Communicating the noise message

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ABSTRACT

This paper revisits the key aspects of noise communication addressed by the authors in a previous paper and provides a summary of current practice and suggests strategies for improving the communication of information on noise so that it achieves the best outcomes. A discussion is presented on the limitations of noise assessments and public understanding as well as the consequences of good/bad noise communication. In addition, this paper also examines contemporary issues of changing expectations in communities and the dissemination of misinformation.

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I-INCE Classification of Subjects Number(s): 01.9, 06, 07, 66.2

1. INTRODUCTION

Generally the community or even environmental professionals when confronted with a noise problem will typically state "*I have a good understanding of all environmental issues like water, waste and air quality but noise is a black art which I do not understand…….*". This position can be further exacerbated by a plethora of available information ranging from the basic to the extremely complex. Additionally, there may be significant bodies of conflicting information.

The present paper expands on a previous paper by the authors (1) in discussing emerging issues, the valuable role noise communication plays in the development of community expectation and in the management of noise issues including the concept of adapting risk communication strategies to the area of noise management.

In Australia, a process similar to that which takes place in most developed countries is used to identify potential environmental impacts from proposed development projects. Compliance with environmental requirements is generally demonstrated through the preparation of an Environmental Impact Statement (EIS) or similar documentation.

The purpose of environmental impact assessment is to:

- assess the impacts of a proposed activity on the environment before making the decision on whether to carry it out; and
- develop and assess measures to avoid or minimise those impacts if it is decided to carry out the activity.

For most proposed activities, environmental impact assessment can be considered throughout the six stages of project development as summarised in the following:

1.1 Strategic

This establishes the need for the proposal. Defines the framework for the later stages including what will affect, and be affected by the proposal, along with an assessment of cumulative impacts.

1.2 Concept

Evaluates a number of preliminary studies (including environmental assessment) undertaken to

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identify the need for the development and select a preferred option.

1.3 Detailed Assessment

At this stage the preferred option is examined in detail along with the likely environmental impacts and proposed safeguards. To assist the process, specialist reports will be prepared where required and may include a detailed noise assessment.

1.4 Public Consultation

Environmental impact assessment documentation is placed on exhibition and both public and key agency comment is sought.

1.5 Approval

Having considered the process and documentation including submissions, project approval may be granted by the appropriate consent authority subject to any required conditions. These conditions may include a requirement to meet particular noise level objectives.

1.6 Implementation

This stage includes detailed design and establishes how the proposed work will be undertaken, including implementation of environmental safeguards. Development of any contract environmental specifications and environmental management systems will be completed at this stage. Audits and completion of noise monitoring requirements may be part of this process.

Typically for any new industrial plant or major infrastructure project such as a new road or railway, the public has a high level of concern regarding the impacts that will occur to the community and changes to the quality of life if the project is approved. Good, transparent noise communication can assist in alleviating community fears of new projects with the potential to generate high levels of noise.

Examples of such projects are:

- building a new chemical processing facility;
- major extensions to an existing airport;
- new freeway construction;
- new rail line; and
- mining in close proximity to residential areas.

2. Limitations of policies and guidelines

Policies and guidelines are often initially established to address particular issues or projects. Over time these documents and the practices they support often become outdated or are applied to situations they were not initially intended for. An example of this is the Australian and New Zealand Environment Council (2) blasting guidelines which were developed 25 years ago when a large open cut coal mine was 2 mtpa. Now a large mine is 20 – 30 mtpa, often over 5 km long and will have multiple pits operating simultaneously and employ vastly different blasting techniques, yet the guideline still limits these mines to one blast per day.

Importantly, the established practices, interpretations and intent of the guidance documents may be lost over time or when challenged in a legal arena. It is therefore essential that policies and guidelines are reviewed at regular intervals and certainly less than 10 years to ensure they remain contemporary, gaps in understanding are addressed, emerging issues are identified and supporting scientific studies undertaken where appropriate.

