



A Community Response to the NSW DRAFT INDUSTRIAL NOISE GUIDELINE

Version ISBN 978 1 74359 940 2
EPA 2015/0185
September 2015

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1. Foreward

The Leard Forest Research Node (LFRN) is a citizen science community network operating from the farming locality of Maules Creek, Northwest New South Wales, which is affected by a precinct of nearby coal mines.

Pollution problems emanating from the Maules Creek coal mine have stimulated the growth of citizen science which provides the community with important information about the status of their environmental health.

It has the potential to contribute a great deal to evidence-based decision-making.

Volunteers engaged in citizen science build their collective knowledge with the assistance of subject matter experts.

What LFRN may lack in technical or academic subject-specific qualifications, it compensates for by full transparency enabling regulators, and other stakeholders to have access to our research.

Citizen science provides the community with independent data which is important to enable community members to advocate for their best interests by use of evidence.

In the case of noise, it became apparent since 2014 that the level of noise and sleep disturbance beyond the 35dBA LAeq,15min contour (hereafter referred to as the “35dB contour”) around 4 km from the mine is far greater than the modelled prediction. Complaints of excessive noise occur many kilometres beyond the 35dB contour, challenging the acoustic impact assessment and the noise modelling that was submitted to the NSW Government to obtain approval for the mine.

Noise monitoring surrounding the greenfield mine site of Maules Creek has provided LFRN with necessary insights into the seemingly intractable problem of low frequency noise (LFN) from open cut coal mines. Given that the disturbance is strongly correlated with sound power at the lowest levels of human hearing, leads us to conclude that the problem is not one simply of noise and that further investigation is required to ascertain, for example, the impact of coal washers which operate at the 16 and 25Hz frequencies, which straddle the oft-cited cut-off for human hearing, 20Hz.

The LFRN is currently undertaking Stage 2 of its Maules Creek noise study and obtaining independent evidence of low-frequency noise using a class I acoustic device.

It is recognised internationally that second only to clean air, absence of noise is a most highly valued public good.

As a consequence, the LFRN thanks the New South Wales EPA for the opportunity to comment on the Draft Industrial Noise Guideline. We recommend that the Guideline be renamed.

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November, 2016

2. Objections to Draft Industrial Noise Guideline

2.1 Replaces a Policy with a Guideline

The substitution of the present Industrial Noise “Policy” with an Industrial Noise “Guideline” is not acceptable.

If it requires updating, the INP should be replaced with another “policy”.

The reason for this is that the proposed “Guideline” states that it should be used “as a reference to assist strategic land use planning” as quoted in the Introduction (p 1), and is therefore a lesser standard than the original “Policy” which actually enables regulation i.e. “a framework and process for deriving noise limit conditions for consents and licences that will enable the EPA to regulate premises”.

In the hierarchy of legislating within civic administration, a guideline is a subservient instrument compared with a policy. The difference is that policies are enforceable, whereas guidelines are not required to be followed.

LFRN recommendation 1:

The Industrial Noise Policy should be retained as “Policy”, albeit modified to take into account new research on the impacts of industrial noise, and not be reduced to a “Guideline”.

2.2 Removes “negotiation” step with community

Previously, under the INP, “Applying the Policy” Steps 7 and 8, (p 3) prior to setting statutory compliance levels, where the project-specific noise levels are exceeded, the EPA is required to:

“**Negotiat[e]** between regulatory/consent authority and the proponent and between the community and the proponent.” [Emphasis added]

Under the ING, Step 4 (p 5) when noise levels exceed the “trigger level” the regulatory/consent authority can “Consider the acceptability of the residual noise” and set statutory compliance levels after only “consultation” with the community without requiring any “negotiation”.

LFRN recommendation 2:

The negotiation step is so important that it is imperative that it should not be deleted from the ING.

2.3 Increases discrepancy between daytime minimum assumed rating background level and observed levels

Under the current policy, if the rating background level (RBL) is found to be less than 30dBA LAeq,15min *for any time of day* then it is set to 30dBA LAeq,15min as an assumed minimum.

Already this is an anomaly, as it does not reflect the true background levels in green fields sites.

Under the ING, the daytime RBL will be increase to 35dBA LAeq,15min.

This increase will inject an even greater discrepancy between the observed background levels (confirmed by numerous monitoring) and the RBL, which will have negative impacts on the reliability of the ING to instil reliable conditions for intrusiveness.

LFRN recommendation 3:

The minimum assumed RBL for daytime should not be increased from 30dBA LAeq,15min to 35dBA LAeq,15min.

2.4 Night-time minimum assumed RBL not justified

We refute the justification contained in Attachment 1 of the Draft ING Technical Background Paper (p 30) which provides the original basis for assuming a 30dBA LAeq, 15min minimum background noise level in the current INP.

We cite the rationale that “applying a very low background noise level would not improve the level of protection” to the community. We strongly disagree with this non-evidence based conclusion considering the flood of complaints that continue to flow from the affected Maules Creek community regarding the night-time noise. It has become increasingly obvious that applying a low background noise level during night-time will improve the level of protection.

The LFRN has logged as low as 20dBA LAeq,15min on occasions that the mine was not operating. In the case of Maules Creek, the true background noise level has been measured to be as low as 16dBA LAeq,15min. We think this is creating a serious disconnect between the perceived noise intrusiveness and the noise limits of night-time coal mining.

LFRN recommendation 4:

We recommend that no minimum assumed RBL be used for setting night-time noise limits

2.5 “DEFRA” method of calculating LFN Modifying factor not validated for open cut coal mining

A key premise of the ING is that it follows the UK example defined by the DEFRA Review of European LFN criteria (DEFRA being a reference to the UK Department for Environment, Food and Regional Affairs). It has been described by NSW Government representatives as the most comprehensive study of low frequency noise (LFN) of its kind.

This is discussed at pp 15-16 of the Draft ING Technical Background paper (the “Technical Background Paper”, where Table 8 lists the “criterion values”.

A more in-depth reading of the Draft ING, the Technical Background Paper and also Leventhall’s *A Review of Published Research on Low Frequency Noise and its Effects*¹ Report for DEFRA by Dr Geoff Leventhall of the UK, reveals that the criterion values have been derived and validated using data that bears no relation to the noise from open cut coal mines, nor the affected demographic of rural farming communities mostly affected by such developments in green fields locations. This will be addressed in detail elsewhere in the submission.

Using the DEFRA criterion values as a starting point, the ING Committee has made certain adjustments to those values to reflect the fact that noise exposures in the original research were based on impacts on subjects *inside their homes*.

The ING has made the adjustments to criterion values for each frequency in the Third Octave, to reflect the fact that the European criterion values were derived from studies of noise affectation inside buildings, not outside residences within 30m as measured by NSW regulation.

| Third Octave Fluctuating Criterion Values | | | | | | | | | | | | | |
|--|-----------|-------------|-----------|-----------|-----------|-------------|-----------|-----------|-----------|-----------|------------|------------|------------|
| Frequency Hz | 10 | 12.5 | 16 | 20 | 25 | 31.5 | 40 | 50 | 63 | 80 | 100 | 125 | 160 |
| DEFRA | 92 | 87 | 83 | 74 | 64 | 56 | 49 | 43 | 42 | 40 | 38 | 36 | 34 |
| ING | 92 | 89 | 86 | 77 | 69 | 61 | 54 | 50 | 50 | 48 | 48 | 46 | 44 |

The possibility that C-weighted sound levels could be below the Third Octave criteria, i.e. possibly under 10Hz is also neglected.

We are especially concerned at where the 16Hz frequency band limit sits, at 86 dB. This frequency is largely outside the range of human hearing. Yet we believe this frequency, in fact specifically the frequency band 16-25Hz poses particular challenges for regulators. It is known that some coal mining production plant, eg coal washeries, result in volumes of complaints even when the measurable sound power levels are not exceeding the noise limits (under the INP). This suggests that valid claims of physical disturbance may be caused by noise levels too low for many community members to hear. This may reflect the

¹ Leventhall, G (May 2003) “A Review of Published Research on Low Frequency Noise and Its Effects” Department for Environment, Food and Rural Affairs, Defra Publications
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fact that a proportion of people have hearing ability that extends up to 12Hz below the average, at certain sound power levels.²

There is also an issue around the harm caused by inaudible sound levels i.e. infrasound.

The NSW Government has a duty of care to the people of NSW to ensure that through its decisions and practices it does not bring about harm to communities affected by industrial noise. Based on its current approach to LFN, it does not appear that the Government is heeding best available scientific or epidemiological information. In any case, we believe there is no adequate field research available to properly guide the policy making in NSW.

LFRN recommendation 5:

The NSW Government should immediately revise the scope of the ING to include recommendations for a new metric for applying to the measurement and reporting of coal mine noise, which takes into account the specific kinds of noise associated with mines including washing, crushing and loading, as well as the real-world profile of the receiver communities which are farming rural, or small town rural.

2.6 Insurmountable problems of LFN from coal washers and crushers

It is widely recognised, including by the NSW EPA and the NSW Dept of Planning and Environment, that the washing of coal is one of the most serious noise nuisances caused by the industry. It is furthermore known that coal washers create intense levels of sound energy in the 16-25 Hz range, a frequency band which straddles the “audible” and non-audible range of human hearing.

Certainly there is potential for endless debate over the limits of human hearing and how to regulate infrasound over the lower limits of human hearing, but prolonged debate will not help the communities forced to endure low frequency noise pollution. Specific trouble-shooting must be enabled with co-operation of the proponents, Dept of Planning and Environment, and affected communities. It could be fairly said, that until now the Department has not shown a willingness to proactively address noise pollution, by approving mines on conditions that prevent publication of LFN levels, and monitoring based on a mere 24 attended monitoring events of 15 minutes each per month, which equates to 0.8% of the time that the mine is operating.

The following table identifies coal washers as the single most noise producing fixed or mobile plant in an open cut coal mine.³ This table does not include the sound power levels of coal loaders, which are also ranked as high noise emitters in mines where they occur.

