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White Bay Berth 4 Bulk Liquids Handling
Eastern Liberty
Compliance Noise Monitoring Report

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Compliance Noise Monitoring Report

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1 INTRODUCTION

SLR Consulting has been commissioned by Sydney Ports Corporation (SPC) to conduct monitoring of noise emissions during the loading of the "Eastern Liberty" (a bulk liquids vessel) at White Bay Berth 4 (WB-4), as required under Clause M4.1.1(a) of the EPA's Environment Protection Licence (Licence No 12095).

Noise measurements were conducted when the ship was berthed at the completion of cargo handling operations (ship auxiliary power unit (APU), ventilation fans, pumps and truck activity on the wharf) at two locations considered representative of the potentially most exposed residential receivers. The locations are at Balmain to the west and at Pyrmont to the east of WB-4. Measurements at both representative locations were conducted during the loading of bulk liquids from road tanker trucks to the ship via pumps on the wharf. The measurements were conducted after the ship arrived, between 1.53 am and 2.57 am on 24 December 2012, with the weather consisting of clear sky condition.

An additional "reference" noise measurement was carried out in close proximity to the Eastern Liberty vessel, where the noise environment was dominated by the WB-4 based bulk liquids cargo handling noise sources. The reference noise level was then used to predict noise levels at the representative receivers for comparison with the attended measurements.

The predicted noise levels correlated well with the measured levels and were assessed against the noise goals set out in Table U1 of the Environment Protection Licence. Feasible and reasonable noise mitigation measures are discussed in broad terms, with the aim of minimising the noise impacts from the operations, where the noise goals are exceeded.

2 SITE DESCRIPTION

The White Bay Port facility is located at the southern end of the Balmain peninsula. The facility occupies approximately 40 hectares of waterfront land and forms a crescent around White Bay, with a water frontage of about 2,100 m in length.

The facility layout comprises the following main elements:

- Five multiple-use berths spread along the northern side of White Bay;
- Storage warehouse situated to the northeast of White Bay, Berth 4 (WB-4); and
- Internal road continuing from Robert Street providing truck access to the storage areas of Docks 1 to 6.

The Glebe Island facility, which includes four multiple-use berths, is located adjacent to the White Bay Port on a neighbouring peninsula south of White Bay.

Berth 4 is located approximately in the middle of the northern side of White Bay, as shown in **Figure 1**. To the north and northwest of the site is a mixture of residential dwellings consisting of 1 and 2 storey detached houses and terraces. A number of recently constructed 4 and 5 storey residential developments are situated directly west of Berth 4 and incorporate acoustic façade treatments to achieve satisfactory internal noise levels. In addition, buildings in direct view were designed to provide significant acoustical shielding to the rest of the development. The storage warehouse (on port land) to the northeast of WB-4 is about 20 m at the highest point and provides acoustic shielding to the residential properties directly behind. To the southeast of the site is Glebe Island, another working port area with four multiple-use berths. To the southeast of WB-4, about 550 m across the water, is the Pyrmont Peninsula, with a number of high-rise residential apartments near the waterfront

2.1 Measurement Locations

The Noise Impact Assessment (NIA) Study (Report Number 10-4309-R1 prepared by Heggies Pty Ltd) for the proposed bulk liquid terminal operation has previously identified 5 Waite Street and 36 Refinery Drive as the most affected receiver locations within the Balmain/Rozelle and Pyrmont/Glebe areas respectively.

For the current study, in the Balmain/Rozelle area, monitoring was carried out only at 13 Donnelly Street (also assessed in the noise impact assessment) due to the availability of day/night access to the property boundary. Note that noise measurements at 13 Donnelly Street can be carried out off-street, whereas at 5 Waite Street noise measurements require backyard access. Furthermore, the location at 13 Donnelly Street is in close proximity of 5 Waite Street. It is approximately the same distance away and is also directly exposed to loading operations at WB-4. It is therefore considered to be of a similar acoustical environment to that of 5 Waite Street, Balmain.