Some limitations of noise policies and guidelines may be:

- lack of, or changes in the science underpinning the documents;
- setting unrealistic noise objectives that are usually never enforced;
- inflexible for unforeseen circumstances;
- being prescriptive rather than performance based;
- comparison to noise criteria which has been set as a single A-weighted sound pressure level is sometimes problematic. An example here is the failure of a night–time LAeq metric to account for the high levels of annoyance and sleep disturbance that result from the use of excessively noisy heavy vehicle engine brakes;

- limited dose/response studies for any noise source apart from transportation that can be used to assist in setting noise limits; and
- inability to practically limit relative noise increases in areas of low background levels.

3. Limitations of noise assessments

Noise impact assessment will vary for specific projects, however generally it will consist of the following basic components:

- identification of closest receivers;
- determination of background noise levels;
- development of noise criteria;
- identification of noise sources and their sound power levels;
- prediction of noise levels at sensitive land uses;
- identification of noise criteria exceedances; and
- development of noise mitigation measures.

The general principle of noise assessments would appear to be the meeting of the noise criteria. If the noise criteria is met, most noise assessments will present a final conclusion that the 'project will not have any impact on the residential receivers'.

Some major limitations of noise analysis and assessment are:

- predictions of noise impacts are associated with significant uncertainty. Specifically, environmental noise levels can vary up to 20dB due to changes in meteorological conditions;
- equipment noise levels can vary substantially from manufacturer to manufacturer or even due to the level of maintenance; and
- meaningful comparisons of the assessed noise are often difficult as similar noises are not compared. Therefore, setting noise criteria becomes a complex debate. It is very difficult to find comprehensible ways of presenting complex technical material that is clouded by uncertainty and inherently difficult to understand.

Noise is a quantitative term and generally when we have a quantitative measure, it needs a comparison to place it in perspective. A numerical value of noise without benchmarks or points of reference is abstract and cannot be readily understood by the general public. Acoustic practitioners often find themselves reducing the complexity of a situation down to whether it is 'above or below the criteria', which tends to infer that the criteria itself communicates some degree of acceptability of the noise level, and that meeting this criteria will mean that there will be no health impacts, no annoyance and no change in the noise amenity of the location. Clearly this is not the case and it may well be that meeting absolute noise criteria is only part of the story.

For example DoTaRS (3) identified shortfalls in communicating aircraft noise impacts by a single complex noise descriptor where, *"experience in recent years has demonstrated that the aircraft noise problem is not confined to areas inside the noise contours. In fact most complaints about aircraft noise at Australian airports come from people who live outside the published ANEF noise contours …..90% of the complaints came from residents of areas outside the 20 ANEF contour"*. To improve communication of air traffic noise impacts, the N70 results are now also being reported which the community has indicated provides an additional and easier to understand measure of noise impact.

For more controversial projects the proponent often will be frustrated when the findings of specialist environmental studies such as a noise assessment study are ignored by the public and mistrust develops regarding the valuing of potential benefits that the development would bring as opposed to the public value of the loss of certain amenities in maintaining a life style. At such times, noise communication becomes an important tool in the overall noise management process.

4. Limitations of public understanding of noise

Proponents, noise specialists and the regulatory authorities are not the only groups that have a vested interest in the outcome of the environmental approval process. Project financiers, shareholders, insurers, general public, neighbouring population, special interest groups and employees may also

have an interest in the impacts that result from a development. Often the perception of noise from these parties varies.

It is generally accepted that the public mistrusts politicians, developers and paid experts. Whilst there is little that can be done to improve widely held views of politicians and developers, the acoustic community can take action to address its credibility.

Experts and specialists are often guilty of not acknowledging that the notion that noise as perceived by the scientific community is as rational as noise perceived by non-scientific public. This lack of understanding by the specialists of the public perception and the tendency to dismiss public understanding of technical issues has often resulted in adverse reaction and increased community opposition to a project. Often this public perception of specialists has been perpetuated by claims that meeting criteria is an acceptable outcome and will not result in an unacceptable impact.

