Noise Impact Assessment

APPENDIX 2

Project No: 11645

Noise Impact Assessment
Ashton Central Gas Drainage Project
Camberwell, NSW

Prepared for:

Wells Environmental Services
PO Box 205
East Maitland NSW 2323

Author:

………………………………………
Neil Pennington
B.Sc., B. Math.(Hons), MAAS, MASA
Principal / Director

Review:

………………………………………
Ross Hodge
B.Sc.(Hons)
Principal / Director

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EXECUTIVE SUMMARY

A Noise Impact Assessment (NIA) has been prepared for the proposed construction and operation of a central gas drainage plant and associated infrastructure at the Ashton Coal Project (ACP) near Camberwell, NSW.

The assessment is based on or refers to the Office of Environment and Heritage (OEH) *NSW Industrial Noise Policy* (2000). A brief summary of essential data, results and recommendations arising from this assessment is presented below.

Operational Noise Criteria

Construction and operation of the project will be required to satisfy the existing noise criteria, when considered cumulatively with all other ACP noise emissions.

Existing noise criteria are reproduced below.

Location	Day	Evening	Night	
	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{A1(15min)}$
Any residence not owned by the Applicant or not subject to an agreement between the Applicant and the residence owner as to an alternative noise limit.	38	38	36	46

Summary of Findings

The assessment has found that noise emissions from the worst case construction and operational scenarios would be below the existing noise criteria at all receivers under all meteorological conditions, except for a moderate 3dB exceedance at Receiver 130 (A. Bowman) when the gas drainage bore nearest to this receiver is being drilled. The following noise control options are recommended:

Noise Control Recommendation.
Option A: Orient the drill so that the quietest side (IF this is less than 105 dB(A) sound power level) is facing Receiver 130; OR

Option B: Site sheds or shipping containers should be strategically placed to act as a noise barrier to Receiver 130. Noise monitoring should be conducted during this activity to confirm compliance with the noise criterion.

No sleep disturbance impacts have been predicted at any receiver. Night time maximum noise levels 15 dB or more below the criterion have been predicted. Changes in off-site traffic noise levels due to vehicles associated with the project have also been found to be well below the level of perceptibility.

1.0 INTRODUCTION

1.1 The Proposal

Ashton Coal Operation Limited (ACOL) seeks project approval to install and operate a central gas drainage plant and associated network of up to 80 gas drainage bores and connecting pipelines above the existing underground workings. A detailed description is contained in the main volume of the Environmental Assessment (EA). Accordingly, a noise impact assessment (NIA) is required for inclusion with the (EA). This NIA has been conducted in accordance with relevant NSW Office of Heritage and Environment (OEH) policies and guidelines.

The project will comprise:

- Construction of a central gas drainage plant (including flares and a ventilation stack) to provide continuous extraction of gas from a series of gas drainage bores.
- Drilling of a maximum of 80 gas drainage bores over the underground workings, staged with the progression of underground mining.
- Construction of a temporary surface reticulation network for the conveyance of gas to the central gas drainage plant.

The modification also includes minor associated infrastructure required to provide access and electricity where necessary.

1.2 Study Area

The Ashton Coal Project (ACP) is located 14 km northwest of Singleton in the Hunter Valley of NSW within the Hunter coalfields of the Sydney Basin. The gas drainage infrastructure is located approximately 880m southwest (at its closest) of the village of Camberwell, on the southern side of the New England Highway. The indicative extent of the gas drainage project is illustrated in **Figure 1**. Noise sources associated with Scenario 1 (Sc1) and Scenario 2 (Sc2) discussed in Section 3.2.2 are also indicated in Figure 1.