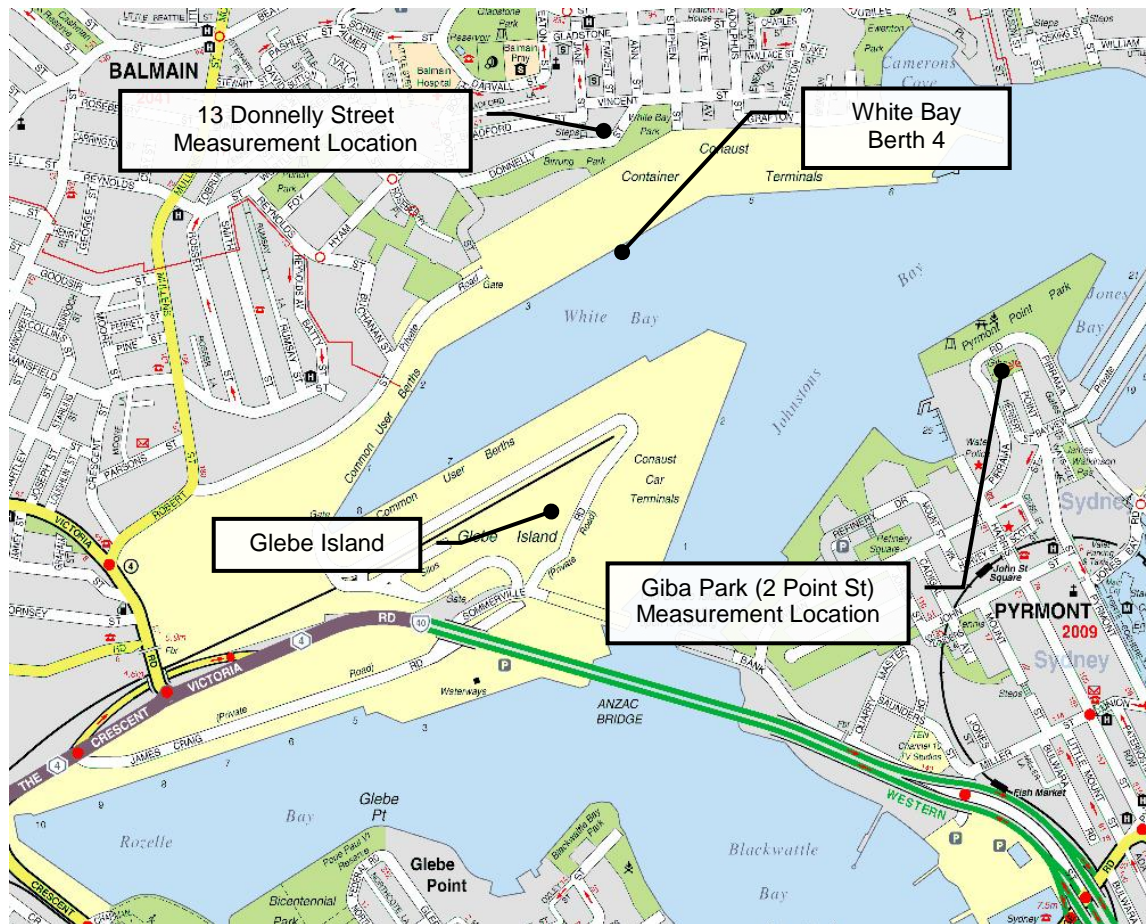
The monitoring location at 36 Refinery Drive, identified by the NIA as being the most affected receiver in the Pyrmont/Glebe area, was found to be exposed to high levels of traffic related noise from the Anzac Bridge. Giba Park (a publicly accessible park situated at the front of the 4 level apartment complex at 2 Point Street) was therefore selected as the representative measurement location for the Pyrmont/Glebe area, as it allowed ship noise measurements to be taken in the relative absence of traffic noise. Giba Park is considered to be acoustically equivalent to 2 Point Street, Pyrmont.

Table 1 summarises the receiver locations where measurements were conducted in each area and gives a brief description of each location.