² International population studies have addressed human hearing thresholds for many years, especially in relation to low frequency noise. There is a detailed list of source references and some analysis in the *Draft Industrial Noise Guideline Technical Background Paper* published by NSW EPA, May 2015

³ Parnell, J (2015) “*The Generation And Propagation Of Noise From Large Coal Mines, And How It Is Managed In Nsw*” Conference Paper, Acoustics 2015 Hunter Valley, 15-18 November 2015, p.

Table 2. Typical Fixed Plant Sound Power Levels.

| Description | No, length or Area | L _w L _{eq} dB(A) | Controlling Frequency Bands |
|----------------------------------|------------------------|--------------------------------------|-----------------------------|
| Coal Washery | 1 x 2000m ² | 114 - 125 | 16 - 63 |
| Crushing Plant | 1 x 600m ² | 104 - 118 | 16 - 125 |
| Transfer Conveyors | Up to 3 km | 102/100m | 63 - 500 |
| Total Typical Fixed Plant | | 127 - 130 | |

Table 3. Typical Mobile Plant and Equipment Sound Power Levels.

| Description | No, length or Area | L _w L _{eq} dB(A) | Controlling Frequency Bands |
|-----------------------------------|--------------------|--------------------------------------|-----------------------------|
| Tracked Dozers | 3 - 10 | 114 - 125 | 63 - 1000 |
| Front End Loader | 2 - 4 | 110 - 125 | 63 - 1000 |
| Reject/Product truck uphill | Up to 40 | 116 - 125 | 63 - 500 |
| Excavator/Shovel | 2 - 6 | 116 - 125 | 63 - 500 |
| Total Typical Mobile Plant | | 130 - 138 | |

As it is one of the most vexed noise problems, we would have expected the ING to make specific reference to the LFN impacts of coal washeries, given that the Dept of Planning and Environment's own "noise specialist" has stated:

"Open-cut coal mining in NSW presents considerable noise management difficulties ... these mines continue to be the source of significant levels of community complaint. Property acquisition is not an ideal form of noise management as it can impact upon the social fabric of small villages and can be socio-economically divisive despite it being a commercial option for managing excessive noise."⁴

LFRN recommendation 6:

The ING must address the specific LFN pollution relating to coal mines in a material and considered way, and not extrapolate coal mine impacts from analysis of other industrial LFN sources such as wind farms and power generation infrastructure.

Coal washers, crushing plants and coal loaders all call for subject specific analysis and regulatory solutions, which most likely include complete refusal of planning consent to operate between 10PM-7AM in rural areas, which would include small towns in an approximately 15-20km radius around a major coal mine such as Maules Creek mine.

The Government must commission field studies that should include transect studies in a northerly, north-eastern, north-western direction at the very least corresponding with the direction in which most affected communities members reside. The study should publish these results for public education and scrutiny. The study should include down to 10Hz but also explore the possibility that there may be power levels at <10Hz that could be causing complaints that continue to be unresolved.

⁴ Ibid Parnell, J (2015) fn.2 at p. 11
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2.7 Noise criteria must be measured inside homes as well as outside

In NSW, noise criteria are not measured inside homes as they are in all of the European studies which have given rise to the proposed LFN Third Octave criterion values. In NSW typically noise criteria are measured strictly more than 3 metres from a reflective vertical surface and within 30m distance. According to the Draft Industrial Noise Guideline Technical Background paper, “The use of internal criteria would raise a number of complexities including the need to access buildings for compliance assessment purposes.”

This concern is overstated. It is not uncommon and in fact considered to be best practice in major projects to undertake internal examination in homes inhabited by potentially impacted community members.⁵ The costs of undertaking internal measurements needs to be factored into the cost of the project. In rural areas there is not a density of population so internal noise measurements should not be prohibitive.

The importance of assessing the effects of noise pollution inside the home is well understood, however it is disregarded by the Technical Background Paper. It is widely acknowledged, including as cited by the Technical Background Paper, that the low-frequency noise problem can often be worse inside premises than outside.⁶

LFRN recommendation 7:

The Draft Industrial Noise Guideline Technical Background Paper should be revised to fully consider a new means of measuring noise affectation from coal mine in rural areas, indoors where people inhabit, not outside the homes. This is essential.

2.8 Conflict between noise regulation and NSW Voluntary Land Acquisition and Mitigation Policy

Under the proposed new system where the Policy is replaced with a Guideline, the NSW Voluntary Land Acquisition and Mitigation Policy (VLAMP) will have precedence over the ING thereby placing the interests of mining, petroleum and extractive industry development over public health. The purpose of the VLAMP is stated as follows (p 1 “Preliminary”):

“This document describes the NSW Government’s policy for voluntary mitigation and land acquisition to address noise and dust (particulate matter) impacts from State significant mining, petroleum and extractive industry developments.”

This is further evidence that rural communities are being sacrificed for the interests of the extractive industries. By relegating the health and amenity of affected farming families below the interests of coal speculation, this amounts to extreme “social engineering”.

⁵ For example, during the Sydney Airport link train line construction, the project proponents conducted vibration monitoring of any residences situated above the train tunnel which necessitated installing vibration measuring devices and reporting back on the results.

⁶ for example in Leventhall, *ibid* 1. at pp36, 48, pars 8.2.11, 12.1.4
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The consequences of this conflict between noise regulation and the establishment of buffer zones around coal mines are that neighbours of coal mines will be forced to endure far higher levels of pollution than currently allowed, without being regarded as “affected” by the mine.

LFRN recommendation 8:

If the NSW Government is insistent on approving a proliferation of coal mining in rural regions, despite lack of community approval, it must embark on an honest process of resetting the buffer zones around coal mines and instigating a fair and just system of compensating rural landowners who are unfortunate to find themselves as neighbours of a mine. At the same time, this process should include an appraisal of how much agricultural land is really being taken over by mining companies in addition to the actual mine lease, so that strategic planning for land use in New South Wales takes into account the future food production needs of the State, and the Country.

2.9 Evaluation should be evaluated in “consistent and transparent manner”

At Par 1.1 (p 1) of the Draft ING, it states:

“The purpose of the guideline is to ensure noise impacts associated with particular industrial developments are evaluated *in a consistent and transparent manner.*”

However, it does not provide requirements that low frequency noise is reported consistently and transparently.

Through the imposition of weak noise conditions, the Department of Planning and Environment has created a dysfunctional situation whereby LFN is required to be considered (owing to the need to comply with the INP) but not disclosed as part of its environmental reporting.

Low frequency noise is one of most contentious aspects of noise pollution and it follows that the subject should be transparent and open to evaluation. Instead, the LFN is treated as “commercial in confidence” and even the NSW EPA is unable to freely obtain this information from mine proponents.

We regard this as a regulatory “sham” that calls for correction in the forthcoming replacement of the INP.

LFRN recommendation 9:

From now on, low-frequency noise data from coal mines should be required to be disclosed to the public and not kept secret under the “commercial in confidence” blanket. This requirement should be incorporated in any successor to the INP.

2.10 New South Wales need to develop new noise metric for open cut coal

Following our evaluation of both the “simplified Broner” and DEFRA methods for evaluating the impacts of LFN, the LFRN concludes that neither of these approaches satisfactorily reflects the specific real-world characteristics of a 24/7 industrial operation covering several square kilometres in area, within a greenfield i.e. rural region with no existing industrial operations.

We believe applying simplified Broner is simply irresponsible, and DEFRA is fraught with inadequacies. Our group has found that the criterion values adapted from DEFRA for this Draft ING do not adequately reflect levels of annoyance or affectation in the community.

LFRN recommendation 10:

As a world leader in coal mining and exportation, the State of New South Wales has a duty to develop policy that is suited for the conditions of this state, and not to attempt to adapt approaches which were developed for very different industrial sources, in non-rural green fields settings.

This should now become a priority for the regulation of mining in NSW.

3. Background of Submission

This submission very specifically relates to noise pollution from open cut coal mines. Coal mines are the specific subject of our continuing investigations. Seeing that in NSW there are many more new coal mines currently being proposed, some in green fields locations, this class of industrial noise polluter deserves special attention.

The observations gained by the Leard Forest Research Node are specifically derived from the group's 18 month-long experience monitoring the Maules Creek coal mine. This has included monitoring locations nearly 20 km distance from the mine.

Noise including regular exceedance of the night-time limit of 35 dB_{15min} can be experienced up to and beyond the monitoring locations shown in the diagram below, at Section 5.4 of this submission.

Noise from such plant as coal washeries, coal crushers and train loaders are proving to be impossible to resolve despite years of toleration by the NSW Government. This infrastructure has noise characteristics that are not shared by wind farms, gas turbine power stations, locomotives or main roads which are the main areas of study concerning LFN in the source literature. Coal mine noise thus requires dedicated research, not to rely on learnings from noise sources with entirely different characteristics.

Additionally, there is the matter of range of human hearing ability. It is known that the WHO assumed human hearing threshold of 20dB is not fixed. For example, Leventhall states:

“2.4 Low frequency noise and infrasound. The frequency range of infrasound is normally taken to be below 20Hz and that of audible noise from 20Hz to 20,000Hz. However, frequencies below 20Hz are audible, illustrating that there is some lack of clarity in the interpretations of infrasonic and audible noise. Although audibility remains below 20Hz, tonality is lost below 16-18Hz, thus losing a key element of perception. Low frequency noise spans the infrasonic and audible ranges and may be considered as the range from about 10Hz.”⁷

Leventhall further states:

“2.6 Infrasound. There are a number of misconceptions about infrasound, such as that infrasound is not audible. As will be shown later, frequencies down to a few hertz are audible at high enough levels. Sometimes, although infrasound is audible, it is not recognised as a sound and there is uncertainty over the detection mechanism.”⁸

For example, we are aware that 16Hz is on the borderline of audibility, and yet it is the signature frequency of one of the key components of the coal washery at Maules Creek and elsewhere. There is a lot of energy specifically at 16Hz and 25Hz, and this pushes up the energy but you may not hear it. Yet, there is no requirement to report these troublesome matters even though we understand the regulators are expending considerable resources in managing the problems of LFN in the compliance context.