1.3 Surrounding Land Uses and Receivers

The village of Camberwell is located approximately 880m north east of the site. Given the localised position of the gas drainage infrastructure, the nearest residences in Camberwell village are considered to have the greatest potential for noise impacts from the project. Representative non-mine related receivers considered in this assessment are listed in **Table 1** below and illustrated in Figure 1

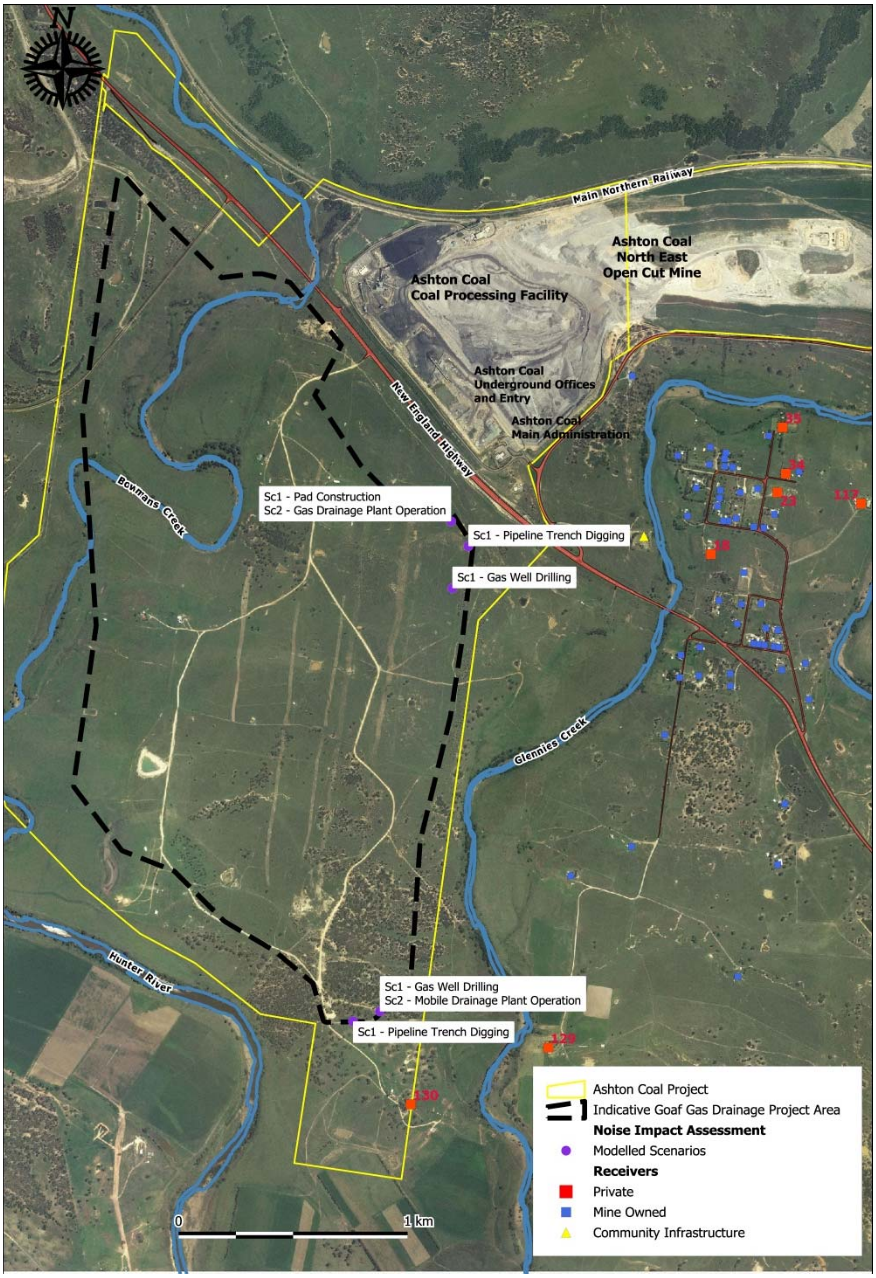

Figure 1. ACP Gas Drainage Site and Assessed Receiver Locations

TABLE 1

Non-mine related receivers considered in this assessment.