Table 1 Representative Receiver Locations

Location	Representative Receiver Location	Description
Balmain and Rozelle	13 Donnelly Street, Balmain	Ground level at the front of residence, about 7 m away from the façade
Pyrmont and Glebe	2 Point Street, Pyrmont	At Giba Park, in front of 4 storey building at 2 Point Street
Reference Measurement	White Bay Berth 4 Deck	On deck of White Bay Berth 4, approximately 60 m from the rear engine room/exhaust stack area, the main source of noise from the Eastern Liberty vessel

Figure 1 White Bay/Glebe Island Layout with Attended Noise Monitoring Locations



3 EPA LICENCE NOISE GOALS

For the purpose of the bulk liquid cargo handling operations at White Bay Berth 4 (WB-4), the Environment Protection Licence granted by the EPA sets out the project noise goals at the neighbouring residential communities. The noise goals are set out in Table U1 of the Licence conditions and reproduced in **Table 2**.

Table 2 EPA Licence Noise Goals (Reproduced from Table U1)

Location	Night		
	LAeq(15minute)	LAeq(Night))	LAmx
Balmain and Rozelle	49 dBA	41 dBA	59 dBA
Pyrmont and Glebe	41 dBA	Not Applicable	51 dBA

Explanatory notes:

1. LAmx means maximum A-weighted sound pressure level measured on fast time weighting during the time over which sound is measured.
2. All other acoustic terms including "night" have the same meaning as in the INP.
3. Not Applicable: In instances where the amenity criteria LAeq(Night) has been determined to be a higher number than the intrusive criteria LAeq(15minute) that the amenity criteria is less stringent than the intrusive criteria, then the amenity criteria becomes 'not applicable'. This is because compliance with the criteria will ensure compliance with the intrusive criteria will ensure compliance with the amenity criteria.

4 MEASUREMENT METHODOLOGY AND INSTRUMENTATION

The licence requires L_{Aeq} (A-weighted equivalent continuous) sound pressure level measurements to be carried out at locations representative of those potentially most affected (ie waterfront) locations during loading operations (eg, ship pumps and truck activity on the wharf in addition to APUs), in accordance with Clause M4.1.1(a).

After the ship berths, the equipment is set up (hoses unrolled and connected to the ship's manifold etc). The equipment setup phase usually lasts less than 2 hours, after which the loading is continuous, with up to two road tankers filling the ship at any one time. Ship noise measurements during periods of activity can be measured at any time after loading commences, representing "normal maximum operations".

The previous ship noise monitoring report prepared by Heggies (Report Number 10-4309-R2 Revision 1) concluded that measurements are best carried out at night (preferably after 1:00 am). Extraneous noise (not related to the subject activity) is generally at a minimum at this time and measurement results are consequently likely to be much more meaningful.

The bulk liquids ship Eastern berthed at approximately 12.31 pm on 23 December 2012 and departed at 3.58 am on 24 December. Pumping had commenced after the vessel berthed and was completed the following morning. Measurements were conducted between 1.53 am and 2.57 am on 24 December 2012, following the arrival of the vessel.

Attended noise level measurements were carried out at 1.5 m above ground level at both 13 Donnelly Street and Giba Park, located adjacent to the residential apartment complex at 2 Point Street, Pyrmont.

A "reference" measurement was conducted in close proximity to the Eastern Liberty, where the noise environment was dominated by bulk liquids loading related noise. The "reference" measurement was then used as a basis for the estimation of WB-4 activity related noise at the receivers of interest.

An equivalent ship sound power level was calculated based on the "reference" measurement and noise contributions related to the bulk liquids cargo handling were estimated at each noise sensitive location.

All items of acoustic instrumentation employed during the noise monitoring surveys were designed to comply with the requirements of AS IEC 61672.1-2004 "*Electroacoustics-Sound level meters-Specifications*" and carried appropriate and current NATA (or manufacturer) calibration certificates. Calibration was checked prior to and subsequent to the survey. Any drift in calibration was within 0.5 dBA and considered acceptable.

The survey instrumentation used during the studies is set out in **Table 3**.

Table 3 Noise Survey Instrumentation

Type	Serial Number	Instrument Description
2260	2414605	Brüel & Kjær Modular Precision Sound Level Meter
4193	2677334	Brüel & Kjær 12.5 mm Pre polarised Condenser Microphone
4231	2218228	Brüel & Kjær Calibrator

Environmental noise measurements were carried out with reference to the guidelines contained within the NSW Industrial Noise Policy, 2000 (INP). In circumstances where it was not practical to carry out measurements at the potentially most affected receiver locations as predicted by the Noise Impact Assessment, locations of similar noise characteristics were chosen, as described in **Section 2.1**.