As early as in 2000, LFN radiation from coal washers was the subject of a CSIRO investigation.⁹ In that case, vibration of components in buildings in the area of a coal washery was attributed to a large de-watering screen. Once again, the vibration of components in buildings near the coal washery were observed to be at 16.3 Hz: from noise measurements made at various locations, there was clear evidence of a strong tone at 16.3 Hz, which was the operating frequency of the washery screen.

The nuisance caused by noise in the 16Hz - 25Hz is well documented in other coal-mining regions, such as Lithgow: “The operation of the washery and the elevated conveyers at the Clarence Colliery generates a 16Hz component and also a component just above 20 Hz which can be detected in the signatures recorded at the Clarence property that should be inaudible and not of significance.”¹⁰

It is these final words - “*should be inaudible and not of significance*” that now require a through rethink by the NSW Government, because there appears to be a distinct link between the level of disturbance in mine-affected communities even though theoretically 20 Hz is the threshold of human hearing. This is because the threshold is not fixed.

According to Leventhall, an approximate estimate is that about 2.5% of the population may have a low frequency threshold which is *at least 12Hz more sensitive* than the average threshold, corresponding to nearly 10,000,000 people of whom 1,000,000 are in the

⁷ Leventhall, G (2003) Ibid fn 1, at p.8

⁸ Leventhall, G (2003) Ibid fn 1, at p.8

⁹ Shepherd, I. “Low frequency noise radiation from a coal washery screen” *Inter-Noise 2000, The 29th International Congress and Exhibition on Noise Control Engineering 27-30 August 2000, Nice, France* p.1

¹⁰ “Noise Monitoring - Clarence and Springvale Collieries” Prepared for Centennial Coal Company Ltd, by The Acoustic Group. This document can be found at Select Committee on Wind Turbines (Australian Commonwealth), Submission 374 - Attachment 4 at pp. 42-43

50-59 year old age group in the EU-15 countries. This is the group which generates many complaints.¹¹

This means an estimated 2.5% of people could hear down to 8Hz, so presumably an even higher number would be able to hear 16Hz.

Leventhall is an acknowledged world leader in LFN with a reputation for rational analysis and not being prone to excessive and unsubstantiated claims about LFN.

Some means must be found to properly reflect LFN impacts from coal mines. However, the proposed methods of adjusted DEFRA or the simplified Broner method do not achieve this outcome. They not reflect the annoyance and disturbance of the noise from open cut coal mines, especially during the night-time hours.

A particular focus of this submission has been to analyse the relevance and effect of using the so-called DEFRA method to calculate the Modifying Factor for low frequency noise, also the “simplified Broner” method being promoted by the NSW Minerals Council.

The LFRN has also examined a number of key direct and indirect sources which have informed and influenced the Draft Industrial Noise Guideline (ING). These documents are included in a bibliography (below).

Our goal has been to establish what form of modifying factor is appropriate to reflect the affectation of green field receiver communities which are subjected to 24 hour noise from coal mines. Neither A-weighted, C-weighted, nor an inadequate formula using both, adequately address the noise characteristics of open cut coal mines.

It is frequently reiterated by NSW Government representatives, that limits placed on noise pollution from coal mines do not - and should not be expected to - provide 100% protection from hearing the mine:

“The reaction to noise varies widely from individual to individual. Because of this it is not possible to adopt noise levels that will guarantee that no one will experience an impact. The criteria in this guideline should not be interpreted to mean that industrial noise will be inaudible, or that all members of the community will find the noise acceptable.”¹²

The Draft Industrial Noise Guideline Technical Background Paper affirms:

“4.10 Acceptable noise levels do not equate to inaudibility

It needs to be made clear at the policy and project level that the draft ING criteria are not, and should not, be about making industrial noise inaudible. Effectively communicating this will assist in eliminating false expectations. This point has been clarified in the draft ING.”

However, we believe the emphasis should not be so much on inaudibility, but what noise impacts of industry - specifically the open cut coal mining industry - are acceptable according to standards of community health, amenity and land use planning.

We are also using this opportunity to call on the NSW Government to immediately instigate original research on the impact of specific, known noise nuisances from coal

¹¹ Leventhall, HG (2004) *Low Frequency Noise and Analysis* Vol 6 (2004) Issue 23

¹² Draft Industrial Noise Guideline, p.1
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mines, on rural receivers, especially green fields sites where there is no other existing industry and little road traffic.

We also provide comment on the assumed background noise levels and proposed new maximum noise limits under the ING.

4. Green field coal mine sites require specific policies

The UK Department of Environment, Food and Regional Affairs (DEFRA), itself the source of the proposed changes to the way that NSW assesses low frequency industrial noise, states “no generic approach appears to be possible”:

‘The procedure is intended to assist in the evaluation of existing problems. It is not intended as a means of predicting when disturbance might occur, for example in a planning situation, and would not be reliable to use as such. This is because disturbance by LFN depends on a number of factors, such as the character of the sound, whose effects are neither well understood, nor readily predictable. **Levels of sound above criteria based on the average threshold of hearing are frequently found to be acceptable and levels falling marginally below can occasionally cause disturbance, so no generic approach appears to be possible.**’ [Emphasis supplied]

We say if the DEFRA method is unable to reliably predict when disturbance might occur, the more primitive Broner method certainly cannot fulfil the brief.

Coal mines have noise profiles not shared by many of the other industrial noise sources used in the research. The noise travels much further than any modelling by the proponents ever predicts.

Factors such as tonality, intermittency, irregularity and dominant low-frequency content are all features of open cut coal mine noise and in particular the associated production activities associated with the mining, such as washing, crushing and loading of coal. How these acoustic factors are affected by expanses of open farmland is poorly understood, even though NSW is one of the biggest coal producers and coal exporters in the world.

The LFRN has conducted transect studies which illustrate that the NSW Department of Planning and Environment’s understanding of LFN in rural environments is extremely poorly understood, in part due to its limited field studies.

We also don't see any evidence that the Department has considered a relevant international standard, *ISO 9613-2 (1996) Acoustics - Attenuation of sound during propagation outdoors*.

The issue of attenuation of sound from the open cut mines is addressed below in detail.

5. Objections to Draft ING low frequency noise criteria

5.1 Insufficient or no real world validation

The Third Octave criterion values in the ING are derived from a range of European studies, distilled into the DEFRA criterion values. The conditions under which the noise testing was done, the subjects of research and validation bear no resemblance to real world conditions in rural and small town NSW which are at risk from green fields coal mining developments.

This is because:

1. **Age group:** Most complaints come from 55-70 age group¹³ yet the DEFRA conducted validation of their Third Octave limits using two study groups - a group of 18 otologically normal young adults (i.e. 18-25 years of age) as well as a smaller group of four older people (41-57 years) who were regarded as sensitive receivers.

To gain a good picture of noise sensitivity in the community, it is important to have a representative sample reflecting the demographic of the community. Granted, the use of the 18-25 years age group is stipulated by ISO:226 (1987)¹⁴ but if the standard does not have relevance to this particular industrial context, this calls for industry-specific methodology.

The ING references ISO:226 as a guide to receiver profile, but its the wrong demographic: The ING (at p.15) states that “70dB at 20Hz is below the human hearing threshold in ISO:226, 2003⁸ and therefore would be unlikely to represent an impact”. However, as ISO:226 was developed with a standardised group aged between 18 and 25 as the assumed receiver, this bears no relation to many rural communities (Maules Creek being one of them). Quite the contrary, this age group is noticeably absent within the rural communities. Also, it is to be noted that the 20Hz threshold is extremely elastic and as discussed elsewhere in this submission, may vary by up to 12Hz lower in 2.5% of the population (at least).

2. **Reliance on World Health Organisation (WHO) Night Noise Guidelines for Europe (NNG-2009):** Despite the many valuable insights it provides into the character and epidemiology of sleep disturbance, the WHO Night Noise Guidelines do not specifically envisage that mining could be a night time sleep disturbance. In fact, the entire category of “Industry” as a whole is classified as the lowest generator of sleep disturbance behind road traffic, neighbours, air traffic, recreation, rail traffic and construction for the years 1998 and 2003.¹⁵ Therefore, we do not believe that the

¹³ Leventhall, HG (2004) “Low Frequency Noise and Analysis” Vol 6 (2004) *Noise and Health* Issue 23, anecdotally validated by LFRN enquiries in community but pending a detailed community analysis

¹⁴ Normal Equal-Loudness Level Contours ISO:226 (1987)

¹⁵ World Health Organisation (WHO) Night Noise Guidelines for Europe (NNG-2009), p. IX November 2016

noise limits suggested in this report should be applied directly to the rural situation in New South Wales.

- 3. Validation of DEFRA criterion values did not consider mining noise:** In Leventhall's "Review of published research on low-frequency noise and its effect", he refers to the validation of national assessment methods for a range of European countries.¹⁶ The noise examples include: traffic, drop forge, gas turbine, fast ferry, steel factory, generator, cooling compressor and discotheque. Clearly none of these are similar to the processes in a coal mine, with the exception of the generator (of which there are many large diesel powered ones on coal mine sites, including "daymaker" flood lights used for night-time operations which generate high sound power levels - the LFRN referred to these in its August 2015 Pilot Study, including the fact that they had not been included in the noise modelling submitted by the proponent to the New South Wales Government) and the drop forge. We regard the latter has having some similarities, due to the fact that one of the nuisance noises is the dropping of large rocks onto steel. The sound of a drop forge and atmosphere outside a drop forge factory may be heard at the following website to give a comparison. Even so, a drop forge in a closed factory cannot be compared with a coal mine, despite some similar aspects of the sounds.