Receiver	Owner / Description
35	De Jong, Meindert & Thelma Eileen
34	Oloffson, Torbjorn Anders & Diedre Ella
23	Lopes, Valda Kim
18	Turner, Sandra Phyllis
117	McInerney, John Charles & Judith
129	Bowman, W.H., M.H., W.G. & Elder, G.R.
130	Bowman, Alistair Stuart

2.0 THE EXISTING ENVIRONMENT

The existing meteorological and acoustic environments were studied and reported as part of the recent South East Open Cut (SEOC) EA. Meteorological data relevant to the current study are summarised below.

2.1 Meteorology

2.1.1 Wind Speed and Direction

Winds are an assessable feature of an area if the sum of wind vector components up to 3 m/s from a given direction occurs for more than 30% of the time during the day, evening or night periods in any given season. Analysis of winds for the SEOC noise assessment did not separate the day, evening and night periods so any assessable wind is assumed to occur at all times of the day during the relevant season(s), as a worst case.

Wind roses were analysed as part of the SEOC project. The analysis procedure is explained in Appendix B.

Results of the analysis are summarised in **Table 2** with assessable winds (>30% occurrence of vector components 0.5-3 m/s) indicated in bold type. Wind directions selected for noise modelling are shaded grey.
[NOTE: Since winds from each direction are also included as vector components for six 'side-band' directions, the total percentages for each season in Table 2 are significantly greater than 100%]

TABLE 2
Summary of wind vector components from 0.5 m/s to 3 m/s.

Direction	SEASON			
	Summer	Autumn	Winter	Spring
N	5.91%	20.30%	30.10%	17.20%
NNE	17.31%	22.70%	10.60%	18.00%
NE	44.77%	31.30%	12.10%	33.50%
ENE	53.65%	43.40%	21.10%	41.40%
E	41.86%	43.00%	21.20%	38.00%
ESE	43.87%	43.30%	21.70%	38.30%
SE	47.85%	44.30%	23.60%	40.40%
SSE	57.30%	47.00%	26.80%	45.50%
S	48.55%	38.90%	28.70%	42.00%
SSW	19.00%	27.40%	23.40%	25.30%
SW	7.40%	24.70%	34.90%	21.60%
WSW	8.00%	26.80%	38.40%	24.10%
W	6.97%	20.70%	31.20%	21.00%
WNW	6.06%	21.90%	25.10%	18.70%
NW	5.65%	21.80%	24.90%	18.40%
NNW	5.67%	24.00%	29.30%	19.00%
Calms	8.50%	14.50%	7.80%	6.90%

Point source modelling was conducted and it was found that winds from the west are worst case with respect to receivers in Table 1.

2.1.2 Temperature Inversions

A temperature inversion study was conducted by Spectrum Acoustics on the ACP site during August/September 2006, with five Gemini data loggers placed at various locations on the site and in Camberwell village to cover a total altitude separation of 79m. The tenth percentile inversion strength was found to be 4.7^0C/100m. Since the construction stage of the project will occur only during daytime hours, this inversion strength was included in noise modelling for the operation of the central gas drainage plant only.

3.0 NOISE CRITERIA AND PREDICTED IMPACTS

3.1 Existing Noise Criteria

The proposed gas drainage plant (and associated infrastructure) construction and operation will be required to satisfy the existing noise criteria, when considered cumulatively with all other ACP noise emissions. Existing noise criteria are reproduced below.

Location	Day	Evening	Night	
	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{A1(15min)}$
Any residence not owned by the Applicant or not subject to an agreement between the Applicant and the residence owner as to an alternative noise limit.	38	38	36	46

3.2 Noise Impact Assessment Procedure

The assessment of noise emissions was conducted using RTA Technology's Environmental Noise Model (ENM v3.06). Major noise producing items were modelled as point sources and point calculations were performed for the receivers in Table 1.