Given the relatively constant nature of noise related to the bulk liquids cargo handling operations, short-term measurements (of 15 minute duration) are usually considered to be sufficient to provide adequate information to enable an estimate of the LAeq(night) noise levels at the selected residential receivers. A brief description of acoustic terminology used in this report is presented in **Appendix A**.

Attended measurements of periods of unloading activities were carried out during the early morning of 24 December 2012, commencing at approximately 1.53 am.

Two separate 15 minute measurements were carried out at the representative Balmain location during cargo handling operations at WB-4, at 1.53 am and 2.22 am. At this location, the noise from bulk handling at WB4 was clearly audible and was considered the main contributor to the measurement, with the measurements also potentially influenced by traffic on Anzac Bridge and general urban noise.

One 15 minute noise measurement was also carried out at the representative receiver at the Pyrmont site, commencing at 2.57 am on 24 December 2012. At this location, the vessel was inaudible.

5 RESULTS AND ANALYSIS

The results of the 15 minute duration attended noise measurements are summarised in **Table 4**. Discussion of the results is presented in **Section 6** of this report. It should be noted that the measured noise levels presented below include noise from the bulk liquids cargo handling facility at WB-4 as well as ambient noise unrelated to the facility.

Table 4 Measured Noise Levels - Unloading Activity

Address	Start Time	LAeq (15min)	LA90 (15min)	WB-4 Related LAmax Range	Comments
13 Donnelly Street (Balmain/Rozelle)	2.22 am	46 dBA	45 dBA	54 dBA	LAeq influenced by WB-4 noise
Level 5, 2 Point Street (Pyrmont/Glebe)	2.57 am	43 dBA	42 dBA	Non observed	Eastern Liberty vessel not audible

During the measurements at 13 Donnelly Street (at approximately 2.22 am) noise from WB-4 operations such as the ship APU was clearly audible. Noise from the ship APU was considered the dominant source influencing the LAeq noise level and was found to be constant in nature. Noise from the pumps was audible during survey.

During the measurement at Point Street, the ambient noise resulted from Anzac Bridge traffic as well as the general urban hum or city noise. There was also noise from local traffic. An LAeq noise level of 43 dBA was recorded for the 2.57 am survey.

Arrival of trucks began at 2.05 am. Noise from trucks and truck loading was audible at Balmain, with a summary of the LAmax truck noise events at the site presented in **Table 5**. WB 4 related LAmax noise events were not observed at the Pyrmont monitoring location.

Table 5 Summary of Attended LAmax Noise Levels at 13 Donnelly Street, Balmain

LAmax Source	LAmax Range	Notes
Truck unloading	50 dBA to 52 dBA	'Clunks' of a short duration were audible from the trucks unloading. The events last for approximately 1 second.
Truck air brakes	52 dBA to 54 dBA	Truck parking brake air was heard from a truck on arrival to the site. The event lasted for approximately 1 second.
Truck engine	46 dBA to 49 dBA	Truck engine audible as it both arrived and departed.

In order to confirm the contribution to the ambient noise by bulk liquids related noise, noise levels were predicted based on the reference measurements taken in close proximity of Eastern Liberty, where the noise environment was dominated by bulk liquids loading related noise.

Table 6 Eastern Liberty “Reference” Noise Level

Reference	Location	Distance from Source	Height of Source	LAeq
1	WB-4	60 m	15 m	58 dBA
2	WB-4	10 m	15 m	63 dBA

Calculations were performed with the reference measurements taken in close proximity of the Eastern Liberty vessel. Up to three silenced pumps have been assumed to be continuously operational in any 15 minute period and pumping would occur for typically 30 percent of the night-time period. Therefore for comparison with the licence conditions, which are applicable during the night-time period only, calculations were performed in order to determine the LAeq(15minute) and the LAeq(9hour) noise levels.

Predictions that indicate bulk liquids loading related LAeq(15minute) noise levels at the representative receiver at 13 Donnelly Street are 48 dBA to 49 dBA for the ship only and the ship plus pumps respectively. At 2 Point Street, the predicted noise level for the ship and pumps is 39 dBA.