It can never be expected that the general public will fully understand the scientific and engineering aspects of noise assessment and nor should they necessarily need to. Specialists will however, often forget who their target audience is, and overly complicate a simple message with technical jargon and use of difficult to understand concepts. It should always be remembered that the objective of a specialist noise report is to provide an unbiased and objective assessment of the noise impacts of a proposal. The report must be written so that it is readable by the general public yet provide enough technical detail to satisfy scientific interrogation. This is a view supported in a NSW Land and Environment Court decision (4), where Justice Cripps stated that an EIS "*should be written in understandable language and should contain material which would alert lay persons and specialists to problems inherent in the carrying out of the activity*".

People's perceptions of noise are often inconsistent and in many cases, inaccurate. This has led the expert labouring under the illusion that his/her perception of noise is the correct one, as it is based on scientific analysis, whereas that of the non-specialist is necessarily irrational. The public generally does not distinguish between the magnitude of a maximum noise level and its likelihood of occurrence. Merely mentioning possibility of a high noise level (no matter how rare) could increase their level of concern, whilst the community must also understand that 'inaudibility' is not a criterion for any project.

Much has been written on how organisations should communicate with the environment external to the corporation (public, stakeholders, government) (5). The importance of timing of release of information, crafting of the message, interactions with the audience etc. are stressed. The definition of noise communication implies that the process requires accepting and involving the public as a legitimate partner and involving the people in on-going noise decisions. This also means that the industry needs to make changes in response to outside concerns rather than merely listen to them.

5. Consequence of Good/Bad Noise Communication

Schomer (6) believes that whilst only scant information is available to quantify an adjustment for public perception, it is reasonable to assume a range from a 5dB penalty to a 5dB bonus depending on the quality of the relations between the noisemaker and the community (7). This range is within that which the authors have experienced in Australia, and may in-fact tend to be a conservative estimate of the benefits of good community relations. Anecdotally, values of greater than 5dB(A) have been suggested for road and mine projects, whilst communities have been known to tolerate 20+ dB(A) above recommended noise levels for short term construction projects with otherwise good environmental and community outcomes. Likewise, the authors are also aware of situations where the proponent has 'gotten off on the wrong foot' with the community and this has always resulted in a conflict situation that has been very difficult to resolve even when the impacts are minor and have been accepted without adverse comment at other similar projects.

6. Improving Noise Communication

Empowering the public is one of the most effective ways to address outrage factors. This can be facilitated by offering the public (through community or residents' groups) early and then continuing input into decision making. It is important to ensure that this does not become a mere presentation of information. This process should include real and thorough power sharing, not just public participation of the 'decide-announce-defend' variety.

Public involvement in decision making, from site selection to operational practice, is vital to ensure the legitimacy of the decision (even if ultimately the 'public' disagrees) as this process will promote

trust. From this, two broad themes are apparent: that communication effort should be more systematically oriented to specified audiences and; that openness is the surest policy.

The major features of effective noise communication are:

- effective communication;
- early and sustained interaction;
- accountability;
- independent review;
- scientific/ technical accuracy and completeness;
- evaluation and feedback;
- respect for audience and its concerns; and
- handling uncertainty such as weather conditions and variations in sound power levels.

Giving the community something it can relate to is a powerful way of conveying a transparent message. Graphics such as those in Figures 1 and 2 present easily understood relationships whereas stating simply that a noise source will meet ‘background + 5dB’ doesn’t tell the public anything about noise impacts or even if they will actually hear the noise source.

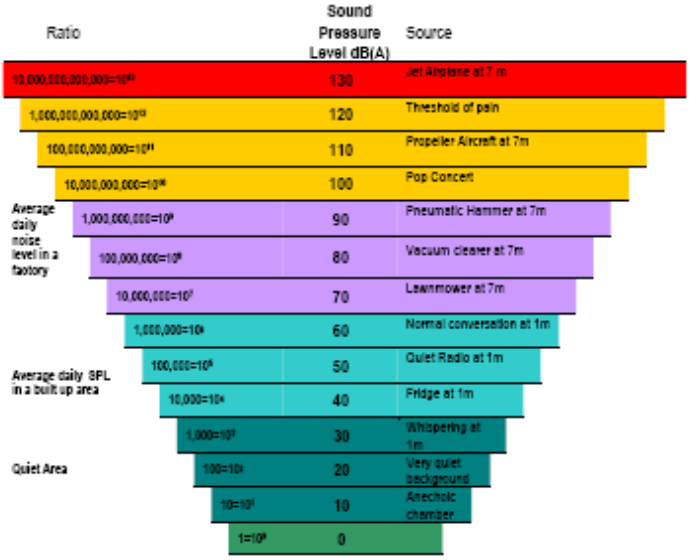

Figure 1. Typical Sound Pressure Levels and Ratio’s

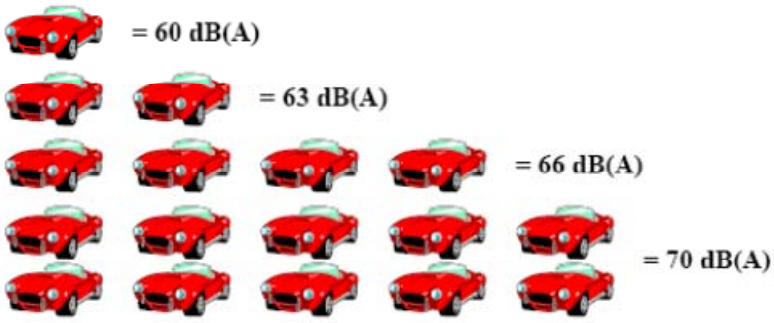

Figure 2. Addition of Noise Sources

More recently, large projects such as open cut mines and airports have been required to have real time noise monitoring systems to allow them to better manage to their noise limits. Use of directional noise monitoring equipment is often used successfully to isolate the source noise in otherwise difficult environments (8). Figure 3 presents a screen shot from the publically accessible website which shows

real time and historical noise levels and aircraft flights for the major Australian airports.

Such approaches are seen as giving the community confidence that best practice measures are being implemented to ensure difficult noise problems are being managed reasonably and feasibly.

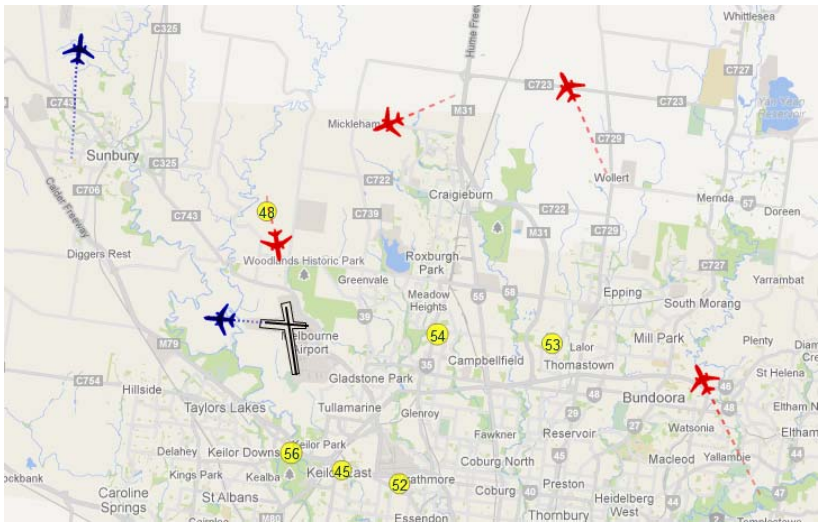

Figure 3. Screen shot of noise levels and aircraft flight paths near Melbourne. (9)

Intuitively it is expected that the opening of a new mine in an area with very low existing noise levels would cause far more change to the amenity of that location than would a mine that is opened next to an existing mining operation in a highly degraded noise catchment even though both proposals result in the same absolute noise levels.