3.2.1 Noise Sources

Sound power levels of operational noise sources used in the modelling are shown below in **Table 3**.

TABLE 3
Modelled noise source sound power levels.

Noise source	Sound power level, dB(A)		Source Height, m
	$L_{eq(15\ min)}$	L_{max}	
Drainage bore drill (290mm diam.)[1]	108	N/A	2
Gas drainage plant (per module, x3)[2]	84	N/A	1
Gasco flares (per flare, x8)[2]	87	97	8
Trench formation / construction[3]	101	N/A	2
Gas plant pad construction[4]	107	N/A	2
Mobile gas drainage plant [5] (diesel compressor)	105	N/A	1

[1] As measured by Spectrum Acoustics at Narrabri Coal Mine.
[2] Noise data supplied by ACOL.
[3] Combined small backhoe and grader, as measured at another site.
[4] Combined small dozer, grader and tip-truck as measured at another site.
[5] Existing Ashton Gas Well 3 as measured in 2010.

3.2.2 Modelled Scenarios

Noise modelling was conducted for the following adverse atmospheric conditions:

- *Adverse winds* – Air temperature 10^{0}C, 70% RH, 3m/s wind from West; and
- *Inversion* – Air temperature 5^{0}C, 85% RH, +4.7^{o}C/100m vertical temperature gradient (gas drainage plant only).

Noise models were generated for the following scenarios using the Environmental Noise Model (ENM v3.06).

<u>Scenario 1</u> – Gas plant pad construction plus gas bore drilling and pipeline trench digging at closest point to nearest receiver (130)* (daytime only).

<u>Scenario 2</u> – Operation of the central gas drainage plant and up to eight flares (24-hour) and operation of the mobile gas drainage plant†.

* Noise source locations as shown in Figure 1 will be the worst case construction scenario.
† While this scenario is presented as a worst case it is not expected that the central plant and mobile plant will operate simultaneously for extended periods.

3.3 Predicted Noise Levels

Predicted noise levels using the ENM point calculation mode are presented below for the modelled operational and meteorological scenarios.

3.3.1 Scenario 1 (Construction)

Predicted noise levels for Scenario 1 (Gas plant pad construction, gas bore drilling and digging trench for 700/500mm pipes) under worst case conditions (West wind) are summarised in **Table 4**.

TABLE 4
Predicted Scenario 1 intrusive noise levels.

Receiver	Predicted $L_{Aeq(15min)}$	Criterion
35	36	38
34	35	38
23	33	38
18	35	38
117	31	38
129	36	38
130	41	38

The above results show noise levels from the worst case construction scenario below the noise criterion at all assessed receivers except Receiver 130 where a moderate 3dB exceedance is predicted. Review of the contributing noise sources confirmed the drill as the dominant source.

There are two recommended options for achieving the required 3dB noise reduction:

(A) The drill sound power level of 108 dB(A) was determined as the logarithmic average of noise levels at four locations at the front, rear, left side and right side of the drill. Drills are highly directional and the loudest side of the particular drill measured by Spectrum Acoustics was 110 dB(A), whilst the quietest side (the front) was 102 dB(A). Orienting the drill with the quietest side facing Receiver 130 would provide the required noise reduction; or

(B) The construction site would contain at least one site shed or shipping container (2.4 – 3m high). This should be positioned to act as a temporary acoustic barrier (ie, between the drill and receiver 130).

3.3.2 Scenario 2 (Operations)

Predicted noise levels for Scenario 2 (Operation of gas drainage plant and up to eight flares, plus mobile drainage plant at nearest point to receivers) under worst case conditions (West wind and inversion) are summarised in **Table 5**. [Note: the ENM algorithms for the effects of winds and temperature inversions are such that a 3 m/s wind is approximately equivalent to a 7.5^{0}C/100m inversion. Results for a 3m/s source-receiver wind are therefore higher than for a 4.7^{0}C/100m inversion.]