<https://www.pond5.com/sound-effects/1/drop-forge.html#1>

- 4. Evaluations should be conducted indoors:** due to the fact that the European assessment methods were based on modelling indoor noise impacts, additional modelling has been conducted by NSW authorities to remove the effect of being indoors, because in NSW noise affectation is measured outside the home. The modelling accounts for the variation between the ING criterion values and those recommended by DEFRA, and referred to in the Draft Industrial Noise Guideline Technical Background Paper (see page 6 above). We feel that this additional modelling takes us even further away from a real-world assessment of noise impacts.

New South Wales needs to get up-to-date with international Best Practice and start to conduct noise affectation measurements indoors of residences, not outdoors.

This should be done through evidence-based investigations, not modelling.

- 5. Emphasis on "annoyance" excludes physiological effects:** There needs to be an epidemiological survey of low-frequency noise effects, not limited to people's subjective account of "annoyance" which after all is a "mood" and while it may be a marker for a psychological state, is insufficiently defined.
- 6. Contradiction as to application of Third Octave criterion values:** The Draft Industrial Noise Guideline Technical Background Paper notes a statement made by DEFRA on low frequency noise that: "The procedure is intended to assist in the evaluation of existing problems. It is not intended as a means of predicting when disturbance might occur, for example in a planning situation, and would not be reliable to use as such".¹⁷ The background paper then states, on the same page, that the

¹⁶ Leventhall, HG ibid fn.1 p. 74

¹⁷ Draft Industrial Noise Guideline Technical Background Paper, p.16
November 2016

DEFRA low frequency noise criteria are "likely to be conservative if used in a predictive/planning sense"?

Clarification is required. What does "likely to be conservative if used in a predictive/planning sense" mean? Does it mean that the environmental impacts are likely to be underestimated? Or does it mean that the noise limits might be set too low, i.e. conservatively? Either way, it reinforces our belief that the Third Octave DEFRA-derived criteria are wrong for predicting noise in green fields environments, particularly from our experience, coal mines.

This contradiction does not encourage confidence in the proposed methodology, nor in the authors of the Technical Background Paper.

As a result of all of the above, the community has no confidence that the proposed LFN criteria are reliable.

5.2 Modifying A-weighted noise levels for low frequency noise component necessary

The prevailing policy applied in NSW under the INP is that the A-weighted 15 minute average noise levels used in regulating industrial noise pollution should be "modified" when certain characteristics are present, such as tonality, intermittency, irregularity or dominant low frequency content.

We agree that this is necessary. Low frequency noise causes community disquiet, physical and psychological effects. Noise pollution also has ramifications in terms of land use planning, and is linked with the so called Voluntary Acquisition and Mitigation Policy of the NSW Department of Planning and Environment.

We think a "stepped" approach as recommended by the Draft ING has merit, as it ensures stronger scientific rigour than the broad brush approach of adding a flat 5dB penalty once the C-A threshold is reached. However, as according to Broner and Leventhall;

"It is recommended that a minimum (C-A) difference of at least 20 dB is necessary to indicate the possible presence of a LFN problem"¹⁸

and

"If it is necessary to utilise a (C-A) SPL difference at all, it is recommended that a (C-A) difference of at least 20 dB be used to indicate the presence of a potential LFN noise problem."¹⁹

¹⁸ Broner, N. "A simple outdoor criterion for assessment of low frequency noise emission" Vol.39 *Acoustics Australia* April (2011)No.1 at p.10 referencing N. Broner and H.G. Leventhall, "Low frequency noise annoyance assessment by low frequency noise rating (LFNR) curves", *J. Low Freq. Noise Vib.* **2**, 20-28, (1983)

¹⁹ Broner, N. "A simple outdoor criterion for assessment of low frequency noise emission" Vol.39 *Acoustics Australia* April (2011)No.1, p. 11
November 2016

Our concern is that even though a “stepped” approach may be the better approach for modifying A-weighted noise, the “stepped” approach may not identify a LFN problem every time.

LFRN recommendation 11

The LFRN therefore recommends that if a new criteria (using one of the “stepped” approaches suggested in the ING) is implemented for applying a modifying factor, then it does so in conjunction with using a C-A differential of 20 dB, i.e. once a threshold is reached with either method then the one modifying factor will apply.

The LFRN further asserts that in future any modification formula must be based on evidence gained in real-world conditions for this state. The present system is not, although as discussed below, its origins are poorly understood at best, even by leading policy makers in NSW.

5.3 “Annoyance” is incorrect measure of harm

Describing noise pollution affectation by way of “annoyance” (“Adjustments for annoying noise characteristics” ING, p.54) has the effect of trivialising the extent of harm and disturbance caused by the sounds of mining stationery and mobile plant operating in a rural environment (or small rural town) with no other industry other than agriculture.

Broner writes:

“It has been known for many decades that gas turbines,boilers, forced draft fans and other sources can produce low frequency noise which can cause feelings of *annoyance* due to *nausea, headache* and uneasiness and vibration induced rattle.”²⁰ [Emphasis added]

Yet, nausea and headache are not mere “annoyances” but medical conditions. Also there is copious evidence of the links between LFN and cardiovascular problems and hormonal effects (especially cortisol production).²¹

In Murphy and King, *Environmental Noise Pollution: Noise Mapping, Public Health and Policy* the authors observe:

“ Environmental noise has traditionally been dismissed as an inevitable fact of life and has not been targeted and controlled to the same extent as other health risks. A growing body of research linking noise to adverse health effects coupled with proactive legislation primarily in the EU, is now driving change. Environmental noise has often been referred to as the ‘forgotten pollutant’ but is now recognised as an environmental and public health issue which needs to be addressed in modern society. *For some people, noise is nothing more than a minor inconvenience, but for others noise exposure can lead to negative health effects*

²⁰ Broner,N. *Acoustics Australia* Vol.39 April(2011) No.1 p.7,at 11

²¹ LFRN does not feel it is up to us to prepare detailed literature review of this subject, as there is a great deal already in the public domain.

varying from annoyance and sleep deprivation to more serious issues such as hearing impairment and cardiovascular diseases."²² [Emphasis added]

The World Health Organization recognises LFN as an environmental problem. Its publication on Community Noise²³ makes a number of references to low frequency noise, some of which are as follows

"It should be noted that low frequency noise, for example, from ventilation systems can disturb rest and sleep even at low sound levels"

"For noise with a large proportion of low frequency sounds a still lower guideline (than 30dBA) is recommended"

"When prominent low frequency components are present, noise measures based on A-weighting are inappropriate"

"Since A-weighting underestimates the sound pressure level of noise with low frequency components, a better assessment of health effects would be to use C-weighting"

"It should be noted that a large proportion of low frequency components in a noise may increase considerably the adverse effects on health"

"The evidence on low frequency noise is sufficiently strong to warrant immediate concern"

Concluding, therefore, ample evidence exists that although the measure of harm can in some cases include "annoyance" LFN has serious medical implications for some.

5.4 "Attenuation" of A vs C-weighted noise not validated

The Draft Industrial Noise Guideline Technical Background Paper states:

*"[T]he 'C minus A' differential will naturally increase as you move away from a noise source due to higher attenuation rates of higher frequencies versus lower frequencies. This can lead to a perverse outcome where a low frequency modification may not apply near to a noise source, but will apply at more removed distances..."*²⁴

This assumption is repeated elsewhere, eg by Broner:

*"At larger distances from many industrial plants, the noise character will be that of LFN due to the relatively large attenuation of high frequency energy as compared to LFN".*²⁵

J. Parnell, Department of Planning and Environment noise specialist also states:

*"[A]ir absorption, topography and intervening ground cover can attenuate some frequencies more than others... particularly over long distances."*²⁶

²² Murphy, E and King, E (2014) *Environmental Noise Pollution: Noise Mapping, Public Health and Policy* (Elsevier) p.xi

²³ Berglund, B Lindvall, T Schwela, D and Goh, K-T (2000) *Guidelines for Community Noise* (World Health Organisation)

²⁴ Draft Industrial Noise Guideline technical background paper p.15

²⁵ Broner, N. *Acoustics Australia* Vol.39 April(2011) No.1 p.7, at 8

²⁶ Affidavit of Jeffrey Parnell, 7 September 2012 *Bulga Milbrodale Progress Association v Minister for Planning and Infrastructure and Warkworth Mining Ltd (ACN 001 385 842)* par. 47
November 2016

Indeed yes, there is an International Standard which informs this specific subject: ISO 9613-2 (1993) *Acoustics - Attenuation of sound during propagation outdoors* which warrants mention. Part 1 - "Calculation of the absorption of sound by the atmosphere", provides guidance on "the general method of calculation":

"7.3 Ground Effects (Agr)

7.3.1 General method of calculation

3 distinct regions for ground attenuation

(a) source region

(b) receiver region

(c) middle region"

According to this scheme, attenuation does not increase with the size of the middle region but is mostly dependent on properties of source and receiver regions.

Over a 12 km distance, ie the distance from the mine boundary to the furthest monitoring location, the source, receiver and middle regions need to be identified. Then the characteristics of the terrain need to be described. For example, under ISO 9613-2 *Annex A (Informative) Attenuation of sound during propagation through foliage*:

"A1. Foliage (A_{fol})

The foliage of trees and shrubs provides a small amount of attenuation, but only if it is sufficiently dense to completely block the view along the propagation path, i.e. when it is impossible to see a short distance through the foliage."

The main argument that seems to be given for replacing the C-A method with another method, is that the C-A method does not take into account that A-weighted noise attenuates at a different rate to C-weighted noise. However a shortcoming of this argument is that it assumes a greater degree of attenuation of A-weighted noise levels than takes place in reality. This attenuation may apply to shorter distances, or where there is dense vegetation instead of open fields, but with our noise surveys, no difference in attenuation has ever been evident within the range of 4.5 to 12km from the source.

The Leard Forest Research Node has studied the C-A method in the greenfield coal mine impacted locality of Maules Creek, NorthWest NSW. Our results are summarised below in the Case Study: Attenuation of noise between 4km and 12km distance of Maules Creek coal mine.²⁷

Case Study: Attenuation of noise between 4km and 12km distance of Maules Creek coal mine

Over June/July 2016, we conducted a noise study starting at 4.5km distance from the Maules Creek coal mine, with the furthest point being 12km from the mine. 15-minute averaged noise readings were conducted using a SVAN 971 Class 1 instrument (with wind filter) and with a floor of 20dB, measuring A- and C-weighted noise.

In the map below, Maules Creek Coal mine is located at CLO375, which is the mine lease.

Locations 5, 10, 13 and 15 are situated at Harparary Rd, the supposed 35dBA LAeq,15min contour (whose validity is contested by LFRN) which relevantly bears no relationship to

²⁷ Leard Forest Research Node, Maules Creek NSW, July 2016
November 2016

any topographical feature which might justify it being the cut-off of 35dBA LAeq,15min average noise readings. This road is about 6km from the mine boundary and around the furthest extent that the Department of Planning and Environment envisages there to be a noise exceedance, based on the Maules Creek noise impact modelling.

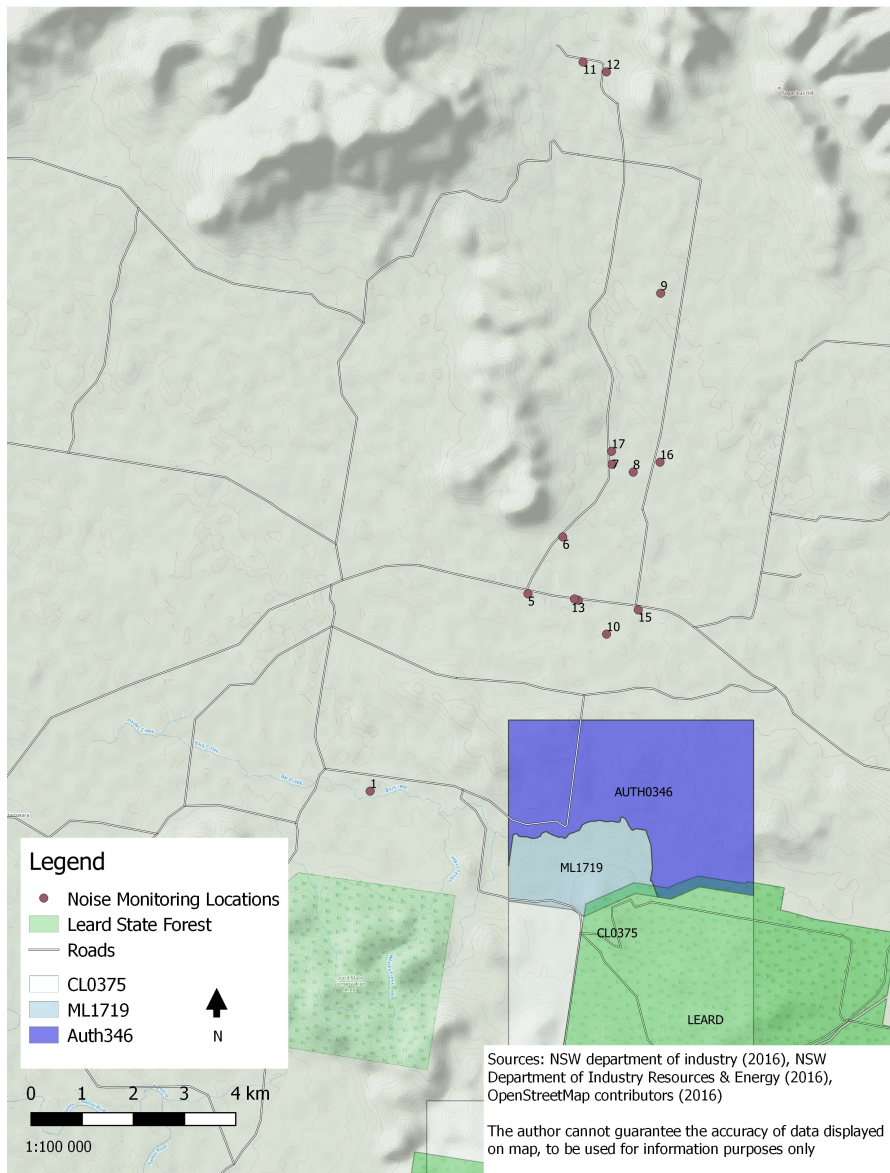
We should point out that the mine is expected to encroach further to the north over exploration area A346, as Whitehaven Coal has advised the market that it has revised its reserves following exploration of this area.

From 4.5 to 12km distance from the mine is a gently rising expanse of cropland and pasture, with some wooded patches and a creek line.

Line of sight vision of the mine is available from all monitoring locations, i.e. there is insufficient vegetation to obscure the mine and accordingly interfere with the propagation of noise.

MAP SHOWING MONITORING LOCATIONS AND DISTANCE FROM MAULES CREEK MINE

Noise Monitoring Locations



During this survey over 100 readings were taken. Many had to be disregarded due to extraneous noise during the 15 minute measuring period, but on 26 occasions the noise emanating from the Maules Creek coal mine registered as a breach (> 35dBA LAeq,15min d) under the current guidelines. We used these 26 occurrences to test the theory that the attenuation of A-weighted noise with distance from its source is greater than the attenuation of C-weighted noise, as we could be certain the noise levels being measured were being generated solely from the mine and not from closer sources. We plotted LAeq15 – LCeq15 with distance from the mine (km) to produce the following graph.

Figure: Distance from mine noise attenuation in Maules Creek

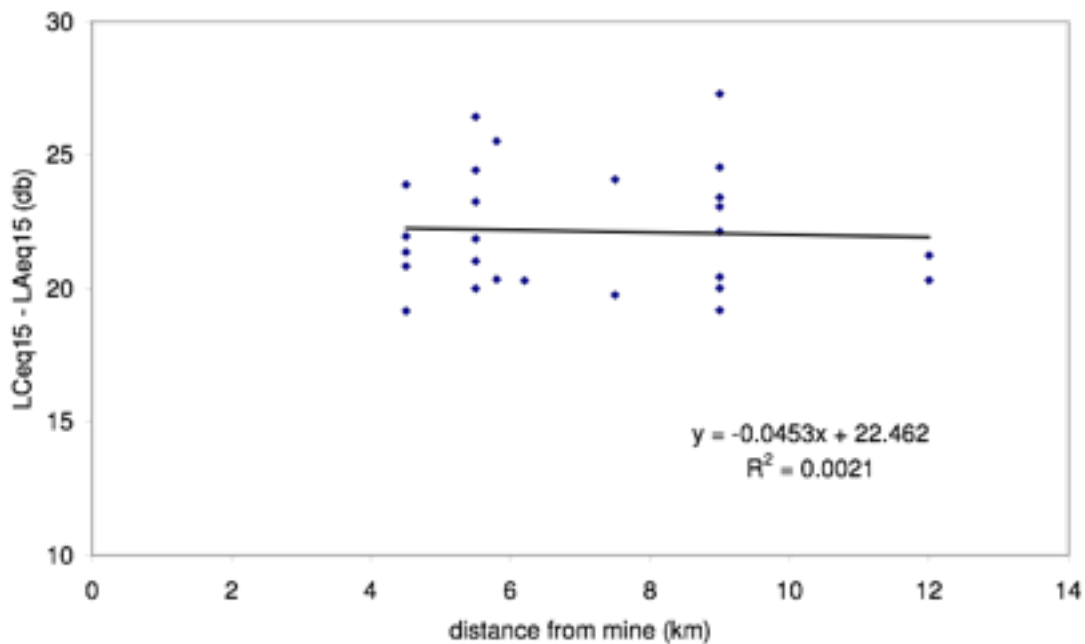


Table: Average C – A weighted noise levels for each location

| | | | | | | |
|-------------------------|------|------|------|------|------|------|
| distance from mine (km) | 4.5 | 5.5 | 5.8 | 7.5 | 9 | 12 |
| LCeq15 - LAeq15 (mean) | 21.4 | 22.8 | 22.9 | 21.9 | 22.5 | 20.8 |

Conclusions

From our observations and the R^2 value, these are our conclusions:

1. The difference between C- and A-weighted 15 minute readings rarely dropped below 20dB for any individual reading, and on average the C - A weighted levels for each location was always greater than 20 dB (refer above table).
2. As to the relative attenuation of C- and -weighted noise levels, the difference between C- and A-weighted 15 minute averages remained constant between 4.5km and 12km distance from the Maules Creek coal mine heading north. Therefore A-weighted noise was not attenuating at a different rate to C-weighted noise.

3. The R^2 value on the plot is extremely low and indicates that there is no relationship between C and A weighted noise attenuation and distance.
4. The reason given in the Draft Industrial Noise Guideline Technical Background Paper that ‘the C minus A differential will naturally increase as you move away from a noise source’ is not justified.

LFRN recommendation 12

New South Wales needs to develop a new noise metric for evaluating the impacts of LFN that is more specific to NSW communities and more specific to mining activities. However until then, the C minus A criteria should be maintained as the reasons for removing this criteria have not been adequately justified.

6. “Simplified Broner method” doesn't reliably predict LFN impacts

In 2010 the NSW Department of Planning and Environment (DPE) engaged acoustic expert Dr Broner to advise on the methods for determining modifying factors for LFN. However, Dr Broner was engaged “as a result of concerns about LFN impacts from gas fired power stations”²⁸, not coal mines.

Despite this the Department has expanded Dr Broner’s method to mine regulation without justification.

The Department refers to his 2011 technical paper “A simple outdoor criterion for Assessment of Low Frequency Noise Emission”²⁹ in its assessment approach for LFN³⁰ and is believed to have guided planning conditions for some years now.

The NSW EPA retains the INP for regulation of the licence conditions and is considering replacing the current C-A method with the DEFRA method.

This seems like a dysfunctional system, to have the planning agency use one method and the pollution watchdog use another to calculate the nuisance value of LFN and ascertain how much of a modification to the A-weighted 15 minute average it warrants.

One assumes that the Broner method was used in determining the project specific noise conditions for the Maules Creek coal mine. Thus we can see the seeds sewn for the

²⁸ Affidavit of Jeffrey Parnell, 7 September 2012 *Bulga Milbrodale Progress Association v Minister for Planning and Infrastructure and Warkworth Mining Ltd (ACN 001 385 842)* par. 49

²⁹ Broner, N. “A simple outdoor criterion for assessment of low frequency noise emission” Vol.39 *Acoustics Australia* April (2011)No.1

³⁰ Letter from NSW Minerals Council to NSW EPA Noise Policy Section, 13 November 2015 “NSWMC submission: Draft Industrial Noise Guideline”, p.1
November 2016

problems currently being experienced whereby the impacts of noise were dramatically understated³¹.

According to the Draft Industrial Noise Guideline technical background paper:

“In 2010 the NSW Department of Planning and Infrastructure recommended an alternative approach based on work by Dr Norm Broner (SKM)¹, a world recognised leader in LFN assessment. The criteria recommended by Broner are based on overall C-weighted levels: L_{Ceq} 65 dB daytime and L_{Ceq} 60 dB night-time. The recommended criteria *relied largely* on the work by Hessler 2004, which relates to emissions from gas turbines, which characteristically have significant emissions in the lower end of the low frequency range; i.e. nominally dominant low frequency energy from 16 Hz to 63 Hz.”³² [Emphasis added]

The authors admit Broner’s criteria “relied largely” on gas turbine noise emissions but have failed to concede, however, that even the author Hessler states in the abstract of the publication: “This paper proposes a ‘C’ weighted overall sound level criterion. The proposed criterion *should be applicable to most industrial sources of steady low-frequency noise in addition to combustion turbines.*”³³ [Emphasis added] Open cut coal mines have many relevantly different characteristics than the industrial noise sources studied by Hessler.

The Department appears to have accepted the Broner method without considering adequately, if at all, a number of key distinctions between the Hassler research and the conditions under which Broner advocates applying the ‘C’ weighted overall sound level criterion such as:

1. Open-cycle combustion turbine plants drive generators for peak power generation, and can operate 24/7 in very limited circumstances: “Typically the units may operate daily during [very hot summer months and/or very cold winter months], starting in early afternoon and shutting down by midnight.”³⁴ Hessler adds: “there is also some greater tolerance of excessive low-frequency noise from open-cycle peaking plans that essentially operate only during very hot or very cold periods, shut down at night time, and do not operate for extended periods of the year.”

Why, when NSW open cut coal mines are granted approval to operate 24/7 continuously throughout the year, would the NSW Government consider Hessler’s criteria suited at all for coal mining projects? This question needs to be addressed.

2. The author Hessler states (p.180): “It is believed that the proposed limits would also be valid for other steady and tonal sources of low-frequency noise, such as compressor stations, wind turbines, diesel generators, and others. *The criteria are not intended for impulsive sources of infrasound.*” [Emphasis added]

³¹ NSW EPA identified 100 noise exceedances at one affected property “Eilerslie” in 2015. Also the Leard Forest Research Node published its *Maules Creek Community Noise Pilot Study*, August 2015 which stated that 25% of all noise logs conducted during the pilot beyond the 35dB contour (using only a Class II instrument, and not applying any C-weighted modifications) exceeded the 35 dB noise limit.

³²Draft Industrial Noise Guideline technical background paper p.15

³³ Hessler, G. “Proposed criteria in residential communities for low-frequency noise emissions from industrial sources” (2004) Noise Control 52(4) 179

³⁴ Hessler, G. *ibid* fn.28, p.180

We have to ask, if the author Hessler himself excluded impulsive sources and did not include open cut mines, nor indeed any mines, how can the Department justify applying Broner's C-weighted overall sound level criterion. The noise problems of open cut mines include many impulsive aspects.

3. Hessler's research which was the foundation of the Broner method, relied on testing the impacts of gas turbines at residential receivers. It is immensely important in any discussion of the relative differences in attenuation of A-weighted and C-weighted noise, that the only one of the test sites which was rural is near a major roadway and the two closest residences are less than 120m from the 20 MW combustion turbine.

Other test sites were 400-900m from suburban residential areas with ambient noise character including local traffic and other low-level industrial sources.

These distances and circumstances bear no relation to the real world situation in rural New South Wales where any residences would be unlikely to be this close and the affectation extends close to 20km distance depending on weather conditions. Severe affectation is experienced at 8 to 10km distance.³⁵

In other instances, Hessler also used test sites in very rural, quiet areas with no environmental noise sources but, again, the test sites were in the order of 800m away from the source. Finally, a further test site located at approximately 800m was only tested on one sunny afternoon when sound propagation conditions over the long path were not favourable.

Given that the key premise for abandoning the C-A method is the difference in attenuation of A-weighted and C-weighted noise over distances, these facts about the basis of Broner's method should have been considered in detail in the ING technical background paper. Again, we seek specific response on this point.

In the field studies conducted by LFRN, C-weighted 15 minute averages rarely reached 60dBC L_{Ceq,15min} or over, even in circumstances where the level of disturbance from LFN was described by operators and community members as very high. This would never trigger Broner's penalty as he has recommended 60dBC threshold for any application of the 5dB modification. LFRN found that C-weighted averages over 50dBC were extremely common, even when A-weighted averages are well below the 35dB intrusive noise limit prescribed by the Maules Creek mine conditions. In such circumstances, disturbance from LFN itself was the problem, irrespective of the A-weighted noise levels.

In other words the Broner method doesn't bear scrutiny in the real world environment of rural coal mine affected communities. It seems likely that this would be the same in other rural areas.

Broner makes the statement that, "Based on empirical and laboratory studies, it can be shown that the primary effect due to LFN appears to be annoyance."³⁶ Once again we

³⁵ By "severe affectation" the authors refer to sleep disturbance, and residents being compelled to take expensive remedial measures to create barriers around their homes.

³⁶ Broner, N *ibid* fn.22, p.10
November 2016

reiterate that “annoyance” is not an appropriate measure to use in planning LFN policy, being a “mood” which is manageable as opposed to a physical condition that is not.

Broner’s “simplified” method must be avoided. It undermines evidence-based decision making and is causing uncertainty and chaos in mine regulation.

7. Proposal 5 - removal of subjective terms

The ING proposes (at p. 14) that “subjective terms such as sustained non-compliance” be removed from the guideline. At first blush, we welcome the certainty that such a move may provide, however it is unlikely that this guideline will provide certainty. It seems that the downgrading of the former policy to guideline does precisely the opposite.

Substituting the subjective “sustained non-compliance” with a guide, being that the non-compliance must occur for greater than 10% of the assessment period, is unnecessarily formulaic and will hamstring the EPA even more than it is now.

Also, we think that it is unreasonable to round *all* noise levels to the nearest integer number before comparing to a noise limit, although in some cases this may be acceptable.

8. NSW regulators must forge original regulation for Australia’s unique conditions

8.1 Why NSW should not be deriving its noise policy and guidelines from Europe

NSW is home to 56 coal mines including some of the largest open-cut coal mines in the world. Production from these mines varies from around 2 MTPA³⁷ up to 30 MTPA. In 2012-13, NSW produced 196 MT of coal, 136 MT of which was exported, accounting for 31% of all merchandise leaving NSW. During this period Australia exported 335 MT of coal, which is 30% of the world’s exports.³⁸

Despite this dubious pre-eminence, NSW is not similarly a leader in the regulation of the noise from the huge open-cuts, preferring instead to derive its evolving regulation from mainly European experience, involving very little mining, and where mentioned referred to as “quarries” as opposed to today’s “mega coal mines” in agricultural regions.

³⁷ MTPA stands for “million tonnes per annum”

³⁸Parnell, J“ The generation and propagation of noise from large coal mines, and how it is managed in NSW” *Acoustics 2015 Hunter Valley Conference*, p.1 citing the following:
NSW Minerals Council. Accessed 20/6/15 <http://www.nswmining.com.au/industry/fast-facts> and Minerals Council of Australia. Accessed 20/6/15 <http://www.minerals.org.au/>

The one aspect of European regulation which we agree with is the calculation of noise affectation inside residences, not outside.

8.2 Minerals Council preference for BS 4142:2004 rejected

The ING supports the use of ISO 1996-1:2003 “Acoustics – Description, measurement and assessment of environmental noise” but the NSW Minerals Council is lobbying for adoption of the newer BS 4142:2014 “Methods for rating and assessing industrial and commercial sound”, a British standard.

However, BS 4142:2014 explicitly states: “Not applicable *when background and rating very low i.e. 25dB and 30dB* (reduction of 5dB on previous guidance)” [Emphasis added]

The industry body is seeking to persuade the Government of the merits of BS 4142:2014, at a time when true background noise is as low as 20 dB and sometimes lower, during night time. It is inappropriate.

8.3 A new form of metric is called for to replace C-A method, but not DEFRA Third Octave analysis

We have referred above to the failings of the “simplified Broner” LFN modifying factor method. However, this is not to say that the proposed alternative of Third Octave analysis is suitable for regulation purposes, whether for planning or compliance purposes.

Hessler lists some of the difficulties of using Third Octave band spectra for regulation purposes³⁹. The following reasons have merit in our opinion:

- one third octave analysis requires instrumentation and expertise which is not readily available to measure frequencies of 10, 12.5, 16 and 20Hz, where open cut coal mines produce large amounts of sound power, let alone any lower frequencies.
- low frequency tones may fall right on a band frequency range limit. For example, if this occurs at 11 Hz, which is the upper and lower limit of the 10 and 12.5 Hz one third octave bands, this complicates the approach.
- there may be troublesome noise lower than 10 Hz and this could be a problem using the C weighted network with an undefined response below 10Hz

As a world leader in coal mining and exportation, the state of New South Wales has a duty to develop policy that is suited for the conditions of this country, this state, and not to apply in an irresponsible manner systems of noise analysis that have been developed in other countries, for wildly dissimilar conditions.

