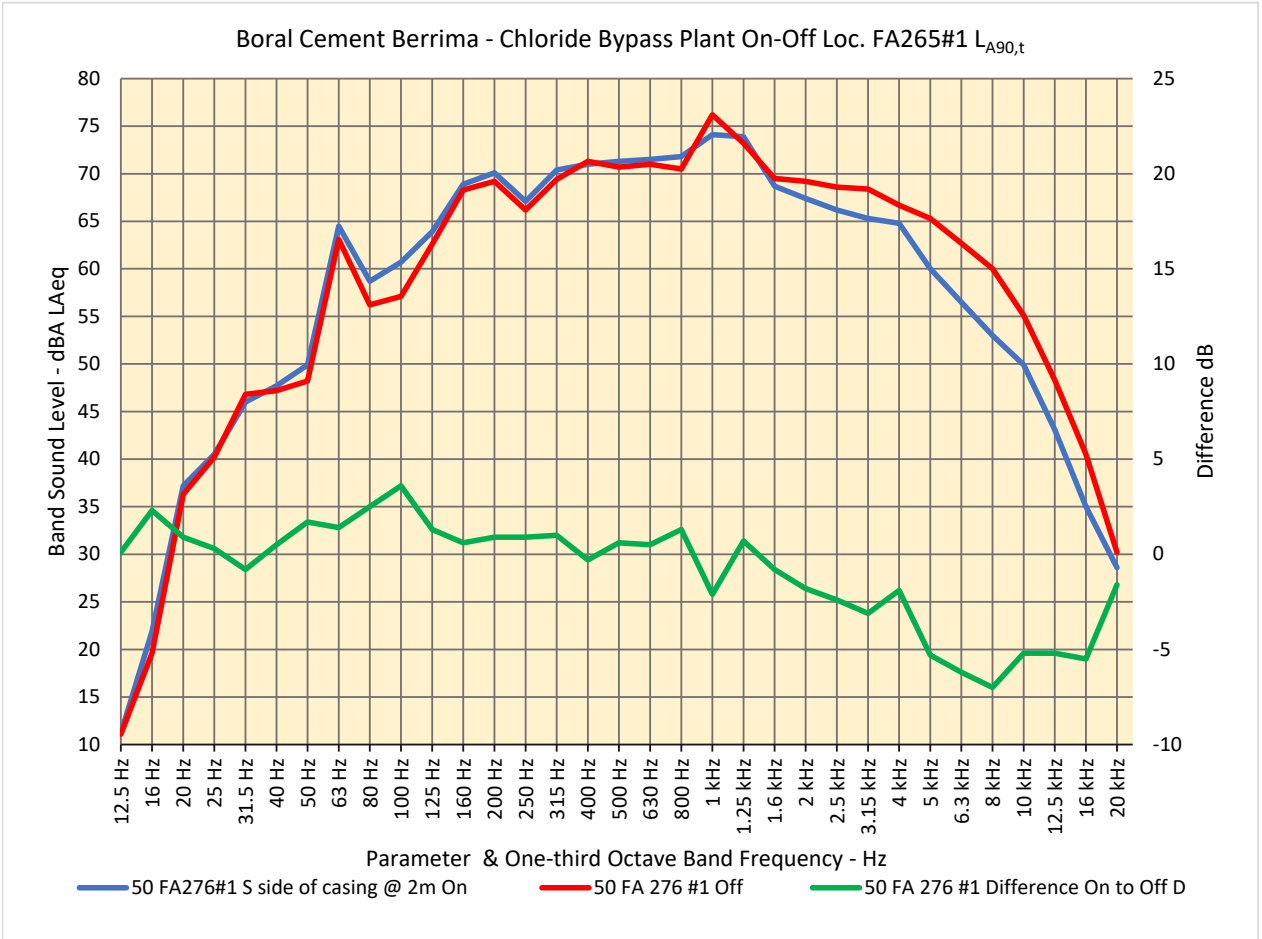
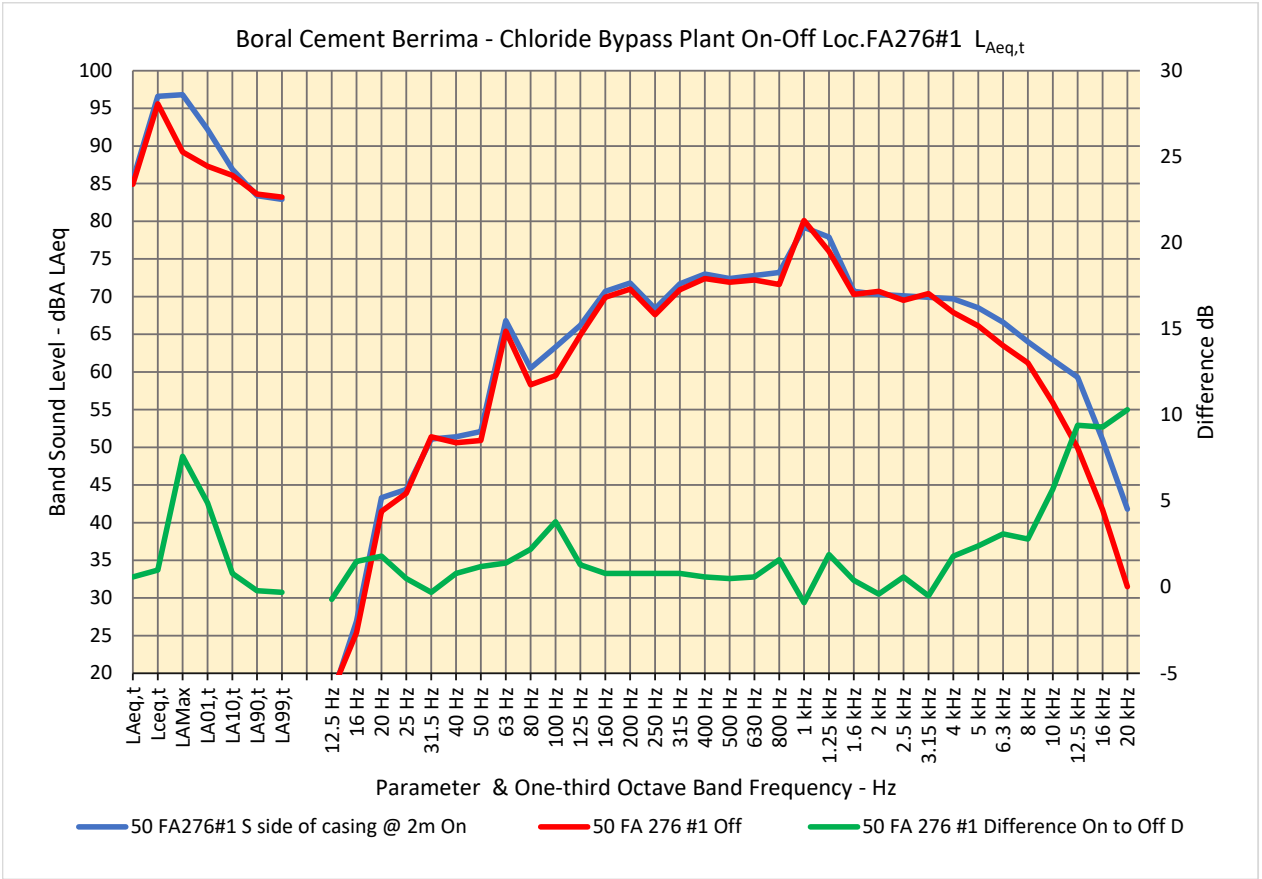
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.V $L_{Aeq,t}$

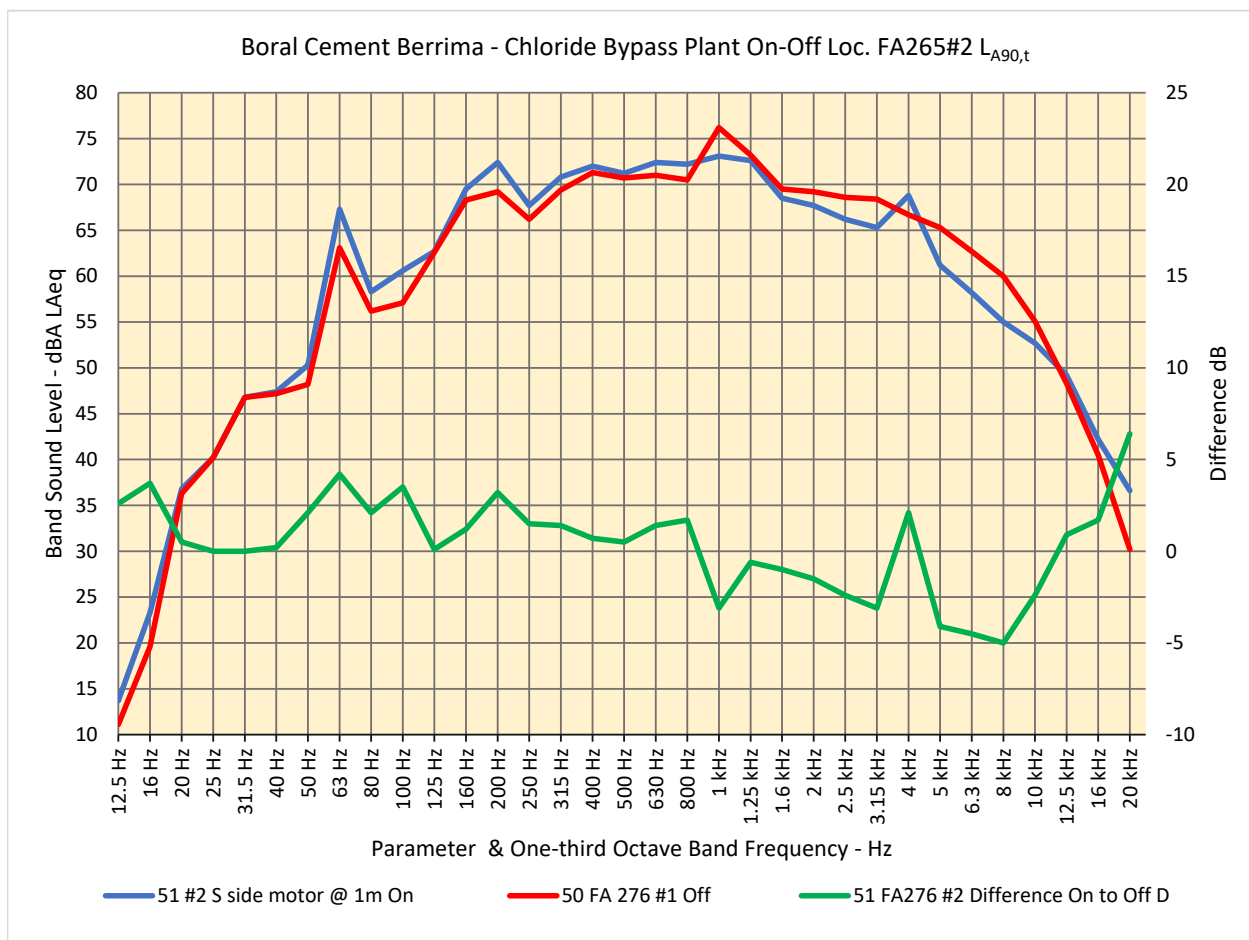
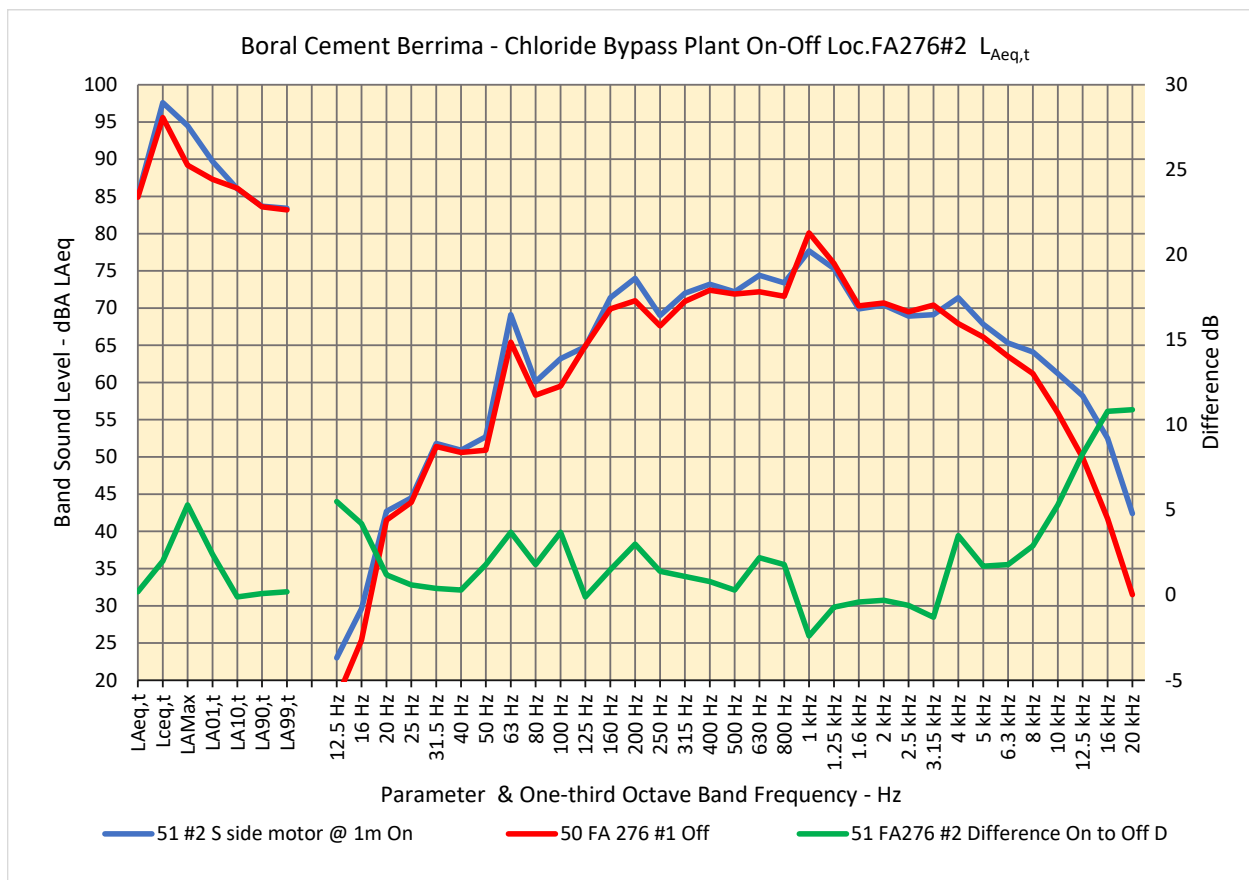


Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.V $L_{A90,t}$

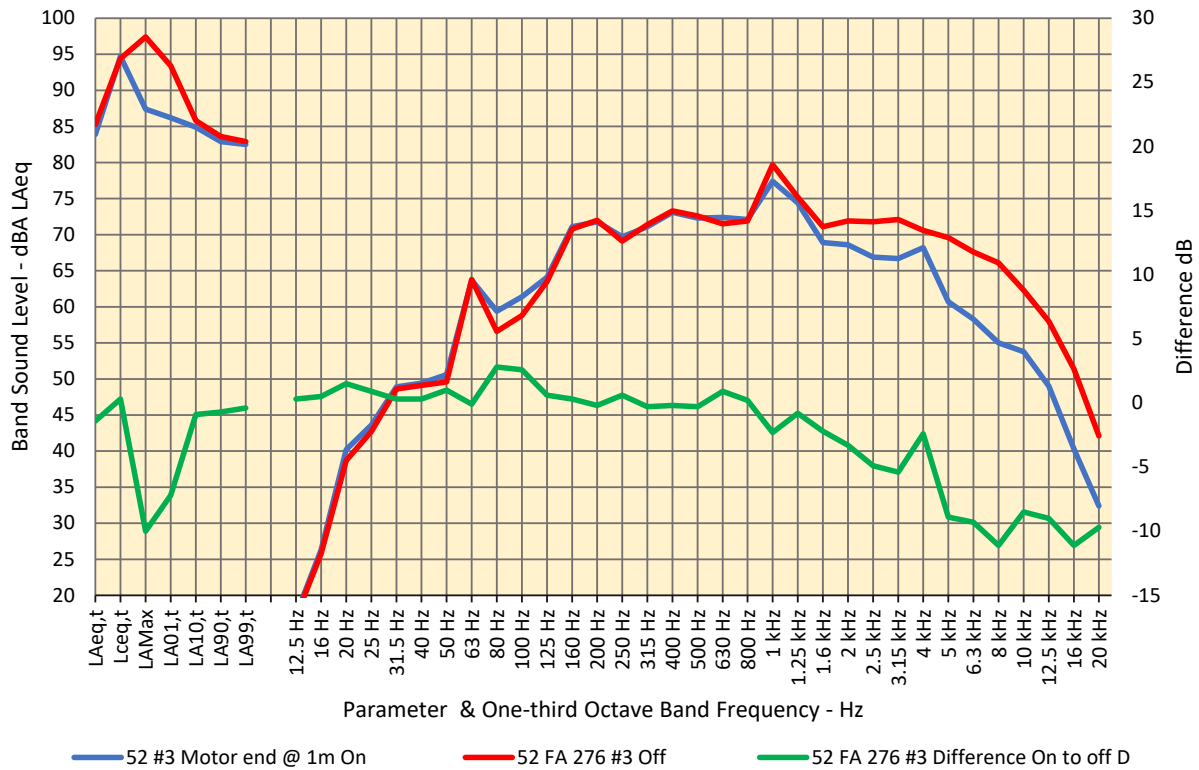




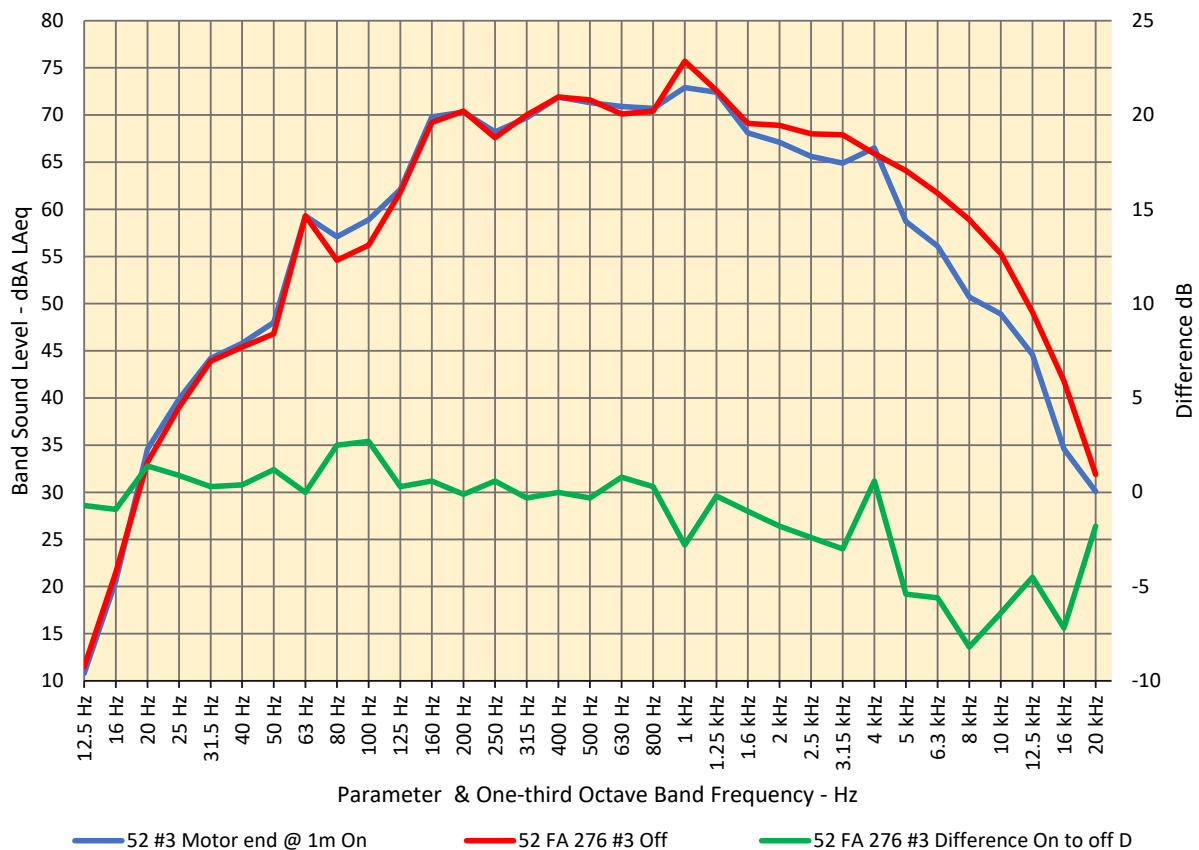




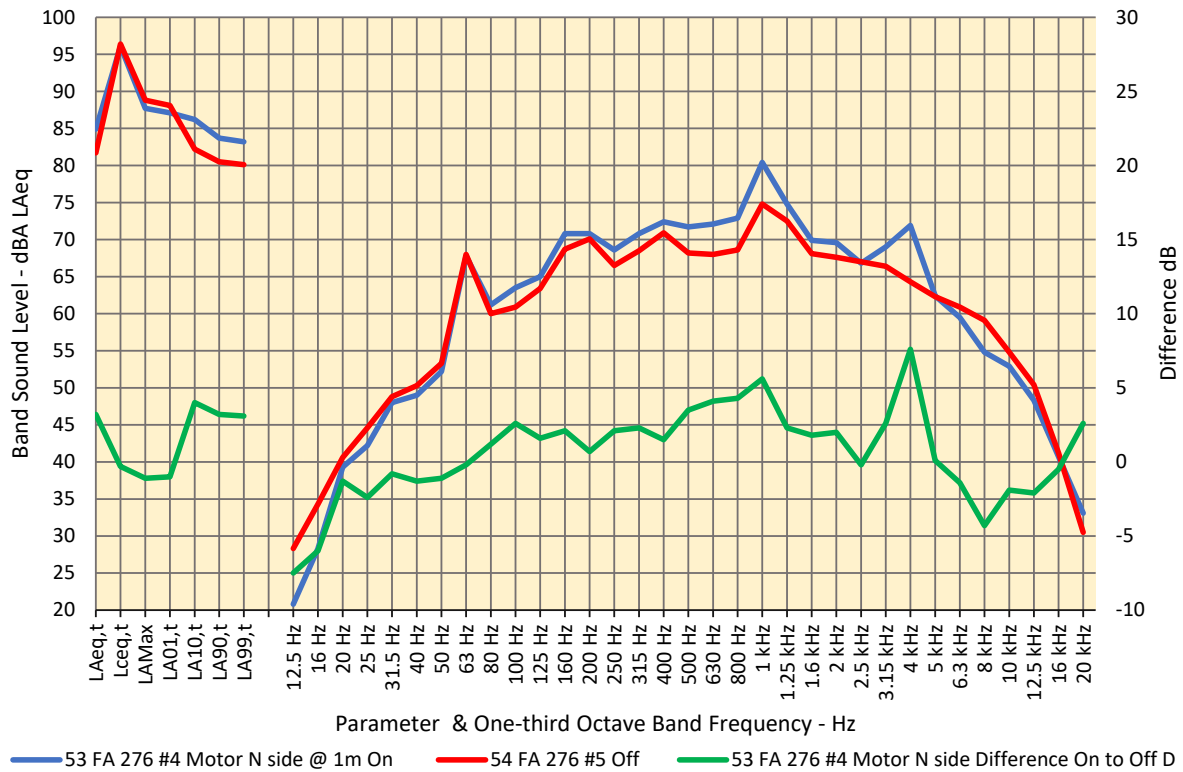
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.FA276#3 $L_{Aeq,t}$



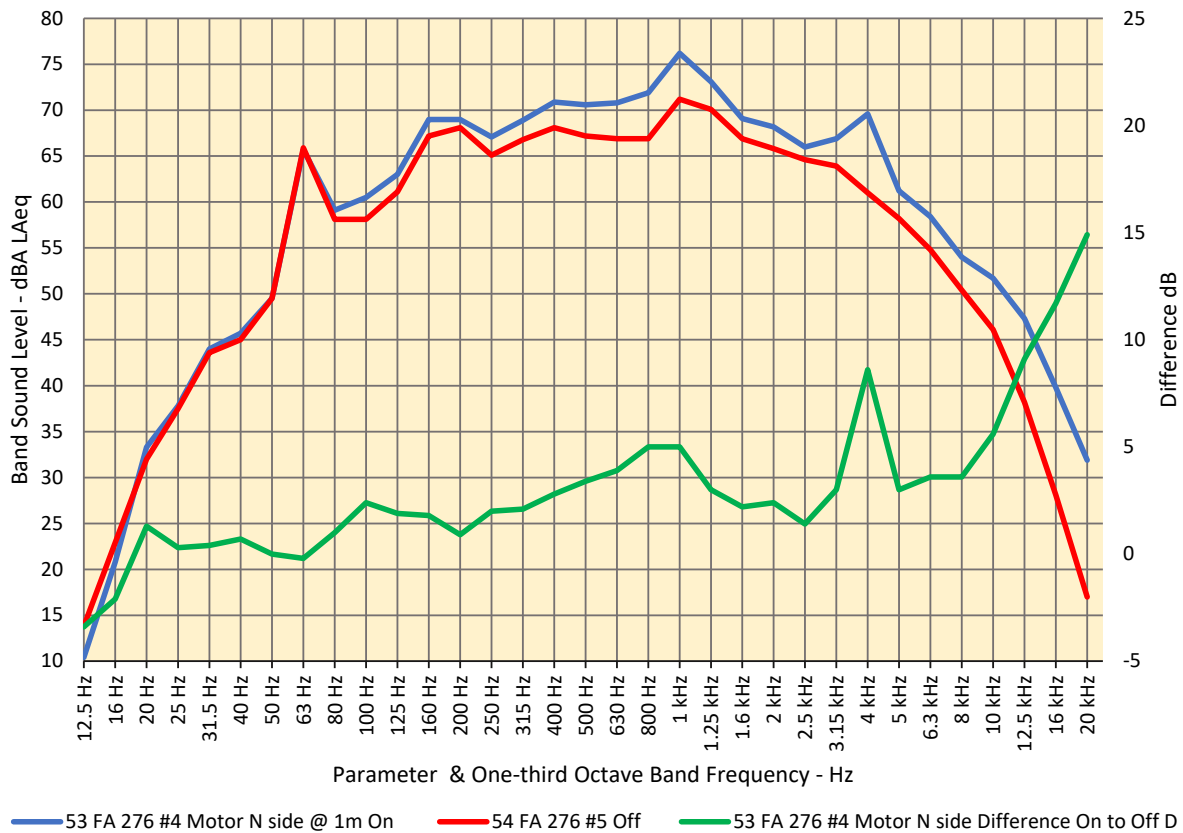
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc. FA265#3 $L_{A90,t}$

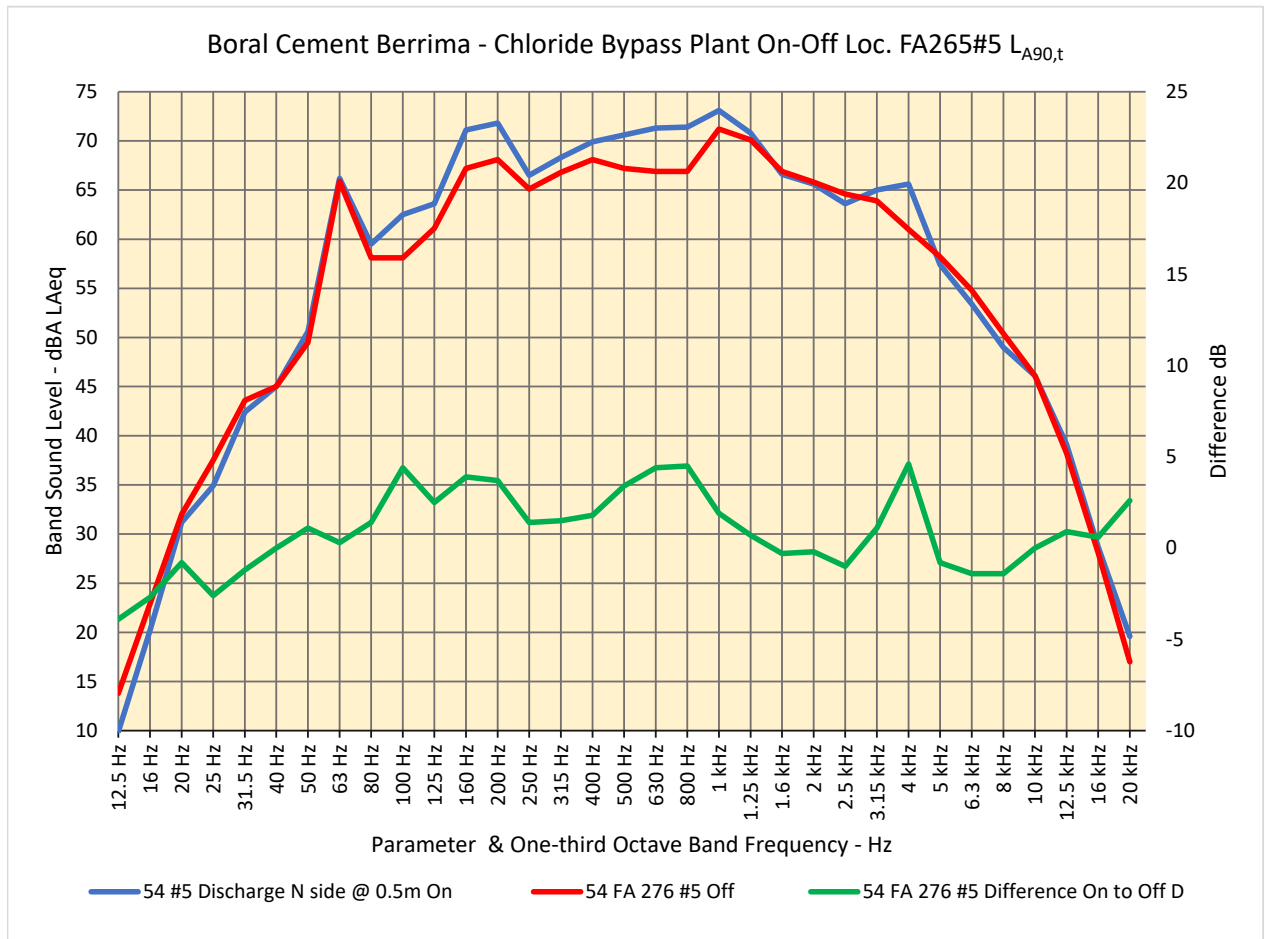
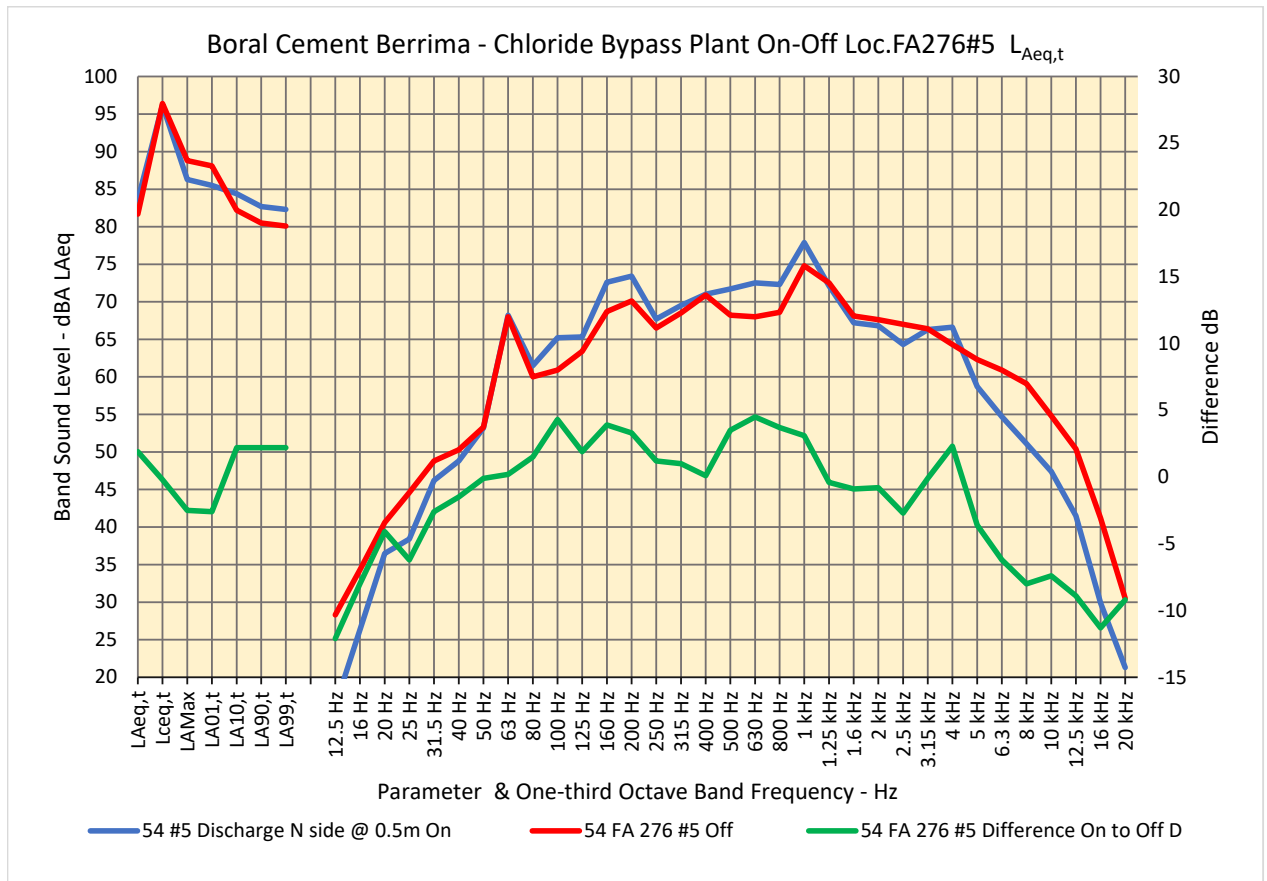


Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.FA276#4 $L_{Aeq,t}$

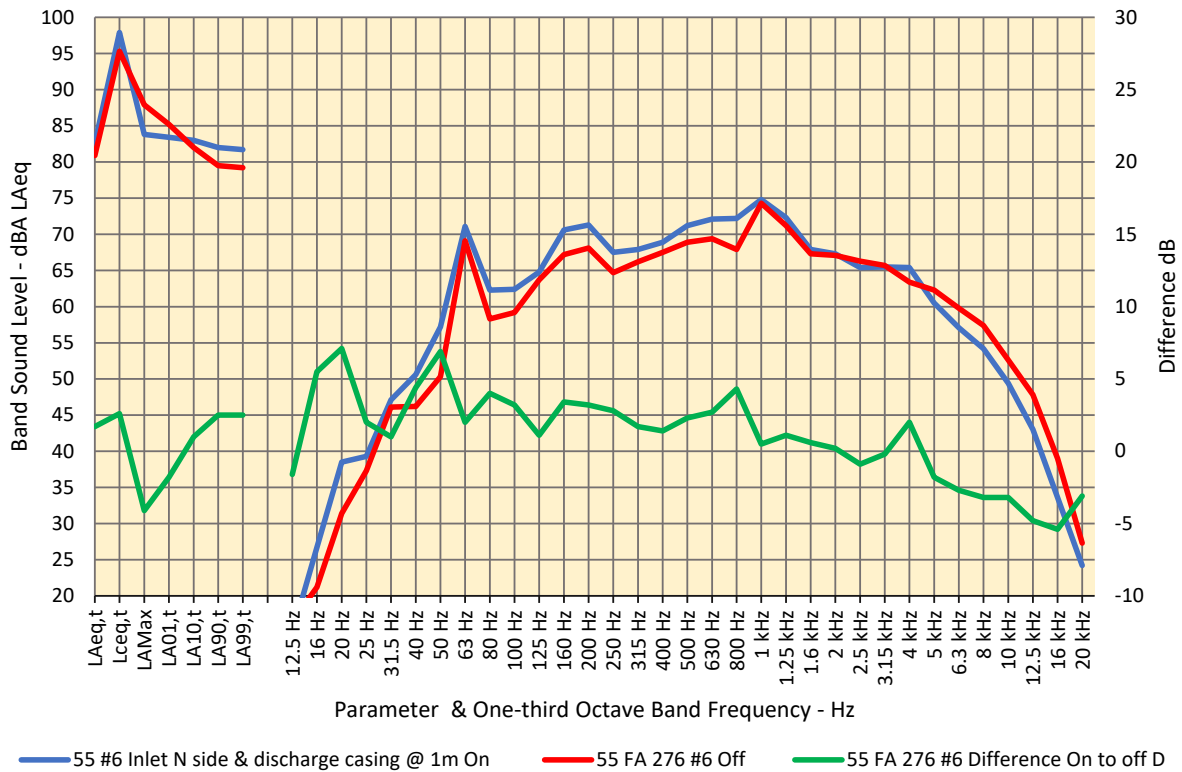


Boral Cement Berrima - Chloride Bypass Plant On-Off Loc. FA265#4 $L_{A90,t}$

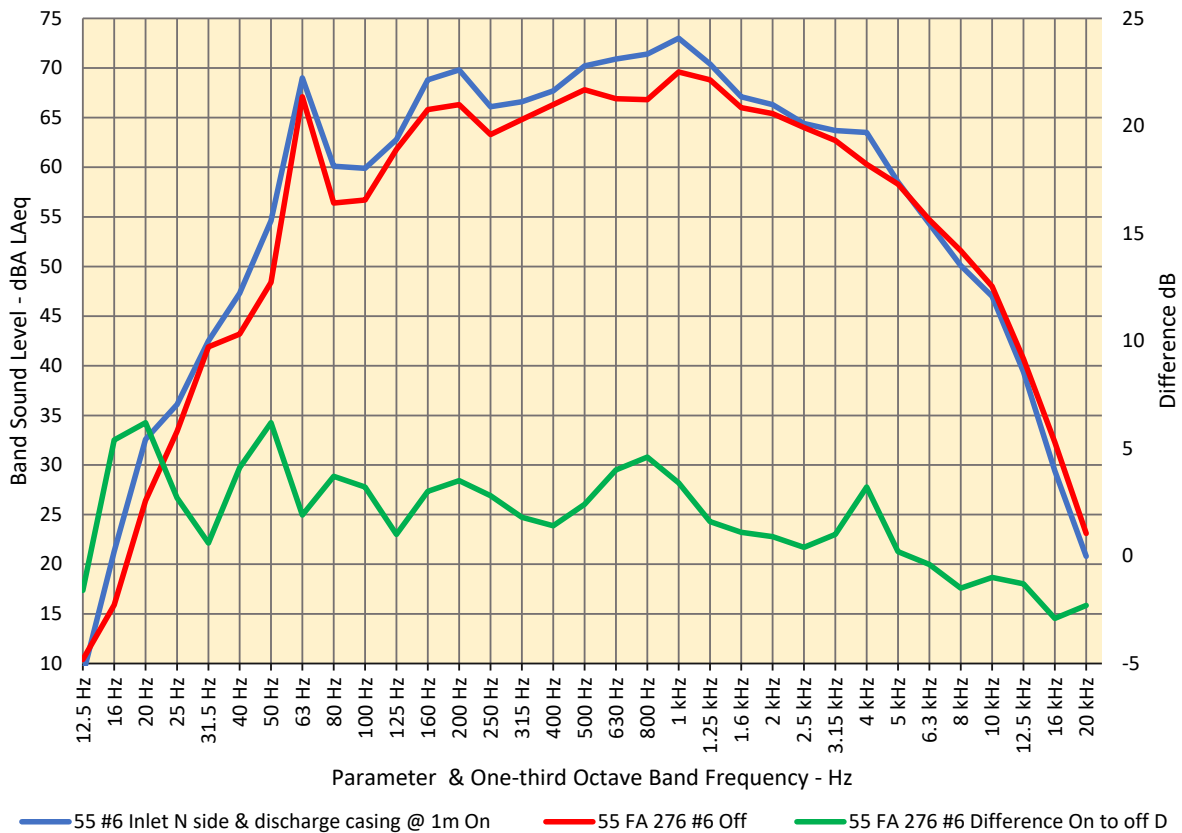




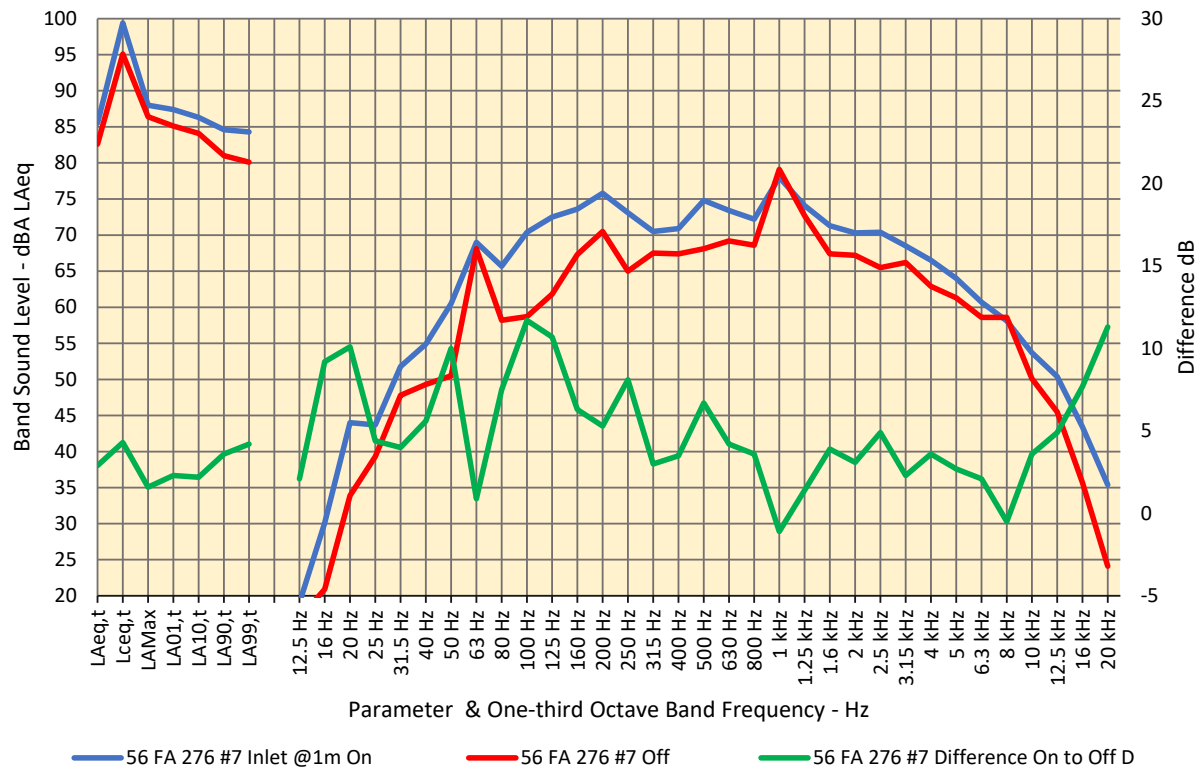
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.FA276#6 $L_{Aeq,t}$



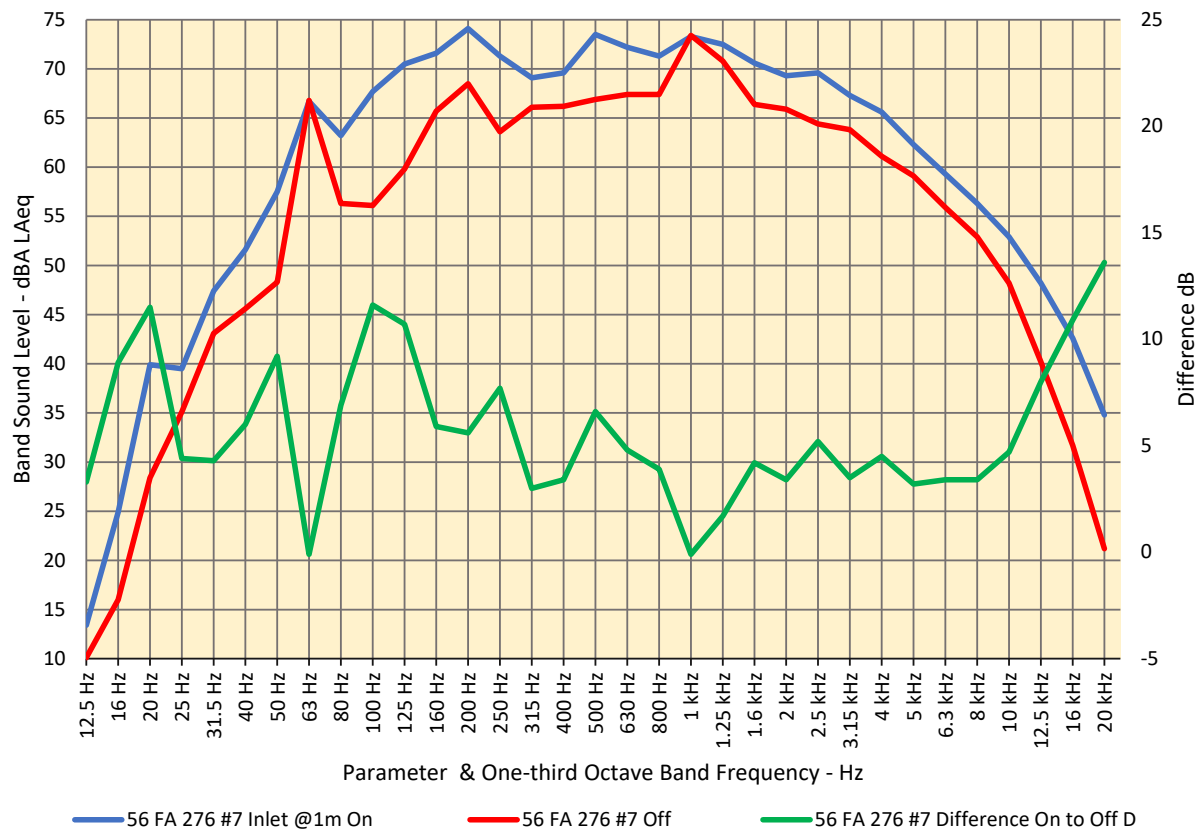
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc. FA265#6 $L_{A90,t}$

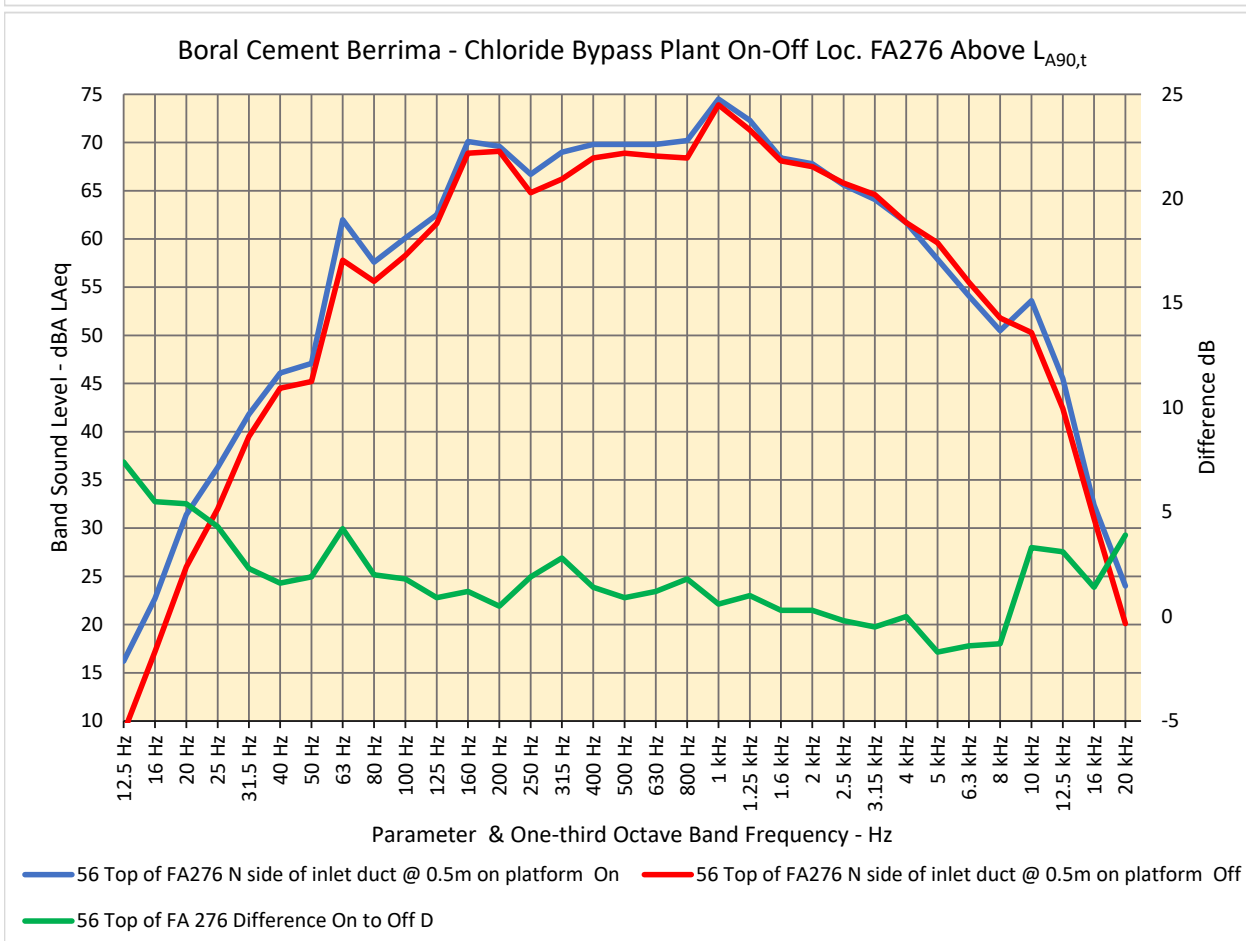
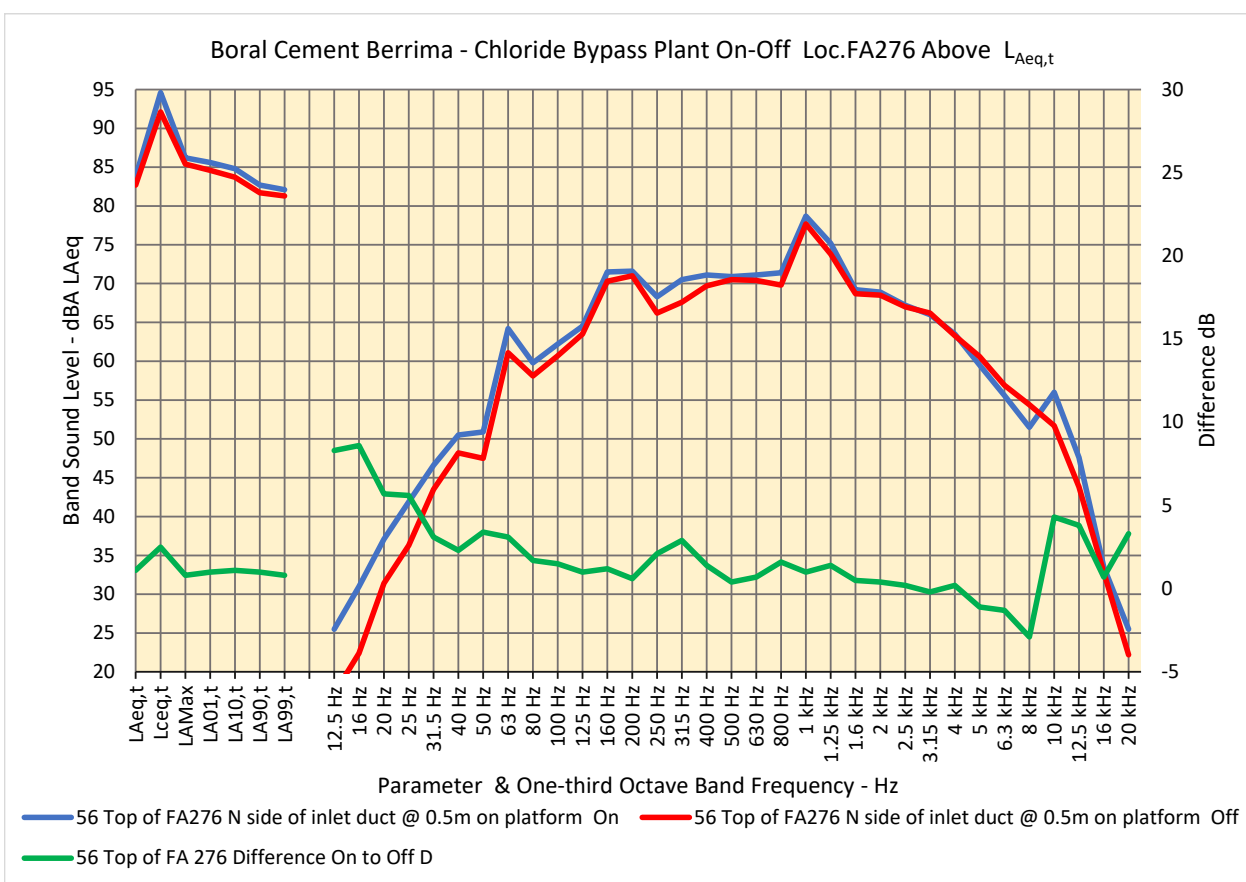


Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.FA276#7 $L_{Aeq,t}$



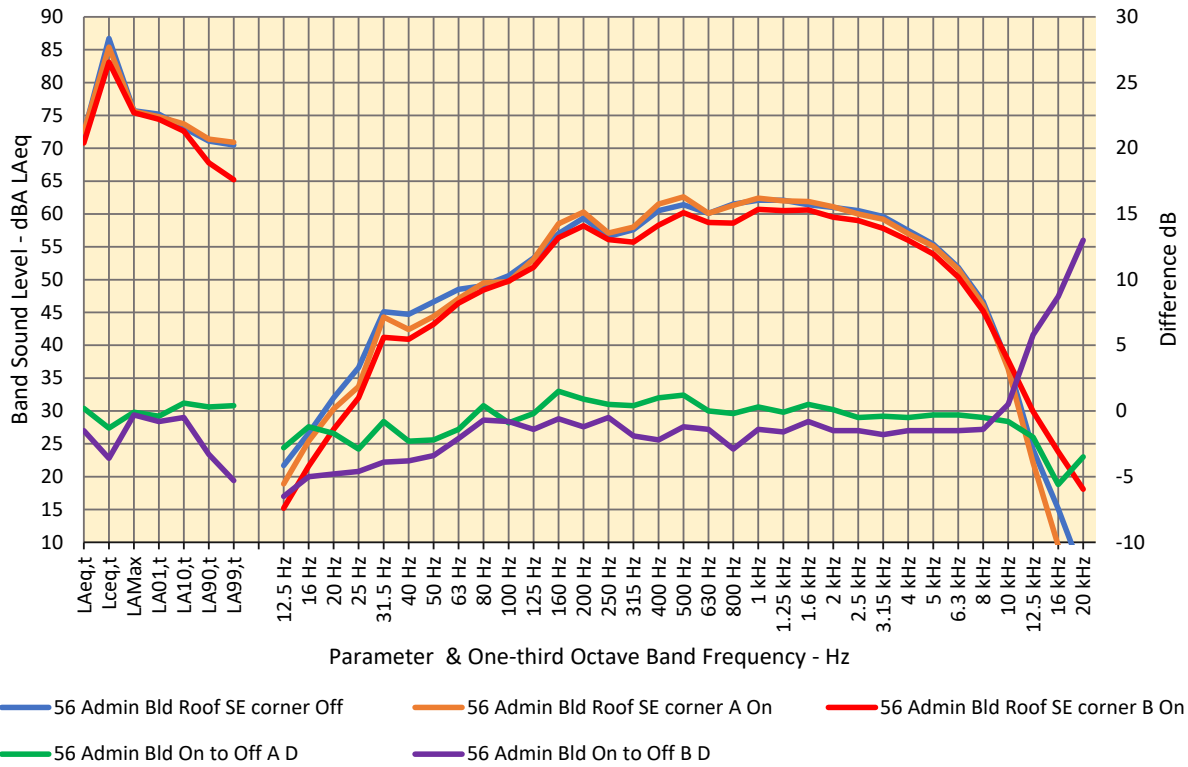
Boral Cement Berrima - Chloride Bypass Plant On-Off Loc. FA265#7 $L_{A90,t}$





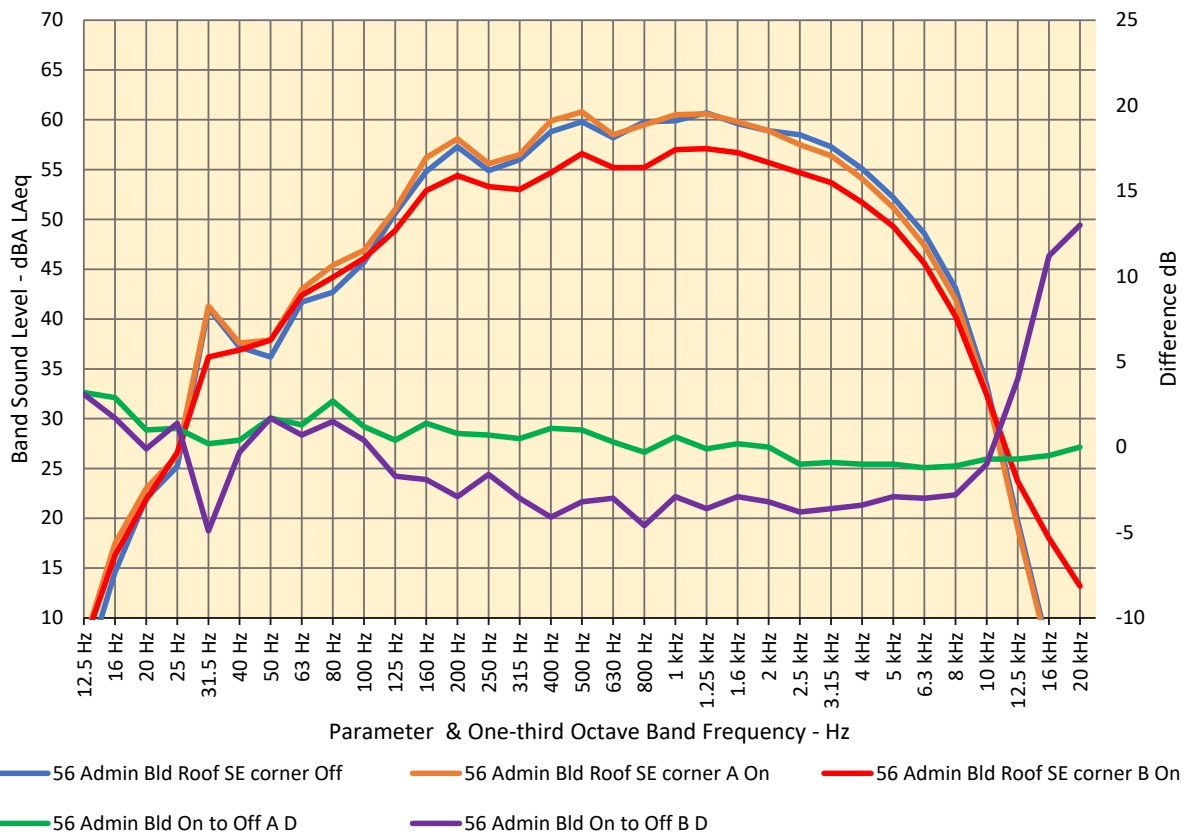
Boral Cement Berrima - Chloride Bypass Plant On-Off

Loc. Admin Bld Roof SE Corner $L_{Aeq,t}$

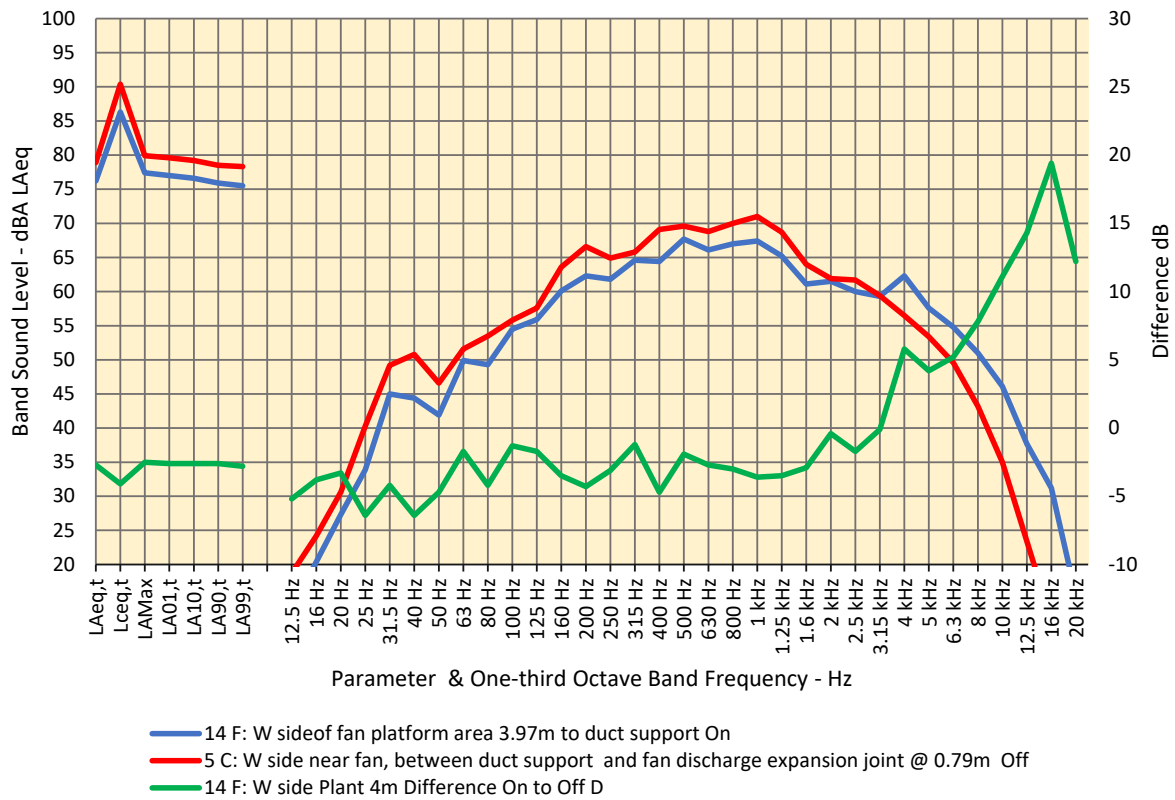


Boral Cement Berrima - Chloride Bypass Plant On-Off

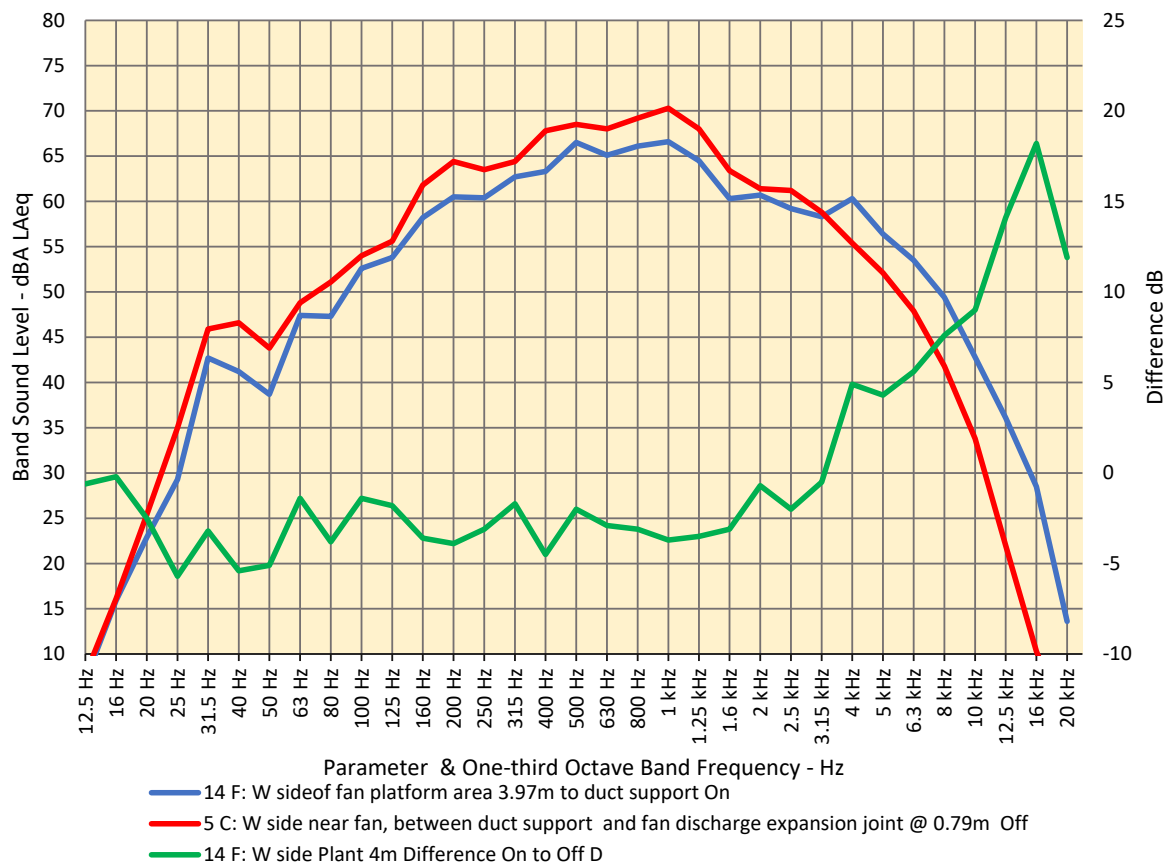
Loc. Admin Bld Roof SE Corner $L_{A90,t}$



Boral Cement Berrima - Chloride Bypass Plant On-Off Loc.F $L_{Aeq,t}$



Boral Cement Berrima - Chloride Bypass Plant On-Off Loc. F $L_{A90,t}$



Appendix B: Sound Power results using the Sound Intensity Method and Measurement locations

Table B1 The measured sound power Results using the Intensity scanning Method to ISO 9614 -2

ID	Section	position No	description	Height from Ground (m)	Easting	Northing	Sound Power One-Third Spectra - Lw dBA																											
							Lw 50	Lw 63	Lw 80	Lw 100	Lw 125	Lw 160	Lw 200	Lw 250	Lw 315	Lw 400	Lw 500	Lw 630	Lw 800	Lw 1k	Lw 1.25k	Lw 1.6k	Lw 2k	Lw 2.5k	Lw 3.1k	Lw 4k	Lw 5k	Lw 6.3k						
4	Motor Platform	Motor_CBP	Motor Platform - Motor_CBP	2.0	255479.37	6177999.66	39.1	52.8	41.7	54.8	52.4	52.3	60.0	59.1	62.6	61.4	60.7	60.0	61.0	60.5	58.3	62.0	78.1	61.5	65.8	85.0	65.7	61.9						
5	Motor Platform	Pos E	Motor Platform - Pos E	1.6	255479.32	6177997.45	44.0	55.7	37.0	43.0	50.2	50.7	52.6	58.5	58.7	56.8	56.3	53.8	54.4	55.8	52.1	45.0												
6	Motor Platform	Fan W	Motor Platform - Fan W	1.6	255477.92	6177997.45			45.8			50.8	55.8										49.6			61.4	42.1	37.2						
7	Motor Platform	Pos G	Motor Platform - Pos G	3.6	255479.97	6177995.83		43.3				45.7	47.3							51.5														
8	Ground Level	Pos B	Ground Level - Pos B	1.3	255489.59	6177999.66		49.4	46.7	49.8	35.6		53.8													59.0								
9	Ground Level	Pos F	Ground Level - Pos F	1.3	255468.90	6177996.65	46.4	53.9		52.1	57.0	54.6	60.4	59.6	60.1	59.5	58.9	56.9	63.0	62.8	66.6	61.7	59.9	58.5	55.4	52.8	48.6	46.0						
10	Ground Level	Pos H	Ground Level - Pos H	2.5	255479.32	6177970.25	43.9	39.5	36.0	53.2	53.4	55.4	53.3	59.1	57.7	59.4	55.4	55.6	59.1	58.7	58.1	53.7	50.0	50.6	45.4	43.8	30.7	38.2						
11	Ground Level	Pos A	Ground Level - Pos A	1.3	255479.37	6178005.60									45.1								50.4			61.7								
12	Ground Level	Pos H'	Ground Level - Pos H'	1.3	255490.03	6177997.19	52.4	50.7	38.2	50.4						43.6	51.2	50.6	51.8				46.8			57.8	36.6	33.3						
13	Level 1	Pos J	Level 1 - Pos J	4.4	255477.56	6177989.47			34.3	39.3	50.1		50.5	53.9	52.6	54.8	51.1	49.4	57.1	55.2	57.4	43.0						40.2						
14	Level 1	Pos J'	Level 1 - Pos J'	4.4	255477.56	6177991.06		45.5	47.6	54.9			58.7			56.8	56.7	56.3	56.9	55.8	45.2	49.3	52.4		42.0	59.8	47.4	46.3						
15	Level 1	Pos J'''	Level 1 - Pos J'''	4.4	255481.18	6177991.06		47.2	49.4		42.4		46.7						46.0															
16	Level 2	Pos K	Level 2 - Pos K	3.8	255470.46	6177986.07	34.3				43.0																39.2	47.8						
17	Level 3	Pos L	Level 3 - Pos L	9.1	255487.21	6178003.50				60.4		59.8	66.1	69.1	65.7	65.6	68.6	70.3	65.6	66.3	67.7	57.5	47.1		55.0	57.2	53.5							
18	Level 3	Pos M	Level 3 - Pos M	8.2	255484.18	6178004.90	46.4			44.6		52.3	61.1	60.1	57.4	58.0	61.6	62.5	62.4	62.9	63.8	62.6	62.6	60.7	56.8	55.8	50.1	46.3						
19	Level 3	Pos M'	Level 3 - Pos M'	9.0	255483.73	6178003.61				59.7	49.0	51.2	48.7	57.3	56.1	56.1	59.5	59.1	59.6	60.0	62.2	61.6	57.5	55.4	53.5		48.8	45.6						
20	Level 3	Pos M' East	Level 3 - Pos M' East	8.6	255484.62	6178003.03						54.7									52.7													
21	Level 3	Pos N East	Level 3 - Pos N East	11.6	255480.12	6177986.98					46.0	51.3									56.0													
22	Level 3	Pos N West	Level 3 - Pos N West	11.6	255478.62	6177986.98																	41.2			43.1	42.1	33.7						
23	Level 3	Pos O	Level 3 - Pos O	10.8	255474.12	6177991.43																					44.4	42.0						
24	Fan	Pos T	Fan - Pos T	14.8	255485.27	6177977.63								50.4	53.8	54.9		53.3	56.1	57.6	59.6	53.2	53.2	52.6	51.4	47.5	45.2	41.6						
25	Fan	Pos T'	Fan - Pos T'	17.5	255483.94	6177978.75	30.8							40.3																				
26	Fan	Pos U	Fan - Pos U	14.8	255485.27	6177979.87						43.8							36.4	56.7	58.0	26.7	41.1		40.2		35.5							
27	Fan	Pos W	Fan - Pos W	7.1	255483.49	6177978.25		39.1	44.1			44.1	57.9	54.3	50.0	54.7		52.3	58.0	57.2	60.7	55.7	52.8	51.0	47.8	45.0	43.3	43.5						
28	Fan	Pos V'	Fan - Pos V'	12.0	255485.27	6177979.87	56.9	57.1	54.6	54.8	45.8	50.7					44.0	53.1	55.9		48.4	53.1	53.4	50.6	48.3	45.9	43.9	45.0						
29	KILN	Motor_KILN	KILN - Motor_KILN	11.4	255486.28	6177959.85	34.8	30.2	36.4	42.6	48.1	52.7	52.2	54.1	58.8	59.1	62.7	67.9	74.0	75.3	67.4	64.5	62.8	64.7	70.1	72.5	60.1	58.8						
30	KILN	Fan_Inlet_E	KILN - Fan_Inlet_E	11.4	255491.22	6177959.85	59.7	64.9	66.4	72.0	74.1	73.4	73.6	71.5	70.2	70.9	70.4	69.4	70.5	71.4	70.0	69.1	69.5	68.6	67.0	64.9	61.5	58.2						
31	KILN	Fan W	KILN - Fan W	11.1	255488.27	6177961.12				58.1	54.4	61.2		57.6	53.0	62.7	58.9	65.1	67.4	67.2	64.3	60.2	58.1	55.4	56.5	54.6	51.0	47.5						
32	KILN	Fan E	KILN - Fan E	11.1	255489.07	6177961.12		59.2	50.5	52.5	57.0	65.1	71.3	65.4	61.9	65.4	67.5	68.6	70.0	70.9	67.6	63.7	61.5	58.1	56.3	54.2	46.0	40.4						
33	KILN	Fan_inlet_S	KILN - Fan_inlet_S	11.4	255490.35	6177959.85					57.8	63.9				63.5		63.6	64.5		69.2	62.8	62.4	59.6										
34	Top	Pos S	Top - Pos S	34.5	255486.98	6177991.43							44.6					53.5	57.4	58.0	59.1	55.3	55.6	56.6	53.3									
35	Level 1	Pos J''	Level 1 - Pos J''	6.9												49.1	51.5	54.4	51.9	47.6			48.6	50.9	56.8	54.9	47.5	43.4						

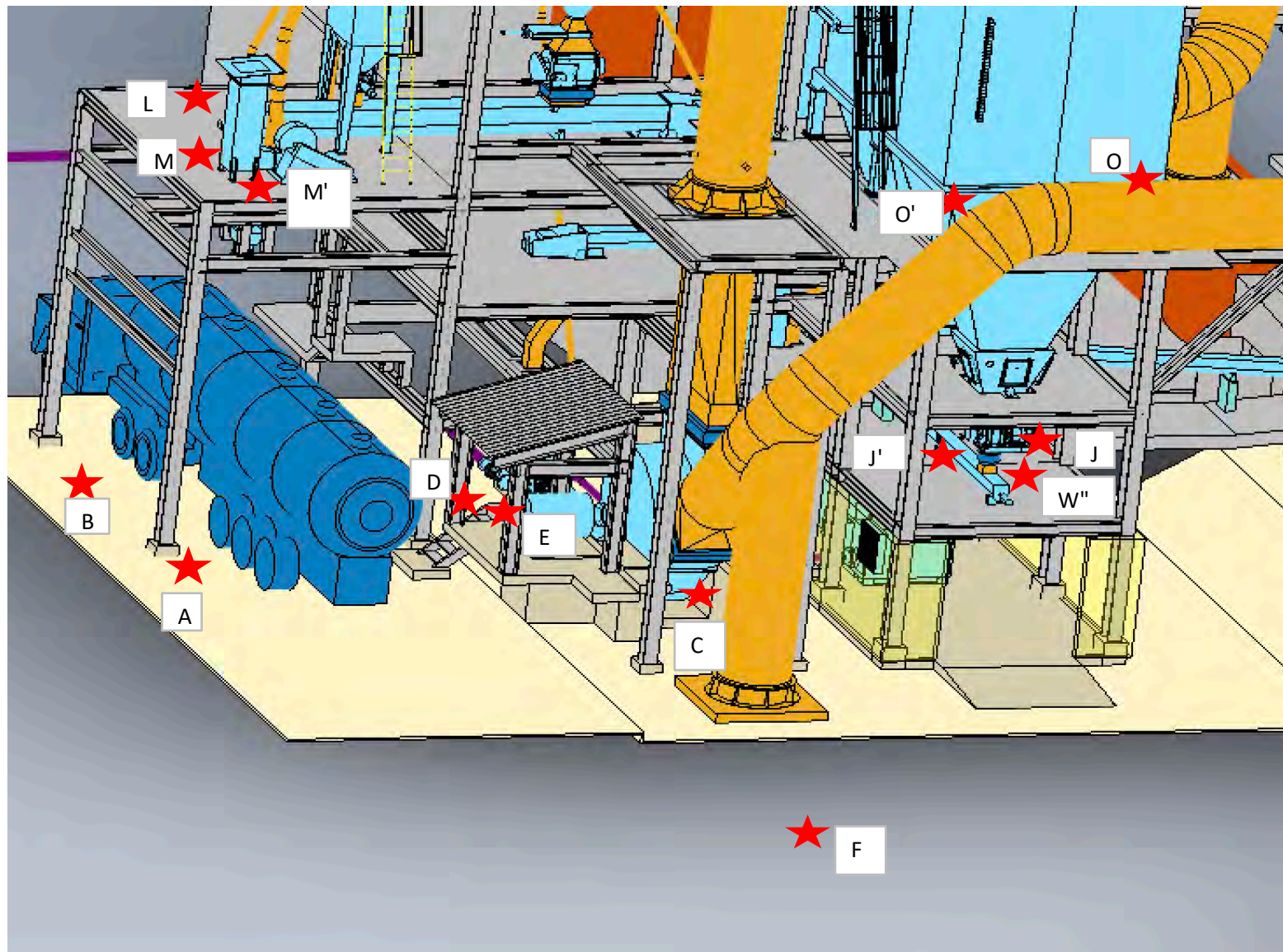


Figure B1 Location of measurement points

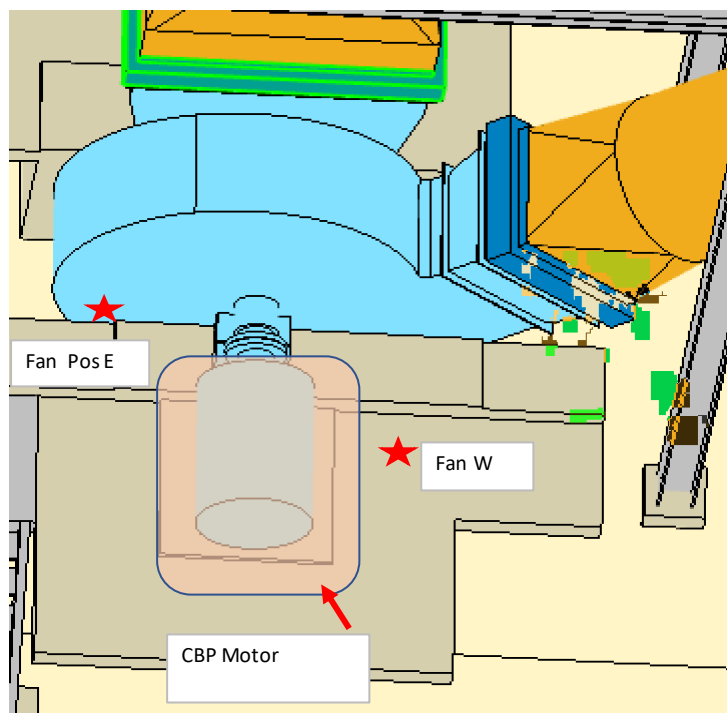


Figure B2 Location of measurement points relating to intensity measurements



Figure B3 Location of measurement points

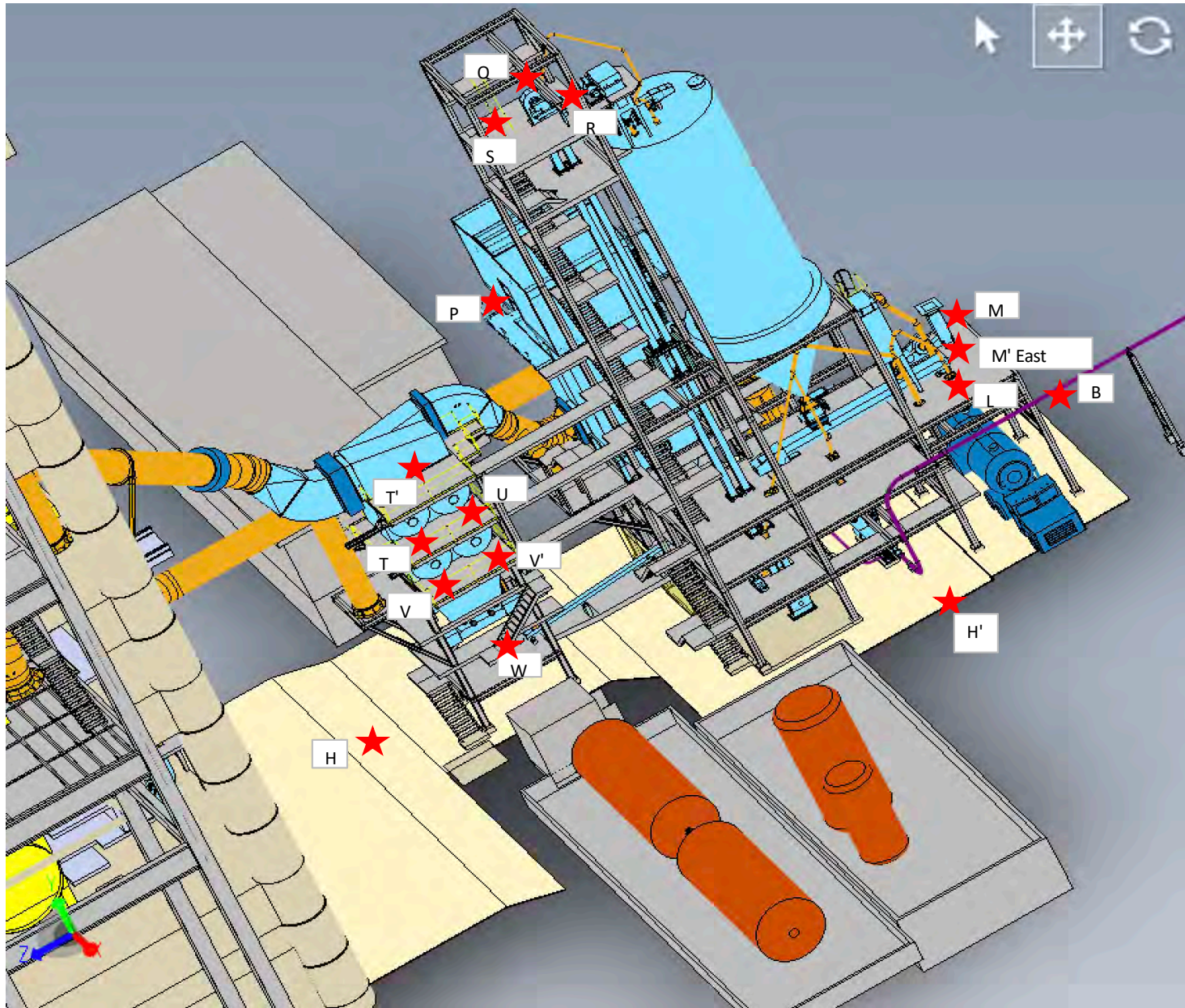


Figure B4 Location of measurement points - cont

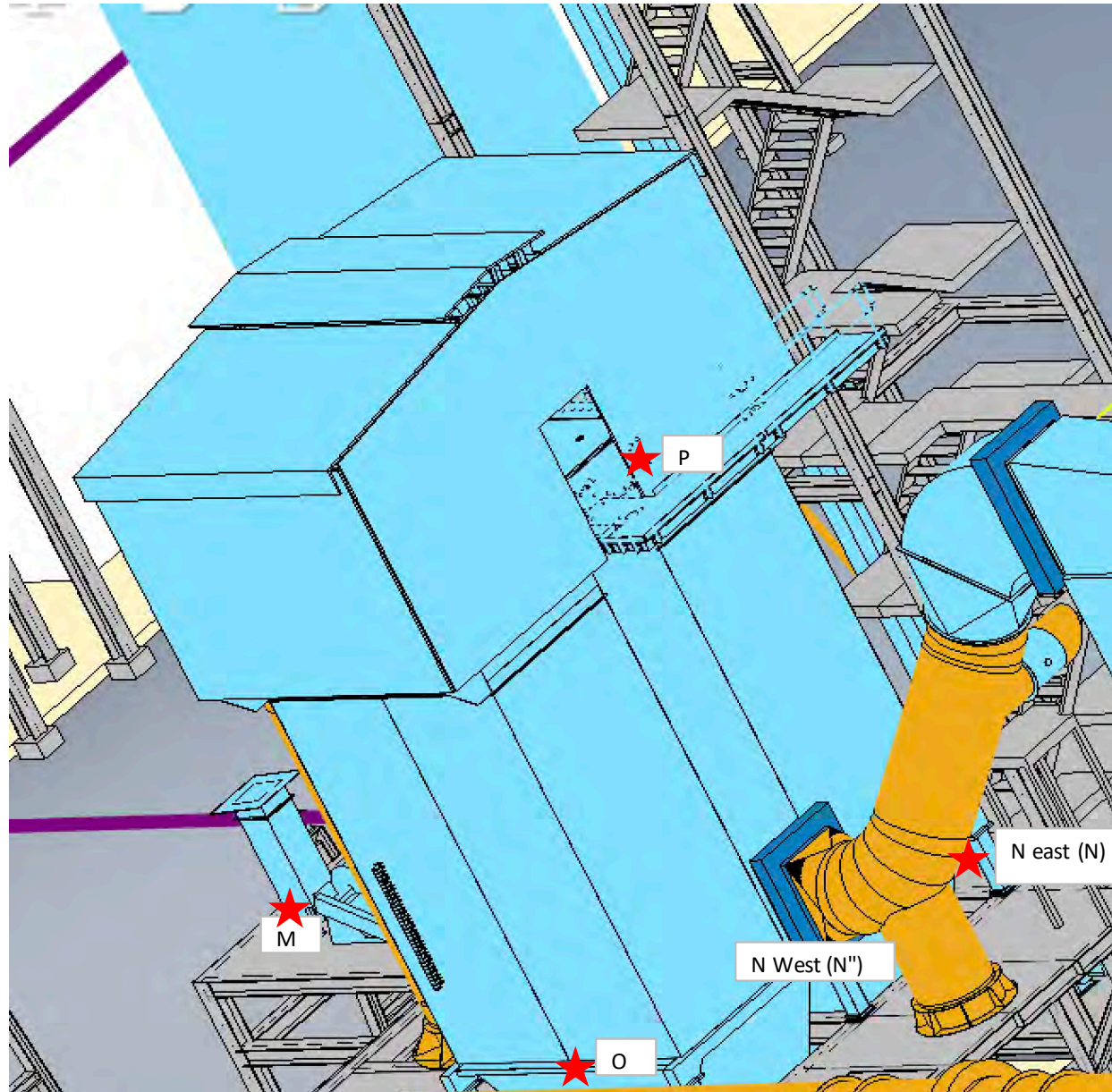


Figure B5 Location of measurement points - cont

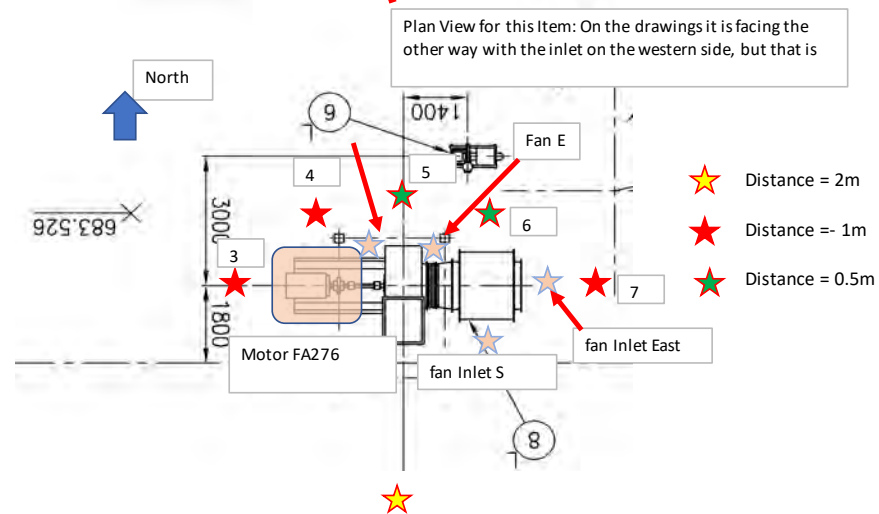
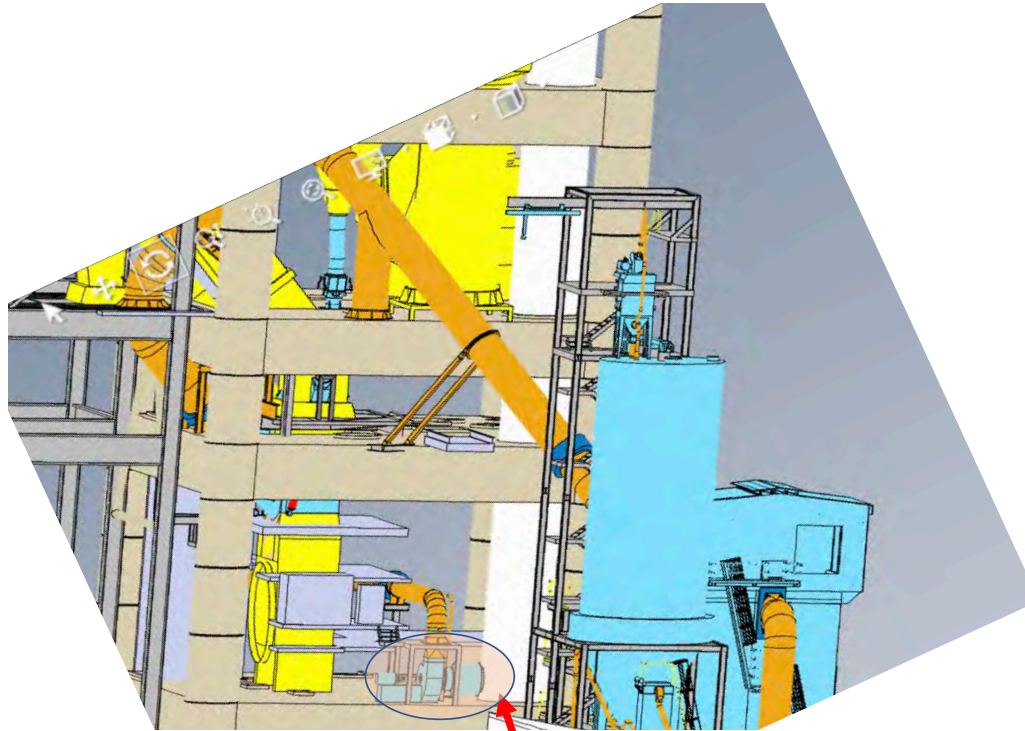


Figure B6 Plan view of Fan FA276 Mixing chamber Bypass Air Fan

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