To differentiate between the two proposals requires a more subjective measure which values the existing noise amenity of a locality upon which the noise source will impact. This measure does not need to be related directly to annoyance or health impacts which are best assessed by absolute criteria. It needs to measure a less tangible quality more related to visual amenity in the way it is to be assessed.

The need to develop a measure of the impact of a proposal on the noise amenity of a location is in response to community concern that use of absolute criteria does not consider situations where a project results in significant changes to the existing noise exposure in an area.

Table 1 suggests for any permitted operation the goal should be to minimise increases in sound pressure level above the ambient levels at noise sensitive receivers. For land uses zones with typical backgrounds such as the informative levels given in Australian Standard 1055.2 (10), increases in the ambient level ranging from 0-3dB should have no appreciable effect on receivers. Increases from 3 to 5dB may have potential for adverse noise impact only in cases where the most sensitive of receivers are present. Sound pressure level increases of more than 5dB would be quite noticeable and may be found to be intrusive. A SPL increase of 10dB would result in a perceived doubling of noise and would be very noticeable.

Table 1.Human Reaction to Increase in SPL

Increase in Sound Pressure Level, dB	**Human Reaction**
Under 5	Unnoticed to tolerable
5-10	Intrusive
10-15	Very noticeable
15-20	Objectionable
Over 20	Very objectionable to intolerable

Source: (11)

7. The challenge of changing expectations

An issue that proponents and regulators may need to manage in certain specific areas relates to changing expectations. As developed countries move from heavier industries and manufacturing towards service industries there is often a gentrification of previous industrial/port interfaces. This is particularly evident where these areas have desirable attributes such as water views. Such a change in land use and demographic is often accompanied by differing tolerance to noise.

Another cause of noise conflict often results from 'lifestyle retirees' who move to rural areas with a high expectation of pristine acoustic environments only to find that other legitimate activities such as wind farms or open cut coal mines currently operate, or are proposed in the vicinity. These high expectations are often at odds with other sections of the community who derive income from the area and see potential opportunities, often in otherwise depressed rural areas.

In considering these high expectations the Victorian Civil and Administrative Tribunal found in Perry v Hepburn Shire Council (12) for the approval of a wind farm that:

"The judgement held that an area's tranquillity is not something the Planning Scheme seeks to protect *per se*. Rather, the Scheme applies standards against which noise impacts in rural areas are assessed. The Tribunal and Panels have consistently concluded that although many people wish to maintain a peaceful setting, tranquillity is not the test upon which reasonable expectations in a Farming Zone or Rural Zone is based in terms of a Scheme assessment. The use of land for purposes such as farming can be noisy and the Scheme seeks to protect legitimate activities in rural areas from unreasonable amenity expectations of residential neighbours."

8. Managing outrage

Since noise communication usually involves multiple messages from many sources, and because these messages contain difficult and complex ideas, there is no simple way of making noise communication easy. Noise messages necessarily compress technical information which can lead to misunderstanding, confusion, and distrust.

Preparing noise messages can involve choosing between a message that is so extensive and complex that only experts can understand it, and a message that is more easily understood by non-experts but that is selective and thus subject to challenge as being inaccurate or manipulative.

A novel concept in noise communication, based on the perception of noise, could be that expert perception of noise and the layperson's perception of noise are at odds and the resultant reactions of these two individuals are diametrically opposed (13). Therefore, the total noise must be the sum of these two noise perceptions and not just one or the other, leading to the following equation:

Noise = Statistical Noise Level + Outrage

Statistical Noise Level is the product of noise magnitude and probability, while 'outrage' is a function of whether people feel the authorities can be trusted, whether control over noise management is shared with affected communities, etc. No matter how serious the noise is (in Statistical Noise Level terms), and no matter how much technical detail is used to explain it, this view maintains that the degree of 'outrage' is likely to determine much of the public's response to the noise.

Communication about noise then, is not merely an exercise in explaining data from formal noise assessments. Outrage factors must be recognised, understood and addressed to ensure they are not embellished by those with a vested interest.