Just as the currently used filters were devised historically to address specific industrial needs, we argue that a new form of metric is called for that adequately takes into account the specific features of the new wave of greenfield coalmines that is proposed by the New South Wales government under its land use strategies.

³⁹ Hessler, G. *ibid* fn.22, p.184
November 2016

For example, we know that the A-filter was devised for the purposes of administering occupational health and safety regulation for the purposes of human hearing safety. This is why the dBA frequency response is dismissive at the lower end of the frequency scale, because at the time of its inception there was little or no recognition of low-frequency noise and accordingly no regulation of it. As the human ear is less sensitive to lower frequencies, the A-filter does not recognise other bodily sensations which are frequently reported from LFN such as chest tightening, increased blood pressure, headache, etc as well as cognitive affects such as memory impairment.⁴⁰ These bodily sensations are NOT mere “annoyance”, and should be accounted for by a metric that recognises them as physical reactions though maybe not hearing.

We understand, furthermore, that the C-filter was developed to assist in assessing the growing noise impacts of aviation. Other filters such as B and D-frequency have evolved and subsequently fallen into disuse, and other industries also have specific filters that accommodate their specific circumstances.

We believe that if NSW wants to continue approving open cut coal mines in rural areas, it has a responsibility to dedicate a more evidence-based approach to regulating these extreme sources of noise pollution.

Given the continuing problems associated with noise from these mines, and the seemingly intractable difficulties of regulating their noise emissions, it is time for the NSW Government to adopt a new approach, not trawl the international literature for some solution that could superficially appear to fit our circumstances, but on closer investigation does not.

Take-off and landing restrictions apply to airports, with restrictions as to night-time operations, and there would be a furore if this protection were abandoned. The need to preserve night-time sleep conditions is universally recognised, everywhere except in relation to 24/7 above-ground coal mining.

It is time for the NSW Government to awaken to the fact that night-time open cut coal mining cannot be managed with adequate noise emission controls. It is physically, realistically, not possible for the coal companies to attenuate the noise from their washeries, coal crushers and train loading facilities sufficiently to avoid impacts many kilometres beyond their operational footprint.

The new metric must be capable of reliably predicting (if used in setting planning conditions) and reflecting (if used in compliance) the severity of affectation by noise on receiver communities even if the noise is of a low frequency not previously considered problematic.

At the very least, the NSW Government must initiate a thorough field validation and coordinated population study to verify the ING sound pressure limits at the lower frequencies and provide evidence-based information about the severity of affectation and whether over 5% of the community is severely affected. We suggest using Maules Creek as a research subject for the above.

⁴⁰ Molesworth BR, Burgess M, Gunnell B. (2013) “Using the effect of alcohol as a comparison to illustrate the detrimental effects of noise on performance.” 15 *Noise & Health* 367-373

Some clues are provided in a published article by Broner and Leventhall⁴¹ and a 1997 International Standard⁴², referred to by Dr Broner at pp.10-11 of his article “A simple outdoor criterion for assessment of low frequency noise emission” (cited elsewhere in their submission):

“[A] difference of 20 dB [between C-A] can result in an unbalanced spectrum which could lead to LFN annoyance. Similarly, the Alberta [Noise Control Directive] requires the (C-A) difference to exceed 20 dB to determine the presence of a LFN problem.
...if it is necessary to utilise a (C-A) Sound Pressure Level difference at all, it is recommended that a (C-A) difference of at least 20 dB be used to indicate the presence of a potential LFN noise problem.”

As our case study above demonstrates, 20 dB difference between (C-A) is, in our opinion, a reliable predictor of LFN problems, and this may be a sufficient alteration to the INP to resolve any concerns by regulators and mining industry that a 15 dB difference is not truly reflective of LFN problems.

8.4 New Industrial Noise Policy must require dBZ (linear) reporting

Noise reporting in NSW is restricted to A- and C-frequency weightings, but omits the linear Z-weighting. Z-weighting is a flat, unweighted frequency response introduced in 2003 by the IEC Standard 61672:2003. This response replaces the older "Linear" or "Unweighted" responses as these did not define the frequency range over which the meter would be linear.

“Z-frequency-weighting (zero) is a ‘wider’ version of ‘C’ and is new in **IEC 61672**. As yet, it is not widely used for environmental monitoring but it will become more and more common for peak measurements. ‘Z’ was ‘invented’ by working group 4 of IEC TC1, as the limit values of ‘C’ (31,5Hz and 8000Hz) are too close together to capture all the spectrum of peak sound level.”⁴³

Given that Z-weighting filtering is possible with all professional-standard acoustic devices, it would not be onerous on a proponent or regulating authority. The Department of Planning and Environment should require reporting of this in parallel with A- and C-weighted noise.

It is essential for regulators to have access to the linear data, not just weighted data, as there are so many unknowns as to the relationship of A- and C-weighted noise in coal mine affected rural areas.

⁴¹ Broner, N. and Leventhall, H.G. “Low frequency noise annoyance assessment by low frequency noise rating (LFNR) curves”, *J. Low Freq. Noise Vib.* 2, 20-28, (1983)

⁴² DIN 45680:1997, “Measurement and evaluation of low frequency environmental noise, Foreign Standard” (1997)

⁴³ <http://www.cirrus-environmental.com/blog/noise-measurement-terms/>
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8.5 NSW Government must strive to achieve International Best Practice

By its reliance on the DEFRA LFN modelling method, the NSW Government may think it is adopting International Best Practice, but in reality, it is not. In fact, the Draft ING has omitted to consider that scientific interest has shifted towards soundscape research in which factors including geography, climate, human presence and buildings are considered.⁴⁴

These factors are all necessary for the reliable mapping of noise such that fair and appropriate planning decisions are made taking into account the well-being of communities and the value of quiet in remote areas.

International Best Practice deems it necessary to take into account accurate noise source identification⁴⁵. Unfortunately, despite attempts by the Maules Creek community to achieve some cooperation with industrial proponents i.e., mines in the area, to match noise impacts with on-site plant and operations, this has not been possible because (according to information provided by Departmental officers and confirmed by the proponents themselves) this information is “commercial in confidence”. We don't believe that kind of operational information is “commercial” as such, and believe it of importance in noise identification. Without effective noise identification, there will forever be endless speculation and uncertainty which is entirely preventable with the cooperation of all stakeholders.

Identification of “Quiet areas” using evidence-based techniques is the next important aspect of enquiry. Under the New South Wales system of regulation, however, true background noise levels in proposed development locations is explicitly ignored in favour of an “assumed” background level which in many cases is 5-10 dB higher than reality.

The literature concerning noise analysis over long distances is extensive, and it appears that a scant portion of it was considered by the Draft ING Committee. Consider, for example, the list of methods used in the assessment of noise contained in the Table below, which includes references.⁴⁶

We question why the Government's advisers, Global Acoustics (who also coincidentally are the current acoustic contractors for the Whitehaven Coal company at Maules Creek) and Wilkinson Murray, are unaware of the volumes of international research methods? Or is it perhaps that these International Best Practice methods have been recommended to the New South Wales Government and rejected?

The available methodologies include qualitative methods as well as quantitative methods such as questionnaires. No doubt, the Draft ING committee is correct when it points out that the task is not simple, but the fate of shrinking rural communities is at stake and linked with that is the agricultural productivity and resilience of our State economy.

⁴⁴ Votsi, N-E. Drakou, E. Mazaris, A. Kallimanis, A. and Pantis, J. “Distance-based assessment of open country Quiet Areas in Greece” *Landscape and Urban Planning* Vol 104 Issue 2 Feb 2002 279

⁴⁵ as above, p. 281

⁴⁶ as above, p. 281
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Table 1

Methods used in different studies regarding the assessment of environmental noise. There are two general categories: soundscape approaches based on GIS manipulations (S) and true qualitative methods to calculate noise propagation (N).

| Method | Implemented by | Description |
|---|--|--|
| Quantification and qualification assessment of soundscape (N) | (i) Pathak, Durcan, and Kunimatsu (1999) | Integrating and logging sound level meters with audio data recorders |
| | (ii) Varaldi, Duretto, and Giordanengo (2004) | |
| | (iii) Piccolo, Plutino, and Canistraro (2005) | |
| | (iv) Brambilla and Maffei (2006) | |
| | (v) European Commission Working Group for the Assessment of Exposure to Noise (2006) | |
| | (vi) Zannin, Ferreira, and Szenemeta (2006) | |
| | (vii) Matsinos et al. (2008) | |
| | (viii) Greencluster (2009) | |
| Questionnaires (S) | (i) Aarvang and Engdahl (2004) | Interviews about preferences on sound environment with response alternatives and image experiments on soundscape |
| | (ii) Botteidooren, de Coensel, and de Muir (2006) | |
| Engineering computation methods (N) | (iii) Klæboe et al. (2006) | Development and completion of EC measures concerning noise emitted by major sources (road/rail vehicles, infrastructure, aircraft, outdoor/industrial equipment, mobile machinery) and expansion of additional measures in short, medium and long term |
| | (iv) Nilsson and Berglund (2006) | |
| | (v) Pflüger, Newman, and Manning (2009) | |
| | (i) 2002/49/EC | |
| | (ii) 2003/613/EC | |
| Noise modeling (N) | (i) Price, Attenborough, and Heap (1988) | Commercially available microsimulation packages and GIS-based traffic microsimulations |
| | (ii) de Kluijver and Stoter (2003) | |
| Noise mapping (N) | (iii) de Coensel and Botteidooren (2006) | Assessment criteria for the selection of areas under study |
| | (i) Herzele and Wiedemann, 2003 | |
| | (ii) Waugh et al. (2003) | |
| | (iii) Papadimitriou et al. (2009) | |
| Distance-based criteria analysis (S) | (iv) Azeje et al. (2010) | Implementation of buffer zones (with various radiuses) around noise sources |
| | (i) Waugh et al. (2003) | |
| | (ii) Appelberg et al. (2004) | |
| | (ii) Karvinen and Savola (2004) | |
| | (iii) Jackson et al. (2008) | |

“The technical complexities of characterizing and assessing natural soundscapes, noise propagation and noise ‘influence’ could lead to several debates.”⁴⁷

As a sophisticated, first world country these are the discussions and debates that are necessary to create world-class regulation which enables industry to proceed whilst at the same time balancing the health and well-being of communities, not to mention the prosperity of a broad range of industries such as primary industry and tourism. Right now, air and noise pollution are two factors causing extreme distress to coal-effected rural communities and are being encouraged by ineffective regulation to continue unabated.⁴⁸

This downgrading of the INP to a “guideline” of dubious merit will make regulation of noise pollution even more difficult, and embed NSW securely in the class of “laggard” not “leader” in noise regulation.