TABLE 5
Predicted Scenario 2 intrusive noise levels.

Receiver	Predicted $L_{Aeq(15min)}$		Criterion
	Inversion	Wind	
35	<20	27	36
34	20	26	36
23	23	27	36
18	23	31	36
117	20	25	36
129	<20	<20	36
130	21	24	36

The predicted noise levels in Table 5 for the continued operations of the gas drainage plane are sufficiently low that they would not contribute to an exceedance of the site noise criterion.

3.4 Modifying Factor Corrections

A number of 'modifying factor' adjustments to predicted/modelled noise levels are defined in Table 4.1 in Chapter 4 of the INP (reproduced below as **Figure 3**).

A review of the spectral noise data for the various sources has revealed that there are no appreciable tonal, impulsive or intermittent components of the site noise emissions requiring numerical assessment.

Low-frequency noise emissions must be assessed to determine whether the low-frequency modifying factor adjustment of + 5dB is applicable. In addition to the INP assessment of low-frequency noise in Figure 3, the DP&I have advised that the low-frequency modifying factor is not applicable if the C-weighted noise level is less than approximately 55 dB(C).

A review of point calculation results at all assessed receivers over all modelled scenarios has found a maximum C-A weighted noise level difference of 6 dB. This is sufficiently below the trigger level of 15 dB for low frequency emissions that further quantitative assessment of modifying correction factors is not considered necessary.

3.5 Cumulative Site Noise

Combined worst case noise emissions from operation of the gas drainage plant and the previously assessed upcast ventilation shaft and fans (Spectrum Acoustics report 11645/4314, March 2012) are summarised in **Table 6**.

TABLE 6
Cumulative noise levels from gas drainage plant and upcast ventilation fans.

Receiver	Predicted $L_{Aeq(15min)}$			Criterion
	Vent fans	Gas plant	TOTAL	
35	24	27	28	36
34	24	26	29	36
23	25	27	30	36
18	30	31	34	36
117	23	25	28	36
129	<20	<20	20	36
130	<20	24	24	36

The combined noise levels in Table 6 are below the site noise criterion are will not lead to an exceedance of the criterion at any assessed receiver.

FIGURE 2
INP modifying factor corrections

Table 4.1. Modifying factor corrections
(See definitions in *Section 4.2*)

Factor	Assessment/ measurement	When to apply	Correction[1]	Comments
Tonal noise	One-third octave or narrow band analysis	Level of one-third octave band exceeds the level of the adjacent bands on both sides by: —**5 dB** or more if the centre frequency of the band containing the tone is above 400 Hz —**8 dB** or more if the centre frequency of the band containing the tone is 160 to 400 Hz inclusive —**15 dB** or more if the centre frequency of the band containing the tone is below 160 Hz	5 dB[2]	Narrow-band frequency analysis may be required to precisely detect occurrence
Low frequency noise	Measurement of C-weighted and A-weighted level	Measure/assess C- and A-weighted levels over same time period. Correction to be applied if the difference between the two levels is 15 dB or more	5 dB[2]	C-weighting is designed to be more responsive to low-frequency noise
Impulsive noise	A-weighted fast response and impulse response	If difference in A-weighted maximum noise levels between fast response and impulse response is greater than 2 dB	Apply difference in measured levels as the correction, up to a maximum of 5 dB.	Characterised by a short rise time of 35 milliseconds (ms) and decay time of 1.5 s
Intermittent noise	Subjectively assessed	Level varies by more than 5 dB	5 dB	Adjustment to be applied for **night-time only**.
Duration	Single-event noise duration may range from 1.5 min to 2.5 h	One event in any 24-hour period	0 to –20 dB(A)	The acceptable noise level may be increased by an adjustment depending on duration of noise. (See *Table 4.2*)
Maximum adjustment	Refer to individual modifying factors	Where two or more modifying factors are indicated	Maximum correction of 10 dB(A)[2] (excluding duration correction)	