9. Managing misinformation

A consequence of increasing availability of information on noise impacts is the corresponding growth what may be termed 'misinformation'. The subjective nature of noise impacts combined with a high range of variables such as low frequency noise, infrasound, tonality, impulsiveness, modulation etc, combined with significant gaps in definitive research allow noise impacts to be easily used to support a range of often fanciful claims. Professor Simon Chapman from the University of Sydney records such claims and ailments reported to be as a result of wind farm turbines, particularly those alleged to occur as a result of low frequency noise. Currently this list is at 236 (May 2014 (14, 15).

It is often said "Google knows everything!" and whilst that may be close to the truth, Google will also tell you what you want to hear. Searching the term 'wind farm syndrome' returns 370,000 hits, refining this by adding the term 'myth' returns 115,000 hits (Aug, 2014). This demonstrates how easy it is for individuals or groups with a pre-conceived opinion to find ample justification for maintaining that position.

To ensure a balanced noise message is disseminated, it must be underpinned by strong science including being:

- objective;
- supported by documents of a high scientific structure;
- reputable and well referenced; and
- preferably peer reviewed.

The authors are well aware of numerous articles published on weak or low quality pseudo-scientific web sites or at conferences which report findings of 'self-reported' surveys to support highly dubious claims. As an example, Chapman and St George (16) provide a detailed account of how a factoid of a dubious acoustic affliction became 'irrefutably demonstrated'.

The difficulty for regulators is that they tend to not wish to be in a position where they actively attempt to refute every random claim made in regards to noise impacts. This action will only usually be undertaken when there is a requirement to respond to specific claims. More often this task is left to consultants or academics. As reputations are often at stake, academics, the professional acoustical body or experts in the specific field are generally best placed to respond to such claims.

An example in which some opposition groups have been alleged to have used noise impacts to justify pre-disposed opposition to developments and increase outrage is further examined by Chapman et al (15). Again this has been observed to occur particularly in respect to low frequency noise or infrasound where the knowledge base is low and policy position is generally deficient. To legitimise their claims, occasionally these opposition groups attach to an 'acoustic expert' who whilst they may have some expertise in certain areas, are often well out of their depth in regards to assessment of large scale projects, or at worst they become an advocate for their client. In other cases, opposition groups have been criticised for 'cheery-picking' statements from researched journals. This has been well reported by internationally recognised low frequency noise expert Dr Geoff Leventhall to the Senate Committee on Wind Farms (17) on his personal experiences.

The spread of misinformation or 'scaremongering' has the potential to manifest itself as a legitimate problem as demonstrated by Crichton et al (18) who conducted a sham-controlled double-blind provocation study in which participants were exposed to periods of infrasound and sham infrasound. In this study, symptom expectations were created by viewing information readily available on the internet and it was found that reported symptoms aligned with that information, In conclusion Crichton et al found that results suggested psychological expectations could explain the link between wind turbine exposure and health complaints.

It is therefore critical that all parties in a debate on noise act ethically, impartially and maintain a high level of scientific credibility.

10. CONCLUSIONS

- Access to information is an important aspect in communicating the noise message, however it needs to be concise, understandable and have a strong scientific foundation.
- Noise perception by specialists and professionals can be completely different to that of an impacted community.
- While the specialist may tend to view the noise perception by the impacted community as non-rational, the proponents and decision makers cannot afford to ignore the reasonableness of public perception, which must be understood and addressed.
- Expectations or opposition to a project can result in noise impacts being held fully or in part responsible for a range of aliments and symptoms unlikely to have any relationship with noise.
- Whether real or perceived, concerns regarding noise impacts must be addressed promptly and transparently.
- Misinformation needs to be refuted quickly and decisively. Both proponents and opponents of projects have the same responsibility for any information they disseminate. It must be truthful, unembellished and free from any other unstated drivers.

Any opinions expressed in this paper are those of the authors and do not necessarily reflect those of the NSW State Government.

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