The measured LAeq(15minute) noise level of 46 dBA is lower than the predicted noise level at 13 Donnelly Street, and consistent with influence from localised noise sources. The predicted LAeq(15minute) noise level at 2 Point Street is below the ambient noise level at this location and is consistent with WB-4 related noise being inaudible.

A comparison of the measured and predicted noise levels with the noise goals listed in the Licence Conditions is presented in **Table 7**.

Table 7 Comparison of Measured/Predicted Noise Levels with LAeq(15minute) Noise Goals

Prediction Location	Measured/Predicted LAeq Noise Levels ¹	LAeq(15 minute) Noise Goals	LAeq(15 minute) Exceedance of Licence Goals
13 Donnelly Street (Balmain/Rozelle)	46/49 dBA	49 dBA	No exceedance
2 Point Street ¹ (Pymont/Glebe)	43/39 dBA	41 dBA	No exceedance

Note1: At 2 Point Street, the predicted level is considered more representative of WB-4 noise, given the significant contribution to the ambient noise by other sources at this location, and that WB-4 noise was not audible. This level meets the 41 dBA licence condition.

Table 8 Comparison of Predicted Noise Levels against LAeq(night) Noise Goals

Prediction Location	Predicted LAeq Noise Levels ¹	LAeq(night) Noise Goals	LAeq Exceedance of Licence Goals
13 Donnelly Street (Balmain/Rozelle)	49 dBA	41 dBA	8 dB exceedance
Level 5, 2 Point Street (Pymont/Glebe)	39 dBA	N/A	N/A

Note 1: The predicted LAeq(9hour) night-time level is marginally lower than the predicted LAeq(15minute) noise level presented in **Table 7** as a result of the pumps not operating continuously over the full 9 hour night-time period.

Table 9 Assessment of (WB-4 Related) Measured Noise Levels against LA_{max} Noise Goals

Measurement Location	Range of Maximum Measured Levels (LA_{max} Range)	LA_{max} Noise Goals	Range of Recorded LA_{max} Exceedances of the Licence Noise Goals
13 Donnelly Street (Balmain/Rozelle)	54 dBA	59 dBA	No exceedance
Level 5, 2 Point Street (Pyrmont/Glebe)	N/A	51 dBA	No exceedance

6 DISCUSSION

Predicted ship based LA_{eq}(15minute) noise levels meet the Licence imposed noise goals at the representative location in Pyrmont. At Balmain, the measured and predicted LA_{eq}(15minute) noise level met the Licence imposed night-time noise goal of 49 dBA. Predicted LA_{eq}(night) noise levels exceed the Licence imposed noise goal by 8 dB at this location.

Bulk liquids terminal related maximum (LA_{max}) noise levels were not measured above the ambient noise at the representative monitoring location in Pyrmont. At Balmain, bulk liquids terminal related maximum (LA_{max}) noise level met the night-time Licence goal of 59 dBA.

A Revised Noise Impact Mitigation and Management Strategy (Report No 10-4309-R10 Revision 1) has been prepared for the operation. Taking into consideration the infrequency and limited duration of the operation, expected costs, development times, uncertainty of effective outcome, and the impact on flexibility in relation to ships that may be used in the operation, the implementation of ship specific engineering noise control measures is not considered practical nor reasonable within the Revised Noise Impact Mitigation and Management Strategy. Instead, the document recommends an On-site Noise Management Strategy be implemented based on operator awareness and procedures to identify and repair abnormally noisy equipment, as outlined within the Noise Impact Mitigation Action Plan.

7 CONCLUSION

Noise measurements were carried out during the Eastern Liberty bulk liquids cargo handling operations during the early morning of 24 December 2012. The measured noise levels were found to be potentially influenced by Anzac Bridge traffic and the general urban hum. A reference noise measurement was carried out in close proximity of the Eastern Liberty, where the noise environment was dominated by the WB-4 based bulk liquids cargo handling noise sources. The reference noise level was then used to predict noise levels at the representative receivers, for comparison with the attended measurements.

Predicted ship based LA_{eq}(15minute) noise levels meet the Licence imposed noise goals at the representative location in Pyrmont. At Balmain, the measured LA_{eq}(15minute) noise levels met the Licence imposed noise goals. At Balmain, the predicted LA_{eq}(night) noise level exceed the Licence imposed noise goal of 41 dBA by 8 dB.