Notes:
1. *Corrections to be added to the measured or predicted levels.*
2. *Where a source emits tonal and low-frequency noise, only one 5-dB correction should be applied if the tone is in the low-frequency range.*

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3.6 Sleep Disturbance

Assessment of potential sleep disturbance during night time hours usually begins by considering the OEH recommendation that further assessment is required if maximum noise levels[1] (L_{Amax}) exceed the background level (L_{A90}) by more than 15 dB at a bedroom window. If this level is exceeded then further consideration of potential disturbance to sleep includes the nature and level of ambient noise in the area, with some guidance also offered in Appendix B of the OEH *Environmental Criteria for Road Traffic Noise* (ECRTN, 1999).

1 The sleep disturbance criterion is technically the $L_{A1(1minute)}$ level. As this is the loudest 0.6s during a 15-minute period, the L_{Amax} level is usually adopted.

In this project only the gas drainage plant (fixed and mobile) and up to eight flares would operate during the night. Noise emissions from the drainage plant and flares are characteristically uniform in their noise emissions with very little variation about the mean levels. Further, the predicted noise levels in Table 5 were for worst case meteorological conditions so maximum noise levels would not exceed these values by more than a few decibels.

The sleep disturbance criterion is 46 dB(A) and maximum noise levels from the gas drainage plant and flares would be 15 dB or more below this level.

3.7 Traffic Noise

All traffic created by the project during construction or operation will access the site from the New England Highway. The Traffic Impact Assessment (TIA), provided by SKM for the recently completed Ventilation Shaft project, advised that the daily average of vehicles using the New England Highway was 11,109, 17% of which are heavy vehicles, that is, 1,889 heavy vehicles.

The maximum worst case traffic volume at any time is 14 heavy vehicle movements (7 vehicles) per day. The addition of 14 vehicle movements per day to the existing 1,889 heavy vehicle movements per day on the New England Highway constitutes an increase of less than 1%. This minor increase in movements, and the associated noise, will be imperceptible and further quantitative assessment of noise impacts is not considered necessary.

4.0 SUMMARY

A noise impact assessment of the proposed construction and operation of a gas drainage plant, up to eight gas flares, gas bores and associated connecting pipes at the Ashton Coal Project (ACP) near Camberwell, NSW, has been conducted. The assessment has found that noise levels would be below the site noise criterion at all assessed receivers, provided that noise control in the form of drill orientation or a temporary barrier is utilised during the brief period of drilling the nearest gas drainage bore to receiver 130.

Noise levels associated with off-site traffic generated by the project have been found to be insignificant and below the level of perceptibility.

With the adoption of the recommendation in this report, we see no acoustic reason why the project could not proceed.

APPENDIX A

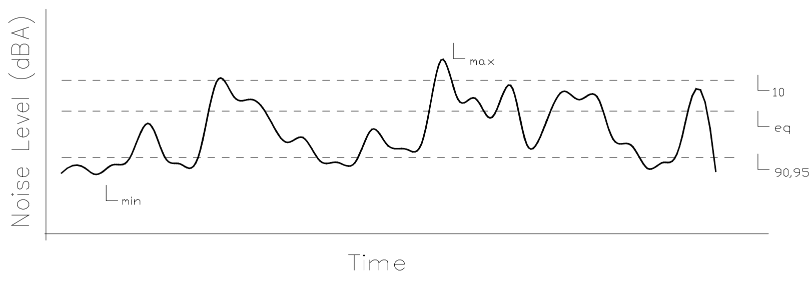
DESCRIPTION OF ACOUSTICAL TERMS

Table A1 contains a glossary of commonly used acoustic terms and is presented as an aid in understanding this report.

The descriptions in this section are not formal definitions of the terms. Formal definitions may be found in AS1633-1985 "Acoustics – Glossary of terms and related symbols".

Table A1. Acoustical Terms

Term	Description
dB(A)	The quantitative measure of sound heard by the human ear, measured by the A-Scale Weighting Network of a sound level meter expressed in decibels (dB).
SPL	Sound Pressure Level. The incremental variation of sound pressure above and below atmospheric pressure and expressed in decibels. The human ear responds to pressure fluctuations, resulting in sound being heard.
STL	Sound Transmission Loss. The ability of a partition to attenuate sound, in dB.
Lw	Sound Power Level radiated by a noise source per unit time re 1pW.
Leq	Equivalent Continuous Noise Level - taking into account the fluctuations of noise over time. The time-varying level is computed to give an equivalent dB(A) level that is equal to the energy content and time period.
L1	Average Peak Noise Level - the level exceeded for 1% of the monitoring period.
L10	Average Maximum Noise Level - the level exceeded for 10% of the monitoring period.
L90	Average Minimum Noise Level - the level exceeded for 90% of the monitoring period and recognised as the Background Noise Level. In this instance, the L90 percentile level is representative of the noise level generated by the surrounds of the residential area.



APPENDIX B

WIND ROSE ASSESSMENT METHODOLOGY

The analysis of source-receiver wind speeds is explained with the aid of **Figure B1** below. For a complete year's wind data, each of the 16 compass directions was considered in turn as the primary (***P***) source-receiver direction. The percentage occurrence of winds from this direction up to 3m/s commenced the summation of total source-receiver wind vector components from this direction. The two neighbouring compass directions at + 22.5^0 and -22.5^0 were then considered. (As an example, if the current primary direction ***P*** is NE, then ***P***+22.5^0 is ENE and ***P***-22.5^0 is NNE).

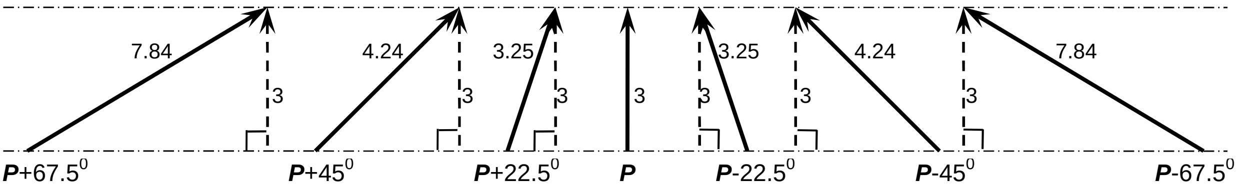


Figure B1. Source to receiver vector components (dotted) of all wind directions within P±*67.5^0.*

Figure B1 shows that winds from ***P***±22.5^0 with total speed of 3.25 m/s have a vector component of 3 m/s parallel to ***P***. The percentage occurrences of winds up to 3.25 m/s from ***P***±22.5^0 were added to the summation for primary direction ***P***. Similarly, the percentage occurrences of winds up to 4.24 m/s from ***P***±45^0 were added to the summation. (In the above example, ***P***+45^0 would be East and ***P***-45^0 would be North).

Finally, Figure B1 shows that at ***P***±67.5^0 winds up to 7.84 m/s have components up to 3 m/s parallel to ***P***. Total wind speeds above 5 m/s are not considered in noise assessments, as this is the limit of noise measurement validity in AS 1055, so the percentage occurrences of winds up to 5 m/s from ***P***±67.5^0 were added to the summation. (In the above example, ***P***+67.5^0 would be ESE and ***P***-67.5^0 would be NNW).

This process was repeated for each of the 16 primary wind directions. Because the assessment of winds in each direction includes information from six 'side-band' directions, the results may bare little resemblance to wind roses of the same data set. Also, since winds from each direction may be included in the summation for up to seven primary directions, the seasonal percentages added over all directions will considerably exceed 100%. This method of wind assessment results in higher percentage wind occurrences from a greater number of directions than results from the OEH "Procedures to estimate the frequency of wind conditions that enhance noise levels" (Oct 2009).