The New South Wales Minerals Council as well as the Department of Planning and Environment regularly argue that the State’s regulation is stringent, whenever faced with evidence of pollution exceedances. We strongly disagree with the unsubstantiated claim that industrial noise regulation of coal mines is stringent.

⁴⁷ Votsi, N-E. Drakou, E. Mazaris, A. Kallimanis, A. and Pantis, J. “Distance-based assessment of open country Quiet Areas in Greece” *Landscape and Urban Planning* Vol 104 Issue 2 Feb 2002 p. 286

⁴⁸ For example, despite the INP being still current in NSW and a number of mine conditions explicitly requiring compliance with it, the Dept of Planning and Environment has been implicitly (and possibly explicitly) encouraging the Broner method to be seen as a viable alternative though it has never been officially mandated.

How do we know the State's regulation of industrial noise is not stringent?

We refer, for example, the extent of noise reporting that has been deemed necessary by the NSW Department of Planning and Environment in the conditions it imposes on coal mines. We use Maules Creek mine as an example, although we understand this inadequate level of noise monitoring is not unusual, and possibly less elsewhere. For a mine operating 24/7, in a calendar month the mine is required to conduct only 24 attended noise measurements, each of 15 minutes duration. This accounts for a mere 0.8% of the time of the mine operates. The duration of attended monitoring is laughable in terms of providing regulators with a reliable picture of compliance. Even more incredible is the fact that the company knows in advance when the compliance team is visiting the area, thus there is no element of surprise and the mine has time to adjust operations to avoid exceedances.⁴⁹

In the setting of noise limits, no attempt appears to have been made by the Department of Planning and Environment to set noise conditions according to the requirement that in rural areas, at least 95% of the community must be free from "high annoyance"⁵⁰, alternatively as stated by Parnell in 2015 the lower threshold of 90% "the Government's objectives for noise which are to be set, where possible, noise levels that will protect a nominated percentage (generally under 90%) of the population from being 'highly annoyed' for most of the time i.e. under 90%"⁵¹.

There has never been any validation of either the 90% or 95% criteria in the case study area of Maules Creek, and we hazard that this is the situation elsewhere in NSW.

These are but two examples, but there are plenty more, attesting to our view that industrial noise regulation of coal mines errs on the side of laxness, not stringency.

⁴⁹ We know from Global Acoustics personnel themselves, that they give up to one day's notice of an impending noise monitoring inspection. This is said to be for the personal safety of the acoustic staff who operate solo. They also alert mine security when they are knocking off duty. This prior notice is defeating effective regulation.

⁵⁰ Draft Industrial Noise Guideline technical background paper p.6

⁵¹ Parnell, J. *ibid* fn. 36, at p. 2
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9. Access to relevant and meaningful information

In 2009, the two main architects of NSW mining noise conditions, D. Kitto and J. Parnell⁵² announced to an international audience the following: “It is a long-term objective of DoP that real time monitoring results will be e-published.”⁵³

Furthermore, according to s.3 of the *Protection of the Environment Operations Act 1997 (NSW)* the objects of :

“3 Objects of Act

The objects of this Act are as follows:..

(c) to ensure that the community has access to relevant and meaningful information about pollution.”

Low frequency noise is one such form of pollution that calls for transparency and increased research.

In the years that have transpired since Messrs Kitto and Parnell addressed the international audience, the Maules Creek mine project approval was issued with conditions that are quite contrary to achieving the objective and indeed contrary to section 3 of the State’s key pollution legislation.

The situation in New South Wales today is that low-frequency noise data is unavailable to the public and there is nil scrutiny because quite simply the project approval conditions do not specify any requirement to disclose C-weighted 15 minute averages. In practice, it is impossible for the community to have any confidence that the modifying factors are being properly assessed.

This situation needs to completely change. In the words of the two key personnel in the Department, Messrs Kitto and Parnell:

“In terms of setting noise criteria for receivers located at significant distances from the source, it is preferable to set noise objectives based on the low frequency content as this is a variable that is least likely to be affected by topography and meteorological effects.”⁵⁴

It is conclusive that low frequency content of mine noise pollution is the essential component that must be reported on and published with full access to the community. The successor to the Industrial Noise Policy must enshrine this requirement.

It is further recommended that noise disturbance investigations should be mandated *inside* homes, not outside as stipulated by the INP. The Draft ING proposes to perpetuate the taking of readings outdoors and not within 3m of a structure to avoid reflected noise. It is not “meaningful and relevant” to measure noise only outside of a residence because

⁵² Respectively the Department’s Director of Mining, and Noise Specialist

⁵³ Parnell, J. Kitto, D. and Wasserman, J. "Assessing and regulating noise impacts from large open cut coal mines in Australia" Euronoise 2009 Conference, Oct 26-28, Edinburgh, Scotland
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⁵⁴ Parnell, J. Kitto, D. and Wasserman, J. Ibid Fn. 33 **6.SUMMARY**
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firstly it might be less loud than inside a structure, and also because one of the main complaints about LFN is sleep disturbance, obviously not something which happens out of doors.

Information about noise impacts is not “meaningful and relevant” unless it takes into account the amplification of noise disturbance which takes place inside some residential buildings, a fact which is well understood by regulators such as the NSW EPA. This subject is well-described in a case study of an investigation in 2014-2015. NSW EPA Bathurst Region became involved in the investigation after receiving complaints from residents in nearby Lithgow and the surrounding area, of LFN of a “generally indeterminate origin” and was seeking to establish if all of the complaints stemmed from a common, identifiable source”.⁵⁵ It was conclusively shown that not only could it be louder inside the residence, but there was considerable difference as to the noise affectation depending on the size and position of the particular room.

⁵⁵ “Noise Monitoring - Clarence and Springvale Collieries” Prepared for Centennial Coal Company Ltd, by The Acoustic Group. This document can be found at Select Committee on Wind Turbines (Australian Commonwealth), Submission 374 - Attachment 4 Appendix 11
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10. Conclusion

The Draft Industrial Noise Guideline, as a regulatory instrument, is inadequate in many ways as demonstrated in this submission. Among the shortcomings include its lack of evidence basis and excessive reliance on modelling derived from overseas data which bears no resemblance to many aspects of Australian industry, which in the case of our submission is referring specifically to open cut coal mining in rural i.e. green fields areas.

Our investigations into the Draft ING have prompted our group to examine the present system of noise regulation in more detail, and we believe it reflects very poorly to say the least on successive New South Wales Governments that the C-A methodology for calculating the modifying factor for low-frequency noise is derived (by the admission of the Department of Planning and Environment's own noise specialist) from studies of locomotive noise at 10m.

There appears to have been no attempt over the years, including now, to validate either the previous scheme nor the currently proposed DEFRA-derived scheme. This has left the community to undertake these activities, frequently experiencing stalking and harassment by security staff of mines. This is not fair.

Being a group of citizens, none of whom have specialist acoustic qualifications, we fully expect to receive criticism that we do not have the expertise to form the conclusions that we have. However, we don't believe that it is possible to get it more wrong than the New South Wales government has done over a period of many years. We have sought to provide substantiation for our conclusions and welcome any further engagement with the government to improve the standard of regulation of noise pollution in rural areas affected by open cut coal mines.

It must be emphasised that noise pollution goes far beyond mere "annoyance". 24/7 open cut coal mining is the source of growing problems and discontent arising from sleep disturbance, with hormonal and cardiovascular pathologies emerging as real public health problems.

Noise pollution is inextricably linked with the subject of land acquisition in areas surrounding coal mines. Entire rural communities are at risk, not necessarily directly from the health impacts of low-frequency noise, but by the planning errors taking place in the assessment of which property is, or is not, in an "affectation zone".

From our research in the affectation zone of the Leard Forest Mine Precinct (which we assess to be 20-25 km distance from centre of the precinct) the Department of Planning and Environment has made serious errors which are impacting on the lives and livelihood of affected community members. In our opinion, the Department has not fulfilled its duty of care because it has not properly assessed or taken into account the evidence and the science behind noise pollution particularly over long distances in a rural environment.

The Draft ING mentions the difficulties of conducting indoor noise assessments, but we believe there is no way to fulfil the statutory obligations, not to mention the duty of care, of the planning authority without doing these investigations.

Even when the government has sought the professional advice of highly respected consultancies such as Global Acoustics and Wilkinson Murray, or Professor Broner, unfortunately for some reason perhaps relating to the scope of the brief, neither the Draft

ING nor the Background Technical Paper cover some of the points that we have raised above.

We would like to know why that is the case.

To conclude, we do not believe that the Draft ING is in any way near ready to assume a role in industrial noise regulation. It requires considerably more real-world, field investigations in rural areas and must develop policy based on evidence. Guidelines will not suffice, unless the Government has an appetite for growing discontent and legal challenges.

Once again, we thank the NSW EPA for the opportunity to provide comment on the Draft ING and advise that the Leard Forest Research Node citizen science group remains willing to contribute in any way that we can to improving this vexed regulatory matter.