At Balmain, bulk liquids terminal related maximum (LA_{max}) noise level met the Licence imposed noise goal of 59 dBA. At Pyrmont bulk liquids terminal related maximum (LA_{max}) noise levels could not be measured above the ambient noise.

Potential noise control measures that may be considered to meet the Licence imposed noise goals (as required by Condition R4.1) subject to feasibility, practicality and reasonability, include a combination of applying engineering noise control measures to trucks and an on-site noise management strategy. Noise impact mitigation measures have been evaluated in the Revised Noise Impact Mitigation and Management Strategy (Report 10-4309-R10 Revision 1), with a list of mitigation measures considered feasible and reasonable identified in the Noise Impact Mitigation Action Plan.

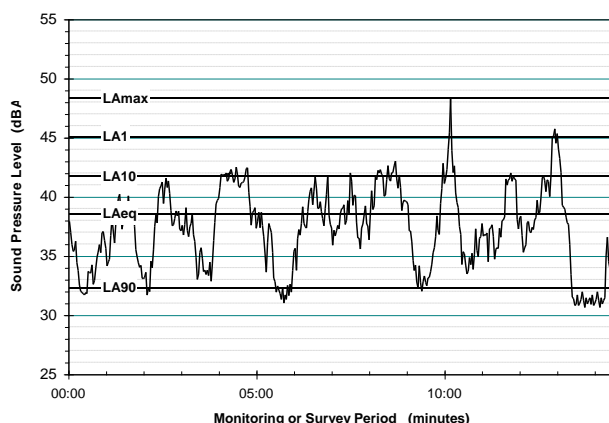
Acoustic Terminology Used in the Report

Typical Noise Indices

This Report makes repeated reference to certain noise level descriptors, in particular the LA10, LA90 and LAeq and LAm_{ax} noise levels.

- The LA10 is the A-weighted sound pressure level exceeded 10% of a given measurement period and is utilised normally to characterise typical maximum noise levels.
- The LAeq is essentially the average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound over the same measurement period. The LAeq(15hour) is the measurement parameter used to describe the road traffic noise level over the entire daytime (7.00 am to 10.00 pm) period. The LAeq(9hour) is the measurement parameter used to describe the road traffic noise level over the entire night-time (10.00 pm to 7.00 am) period. Similarly, the LAeq(1hour) is the measurement parameter used to describe the road traffic noise level during the loudest 1-hour period during the daytime or night-time periods.
- The LA90 noise level is the A-weighted sound pressure level exceeded 90% of a given measurement period and is representative of the average minimum background sound level (in the absence of the source under consideration), or simply the “background” level.

Graphical Display of Typical Noise Indices



The LAm_{ax} noise level is the maximum A-weighted noise level associated with road traffic movements.

Typical Noise Levels

The following table presents examples of typical noise levels.

Typical Noise Levels

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130 120 110	Threshold of pain Heavy rock concert Grinding on steel	Intolerable Extremely noisy
100 90	Loud car horn at 3 m Construction site with pneumatic hammering	Very noisy
80 70	Kerb side of busy street Loud radio or television	Loud
60 50	Department store General Office	Moderate to Quiet
40 30	Inside private office Inside bedroom	Quiet to Very quiet
20	Unoccupied recording studio	Almost silent

A-Weighting or dBA Noise Levels

The overall level of a sound is usually expressed in terms of dBA, which is measured using the “A-weighting” filter incorporated in sound level meters. These filters have a frequency response corresponding approximately to that of human hearing. People’s hearing is most sensitive to sounds at mid frequencies (500 Hz to 4000 Hz), and less sensitive at lower and higher frequencies. Thus, the level of a sound in dBA is a good measure of the “loudness” of that sound. Different sources having the same dBA level generally sound about equally as loud, although the perceived loudness can also be affected by the character of the sound (eg the loudness of human speech and a distant motorbike may be perceived differently, although they are of the same dBA level).

Sensitivity of People to Noise Level Changes

A change of up to 3 dBA in the level of a sound is difficult for most people to detect, whilst a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness.