

NORTHERN TERRITORY NOISE MANAGEMENT FRAMEWORK GUIDELINE

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Table of Contents

1	Introduction.....	1
1.1	What is the purpose of this framework guideline?	1
1.2	Guideline objectives	2
1.3	Scope of guideline.....	2
1.4	Who is the guideline for?	3
1.5	Support	3
2	Regulatory framework for noise control in the NT	4
2.1	Role of the NT EPA.....	4
2.2	The <i>Waste Management and Pollution Control Act</i> (WMPC Act).....	4
2.2.1	General environmental duty under section 12 of the WMPC Act	5
2.2.2	Environmental harm and environmental nuisance offences under section 83 of the WMPC Act	5
2.2.3	How the recommended assigned noise levels in section 3 are used by the NT EPA	6
2.2.4	Environmental management instruments utilised to address noise issues.....	6
2.2.4.1	Environmental audit program issued under section 48 of the WMPC Act ...	6
2.2.4.2	Pollution abatement notice issued under section 77 of the WMPC Act.....	6
2.2.4.3	Authorised officer direction issued under section 72 of the Act.....	6
2.2.4.4	Other measures	6
2.2.5	Who has authority to utilise the environmental management instruments under the WMPC Act?	7
2.3	What about other legislation?	8
2.3.1	The <i>Environmental Assessment Act</i>	8
2.3.2	The NT <i>Planning Act</i> and NT Planning Scheme	8
2.3.3	Responsible authorities – quick reference guide	8
3	Recommended assigned noise levels for various types of noise in the Northern Territory – and how to assess for compliance.....	40
3.1	Neighbourhood Noise.....	40
3.1.1	Background.....	40
3.1.2	Recommended Prohibited Times	41
3.1.2.1	Assigned noise levels for fixed domestic equipment.....	42
3.1.2.2	What to do if you have a noisy air conditioner - a case study	43
3.1.2.3	Recommended assigned noise levels for non fixed machines and power tools	44
3.1.3	Methods used to assess neighbourhood noise.....	44
3.1.3.1	Audibility test applied to recommended prohibited times	44
3.1.3.2	The duration of noise test for vehicle and building intruder alarms – a special case	45
3.1.4	Assessment of offensive noise	45
3.1.4.1	Offensive noise test: the questions that are to be considered by authorised officers and other regulators in applying the offensive noise test	46
3.1.4.2	Measuring noise for comparison against the recommended assigned noise levels covered in this section (Tables 3.2 and 3.3).....	47
3.2	Commercial and Industrial Noise.....	48
3.2.1	Background.....	48

3.2.2	Types of noise sources covered in this section.....	49
3.2.3	Types of noise sources not covered	49
3.2.4	Recommended commercial and industrial project specific assigned noise levels	49
3.2.5	Determining the project specific assigned noise level	50
3.2.5.1	Component A: project intrusiveness noise level	51
3.2.5.2	Component B: amenity noise levels and project specific amenity noise levels	52
3.2.5.3	Residential receiver locations and the Northern Territory Planning Scheme Zones	56
3.2.6	Noise measurement (assessment) locations	57
3.2.7	Effects of changing land use	58
3.2.8	Industrial interface	58
3.2.9	Project-specific assigned noise levels	59
3.3	Construction Noise	61
3.3.1	Background	61
3.3.2	Recommended standard hours for construction work	61
3.3.3	Construction outside the recommended standard hours	62
3.3.4	Recommended Assigned Construction Noise Levels – Airborne Noise and Ground-borne Noise	62
3.3.4.1	Assigned construction noise levels for airborne noise at residential premises	63
3.3.4.2	Recommended assigned construction noise levels for airborne noise at other sensitive noise receptors (land uses)	64
3.3.4.3	Recommended assigned construction noise levels for airborne noise for commercial and industrial premises	65
3.3.4.4	Recommended assigned construction noise levels for ground-borne noise at residences	65
3.3.5	Methods used to assess construction noise for both airborne and ground-borne noise	65
3.3.5.1	Qualitative noise assessment – construction noise	66
3.3.5.2	Quantitative noise assessment – construction noise	68
3.3.6	Examples of feasible and reasonable practices applied on construction sites	69
3.3.7	Case studies	70
3.4	Entertainment Venue Noise.....	70
3.4.1	Background	70
3.4.2	Application of this section	71
3.4.3	Definition of indoor entertainment and outdoor entertainment venues	71
3.4.4	Other relevant terms used in this section.....	71
3.4.5	The ‘Agent of Change Principle’	72
3.4.5.1	How the “agent of change” principle is to be applied in the Northern Territory	73
3.4.6	Operating periods for indoor and outdoor entertainment venue noise	73
3.4.7	The recommended project specific assigned noise levels for indoor entertainment venue noise	73
3.4.8	The recommended project specific assigned noise levels for outdoor entertainment venue noise.....	74
3.4.9	Methods used to assess entertainment venue noise	75

3.4.9.1	Location of measurement point	75
3.4.9.2	Common measurement and analysis procedures	75
3.4.9.3	Assessment specific to indoor entertainment venues	75
3.4.10	Noise management for outdoor events – guidance to proponents on planning for outdoor events	76
3.5	Vibration and Blasting	79
3.5.1	Recommended assigned noise levels for vibration	79
3.5.2	Vibration measurement and prediction	80
3.5.3	Human comfort vibration	80
3.5.4	Mitigation of vibration impacts	80
3.5.5	Environmental impact assessment requirements for noise and vibration	80
4	Further Help	81
4.1	Northern Territory Contacts	81
4.2	Reference Material	81
4.2.1	Standards	81
4.2.2	Other useful references	82
5	Glossary of Terms and Abbreviations	84
	Guidance Document Number One	89
	Noise Management Tools: Using Non-Regulatory and Regulatory Measures To Deal With Noise	89
1	The spectrum of noise management options	89
1.1	Noise control at each stage of land use development and planning	90
1.1.1	Background	90
1.1.2	The three stages of development	90
1.1.2.1	The initial planning stage	91
1.1.2.2	The subdivision stage	91
1.1.2.3	The building design stage	91
1.1.3	Acoustic reports as a noise planning tool	92
1.2	Dealing with the community	93
1.2.1	Consultation	93
1.2.2	Communication between neighbours	93
1.2.2.1	Tips for talking to your neighbour about a neighbourhood noise problem	93
1.2.2.2	How to prevent neighbourhood noise problems	94
1.2.3	Education as part of the NT EPA's compliance approach	94
1.3	Contacting the Community Justice Centre	95
1.4	Other noise management options	96
1.4.1.1	Voluntary environmental audits	96
1.4.1.2	Environmental audits required by the NT EPA under the WMPC Act	96
1.4.2	Environmental management plans	96
1.4.3	Contract specifications	96
1.4.4	Working with other regulators	96
1.5	Noise management plans	96
1.6	Applying for a noise abatement order	98
1.7	Lodging a complaint with the NT EPA	98

1.7.1	NT EPA complaints management process	99
1.7.2	Keeping a noise log.....	100
1.7.3	Affected person in a sensitive noise receptor	100
1.7.4	What the NT EPA will take into account when investigating noise complaints.....	101
1.8	Guidance on managing existing noise problems	101
1.8.1	Mitigation measures – ways to reduce noise impacts	102
Appendix A: Noise Log.....		104
Guidance Document Number Two.....		106
The Science of Sound.....		106
1 Background.....		106
2 What is the difference between sound and noise?		106
2.1.1	Measuring noise.....	106
2.1.2	Some useful rules of thumb.....	107
2.1.3	Noise descriptors used in noise assessment.....	107
2.1.4	Frequency weightings relevant in the setting up of SLM	110
2.1.4.1	A- weighting	110
2.1.4.2	C-Weighting	110
2.1.4.3	Z-Weighting.....	111
2.1.4.4	Time weighting	111
2.1.4.5	Ambient noise level	111
2.1.4.6	Rating level	111
2.2	Assessing noise with Sound Level Meters (SLM)	112
2.2.1	Measuring equipment.....	113
2.2.1.1	Types of SLMs	113
2.2.2	Laboratory calibration and maintenance.....	114
2.2.3	Field calibration checks	114
2.2.4	General procedures.....	114
2.2.5	Noise assessment reports	115
2.2.6	Compliance justification.....	115
2.2.7	Commercial and industrial noise and the use of SLMs	116
Guidance Document Number Three		117
Health effects of noise.....		117
1 Background.....		117
1.1	Amenity/quality of life effects	117
1.1.1	Annoyance	117
1.1.2	Sleep disturbance	117
1.1.3	Health effects	121
1.1.3.1	Hypertension.....	121
1.1.3.2	Hearing loss.....	121
1.1.4	Mental health.....	121
1.1.5	Cardiovascular disease	121
1.1.6	Productivity and learning effects.....	122

1.1.6.1	Cognitive impairment in children	122
1.1.6.2	Productivity	122
1.1.7	Other noise effects	122
1.1.8	The Munich Airport study (Germany) – a case study on effects on noise exposure on children	122
1.1.9	Australian surveys of noise exposure	123

Table of Tables

Table 2.1	Northern Territory Responsible Authorities	10
Table 3.1	Recommended prohibited times for particular noise sources	41
Table 3.2	Recommended assigned noise levels for fixed domestic equipment when they are operated within the permissible time periods	43
Table 3.3	Recommended assigned noise levels for non-fixed machines and power tools	44
Table 3.4	Minimum assumed RBLs and project intrusiveness noise levels	52
Table 3.5	Recommended maximum assigned amenity noise levels	54
Table 3.6	Determining which of the residential receptor categories applies	56
Table 3.7	Recommended standard hours of work	62
Table 3.8	Recommended assigned construction noise levels for airborne noise at residential premises using both assessment methods	63
Table 3.9	Recommended assigned construction noise levels for airborne noise at sensitive noise receptors (other than residences) using the quantitative assessment method	64
Table 3.10	Recommended assigned noise levels for airborne noise at commercial and industrial premises	65
Table 3.11	Recommended assigned construction noise levels for ground-borne noise at residences	65
Table 3.12	Operating periods for indoor and outdoor entertainment venues	73
Table 3.13:	Recommended project specific assigned noise levels for indoor entertainment venues	74
Table 3.14	Recommended project specific assigned noise levels for outdoor entertainment venues	74
Table 3.15	Base noise limits for night period	76

Table of Figures

Figure 3.1 Determining the intrusiveness noise level	52
Figure 3.2 Determining the project specific assigned noise level	60
Figure 3.3 Determining the recommended project specific assigned noise levels and project specific effective noise levels for entertainment venue noise	78

1 Introduction

Noise pollution can be defined as unwanted noise that unreasonably intrudes on daily activities. In urban areas¹, noise pollution has many sources, most of which are associated with urban living: road, rail and air transport; industrial and commercial noise; construction noise and neighbourhood and recreational noise. The level of annoyance or discomfort caused by noise depends on the type, timing, duration and frequency of noise or if the disturbance is out of the ordinary. Noise pollution can have negative impacts on the quality of life and health, and needs to be addressed in planning and pollution control strategies.

The impact of noise on human health has emerged as an increasingly significant issue that justifies considerable management effort. The *Guidelines for Community Noise* (WHO 1999) and *The Health Effects of Environmental Noise – Other than Hearing Loss* (enHealth 2004) identify the significant health effects of exposure to environmental noise.

In the Northern Territory (NT), the NT Environment Protection Authority (NT EPA) is the main regulator that sets standards, assesses, manages and regulates noise issues and resolves complaints under the provisions of the *Waste Management and Pollution Control Act* (WMPC Act).

The NT EPA responds to a high number² of noise complaints from a variety of commercial, industrial, entertainment and domestic sources.

To address noise matter, the NT EPA utilises the WMPC Act, which is the key legislation for environmental protection in the NT. The WMPC Act grants the NT EPA broad powers to deal with unreasonable noise emissions and contaminants which cause environmental harm. The definition of “contaminants” also includes noise.

The specific provisions of the WMPC Act applicable to noise are covered in this guideline. It provides both technical and regulatory guidance on noise regulation in the NT for the broad range of noise sources encountered. It also covers a range of measures which are part of the noise management spectrum that can be employed to resolve noise complaints.

1.1 What is the purpose of this framework guideline?

The purpose of this framework guideline is to assist and provide guidance to the community and industry about the noise regulatory framework as it applies in the NT. It addresses the noise issues that the NT EPA and other NT noise regulators deal with on a day to day basis in a one stop shop basis so that the NT community is aware of its rights and responsibilities.

In summary it covers information and technical guidance on:

- The NT noise regulatory framework including the WMPC Act and appropriate regulatory agencies (section 2)
- Recommended assigned noise levels for various types of noise (section 3)

¹ i.e. defined as built up areas and characteristic of cities or towns and is distinct from the definition of rural

² About 20% of the total number of NT EPA pollution reports it receives are noise related. The trend over the last three years has been upwards.

- Further reference resources (section 4)
- Glossary of terms and abbreviations (section 5)
- *Guidance document number one* on noise management tools as part of the noise management spectrum
- *Guidance document number two* on the science of sound, and
- *Guidance document number three* on the health and amenity effects of noise.

1.2 Guideline objectives

The main objectives of this guideline are:

- to provide greater certainty for business and the community in understanding how noise is regulated in the NT
- to promote a clear understanding of ways to identify and minimise noise from the main noise sources in the NT and to provide advice and guidance on how noise regulatory requirements can be met in the NT
- to encourage certain activities to be undertaken at particular times by setting benchmark levels for the main areas of noise generation in the NT
- to establish a clear and consistent framework for assessing environmental noise impacts from industrial and commercial premises and industrial development proposals
- to provide information on regulatory responses consistent with the level of harm generated, and
- to provide guidance to NT regulatory agencies in addressing noise matters.

1.3 Scope of guideline

The guideline addresses noise from:

- neighbourhood noise i.e. people's activities in and around the home
- business activities, including the industrial and commercial sectors and government
- construction noise
- entertainment venue noise, and
- vibration and blasting.

In all of these areas, people's actions have a direct impact on environmental noise levels.

The guideline is not intended to apply to noise made by:

- Commonwealth jurisdiction aircraft within the meaning of the *Air Services Act 1995* (Commonwealth)
- a person using his or her body
- an animal in the ambient environment

- workplace noise (covered by NT Worksafe),
- noise caused by emergency vehicle sirens
- noise outside of the human audible range
- infrasound (Low Frequency Noise below 20 Hz)
- noise from a school, kindergarten, child care centre or place of worship
- ground-borne Low Frequency Noise associated with entertainment venues, and
- a motor vehicle being driven on the road.

Also, noise will not ordinarily be subject to any regulatory action if the noise is emitted in the course of:

- protecting life or property
- preventing, minimising or remedying another form of environmental harm or environmental nuisance, and
- conducting an activity for which an approval or licence granted under a law applicable in the Northern Territory is in force and that the approval or licence is being complied with.

1.4 Who is the guideline for?

The guideline is for:

- proponents of existing and proposed residential, industrial and commercial developments
- acoustic practitioners
- consultants
- consent/approval authorities
- land use planners
- members of the community
- regulators, and
- local government.

1.5 Support

If you would like more help in interpreting this guideline or want advice about its application you can call the NT EPA on (08) 8924 4218 or email pollution@nt.gov.au.

2 Regulatory framework for noise control in the NT

2.1 Role of the NT EPA

The NT EPA is the statutory body established under the *Northern Territory Environment Protection Authority Act* to:

- (a) promote ecologically sustainable development
- (b) protect the environment, having regard to the need to enable ecologically sustainable development
- (c) promote effective waste management and waste minimisation strategies, and
- (d) enhance community and business confidence in the environmental protection regime of the Territory.

The NT EPA is responsible for administering a number of Acts including the WMPC Act and associated Regulations.

The NT EPA's function is to manage a broad range of environmental issues including protection of air, water and soil, and the ecosystems they support. It is also primarily responsible for environmental noise management in the NT. The term "environmental noise", as used in this guideline, refers to noise from all sources, except noise at the industrial workplace (see Table 2.1 for the noise responsibilities of agencies in the NT).

The NT EPA's role in environmental noise management involves carrying out its functions under the WMPC Act and, in connection with that role, coordinating activities related to preventing and controlling noise. This includes development of policies, regulations and guidelines, issuing approvals, licences and notices and investigation and enforcement of noise related issues.

In relation to the regulation of noise, the NT EPA considers the following principles as relevant:

- that regulatory controls should enable economically desirable or socially acceptable activities to take place provided that all reasonable steps consistent with the expectations of the overall community will be taken to minimise noise from such activities
- that acoustic environmental values secured through noise standards should protect the health and wellbeing of the community and the individual, and
- that regulatory intervention to control noise from an activity is only warranted where that noise is having an adverse impact on an affected person (see Guidance Document Number One for an explanation of affected person).

2.2 The *Waste Management and Pollution Control Act* (WMPC Act)

The WMPC Act provides the main legal framework and basis for managing unacceptable, offensive noise in the NT. The WMPC Act contains obligations on all persons to prevent noise pollution, and includes general offences and regulatory tools that may be utilised to effect compliance. It also includes substantial penalties for environmental offences. This guideline provides direction on meeting these legislative requirements.

The following discussion covers the key sections of the WMPC Act which deal with noise matters.

2.2.1 General environmental duty under section 12 of the WMPC Act

The general environmental duty under section 12 of the WMPC Act states that:

a person who:

- (a) conducts an activity that causes or is likely to cause pollution resulting in environmental harm or that generates or is likely to generate waste; or*
- (b) performs an action that causes or is likely to cause pollution resulting in environmental harm or that generates or is likely to generate waste;*

must take all measures that are reasonable and practicable to:

- (c) prevent or minimise the pollution or environmental harm; and*
- (d) reduce the amount of the waste.*

Section 12 then sets out certain matters to which a person should have regard in determining which measures are reasonable and practicable to prevent or minimise the pollution or environmental harm and reduce the amount of waste.

The general environmental duty applies to all persons undertaking activities that cause or are likely to cause noise pollution resulting in environmental harm and/or environmental nuisance. The general environmental duty requires all persons undertaking such activities to take all measures that are reasonable and practicable to prevent environmental harm and/or environmental nuisance.

In terms of noise emissions, the NT EPA considers “reasonable and practicable” measures to be those that are generally consistent with guidance document number two of this guideline. See also section 5 for a definition of “feasible and reasonable measures”.

2.2.2 Environmental harm and environmental nuisance offences under section 83 of the WMPC Act

Section 83 of the WMPC Act provides for the general offences of environmental harm. Environmental harm is defined in the WMPC Act as “any harm to or adverse effect on the environment; or any potential harm (including the risk of harm and future harm) to or potential adverse effect on the environment, of any degree or duration and includes environmental nuisance”.

Under section 83(5) of the Act, it is an offence to cause “environmental nuisance”. The WMPC Act defines environmental nuisance as:

(a) an adverse effect on the amenity of an area that:

- i. is caused by **noise**, smoke, dust, fumes or odour; and*
- ii. unreasonably interferes with or is likely to unreasonably interfere with the enjoyment of the area by persons who occupy a place within the area or are otherwise lawfully in the area; or*

(b) an unsightly or offensive condition caused by contaminants or waste.

2.2.3 How the recommended assigned noise levels in section 3 are used by the NT EPA

The NT EPA will use the recommended assigned noise levels presented in section 3 of this guideline in determining whether a particular noise source has caused or is causing environmental harm and/or environmental nuisance and whether the general environmental duty has been complied with. Unless otherwise specified, an activity that emits noise from a premises will ordinarily be deemed to cause environmental harm/environmental nuisance if that noise exceeds this guideline's recommended assigned noise levels for that activity.

2.2.4 Environmental management instruments utilised to address noise issues

As stated above, the NT EPA can utilise a number of regulatory tools under the WMPC Act to ensure that noise does not impact neighbouring communities. Once the NT EPA forms a reasonable belief that a person has committed or may commit an offence against section 83 or has failed or may fail to comply with the general environmental duty in section 12 of the WMPC Act, the NT EPA will then determine the appropriate action to take to address the noise non-compliance.

The following are the key regulatory measures that may be utilised by the NT EPA to ensure compliance with the WMPC Act for noise pollution matters. One or more of these instruments can be utilised for the same noise matter.

2.2.4.1 Environmental audit program issued under section 48 of the WMPC Act

A notice to conduct an environmental audit program may be used by the NT EPA under section 48 of the WMPC Act, where the NT EPA is satisfied that noise is impacting sensitive noise receptors³. A notice to carry out an environmental audit may involve an assessment of the effectiveness of measures to prevent, reduce, control, rectify or clean up pollution or environmental harm resulting from pollution. This may also include an assessment of the extent to which compliance with the WMPC Act has been achieved.

2.2.4.2 Pollution abatement notice issued under section 77 of the WMPC Act

A pollution abatement notice (PAN) is an instrument issued by the NT EPA under section 77 of the WMPC Act, where the NT EPA believes on reasonable grounds that the person has committed or may commit an offence under section 83 (environmental harm offences), or has contravened or failed to comply with section 12 (general environmental duty), or is the owner or occupier of land that is polluted. Section 79 of the WMPC Act lists the requirements that can be included in a PAN to address noise matters.

2.2.4.3 Authorised officer direction issued under section 72 of the Act

An NT EPA authorised officer direction may be given under section 72 of the WMPC Act. Under this provision, an authorised officer may direct a person to undertake a number of actions, including but not limited to, preventing, reducing, controlling, rectifying or cleaning up pollution or environmental harm resulting from pollution.

2.2.4.4 Other measures

In addition to the above, authorised officers may utilise the following in relation to noise matters: formal warning letters; penalty infringement notices issued for non-compliance

³ See section 5 for definition of sensitive noise receptor.

with section 83(5) of the Act (environmental nuisance); and/or prosecution for offences under section 83.

2.2.5 Who has authority to utilise the environmental management instruments under the WMPC Act?

Authorised officers appointed by the NT EPA under section 70 of the WMPC Act have the power to take the range of actions referred to in section 2.2.4. Authorised officers can utilise a range of investigative powers to address noise matters including the following:

- (a) enter land, a vehicle or premises;
- (b) search land, a vehicle or premises and anything found there;
- (c) take photographs, including video recordings or make sketches or other records of land, a vehicle or premises or things on or in land, a vehicle or premises;
- (d) inspect and take copies of a document;
- (e) measure anything, or take samples of anything, on or in land, a vehicle or premises;
- (f) examine or test any equipment, machinery, vehicle and seize object;
- (g) open a package or carton on land, in or on a vehicle or in premises for the purpose of inspecting, or taking a sample of, the contents;
- (h) require a person to produce an environment protection approval, licence, environmental audit program, compliance plan, improvement plan or performance agreement, or a copy of such a document, for inspection;
- (j) require a person on land, in a vehicle or in premises to provide his or her name and address;
- (k) direct a person to prevent, reduce, control, rectify or clean up pollution or environmental harm resulting from pollution or to manage waste on or in land, a vehicle or premises by the method, and within the time, specified in the direction;
- (l) require a person to treat a contaminant or waste, or to take specified measures in relation to equipment, a vehicle or premises, by a specified method and within a specified time, so as to reduce environmental harm;
- (m) direct a person:
 - i. to remove a thing on or in land, a vehicle or premises; or
 - ii. to transport and hold a thing at a specified place, for appraisal, treatment, destruction or other action in accordance with, and within the time specified in, the direction;
- (n) require the driver of a vehicle that the officer believes may contain evidence of pollution, a contaminant or waste or of the commission of an offence against the Act:
 - i. to stop the vehicle; or
 - ii. to move the vehicle to a specified place, to enable the officer to search it;

- (o) authorise a person to provide assistance to an authorised officer in the exercise or performance of the authorised officer's powers or functions under this Act.

These powers may be utilised by authorised officers whenever they are undertaking investigations that may result in the utilisation of one or more of the measures covered in section 2.2.4 to resolve noise problems/complaints. Any use of these instruments will be in accordance with the WMPC Act and the NT EPA 'Compliance and Enforcement Policy' (available at <http://www.ntepa.nt.gov.au/about-nt-epa/publications/policy-and-procedures>).

2.3 What About Other Legislation?

In the NT, a number of other agencies regulate specific types of noise through a variety of statutory and non-statutory instruments.

2.3.1 The *Environmental Assessment Act*

The *Environmental Assessment Act* requires examination by the NT EPA of any matter that has the capability of having a significant effect on the environment.

The NT EPA may require a public environmental report or an environmental impact statement for a particular project (matter) to assess the environmental impacts of a project. As part of this process the NT EPA will normally require that noise impacts be considered.

2.3.2 The NT *Planning Act* and NT Planning Scheme

The *Planning Act* and NT Planning Scheme can play a significant role in the mitigation of noise matters. In this section some of the most relevant aspects of the *Planning Act* are covered. More detailed coverage of the planning process within the noise management regime is covered in guidance document number one.

The *Planning Act* provides for appropriate and orderly planning and control of the use and development of land.

The *Planning Act*:

- establishes the NT Planning Scheme and provides for a development approval process
- provides for interim development control orders pending changes to a planning scheme
- provides for an appeals regime and enforcement for its instruments, and
- establishes the Development Consent Authority.

The Development Consent Authority or relevant Minister can prosecute non-compliant proponents for breaches of the Act, a planning scheme or a development permit.

Planning instruments are key tools in addressing potential noise conflicts. They provide an opportunity to identify and address noise matters before they escalate for example into costly retrofitting noise works and/or regulatory action by the relevant agency.

2.3.3 Responsible authorities – quick reference guide

In the Northern Territory there are a number of agencies that have roles and responsibilities in the management of noise. Table 2.1 provides a quick reference guide as to which agency is responsible for different noise sources and how issues surrounding these noise sources may be assessed and managed.

The table lists four types of responsibilities: primary, secondary, tertiary and shared. Users of this guideline must always make contact with the primary responsible agency for the particular noise issue of concern and includes the associated management approaches/instruments that may be used to address these. If the agency with the primary responsibility for a noise issue does not resolve the issue or if the agency is unable to resolve the issue the secondary and then tertiary agencies can then be contacted in that order. Where there is a shared responsibility each agency that has been named has equal responsibility for the noise source.

As an example, the NT EPA can issue authorised officer directions or pollution abatement notices in its capacity as the responsible agency for a number of noise sources.

The recommended management approaches described in Table 2.1 may not be the only or best approach for individual situations. The last column provides additional reference material that may be useful.

Table 2.1: Northern Territory Responsible Authorities

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
Agricultural activities						
Farm machinery such as tractors and harvesters on private farms	NT EPA		Offensive noise test (3.1.4)	Negotiate implementation of feasible and reasonable best practices Authorised Officer Direction Pollution Abatement Notice		
Intensive agriculture such as poultry farms, piggeries, and feedlots	NT EPA		Offensive noise test (3.1.4)	Negotiate implementation of feasible and reasonable best practices Authorised Officer Direction Pollution Abatement Notice		
Bird Scaring Devices (BSD)	NT EPA	There are applicable limits and defined hours of operation for BSD in the NT.	Audibility test (3.1.3.1), and/or Offensive noise test (3.1.4)	Authorised Officer Direction		The NT EPA <i>Guideline Noise Nuisance from Bird Scaring Devices</i> February 2016 provides the regulatory

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
						requirements when BSD are used.
Aircraft						
Aircraft in flight and Commonwealth owned airports	Commonwealth – Airservices Australia	International Civil Aviation Organisation definitions: ‘Take-off’ commences with the application of power to the aircraft once it is on the runway to bring the aircraft to the speed necessary to become airborne ‘Landing’ ends when an aircraft leaves the runway or comes to a stop on the runway		The Airport Environment Officer employed by the Commonwealth Department of Infrastructure and Regional Development and Cities has regulatory powers		<i>Airports Act 1996</i> Airports (Environment Protection) Regulations 1997 <i>Air Navigation Act 1920</i> Air Navigation (Aircraft Noise) Regulations 1984 Air Navigation (Aircraft Engine Emissions) Regulations
Aircraft on the ground at Commonwealth owned and leased airports – e.g. noise from aircraft engines being tested or when aircraft are parked at a gate or	Commonwealth Department of Infrastructure, Regional Development and Cities (primary responsibility)					<i>Airports Act 1996</i> Airports (Environment Protection) Regulations 1997

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
in a designated aircraft parking area	Relevant airport lessee company under the <i>Airports Act 1996</i>					
Noise resulting from privately operated airports – e.g. aircraft on the ground undergoing excessively noisy engine maintenance	NT EPA	Noise from aircraft on the ground not taxiing, taking off or landing is subject to the requirements of the <i>Waste Management and Pollution Control Act</i> Therefore, noisy aircraft engine maintenance activities on the ground can be controlled by, for example, specifying permitted hours and/or noise limits at affected residences	Offensive noise test (3.1.4)	Negotiate alternative times for engine testing, acceptable hours etc. Authorised Officer Direction Pollution Abatement Notice		Commercial and Industrial Noise Assessment (3.2)
Military aircraft	Department of Defence					
Noise resulting from airports operated by NT public authorities such as local councils – e.g.	NT EPA	As for noise resulting from privately operated airports	Offensive noise test (3.1.4)	Negotiate alternative times for engine testing,		Commercial and Industrial Noise Assessment (3.2)

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
aircraft on the ground undergoing excessively noisy engine maintenance				acceptable hours etc. Authorised Officer Direction Pollution Abatement Notice		
Helicopter premises – e.g. aircraft on the ground undergoing excessively noisy engine maintenance	NT EPA Airservices Australia	<p>WMPC Act may apply to noise from aircraft on the ground</p> <p>Airservices Australia is responsible for noise from aircraft in flight and aircraft movements (taxiing, taking off and landing). This includes conditions specifying, for example:</p> <ul style="list-style-type: none"> • noise limits that apply to aircraft in flight and aircraft movements • permitted hours for movements 	<p>Offensive noise test (3.1.4)</p> <p>Commercial and Industrial Noise Assessment (3.2)</p>	<p>Negotiate alternative times for engine testing, acceptable hours etc. (NT EPA)</p> <p>Authorised Officer Direction (NT EPA)</p> <p>Pollution Abatement Notice (NT EPA)</p>		<p>Recommended assigned noise levels for helicopter noise:</p> <p>The recommended assigned noise levels comprise three separate components, each of which should be satisfied at the nearest affected buildings:</p> <ul style="list-style-type: none"> • The measured LAeq,T(measured over the entire daily operating time of the helipad) shall not exceed 55 dB(A) for a residence. • The measured maximum noise level LA max shall not exceed 82 dB(A) at the nearest residential premises (See Note below). • Operation outside the hours between 7 am and 10 pm shall not be permitted except for emergency flights.

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
		<ul style="list-style-type: none"> permitted number of movements (except in limited circumstances) permitted aircraft models – e.g. models certified to meet a certain noise level in certain specified test conditions 				Note: These levels will generally be met by a separation between the landing site and a residential premises of 150 m for helicopters of less than two tonnes all-up-weight, and 250 m for helicopters of less than 15 tonnes all-up-weight.
Animal noise						
Barking dogs	<p>Local Government (primary responsibility - dependant on whether by laws exist)</p> <p>NT EPA (secondary responsibility)</p>		<p>Mitigation of “hazard or nuisance”</p> <p>or</p> <p>Offensive noise test (3.1.4)</p>	<p><i>Section 195 of the Local Government Act – animals and activities involving animals becoming a hazard or nuisance – issue of “regulatory order”</i></p> <p>Local by-laws (if they exist in the particular local government area)</p> <p>Authorised Officer Direction (NT EPA)</p>	Individuals may also seek a Noise Abatement Order from the local court under the <i>Summary Offences Act</i>	

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
Dog kennels (including dog day facilities and rehoming agencies)	Local Government (primary responsibility – dependant on whether by laws exist) NT EPA (secondary responsibility)		Mitigation of “hazard or nuisance” or Offensive noise test (3.1.4)	<i>Section 195 of the Local Government Act – animals and activities involving animals becoming a hazard or nuisance – issue of “regulatory order” (local government)</i> Local by-laws (if they exist in the particular local government area) Negotiate noise management plan (local government; NT EPA) Authorised Officer Direction (NT EPA) Pollution Abatement Notice (NT EPA)	Individuals may also seek a Noise Abatement Order from the local court under the <i>Summary Offences Act</i>	EPA Victoria Publication 1254 – Noise Control Guideline Chapter 4
Other animal noise such as roosters	Local Government (primary responsibility - dependant on whether by laws exist)		Mitigation of “hazard or nuisance” (local government) or	<i>Section 195 of the Local Government Act – animals and activities involving animals becoming a hazard or nuisance – issue of</i>	Individuals may seek a Noise Abatement Order from the local court under the	

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
	NT EPA (secondary responsibility)		Offensive noise test (3.1.4)	<i>"regulatory order"</i> (local government) Local by-laws (if they exist in the particular local government area) Authorised Officer Direction (NT EPA)	<i>Summary Offences Act</i>	
Construction noise						
General residential/ commercial building construction	NT EPA		Qualitative or quantitative noise assessment depending on length of project (3.3)	Negotiate implementation of feasible and reasonable best practices Authorised Officer Direction Pollution Abatement Notice	Action under the <i>Planning Act</i> if the construction noise is in breach of the planning approval	
Major public infrastructure construction	NT EPA		Qualitative or quantitative noise assessment depending on length of project (3.3)	Negotiate implementation of feasible and reasonable best practices		

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
				Authorised Officer Direction Pollution Abatement Notice		
Public road construction	NT EPA		Qualitative or quantitative noise assessment depending on length of project (3.3)	Negotiate implementation of feasible and reasonable best practices Authorised Officer Direction Pollution Abatement Notice		
Education facilities						
Childcare centres, schools, colleges and universities	NT EPA		Offensive noise test (3.1.4)	Negotiate changed times for activities Authorised Officer Direction Pollution Abatement Notice	Individuals may also seek a Noise Abatement Order from the local court under the <i>Summary Offences Act</i>	Industrial and Commercial Noise Assessment (3.2)
Entertainment						
Loud music, patron noise etc. from hotels and liquor licensed premises	NT Liquor Commission	NT <i>Liquor Act</i> is the main regulatory instrument for	'Excessive noise' assessment by inspectors under the <i>Liquor Act</i>	If conditions in the development consent relating to noise have been	<i>Planning Act</i> consent breaches (<i>Development</i>	

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
(not including noise from equipment such as air conditioners, coolers etc.)	(primary responsibility) NT Police (secondary responsibility) NT EPA (tertiary responsibility)	regulating noise from these sources The WMPC Act can be used should be used as a last resort if all other options fail	(<i>Liquor Commission</i>) Undue noise test (Section 5, <i>Summary Offences Act</i>) Entertainment Venue Noise Assessment (NT EPA) (3.4)	breached, local government could take action under <i>the Local Government Act</i> Authorised Officer Direction (NT EPA) Pollution Abatement Notice (NT EPA)	<i>Consent Authority</i>	
Pyrotechnic displays	NT Police (shared responsibility) NT WorkSafe (shared responsibility)	Only holders of a Northern Territory pyrotechnics licence are allowed to apply for a fireworks permit. Fireworks operators must be trained in the use of fireworks and operate to a national standard. <i>Territory Day</i> Each year the minister responsible	Audibility test (3.1.3.1) Undue noise test (Section 5, <i>Summary Offences Act</i>) Northern Territory Police enforce the timeframe that shopgoods fireworks can be used via Penalty Infringement Notices or consents			Guidance can also be obtained from the NSW Division of Local Government, Department of Premier and Cabinet website www.dlg.nsw.gov.au

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
		<p>for the <i>Dangerous Goods Act</i> and regulations can approve, by gazettal notice:</p> <ul style="list-style-type: none"> • the times and dates when shopgoods fireworks may be purchased • the times and dates during which a person may possess, throw, ignite or explode shopgoods fireworks • areas designated as exclusion zones in which fireworks are not permitted <p>The usual approved period for the sale of shopgoods fireworks is between 9 a.m. and 9 p.m. on 1 July each year, with no sales (including sales of vouchers or coupons) to take</p>	to prosecute in conjunction with NT Worksafe.			

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
		<p>place outside these times</p> <p>The usual approved period for the use of shopgoods fireworks (throw, ignite or explode) is between 6 p.m. and 11 p.m. on 1 July each year, however, the approved possession period is generally extended to 12pm on 2 July. This extended possession time allows retail outlets to return unsold stock to wholesalers and allows the general public to hand in unused shopgoods fireworks to NT WorkSafe</p>				
Outdoor concerts, festivals and cinematic or theatrical events using sound	NT EPA		Entertainment Venue Noise Assessment (3.4)	Authorised Officer Direction		

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
amplification equipment				Pollution Abatement Notice		
Public entertainment facilities such as amusement parks, public concerts	NT EPA		Entertainment Venue Noise Assessment (3.4)	Negotiate implementation of feasible and reasonable best practices Authorised Officer Direction Pollution Abatement Notice		
Playing musical instrument in thoroughfares (buskers)	NT Police (primary responsibility) Local Government (shared responsibility - dependant on whether by laws exist)		Undue noise test (Section 5, <i>Summary Offences Act</i>)	Police direction to stop or abate noise (section 53B of the <i>Summary Offences Act</i>) Police request to depart (section 76 of the <i>Summary Offences Act</i>)		
Industrial premises						
Industrial and commercial premises – excludes mining and petroleum activities where the impact is	NT EPA		Commercial and Industrial Noise Assessment (3.2)	Negotiate implementation of feasible and reasonable best practices		

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
contained within the mining and petroleum leases however it includes these activities if they generate off site (off lease) noise impacts				<p>Authorised Officer Direction</p> <p>Pollution Abatement Notice</p> <p>Environment Protection Licence amendment (where applicable)</p>		
Noise from a mining, petroleum exploration activity, or petroleum extraction activity confined within the land on which the activity is being carried out (i.e. the lease)	Department of Primary Industry and Resources					
Small factories and commercial premises including backyard workshops – e.g. noise from plant and equipment, reversing alarms, public address systems, deliveries (see below for more detail), garbage collection (see	<p>NT EPA (primary responsibility)</p> <p>Local Government (secondary responsibility - dependant on whether by laws exist)</p>		<p>Offensive noise test (3.1.4)</p> <p>Commercial and Industrial noise Assessment (3.2)</p>	<p>Negotiate implementation of feasible and reasonable best practices (NT EPA/local government)</p> <p>Authorised Officer Direction (NT EPA)</p> <p>Pollution Abatement Notice (NT EPA)</p>		

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
below for more detail), air conditioners etc. at shops and offices				Local by-laws (if they exist in the particular local government area) Contract management by council for its waste removal contractors		
Deliveries to shops, supermarkets and services stations.	NT EPA	Where a residential area will be impacted by noise from deliveries, then deliveries should be inaudible in a habitable room of any residential premises (regardless of whether any door or window giving access to the room is open) outside the hours contained in the schedule (see further information column).				Schedule: Deliveries to shops, supermarkets & service stations 7 am — 10 pm Monday to Saturday 9 am — 10 pm Sundays and public holidays Note: All ancillary motors or trucks should be turned off whilst making the delivery
Industrial waste collection	NT EPA	Annoyance created by industrial waste collection tends to intensify in the early-morning period. To this end, early-morning collections should be restricted to non-residential areas to minimise early morning disturbances. Where a residential area is	Audibility test (3.1.3.1) Offensive noise test (3.1.4)	Authorised Officer Direction (NT EPA)		Schedule: Industrial waste collection <u>One collection per week</u> 6:30 am — 8 pm Monday to Saturday 9 am — 8 pm Sunday and public holidays <u>Two or more collections per week</u> 7 am — 8 pm Monday to Saturday

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
		<p>impacted by noise from the collection of refuse, then collections should be restricted to the times contained within the schedule.(see further information column)</p> <ul style="list-style-type: none"> • Refuse bins should be located at sites that provide minimal annoyance to residential premises. • Compaction should be carried out while the vehicle is moving. • . Bottles should not be broken up at collection site. • Routes which service predominantly residential areas should be altered regularly to reduce early morning disturbances. • Noisy verbal communication between operators should be avoided where possible. 				<p>9 am — 8 pm Sunday and public holidays</p> <p>If waste collection emits a (maximum) noise level greater than 60 dB(A) when measured in a habitable room then it should only take place between the hours of 9 am and 7 pm on a Sunday or public holiday, or between 7 am and 7 pm on any other day.</p>
Motor vehicles						
General road traffic noise on local roads	Local Government					
General road traffic noise on highways, main roads	NT Department of Infrastructure, Planning and Logistics (primary responsibility)					The NT Department of Infrastructure, Planning and Logistics traffic noise policy: " <i>Road Traffic Noise on NT</i> "

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
	NT EPA (secondary responsibility)					<i>Government Roads Policy November 2014 Version 1.0".</i>
Motor vehicle on private residential premises causing unnecessary noise during the night or early morning	NT Police (primary responsibility) Local Government (secondary responsibility - dependant on whether by laws exist) NT EPA (tertiary responsibility)		Undue noise test (Section 5, Summary Offences Act) Audibility test (3.1.3.1)	Negotiate for activity to cease Local by-laws (if they exist in the particular local government area) Authorised Officer Direction (NT EPA) Police direction to stop or abate noise (section 53B of the Summary Offences Act)	Noise Abatement Order issued by a Justice of the Peace instigated by the person affected by the noise (Section 53D of the Summary Offences Act)	NSW EPA Managing vehicle noise brochure provides some guidance Other options may include the issuing of a public health notice under section 29 of the <i>Public and Environmental Health Act</i> and /or issuing a public health order under section 32 of the same Act. These are issued under the public health nuisance provisions of the same Act.
Noisy motor vehicles off road on private property (including trail bikes)	NT Police (primary responsibility) Local Government (shared responsibility - dependant on	Police have the power to stop, inspect and test vehicles.	Undue noise test (Section 5, Summary Offences Act)	Negotiate for activity to cease, fitting of appropriate mufflers, conducting activity well away from sensitive noise	Noise Abatement Order issued by a Justice of the Peace instigated by the person	

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
	whether by laws exist) NT EPA (tertiary responsibility))		Offensive noise test (3.1.4)	receivers such as residences Authorised Officer Direction Local by-laws (if they exist in the particular local government area) Police direction to stop or abate noise (section 53B of the Summary Offences Act)	affected by the noise (Section 53D of the <i>Summary Offences Act</i>)	
Excessive noise generated by or from a motor vehicle that is at a public place or on a public street. This includes: <ul style="list-style-type: none"> vehicle alarms vehicle refrigeration units 	NT Police (primary responsibility) Local Government (shared responsibility dependant on whether by laws exist)	NT Police can stop, inspect and test vehicles <i>Traffic Act</i> Vehicles Standards regulations Local Government issues permits for vehicles to use public lands	If a police officer reasonably believes the officer may direct a person having control of the vehicle to reduce or stop the noise (section 29AU, <i>Traffic Act</i>). Potential breach of local government permit if excessive noise is made Undue noise test (Section 5,	Issue of penalty infringement notices Defective Vehicle Notices Identify owner and arrange for alarm to be deactivated Negotiate for vehicle to be moved Police direction to stop or abate noise (section 53B of the	Noise Abatement Order issued by a Justice of the Peace instigated by the person affected by the noise (Section 53D of the Summary Offences Act)	The NSW EPA Managing noise from intruder alarms brochure provides some additional guidance

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
<ul style="list-style-type: none"> vehicle sound systems 			<i>Summary Offences Act)</i>	<i>Summary Offences Act)</i>		
Neighbourhood noise						
Air conditioners	<p>NT EPA (primary responsibility)</p> <p>Local Government (secondary responsibility - dependant on whether by laws exist)</p>	As it is fixed in place and any noise issues are likely to be ongoing in nature, NT EPA and local government are typically the main agencies for control. Local Government's responsibilities extend only insofar as they have made relevant by laws.	<p><u>Night time:</u> audibility test (3.1.3.1)</p> <p><u>Day time:</u> offensive noise test (3.1.4)</p>	<p>Negotiate reduction of noise level – move equipment away from neighbours, install acoustic shielding, install quieter model</p> <p>Mediation may be an option, either informally or through the CJC</p> <p>Authorised Officer Direction</p> <p>Pollution Abatement Notice</p> <p>Local by-laws (if they exist in the particular local government area)</p>	Noise Abatement Order issued by a Justice of the Peace instigated by the person affected by the noise (Section 53D of the <i>Summary Offences Act)</i>	

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
Amplified music, musical instruments	NT Police (primary responsibility) Local Government (secondary responsibility - dependant on whether by laws exist)	Police are typically the main agency for control of noise from late night parties, or where the safety of officers may be a concern or where local government officers may not be available	Undue noise test (Section 5, Summary offences Act) <u>Night time:</u> audibility test (3.1.3.1) <u>Day time:</u> offensive noise test (3.1.4)	Negotiate reduction of volume Mediation may be an option, either informally or through a CJC Local by-laws (if they exist in the particular local government area) Police direction to stop or abate noise (section 53B of the Summary Offences Act) Police request to depart (section 76 of the <i>Summary Offences Act</i>)	Noise Abatement Order issued by a Justice of the Peace instigated by the person affected by the noise (Section 53D of the <i>Summary Offences Act</i>)	
Building intruder alarms	NT Police		Undue noise test (Section 5, <i>Summary Offences Act</i>) Alarm should not be heard in habitable room of residences for longer than	Identify owner/occupier and arrange for alarm to be deactivated Police direction to stop or abate noise (section 53B of the	Noise Abatement Order issued by a Justice of the Peace instigated by the person affected by the noise	The NSW EPA Managing noise from intruder alarms brochure provides some additional guidance

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
			permitted time (3.1.3.1)	<i>Summary Offences Act</i>	(Section 53D of the <i>Summary Offences Act</i>)	
Electric power tools, powered garden equipment	Local Government (primary responsibility – dependant on whether by laws exist) NT EPA (secondary responsibility) Police (tertiary responsibility)	NT Police may become involved when local government or NT EPA officers are not available	Undue noise test (Section 5, <i>Summary Offences Act</i>) <u>Night time:</u> audibility test (3.1.3.1) <u>Day time:</u> offensive noise test (3.1.4)	Negotiate reduction of noise level – using quieter equipment, changing times of use, closing doors, moving equipment away from neighbours Local by-laws (if they exist in the particular local government area Police direction to stop or abate noise (section 53B of the <i>Summary Offences Act</i>)	Noise Abatement Order issued by a Justice of the Peace instigated by the person affected by the noise (Section 53D of the <i>Summary Offences Act</i>)	
Heat pump water heaters	NT EPA (primary responsibility) Local Government (secondary responsibility - dependant on	As it is fixed in place and any noise issues are likely to be ongoing in nature, NT EPA and local government are typically the	<u>Night time:</u> audibility test (NT (3.1.3.1) <u>Day time:</u> offensive noise test (3.1.4)	Negotiate reduction of noise level – move equipment away from neighbours, install	Noise Abatement Order issued by a Justice of the Peace instigated by the person	

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
	whether by laws exist)	main agencies for control. Local Government's responsibilities extend only insofar as they have made relevant by laws.		acoustic shielding, install quieter model Authorised Officer Direction Pollution Abatement Notice Local by-laws (if they exist in the particular local government area)	affected by the noise (Section 53D of the <i>Summary Offences Act</i>)	
Rain water pumps; swimming pool pumps; spa pumps	NT EPA (primary responsibility) Local Government (secondary responsibility - dependant on whether by laws exist)	As it is fixed in place and any noise issues are likely to be ongoing in nature, NT EPA and local government are typically the main agency for control. Local Government's responsibilities extend only insofar as they have made relevant by laws.	<u>Night time:</u> audibility test (NT EPA) (3.1.3.1) <u>Day time:</u> offensive noise test (NT EPA) (3.1.4)	Negotiate reduction of noise level – move equipment away from neighbours, install acoustic shielding, install quieter model (both NT EPA/local government) Authorised Officer Direction (NT EPA) Pollution Abatement Notice (NT EPA) Local by-laws (if they exist in the	Noise Abatement Order issued by a Justice of the Peace instigated by the person affected by the noise (Section 53D of the <i>Summary Offences Act</i>)	

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
				particular local government area)		
Party house noise i.e. Airbnb sourced noise	NT Police		Undue noise test (Section 5, <i>Summary Offences Act</i>)	Police direction to stop or abate noise (section 53B of the <i>Summary Offences Act</i>)	Noise Abatement Order issued by a Justice of the Peace instigated by the person affected by the noise (Section 53D of the <i>Summary Offences Act</i>)	A Body Corporate can also contacted if it involves a residential complex – as this will be in breach of house rules.
Domestic arguments non-life threatening	NT Police		Undue noise test (Section 5, <i>Summary Offences Act</i>)	Police direction to stop or abate noise (section 53A of the <i>Summary Offences Act</i>) Police request to depart (section 76 of the <i>Summary Offences Act</i>)		

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
Undue noise at social gathering after midnight	NT Police		Undue noise test (Section 5, <i>Summary Offences Act</i>)	Police direction to stop or abate noise (section 53A of the <i>Summary Offences Act</i>) Police request to depart (section 76 of the <i>Summary Offences Act</i>)		
Public authorities						
Activities undertaken by or on behalf of public authorities such as Northern Territory government agencies and local councils	NT EPA			Negotiate implementation of feasible and reasonable best practices		
Excessive noise from public housing premises	Department of Housing and Community Development (primary responsibility) NT Police (shared primary responsibility)		Public housing safety officer reasonably believes that excessive noise is being made Undue noise test (Section 5, <i>Summary Offences Act</i>)	Direction under section 28E of the Housing Act to stop engaging specific conduct Police direction to stop or abate noise (section 53B of the	Noise Abatement Order issued by a Justice of the Peace instigated by the person affected by the noise (Section 53D of the	

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
				<i>Summary Offences Act)</i>	<i>Summary Offences Act)</i>	
Domestic kerbside waste collection	Local Government (primary responsibility - dependant on whether by laws exist) NT EPA (secondary responsibility)			Negotiate implementation of feasible and reasonable best practices (via contract negotiations with waste contractors)		The main annoyance produced by domestic refuse collections occurs in the early morning (in other words, before 7 am). Therefore, if possible, routes should be selected to provide the least impact on residential areas during that time. Collection of refuse should follow the following criteria: <ul style="list-style-type: none"> • Collections occurring once a week should be restricted to the hours 6 am — 6 pm Monday to Saturday • Collections occurring more than once a week should be restricted to the hours 7 am — 6 pm Monday to Saturday • Compaction should only be carried out while on the move. • Bottles should not be broken up at the point of collection • Routes that service entirely residential areas should be altered regularly to reduce early morning disturbance, and • Noisy verbal communication

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
						<p>between operators should be avoided where possible.</p> <p>Earlier commencement times may be apply but need to be justified for the following circumstances:</p> <ul style="list-style-type: none"> to avoid an unreasonable interruption or pedestrian traffic; or if other grounds exist that the NT EPA or other regulator determines to be sufficient. <p>If waste collection emits a (maximum) noise level greater than 60 dB(A) when measured in a habitable room then it should only take place between the hours of 9 am and 7 pm on a Sunday or public holiday, or between 7 am and 7 pm on any other day.</p>
Street sweeping	Manage as per domestic kerbside waste collection above.					
Rail						
Rail noise	NT EPA			Negotiate implementation of feasible and		Guidance can be obtained from the NSW DECC Interim guideline for the

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
				reasonable best practices		assessment of noise from rail infrastructure projects Department of Planning Development near rail corridors and busy roads – Interim Guideline
Sporting venues						
Motor boat racing	NT EPA		Offensive noise test (3.1.4)	Authorised Officer Direction Pollution Abatement Notice		
Motor sports – on private land e.g. Hidden Valley	NT EPA		Offensive noise test (3.1.4)	Authorised Officer Direction Pollution Abatement Notice		
Motor sports – on road	NT Police		Undue noise test (Section 5, Summary offences Act)	Police direction to stop or abate noise (section 53B of the Summary Offences Act)		
Outdoor sporting events involving sound amplification	NT EPA (shared responsibility) NT Police (shared responsibility)		Offensive noise test (3.1.4) Undue noise test (Section 5,	Authorised Officer Direction Pollution Abatement Notice	Noise Abatement Order issued by a Justice of the Peace	

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
			<i>Summary Offences Act</i>	Police direction to stop or abate noise (section 53B of the <i>Summary Offences Act</i>)	instigated by the person affected by the noise (Section 53D of the <i>Summary Offences Act</i>)	
Private gun/rifle/pistol clubs	NT EPA		Offensive noise test (3.1.4)	Authorised Officer Direction Pollution Abatement Notice		
Sporting facilities/ events (other than as noted above)	NT EPA (primary responsibility) Local Government (shared responsibility - dependant on whether by laws exist)		Offensive noise test (3.1.4)	Authorised Officer Direction Pollution Abatement Notice		
Vessels						

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
Foreign vessels outside of a designated port	Australian Maritime Safety Authority					
Regulated Australian vessels outside of a designated port	Australian Maritime Safety Authority					
Domestic commercial vessels (e.g. charter boats, fishing boats) surveyed for noise outside of a designated port	Australian Maritime Safety Authority					
Foreign vessels inside a designated port	Australian Maritime Safety Authority (shared responsibility) Port operator (shared responsibility)					
Regulated Australian vessels inside a designated port	Australian Maritime Safety Authority (shared responsibility) Port operator (shared responsibility)					

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
Domestic commercial vessels (e.g. charter boats, fishing boats) surveyed for noise inside a designated port	Australian Maritime Safety Authority(shared responsibility) Port operator (shared responsibility)					
Recreational vessels (e.g. jet skis, speed boats, noisy generators whilst moored)	NT Police (shared responsibility) NT EPA (shared responsibility)	Police have the power to stop, inspect and test vessels	Undue noise test (Section 5, <i>Summary Offences Act</i>) Offensive noise test (3.1.4)	Police direction to stop or abate noise (section 53B of the <i>Summary Offences Act</i>) NT EPA may issue notices under the <i>Waste Management and Pollution Control Act</i>	Noise Abatement Order issued by a Justice of the Peace instigated by the person affected by the noise (Section 53D of the <i>Summary Offences Act</i>)	AS 1949 – method of measurement of airborne noise emitted by vessels in waterways, ports and harbours
Vessels related to activities carried out by the Territory or a public authority	NT EPA			Negotiate implementation of feasible and reasonable best practices		
Vessels within marine parks	NT EPA			Negotiate implementation of feasible and		

Noise Source	Responsibility	Comments	Assessment (relevant section of this guideline)	Suggested Management / Regulation	Possible Further Action	Further Information
				reasonable best practices		
Naval vessels	Commonwealth – Defence Department					

3 Recommended assigned noise levels for various types of noise in the Northern Territory – and how to assess for compliance

This section covers the NT EPA's recommended assigned noise levels for various types of noise sources. Assigned noise levels are the levels that should not be exceeded and, if exceeded, will generally trigger a regulatory response from the NT EPA or other responsible agency (refer to section 2, Table 2.1).

This section also covers the types of noise assessment that can be undertaken by the NT EPA and other responsible agencies listed in Table 2.1 to determine whether particular sources of noise are compliant with the recommended assigned noise levels. It also discusses for example how an NT EPA authorised officer or other regulator can judge whether a noise is audible, excessively long in duration, or offensive, as defined in following sections of this guideline.

In some circumstances noise assessments may require measurement of noise levels and their physical characteristics and these are important in situations where the provisions of the WMPC Act are being applied.

Overall, different types of noise assessments are utilised in this section which examine for example, the nature and characteristics of a noise and may involve verifying aural factors such as:

- the location of the noise source
- its audibility at certain locations
- the time the noise is made and its duration
- its characteristics, and
- the reported effect it has on people.

The different types of noise assessments will be applied to the following noise sources which are covered in this section:

- Neighbourhood noise (section 3.1)
- Commercial and industrial noise (section 3.2)
- Construction noise (section 3.3)
- Entertainment venue noise (section 3.4), and
- Vibration and blasting (section 3.5).

3.1 Neighbourhood Noise

3.1.1 Background

Neighbourhood or residential noise, such as noise from motor vehicles, lawn mowers, electrical tools and equipment, domestic heating/cooling equipment, pumps, musical instruments, radios and television, animals, alarms, machines and parties can be very annoying.

Neighbourhood noise also means any noise emitted from the home, land used in connection with the home such as a nature strip or garage and noise from houses and apartments under construction. Neighbourhood noise is usually most disturbing when it is loud, continues for long periods, or occurs at inappropriate times.

Neighbourhood noise can be a serious environmental amenity⁴ issue that affects many in the community which can and invariably does escalate into serious confrontations within neighbourhoods. Also, management of these noise issues often results in resource intensive compliance activities by the NT EPA and other regulators.

3.1.2 Recommended prohibited times

In considering whether noise from residential premises is likely to constitute an environmental nuisance as defined under the WMPC Act due to its unreasonable level⁵, the NT EPA generally considers that noise from residential premises should not be heard inside a neighbour's residence at the times listed in Table 3.1 for the relevant type of noise. These recommended prohibited time provisions aim to minimise noise when many people are sleeping or resting.

Any residential noise not listed in Table 3.1 and noise occurring outside the recommended prohibited times can still be unreasonable in some cases. Typical problems include noisy items such as subwoofers used throughout the day, poorly located air conditioners, equipment that is noisy because it is not maintained, or groups of people talking loudly outdoors at a late-night party.

What is unreasonable can depend on where people live, as residents living in apartments or attached houses expect to hear some noise from normal activity in neighbouring homes. Neighbours should, however, be considerate of where they live, as closer living means a greater chance of music or general household activities impacting on neighbours.

Table 3.1: Recommended prohibited times for particular noise sources

Noise source – from residential premises	Time when noise should not be heard in a habitable room in a neighbour's residence (a habitable room means any room other than a garage, storage area, bathroom, laundry, toilet or pantry)
Motor vehicles (except when entering or leaving residential premises)	<ul style="list-style-type: none"> • Before 8 am and after 8 pm on weekends and public holidays • Before 7 am and after 8 pm on any other day
Power tools and equipment (powered garden tools; e.g. lawn mowers and leaf blowers; electric or pneumatic tools, chainsaws, circular saws, gas or air compressors and any other impacting tool or grinding equipment) This also covers any electric equipment or appliance including electric gardening	<ul style="list-style-type: none"> • Before 8 am and after 8 pm on Sundays and public holidays • Before 7 am and after 8 pm on any other day

⁴ See section 5 for definition of amenity

⁵ In this guideline if a noise emission is deemed as offensive it will by definition be unreasonable.

Noise source – from residential premises	Time when noise should not be heard in a habitable room in a neighbour's residence (a habitable room means any room other than a garage, storage area, bathroom, laundry, toilet or pantry)
equipment, but not electric equipment or appliances for personal care or grooming, or for heating, refrigeration or preparation of food	
Air conditioners, evaporative coolers and heat pump water heaters	<ul style="list-style-type: none"> • Before 8.00 am or after 10.00 pm on weekends or public holidays • Before 7.00 am or after 10.00 pm on any other day
Swimming pool pumps, spa pumps, water pumps other than pumps being used to fill header tanks, and domestic vacuum cleaners	<ul style="list-style-type: none"> • Before 8 am or after 8 pm on Sunday and public holidays • Before 7 am and after 8 pm on any other day
Musical instruments and electrically amplified sound equipment (e.g. radios, TVs, tape recorders, CD and DVD players, home theatre systems and public address systems)	<ul style="list-style-type: none"> • Before 8 am and after midnight on any Friday, Saturday or the day immediately before a public holiday • Before 8 am and after 10 pm on any other day
Refrigeration units fitted to motor vehicles (this applies whether or not the vehicle is located on residential premises).	<ul style="list-style-type: none"> • Before 8 am and after 8 pm on weekends and public holidays • Before 7 am and after 8 pm on any other day

3.1.2.1 Assigned noise levels for fixed domestic equipment

Fixed domestic equipment, such as air conditioners, swimming pool equipment, spas, ducted heating, vacuum systems and water pumps when they are operated within the permissible time periods, should meet the recommended assigned noise levels in Table 3.2. See also section 3.1.4.2 for an alternative method used to ensure that neighbourhood noise meets the recommended assigned noise level in Table 3.2 as well as Table 3.3 – the concept of the “intrusive” noise level.

Noise from fixed domestic equipment which are not meeting the noise levels specified in Table 3.2 may be considered unreasonable, if they interfere with use of a home or property on a recurring or ongoing basis.

Many purchasers of fixed domestic equipment find that after the unit is installed, the noise annoys their neighbours. It is recommended that prior to installing fixed domestic equipment, responsible persons refer to the manufacturer's information to assess whether the equipment can meet the noise levels in Table 3.2.

If you are the owner/occupier of domestic premises, it is your responsibility to ensure that fixed domestic equipment is not operated if the noise resulting from the operation of the equipment has an unreasonable adverse impact on the amenity of your neighbours.

An owner/occupier must take all reasonable and practicable measures (i.e. feasible and reasonable measures) to eliminate or significantly reduce any unreasonable noise coming from fixed domestic equipment. This includes maintenance and repair of the

equipment, or remedial action (such as erecting a noise barrier) so that the noise from the equipment does not cause an environmental nuisance.

Table 3.2: Recommended assigned noise levels for fixed domestic equipment when they are operated within the permissible time periods

Equipment	Times		Acceptable noise level immediately on neighbours' side of boundary (dB(A))	
			If sensitive areas on the neighbour's side of the boundary are greater than 2 metres from the boundary	If sensitive areas on the neighbour's side of the boundary are less than 2 metres from the boundary
Air conditioners and heat pump water heaters	Night-time	Before 8 am or after 10 pm Sat, Sun or public holidays	35	30
		Before 7 am or after 10 pm on any other day	35	30
	Daytime		45	40
Pool and spa pumps	Night-time	Before 8 am or after 8 pm Sat, Sun or public holidays	35	30
		Before 7 am or after 8 pm on any other day	35	30
	Daytime		45	40
Rainwater tank pumps	Night-time	10 pm to 7 am	40	35
	Daytime	7 am to 10 pm	45	40

3.1.2.2 What to do if you have a noisy air conditioner - a case study

If you have a noisy air conditioner, consider the following questions:

Does the unit need maintenance or replacing? Older units may need a clean or maintenance, or you may find it better and cheaper to replace it with a newer model.

Can you install a barrier or enclosure? These can be effective ways to reduce noise if a unit is well maintained and working properly.

Do you have to restrict the hours you use the unit? If the noise is annoying your neighbours at night, then you may have to switch it off during the prohibited times.

Move the motor? If you need to run the air conditioner and there are no options for maintenance, barriers or enclosures then you may be required to relocate the unit further away from neighbours.

If the unit is causing unreasonable noise, including if it can be heard in a neighbour's home in a habitable room during night-time hours (with their doors closed and windows open if it's the only source of ventilation), then you may be required to take action to reduce the noise. It is more practical and cheaper to properly design and install an air conditioner than to try to fix problems later.

3.1.2.3 Recommended assigned noise levels for non fixed machines and power tools

Non-fixed machines and power tools such as lawnmowers can emit significant levels of noise, but are commonly only used for short periods of time. As it is difficult to set a reasonable recommended assigned noise level for the use of this type of machine, this framework guideline recommends that non-fixed domestic machines emitting a (continuous) noise level greater than 45 dB(A) or a maximum noise level of 60 dB(A) when measured in a habitable room must only be used within the hours prescribed in Table 3.1.

Table 3.3 covers the recommended assigned noise levels for non-fixed machines and power tool usage.

Table 3.3: Recommended assigned noise levels for non-fixed machines and power tools

Type of noise	Recommended assigned noise level (dB(A) – continuous	Recommended assigned noise level (dB(A) – maximum
Chainsaws	45	60
Lawn mower	45	60
Other power tools	45	60

Notwithstanding the above, the NT EPA may take action where it is determined that non fixed machine and power tool noise is unreasonable due to the excessive duration or disturbing nature of the noise emitted.

3.1.3 Methods used to assess neighbourhood noise

3.1.3.1 Audibility test applied to recommended prohibited times

Audibility in a neighbouring residence is used by NT EPA authorised officers to determine whether noise from the noise sources listed in Table 3.1 that often result in neighbourhood complaints is unreasonable and thus is likely to constitute an environmental nuisance.

Noise from equipment listed in Table 3.1 should not be able to be heard in a habitable room in a neighbouring residence during the recommended prohibited times (a “habitable” room is any room other than a garage, storage area, bathroom, laundry, toilet or pantry) with doors closed and windows open if it’s the only source of ventilation otherwise doors and windows are closed.

In response to noise complaints relating to noise associated with fixed domestic equipment authorised officers undertake assessments and satisfy themselves that the noise is audible in the habitable room and is coming from the alleged source before any potential action is taken. This may involve listening to the noise inside and outside the affected residence (sensitive noise receptor). It is expected that a complainant will give the investigating officer access to the relevant habitable room(s) of their home to conduct the audibility test.

As part of this process authorised officers will normally request a signed statement from the affected person about the audibility of the noise inside the residence.

The statement should describe the effect the noise is having on the affected person. Where statements are relied upon by an officer to determine that a noise is ‘offensive’, the person making the statement is advised that they might need to give evidence in court.

3.1.3.2 The duration of noise test for vehicle and building intruder alarms – a special case

The NT EPA recommends that a specific duration test be applied to noise from vehicle and building intruder alarms to determine whether the alarm is causing undue noise or environmental harm.

For motor vehicle alarms if a person causes or permits an alarm to sound for longer than 45 seconds a regulatory response can be triggered (see Table 2.1).

In the case of a building alarm, an occupier of the premises who causes or permits an alarm to sound for longer than the specified time limit and it is audible inside a habitable room of a dwelling may also trigger a regulatory response. Exemptions to this are if the alarm sounds for longer than the specified time limit if the vehicle has been involved in an accident, or has damaged windows or been broken into.

This duration test simply means that a non-compliance has occurred where an alarm sounds for longer than 45 seconds or 5 minutes and that a regulatory response consistent with section 2 may be triggered.

Where an alarm sounds intermittently, it is taken to sound continuously for the purpose of measuring the duration for which it has sounded. For example, a car alarm that sounds for 30 seconds, stops for 60 seconds and sounds again for 30 seconds is taken to have sounded for more than the permitted 45 seconds. This approach applies for both building and car alarms.

The location where the intruder alarm is heard may be important. For building intruder alarms, the assessment is made inside a habitable room in a neighbour's residence. For vehicle intruder alarms the assessment can be made anywhere.

3.1.4 Assessment of offensive noise

In the above cases, the times of use or duration of the noise may automatically make the noise offensive⁶ and therefore likely to be non-compliant with the environmental harm/environmental nuisance provisions of the WMPC Act⁷ as well as the undue noise provisions of the Summary Offences Act.

In other cases NT EPA officers consider a range of factors to determine whether the noise is offensive, including the following:

- the loudness of the noise, especially compared with other noise in the area
- the character of the noise
- the time and duration of the noise
- whether the noise is typical for the area
- how often the noise occurs
- inherently offensive characteristics, and

6

"Offensive noise" has been considered by the Land and Environment Court in *Meriden v Pedavoli* (2009), NSW Land and Environment Court judgement 183 (22 October 2009).

⁷ As discussed above an offensive noise emission is an unreasonable noise emission.

- the number of people affected by the noise.

For the purposes of this guideline the term “offensive noise” is defined as noise:

that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:

- (a) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted; or*
- (b) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted.*

The checklist below is used by NT EPA authorised officers and can be used by other regulators to make systematic judgements about whether a particular noise is offensive. This checklist is not exhaustive and it is not necessary that all the questions are answered “yes” before a noise can be deemed offensive.

The offensive noise test applies to a wide range of situations and relies on the judgement of an NT EPA authorised officer or other relevant officer authorised under other legislation. With regard to NT EPA authorised officers it is utilised when they are considering issuing one or more of the environmental management instruments covered in section 2.

It is important to note that an article or activity may cause offensive noise at any time of the day or night even if it occurs at a time when the use of the article or activity is permitted to be audible.

Although noise measurements are not essential to test whether noise is offensive, an officer may choose to take measurements using a calibrated sound level meter (SLM) if they think it will assist the process, especially to support a prosecution or the issue of a penalty infringement notice (see section 2.2.4).

3.1.4.1 Offensive noise test: the questions that are to be considered by authorised officers and other regulators in applying the offensive noise test

Q1: Is the noise loud in an absolute sense? Is it loud relative to other noise in the area?

This question establishes that the noise is likely to be heard by neighbours. Its volume alone may be annoying. An example would be music playing at a very high volume in a residence so it can be heard over very noisy activity outside, such as construction work. The noise may also be loud relative to the background noise. An example would be loud fireworks set off late at night (excluding the period between 6 p.m. to 11 p.m. on 1 July of each year). Noise measurements using a SLM would help to determine how loud the noise is relative to the recommended assigned noise levels prescribed in Table 3.2 and Table 3.3. Section 3.1.4.2 provides two methods in determining the loudness of the source noise and hence its offensiveness. The default method is to use the recommended assigned noise levels in Table 3.2 and Table 3.3; however in certain situations the “intrusive” noise level approach can be used.

Q2: Does the noise include characteristics that make it particularly irritating?

The presence of tones, impulses or fluctuations in volume can make people more likely to react to the noise. These can be judged subjectively but noise measurements will help to quantify the extent of these characteristics. Examples might be screeching sounds from poorly maintained equipment or a ‘beeper’ alarm that uses a pulsed sound made up of one or two alternating frequency tones, usually higher pitched, that are louder than the background noise in the area.

Q3: Does the noise occur at times when people expect to enjoy peace and quiet?

People usually expect their surroundings to be quieter during the evening and at night. Authorised officers discuss with complainants about how the noise affects them to see if it is interfering unreasonably with their comfort at home. For example, is it regularly disturbing their sleep, making it difficult to have a conversation, study, read or hear the TV? Noise that regularly disturbs sleep is likely to be considered offensive by complainants and this is taken into account in officers' assessment.

Q4: Is the noise atypical for the area?

Where noise from an activity that is new or unusual for an area, people are more likely to react. Officers will look at the typical uses of the area and determine whether the activity is consistent with the local planning zones. An example might be a community event with amplified music affecting a residential area that has not traditionally been affected by such events (see also section 3.4).

Q5: Does the noise occur often?

Noise can be more annoying when it occurs frequently. Examples might be a leaf blower used every morning or a band that practises frequently without regard to the impact on neighbours.

Q6: Are a number of people affected by the noise?

Only one person needs to be affected by the noise for it to be deemed offensive. However, talking to other neighbours likely to be exposed to the same noise about how it affects them may assist in deciding what action to take. The NT EPA for example will normally invoke its noise complaint process which identifies the minimum number of complaints from different individuals before taking formal action (see Guidance Document Number One).

3.1.4.2 Measuring noise for comparison against the recommended assigned noise levels covered in this section (Tables 3.2 and 3.3)

The L_{Aeq} is normally the most suitable descriptor used for describing the noise under investigation. For neighbourhood noise sources this should be measured at the most affected point which is usually in a habitable room even with doors closed and as stated above with windows open if it's the only means of ventilation.

See also Guidance Document Number Two for guidance when using SLMs.

As an alternative to using the recommended assigned noise levels prescribed in Table 3.2 and Table 3.3 it may be appropriate at times to use an alternative method to determine a level of noise that interferes with the amenity of affected residents from neighbourhood noise – the “intrusive” noise level.

Noise is identified as ‘intrusive’ if it is noticeably louder than the background noise (a certain defined level) and considered likely to disturb or interfere with those who can hear it which requires measurement. Pollution abatement notices and authorised officer directions can prescribe noise levels that need to be achieved which are below an intrusive noise level, as defined.

Intrusive noise levels have been defined for a number of situations in section 3.3 and 3.4 of this guideline as outlined below.

Section 3.2 which covers commercial and industrial noise is specifically aimed at large and complex industrial activities, defines intrusive noise as 5 decibels above the background noise level. The section recognises that industrial operations run for extended periods or all day and night and generate steady and continuous noise.

Section 3.3 recognises that there may be some community reaction to noise from major construction projects where this is more than 10 decibels above the background noise level for work during the daytime. This recognises that construction noise is generally temporary with the community having a slightly higher tolerance for it.

The background level that is to be used for neighbourhood noise is the L_{A90} measurement of all noise in the area of the complaint without the subject neighbourhood noise operating or affecting the measurement results.

If measured noise at an affected residential premises exceeds the background noise by more than 5 dB(A) as measured over a 15-minute period (L_{Aeq} (15 minute)) then it will be determined as intrusive and may trigger a regulatory response in accordance with section 2.2.4. The process involves establishing the difference between the background noise level and the noise under investigation

3.2 Commercial and Industrial Noise

3.2.1 Background

Commercial and industrial noise can have a significant effect on sensitive noise receptors surrounding a premises. The focus of this section is on the noise emitted from commercial and industrial sites and how this may impact on nearby sensitive noise receptors. It provides information on the assessment and management of commercial and industrial noise. It also provides a framework for the assessment and derivation of the **project specific assigned noise level** and formally introduces the concept of feasible and reasonable mitigation measures.

This section has been adapted and modified from the *NSW Industrial Noise Policy 2000* and the *NSW EPA Noise Policy from Industry 2017* to provide a balance between protecting community wellbeing and amenity near commercial and industrial premises as well as supporting the social and economic value of commerce and industry.

The key departure from the NSW approach is the inclusion of the concept of the **project specific assigned noise level** which replaces the “project noise trigger level” contained in the *NSW EPA Noise Policy from Industry 2017*. The **project specific assigned noise level** is a recommended mandatory limit and if exceeded will require noise management mitigation actions to be taken by proponents of commercial or industrial premises. A modified table (Table 3.5) has also been added which is to be used when determining component A of the **project specific assigned noise level**. This modified table includes recommended maximum assigned amenity noise levels which are mandatory limits in the NT and differs from the equivalent table in the *NSW EPA Noise Policy from Industry 2017*.

All other aspects of the *NSW EPA Noise Policy from Industry 2017* apart from this variation are applicable to the Northern Territory context.

For example, the following parts can be readily used from the *NSW EPA Noise Policy from Industry 2017*:

- Measurement of existing background levels, using procedures outlined in Fact Sheets A and B
- Predicting or measuring noise levels produced by a development (Section 3.3), having regard to the presence of annoying noise characteristics (Fact Sheet C) and meteorological effects such as temperature inversions and wind (Fact Sheet D)
- What feasible and reasonable mitigation measures are (Section 3.1 and Fact Sheet F)

- Comparing the predicted or measured noise level with the project specific assigned noise level
- Assessing impacts and the need for noise mitigation and management measures (Section 3.4)
- Considering residual noise impacts, and
- Monitoring and reporting environmental noise levels from a development (Section 7).

3.2.2 Types of noise sources covered in this section

The types of noise sources dealt within this section include:

- commercial premises
- industrial premises
- extractive industry premises for impacts of noise beyond leases
- mining operations premises for impacts of noise beyond leases
- petroleum operations premises for impacts of noise beyond leases
- warehousing premises
- maintenance and repair facility premises
- intensive agricultural and livestock premises, for example, cattle feedlots and poultry farms
- utility generation/reticulation service premises
- mechanical plant and equipment
- industrial and commercial processes
- mobile sources confined to a particular location (for example, drag lines, haul trucks, intermodal facilities and rail shunting yards), and
- vehicle movements within the premises and/or on private roads.

3.2.3 Types of noise sources not covered

This section does not apply to:

- vehicles associated with an industrial premises that are on a public road
- transportation corridors (roadways, railways, waterways and air corridors)
- noise from sporting facilities, including motor sport facilities
- neighbourhood (or residential) noise (see section 3.1)
- construction activities (see section 3.3)
- entertainment venue noise (see section 3.4)
- vibration and blasting activities (see section 3.3 and 3.5)
- shooting ranges, and
- internal or occupational noise within any workplace regulated by NT Worksafe.

The following sections cover the key aspects and steps for the management of commercial and industrial noise as modified for the Northern Territory context.

3.2.4 Recommended commercial and industrial project specific assigned noise levels

As discussed above, the following introduces the concept of the **project specific assigned noise level** which is the level which may and will usually require feasible and reasonable noise mitigation measures to be implemented. The **project specific assigned noise level** is derived by considering two factors, or 2 components: shorter-term intrusiveness due to changes in the noise environment (component A) (see section 3.2.5.1), and maintaining the noise amenity of an area (component B) (see section 3.2.5.2).

The **project specific assigned noise level** is the lower (that is, the more stringent) value of the **project intrusiveness noise level** and **project amenity noise level** as determined in Sections 2.3 and 2.4 of the *NSW EPA Noise Policy for Industry 2017* and reproduced below.

The following sections set out the procedure to determine the **project specific assigned noise level** relevant to a particular commercial/industrial premises. The **project specific assigned noise level** applies to existing **sensitive noise receptors** and may also be used in strategic planning processes for proposed land uses or matters capable of having environmentally significant effects under the NT Environmental Assessment Act.

The **project specific assigned noise levels** differentiate between noise impacts during the day, evening and night⁸. More stringent levels are applied for evening and night-time as it is widely accepted that noise is generally more disturbing in the evening and night because more noise-sensitive activities occur at those times (such as socialising, relaxing and sleeping). Also, most residents are typically at home and noise is more intrusive due to lower background levels during the evening and at night.

If noise generated from an existing premises exceeds or if it is predicted that a proposed development is likely to cause the **project specific assigned noise level** from or for a premises to be exceeded at existing or proposed **sensitive noise receptors**, feasible and reasonable mitigation measures need to be considered by proponents to seek to reduce the actual or predicted noise level. It can also be used as a mandatory requirement in a statutory notice (see section 2.2.4) or licence requirement by the NT EPA under the WMPC Act for example to require the implementation of feasible and reasonable mitigation measures.

3.2.5 Determining the project specific assigned noise level

The **project specific assigned noise level** is tailored for each specific circumstance to take into account a range of factors that may affect the level of impact, including:

- the receiver's background noise environment
- the time of day of the activity
- the character of the noise, and
- the type of receiver and nature of the area.

The scientific literature indicates that both the increase in noise level above background levels (that is, the intrusiveness of a source), as well as the absolute level of noise are important factors in how a community will respond to noise from industrial and commercial sources. The **project specific assigned noise level** addresses each of these components of noise impact.

As discussed above, the **project specific assigned noise level** is derived by considering its two components:

⁸ See notes at the of section 3.2.5.1 for a coverage of the times over a 24 hour period

- Component A: shorter-term intrusiveness due to changes in the noise environment (intrusiveness noise level) (Section 3.2.5.1), and
- Component B: maintaining the noise amenity of an area (amenity noise level) (Section 3.2.5.2).

Measurement of existing background levels, using the procedures outlined in Fact Sheets A and B in the *NSW EPA Noise Policy for Industry 2017* is required for this step.

The **project intrusiveness noise level** aims to protect against significant changes in noise levels, whilst the **project amenity noise level** seeks to protect against cumulative noise impacts from industry and maintain amenity for particular land uses. Applying the most stringent requirement as the **project specific assigned noise level** ensures that both intrusive noise is limited and amenity is protected and that no single industry can unacceptably change the noise level of an area.

The worked case studies in Fact Sheet E of the *NSW EPA Noise Policy for Industry 2017* show how both components are used to determine the **project specific assigned noise level**.

Typically, the **project intrusiveness noise level** will inform the **project specific assigned noise level** in areas with little industry (and/or ambient noise levels), whereas the **project amenity noise level** will inform the project specific assigned noise level in areas with higher existing background noise levels.

Intrusive noise levels are only applied to residential receptors (residences). For other receptor types identified in Table 3.5, only the amenity levels apply.

3.2.5.1 Component A: project intrusiveness noise level

The intrusiveness of an industrial or commercial noise source may generally be considered acceptable if the level of noise from the source (represented by the **L_{Aeq} descriptor**), measured over a 15-minute period, does not exceed the background noise level by more than 5 dB when beyond a minimum threshold. The intrusiveness noise level seeks to limit the degree of change a new noise source introduces to an existing environment.

To account for the temporal variation of background noise levels, the method outlined in Fact Sheet A of the *NSW EPA Noise Policy for Industry 2017* is required for determining the background noise level (**Rating Background Level or RBL**)⁹ to be used in the assessment. The outcome of this approach aims to ensure that the intrusiveness noise level is being met for at least 90% of the time periods over which annoyance reactions can occur (taken to be periods of 15 minutes).

Figure 3.1 below provides how the project intrusiveness noise level (Component A) is determined.

⁹ See section 5 for a definition of the RBL.

Figure 3.1: Determining the intrusiveness noise level

$L_{Aeq, 15min} = \text{rating background noise level} + 5 \text{ dB}$

where:

$L_{Aeq, 15min}$

represents the equivalent continuous (energy average) A-weighted sound pressure level **of the source** over 15 minutes.

and

Rating background noise level

represents the background level to be used for assessment purposes, as determined by the method outlined in Fact Sheets A and B in the NSW EPA Noise Policy for Industry.

In some rural situations, the RBL may be the same for the day, evening and night. In these cases, it is recognised that excursions of noise above the **project intrusiveness noise level** during the day would not usually have the same impact as they would during the evening or night. This is due to the more sensitive nature of activities likely to be disturbed at night (for example, sleep and relaxation).

Minimum assumed RBLs apply in this guideline which results in minimum intrusiveness noise levels as follows:

Table 3.4: Minimum assumed RBLs and project intrusiveness noise levels.

Time of day	Minimum assumed rating background noise level (dB[A])	Minimum project intrusiveness noise levels ($L_{Aeq, 15min}$ dB[A])
Day	35	40
Evening	30	35
Night	30	35

3.2.5.2 Component B: amenity noise levels and project specific amenity noise levels

To limit continuing increases in noise levels from the application of the intrusiveness level alone, the ambient noise level within an area from **all** industrial noise sources combined should remain below the **recommended maximum assigned amenity noise levels** specified in Table 3.5 where feasible and reasonable. The **recommended maximum assigned amenity noise levels** contained in Table 3.5 will protect against noise impacts such as speech interference, community annoyance and some sleep disturbance.

The **recommended maximum assigned amenity noise levels** have been selected on the basis of studies that relate industrial noise to annoyance in communities (Miedema and Voss, 2004). They have been subjectively scaled to reflect the perceived differential expectations and ambient noise environments of rural, suburban and urban communities for residential receptors. They are based on protecting the majority of the community (90%) from being highly annoyed by industrial or commercial noise.

The **recommended maximum assigned amenity noise levels** represent **total** industrial noise at a receptor location, whereas the **project specific amenity noise level** represents the assigned noise level from a **single** industrial development at a receptor location.

To ensure that industrial noise levels (existing plus new) remain within the **recommended maximum assigned amenity noise levels** for an area, a **project specific amenity noise level** applies for each new source of industrial noise as follows:

Project specific amenity noise level for industrial development = recommended maximum assigned amenity noise level (Table 3.5) minus 5 dB(A).

The following exceptions to the above method to derive the **project specific amenity noise level** apply:

- In areas with high traffic noise levels (see Section 2.4.1 of the *NSW EPA Noise Policy for Industry 2017*)
- In proposed developments in major industrial clusters (see Section 2.4.2 of the *NSW EPA Noise Policy for Industry 2017*)
- Where the resultant **project specific amenity noise level** is 10 dB or more lower than the existing industrial noise level. In this case the **project specific amenity noise level** can be set at 10 dB below existing industrial noise levels if it can be demonstrated that existing industrial noise levels are unlikely to reduce over time, and
- Where cumulative industrial noise is not a necessary consideration because no other industries are present in the area, or likely to be introduced into the area in the future. In such cases the relevant amenity noise level is assigned as the **project specific amenity noise level** for the development.

Table 3.5: Recommended maximum assigned amenity noise levels

Receptor	Noise Amenity Area	Time of day	L _{Aeq} , dB(A)
See Table 3.6 to determine which residential receiver category applies			Recommended maximum assigned amenity noise level
Residential	Rural	Day	50
		Evening	45
		Night	40
	Suburban	Day	55
		Evening	45
		Night	40
	Urban	Day	60
		Evening	50
		Night	45
Hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks	See column 4	See column 4	5 dB(A) above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day
School classroom – internal	All	Noisiest 1-hour period when in use	35 (see notes for table below)
Hospital ward	All	Noisiest 1-hour	35
		Noisiest 1-hour	50
Place of worship – internal	All	When in use	40
Area specifically reserved for passive recreation (e.g. national park)	All	When in use	50
Active recreation area (e.g. school playground, golf course)	All	When in use	55
Commercial premises	All	When in use	65
Industrial premises	All	When in use	70
Industrial interface (applicable only to residential noise amenity areas)	All	All	Add 5 dB(A) to recommended noise amenity area

Notes: The recommended maximum assigned amenity noise levels refer only to noise from industrial and commercial sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration.

The levels represent outdoor levels except where otherwise stated (see section 3.2.6).

Types of receivers are defined as follows:

- rural residential – see Table 3.6
- suburban residential – see Table 3.6
- urban residential – see Table 3.6
- industrial interface – an area that is in close proximity to existing industrial premises and that extends out to a point where the existing industrial noise from the source has fallen by 5 dB or an area defined in a planning instrument. Beyond this region the amenity noise level for the applicable category applies. This category may be used only for existing situations (further explanation on how this category applies is outlined in section 3.2.8 below)
- commercial – commercial activities being undertaken in a planning zone that allows commercial land uses, and
- industrial – an area defined as an industrial zone; for isolated residences within an industrial zone the industrial maximum amenity level would usually apply.

Time of day is defined as follows:

- day – the period from 7 am to 6 pm Monday to Saturday or 8 am to 6 pm on Sundays and public holidays
- evening – the period from 6 pm to 10 pm, and
- night – the remaining periods.

3.2.5.3 Residential receiver locations and the Northern Territory Planning Scheme Zones

To correctly identify which of the residential receptor categories applies in any particular circumstance careful judgement based on site-specific circumstances and consultation with the relevant consent/regulatory authority may be required.

It is recommended that advice is sought to correctly identify which residential receiver category may be impacted by an existing or proposed project prior to any noise assessment being undertaken.

Table 3.6 aligns residential receivers with the zones included within the Northern Territory Planning Scheme.

Where there isn't any zone (unzoned land) for a particular area or an impacted residential receiver is not adequately defined then the zoning category that will apply for the purposes of this guideline will be the purpose the premises is used for at the time the noise assessment will be undertaken.

Table 3.6 below provides guidance on assigning residential receiver noise categories which is specific for the NT.

Table 3.6: Determining which of the residential receptor categories applies

Receptor category	Typical planning zoning	Typical existing background noise levels	Description
Rural residential	H - Horticulture A - Agriculture RR - Rural Residential RL - Rural Living R - Rural	Daytime RBL <40 dB(A) Evening RBL <35 dB(A) Night RBL <30 dB(A)	Rural – an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic noise and generally characterised by low background noise levels. Settlement patterns would be typically sparse. Note: Where background noise levels are higher than those presented in column 3 due to existing industry or intensive agricultural activities, the selection of a higher noise amenity area should be considered.
Suburban residential	SD - Single Dwelling Residential CV - Caravan Parks CL - Community Living	Daytime RBL <45 dB(A) Evening RBL <40 dB(A) Night RBL <35 dB(A)	Suburban – an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristic: evening ambient noise levels defined by the

			natural environment and human activity.
Urban residential	MD - Multiple Dwelling Residential MR - Medium Density Residential HR - High Density Residential CB Central Business C Commercial T Township	Daytime RBL > 45 dB(A) Evening RBL > 40 dB(A) Night RBL > 35 dB(A)	Urban – an area with an acoustical environment that: <ul style="list-style-type: none"> • is dominated by ‘urban hum’ or industrial source noise, where urban hum means the aggregate sound of many unidentifiable, mostly traffic and/or industrial related sound sources • has through-traffic with characteristically heavy and continuous traffic flows during peak periods • is near commercial districts or industrial districts • has any combination of the above.

3.2.6 Noise measurement (assessment) locations

- **For a residence**, the **project specific assigned noise level** is to be assessed at the reasonably most-affected point on or within the residential property boundary or, if that is more than 30 metres from the residence, at the reasonably most-affected point within 30 metres of the residence, but not closer than 3 metres to a reflective surface and at a height of between 1.2–1.5 metres above ground level. This should not be read to infer that the **project specific assigned noise level** (or a limit in a statutory document) applies only at the reasonably most-affected location.
- **For multi-storey residential buildings** (greater than two storeys) where a ground floor assessment location is deemed to be unrepresentative of the exposure of upper stories, the assessment may be undertaken at a representative elevation and closer than 3 metres to a reflective surface, with agreement of the NT EPA or other relevant regulator. However, the assessed/measured noise level is to be suitably adjusted to reflect a ‘free field’ (that is, nominally no reflective signals) assessment/measurement location.
- **In assessing amenity noise levels at commercial or industrial premises**, the noise level is to be assessed at the reasonably most-affected point on or within the property boundary. Again, this requirement should not be read to infer that the noise level **only** applies at the ‘reasonably worst-affected location’.
- **In assessing amenity noise levels at passive and active recreational areas**, the noise level is to be assessed at the most-affected point within the area that is reasonably expected to be used by people, for example, picnic areas or walking tracks.

Where internal amenity noise levels are made they refer to the noise level at the centre of the habitable room that is most exposed to the noise and apply with doors closed and windows opened sufficiently to provide adequate ventilation, except where alternative means of ventilation complying with the Building Code of Australia are provided (i.e. if windows are the only means of ventilation then they remain open). In cases where gaining internal access for monitoring is difficult, then external noise levels 10 dB(A) above the internal levels apply.

3.2.7 Effects of changing land use

When land uses in an area are undergoing significant change, for example, residential subdivisions with associated development of local and regional roads, the background noise levels would be expected to change, sometimes significantly. The impact of noise from an existing industry on a proposed new residential area should be made using the **recommended maximum assigned amenity noise level** for the residential land use, not the **project intrusiveness noise level**. Where impacts exceed the **recommended maximum assigned amenity noise level**, consideration should be given to how these impacts can be avoided or mitigated, such as modifying the location of the proposed residential development, placing screening land uses in-between the proposed residences and existing industry, or ensuring residences are built in a manner that provides acceptable indoor noise amenity.

3.2.8 Industrial interface

This industrial interface assessment section recognises that a marginally reduced acoustic amenity is acceptable for existing residences co-located with existing industry, and that the availability of feasible and reasonable noise mitigation measures might be limited in these circumstances.

The industrial interface assessment generally applies only for existing situations (that is, an existing sensitive noise residential receptor near an existing industry that is proposing expansion or modification) and generally only for those residential receptors that are:

- in the immediate area surrounding the existing industry (that is, the region that extends from the boundary of the existing industry to the point where the noise level of the existing industry, measured at its boundary, has fallen by 5 dB or as agreed between the proponent and the relevant authority at the commencement of a noise impact assessment or related study), and
- where existing industrial noise levels (including noise from the premises under consideration) are above the relevant rural, suburban or urban **recommended maximum assigned amenity noise levels**.

Beyond the interface region (that is, beyond the point where noise has fallen by 5 dB) the **recommended maximum assigned amenity noise level** relevant to the receiver category that most describes the area (rural, suburban or urban) would apply.

For developments of a limited nature such as an extension to **existing** process or plant, or replacement of part of an **existing** process or plant with new technology, the industrial interface assessment applies.

However, where a new development on an existing site is of a substantial nature (for example, demolition of the existing plant and replacement with current technology or different type of plant) and where replacement of the existing plant has a realistic potential to significantly reduce sensitive receptor noise levels through using feasible and reasonable noise mitigation (that is, where the existing plant is the dominant or a significant contributor to receiver noise levels), then the applicable noise level for the

new development is the appropriate (rural, suburban or urban) **recommended maximum assigned amenity noise level** for the location.

In most cases, the situation will be apparent, but in some cases careful judgement will be required to determine whether the new development is of sufficient magnitude to effectively replace the existing plant. In situations where no clear conclusion on the magnitude of change created by the new development is possible, then the industrial interface assessment should apply.

In all cases, however, the proponent/licensee/occupier is required to demonstrate that all feasible and reasonable noise mitigation measures are being applied before the industrial interface criteria are adopted.

The **project specific assigned noise levels** apply to noise from the whole premises (existing and proposed). However, where the works are relatively minor or contained in a particular area within a premises, contribution noise levels from the new works only may be acceptable and should be set at:

- 10 dB below premises-based **project specific assigned noise levels**, or
- 10 dB below existing premises noise levels where they exceed the **project specific assigned noise levels** and cannot be reduced with feasible and reasonable noise mitigation measures.

Where this approach is proposed, this should be discussed and agreed to by the consent/regulatory authority.

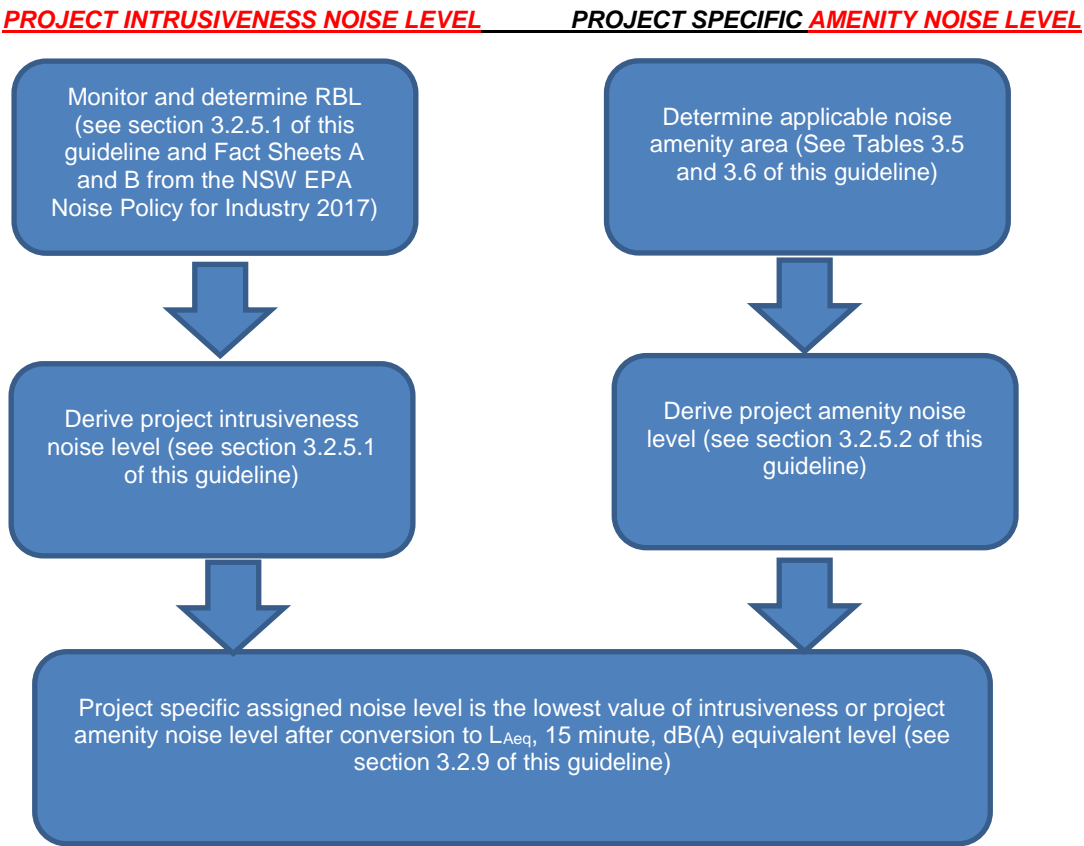
3.2.9 Project-specific assigned noise levels

After determining the relevant noise levels for both component A and component B the **project-specific assigned noise levels** can be assigned.

As discussed above the **project specific assigned noise level** reflects the most stringent noise level requirement from the noise levels derived from both the **project intrusiveness noise level** and **project specific amenity noise level**. They set the benchmark against which noise impacts and the need for noise mitigation are assessed. Applying the most stringent requirement as the **project specific assigned noise level** ensures that both intrusive noise is limited and amenity is protected.

Figure 3.2 summarises the process to be undertaken when determining **project specific assigned noise levels** for commercial and industrial sources.

Figure 3.2: Determining the project specific assigned noise level.



3.3 Construction Noise

3.3.1 Background

This section covers noise associated with construction and includes the erection, installation, alteration, repair, maintenance, cleaning, painting, renewal, removal, excavation, road paving and roadworks generally, dismantling or demolition of, or addition to, any building or structure, or any work in connection with any of these activities, that is done at or adjacent to the place where the building or structure is located.

It primarily covers airborne noise transmitted by the air from the above activities and is usually the type of noise encountered from construction and ground-borne noise generated via vibration transmitted through the ground into a structure, for example, by rock breaking works during construction of a carpark below ground level.

The recommended assigned construction noise levels introduced in this section are important indicators for proponents, managers and others in the construction sector to avoid or minimise noise that, if not considered, could lead to delays and enforcement action.

This section also covers standard hours of operation and exemptions to these as well as the type of assessment used to ensure compliance with the recommended assigned noise levels. The two methods used to assess construction noise and covered in this section include the qualitative noise assessment (section 3.3.4.1) and the quantitative noise assessment (section 3.3.4.2).

This section does not cover the following types of noise:

- occupational noise exposure (NT Worksafe)
- noise from power tools and equipment used on residential premises (neighbourhood noise – covered in section 3.1)
- overpressure and vibration from blasting (see section 3.5)
- human comfort vibration from construction works
- noise from public roads and construction traffic noise on public roads, or
- noise from commercial and industrial sources (for example, factories, quarrying, mining, and including construction associated with quarrying and mining – covered in section 3.2).

Section 10 of the NT EPA publication titled, *Guidelines to prevent pollution from building sites* contains additional information on the management of noise from construction sites in the NT.

3.3.2 Recommended standard hours for construction work

The NT EPA recommends the standard hours for construction work as shown in Table 3.7 to protect the amenity of people during times they are most likely to be impacted (i.e. impact on sensitive noise receptors). Again, people's reaction to noise from construction will depend on the time of day that the works are undertaken. Residents are usually most annoyed by work at night-time as it has the potential to disturb sleep. Noise from work on evenings, Saturday afternoons, Sundays and public holidays can also be annoying to most residents as it may interrupt leisure activities.

The likely noise impacts and the ability to undertake works during the recommended standard hours need to be considered when proponents are scheduling work.

There are some situations (categories), as described below in section 3.3.2, where construction work may need to be undertaken outside of these hours.¹⁰

Table 3.7: Recommended standard hours of work

Work type	Recommended standard hours of work	Notes
Normal construction	Monday to Saturday 7am to 7 pm and between 9am and 6pm Sundays or public holidays	Construction activities occurring before or after the recommended standard hours of work will incur a regulatory response in accordance with section 2.2.4 of this guideline.
Blasting	Monday to Friday 9am to 5 pm Saturday 9am to 1pm No blasting on Sundays or public holidays	

3.3.3 Construction outside the recommended standard hours

The five categories of works that might be undertaken outside the recommended standard hours are:

1. the **delivery of oversized plant or structures** that police or other authorities determine require special arrangements to transport along public roads
2. **emergency work** to avoid the loss of life or damage to property, or to prevent environmental harm
3. **maintenance and repair of public infrastructure** where disruption to essential services and/or considerations of worker safety do not allow work within standard hours
4. **public infrastructure works** that shorten the length of the project and are supported by the affected community, or
5. works where a proponent demonstrates and justifies **a need to operate outside the recommended standard hours. Examples of these are concrete pours in the hot and humid Northern Territory climate and for instances of worker safety and traffic impacts.**

3.3.4 Recommended assigned construction noise levels – airborne noise and ground-borne noise

The following sections cover recommended assigned construction noise levels for airborne noise and ground-borne noise. Where all reasonable and feasible measures have not been applied and a noise assessment conducted exceeds the recommended

¹⁰ The relevant regulatory authority may impose more or less stringent hours of work.

assigned construction noise levels as prescribed in this section it will likely lead to a regulatory response in accordance with section 2.2.4 of this guideline.

Section 3.3.5.2 covers the locations where the different recommended assigned construction noise levels apply (i.e. the noise sampling locations) which can be internal or external.

3.3.4.1 Assigned construction noise levels for airborne noise at residential premises

Table 3.8 sets out the recommended assigned construction noise levels for noise at residences and how they are to be applied and which assessment methods are to be used (see sections 3.3.5.1 and 3.3.5.2).

Table 3.8: Recommended assigned construction noise levels for airborne noise at residential premises using both assessment methods.

Descriptor	Recommended assigned construction noise level at residences L_{Aeq} (15 min)	Notes
Short term construction projects		
Construction projects of less than 3 week's duration	Qualitative Assessment Method is used (see section 3.3.5.1)	
Construction projects of greater than 3 weeks' duration – the quantitative assessment method is used for these projects (see section 3.3.5.2)		
Monday to Saturday 7am to 7pm Sundays and public holidays 9am to 6pm	Recommended assigned noise affected level: RBL + 10 dB	The recommended assigned noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured L_{Aeq} (15 min) is greater than the recommended assigned noise affected level, proponents should apply all feasible and reasonable work practices to meet the recommended assigned noise affected level. Proponents should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
Outside recommended standard hours	Recommended assigned noise affected level: RBL + 5 dB	A strong justification would typically be required for works outside the recommended standard hours. Proponents should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the recommended assigned noise affected level, proponents should negotiate with the community.

Descriptor	Recommended assigned construction noise level at residences L_{Aeq} (15 min)	Notes
		See Guidance Document Number One for guidance on community engagement.

3.3.4.2 Recommended assigned construction noise levels for airborne noise at other sensitive noise receptors (land uses)

Other sensitive noise receptors, such as schools, typically consider noise from construction to be disruptive when the properties are being used (such as during school times). Table 3.9 presents recommended assigned construction noise levels for noise at these other sensitive land uses based on the principle that the characteristic activities for each of these land uses should not be unduly disturbed. Proponents should consult with noise sensitive land use occupants (noise sensitive receptors) likely to be affected by noise from the works to schedule the project's work hours to achieve a reasonable noise outcome.

Table 3.9: Recommended assigned construction noise levels for airborne noise at sensitive noise receptors (other than residences) using the quantitative assessment method

Land use	Recommended assigned noise level L_{Aeq} (15 min) at sensitive land uses (other than residences)
Classrooms at schools and other educational institutions	Internal noise level 45 dB(A)
Hospital wards and operating theatres	Internal noise level 45 dB(A)
Places of worship	Internal noise level 45 dB(A)
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65 dB(A)
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level 60 dB(A)
Community centres	Depends on the intended use of the centre. Refer to the recommended 'maximum' internal levels in AS2107 for specific uses.

3.3.4.3 Recommended assigned construction noise levels for airborne noise for commercial and industrial premises

Due to the broad range of sensitivities that commercial or industrial land can have to noise from construction, the process of defining recommended assigned construction noise levels is separated into three categories. Table 3.10 provides recommended assigned construction noise levels for the three categories.

Table 3.10: Recommended assigned noise levels for airborne noise at commercial and industrial premises

Category	Land use	Recommended assigned construction noise levels
One	Industrial premises	External: L _{Aeq} (15 min) 75 dB(A)
Two	Offices, retail outlets	External: L _{Aeq} (15 min) 70 dB(A)
Three	Other businesses that may be very sensitive to noise such as theatres and child care centres.	See section 3.3.5.2 which refers to AS2107

3.3.4.4 Recommended assigned construction noise levels for ground-borne noise at residences

The recommended assigned construction ground-borne noise levels for residences in Table 3.11 indicate when mitigation management actions are to be implemented. These levels recognise the temporary nature of construction and are only applicable when ground-borne noise levels are higher than airborne noise levels. The recommended assigned construction ground-borne noise levels are for evening and night-time periods only, as the objectives are to protect the amenity and sleep of people when they are at home.

Table 3.11: Recommended assigned construction noise levels for ground-borne noise at residences

Time	Recommended assigned construction ground-borne noise levels
Evening (6pm to 10pm)	Internal: L _{Aeq} (15 min) 40 dB(A)
Night-time (10pm to 7am)	Internal: L _{Aeq} (15 min) 35 dB(A)

3.3.5 Methods used to assess construction noise for both airborne and ground-borne noise

The assessment procedures covered in this section are to be followed when assessing construction site noise. The procedures have largely been adopted from the NSW Interim Construction Noise Guideline (as amended). They are applicable for both proposed projects where noise will likely be an issue and for existing projects which generate complaints to the NT EPA.

Where noise impacts from a construction project are identified via complaints, NT EPA authorised officers have two options available to them to evaluate performance noise emanating from source projects:

- examination of work practices – they undertake a **qualitative noise assessment**, or

- noise monitoring – they undertake a **quantitative noise assessment**.

The qualitative method is generally applied for short-term works such as infrastructure maintenance whilst the quantitative method is generally used for longer-term construction.

3.3.5.1 Qualitative noise assessment – construction noise

The qualitative method for assessing noise is a simplified way to identify the cause of potential noise impacts. It avoids the need to perform complex quantitative noise assessments by using a checklist approach for assessing and managing noise.

Qualitative assessments are normally used by NT EPA authorised officers for short-term infrastructure maintenance works projects. Short-term means that the works are not likely to affect a sensitive noise receptor for more than three weeks in total.

Examples of maintenance works are:

- repair and maintenance of public powerlines
- maintenance or repair of a public road, and
- maintenance or repair of a railway.

Where, for example, there are no assigned noise level conditions prescribed in development approvals and complaints are made by affected residents or other sensitive noise receptors, NT EPA authorised officers will evaluate performance on whether *all* work practices described in the following checklist are being applied by a construction project proponent. The items in the following checklist should be contained in a construction project's Noise Management Plan.

A Noise Management Plan will ordinarily be required for all construction projects. See Guidance Document Number One for the information to be included in an NMP. All NMPs are required to be registered with the NT EPA. Failure to register a NMP after it has been determined that a construction site has contravened the requirements contained in this section will likely result in a regulatory response in accordance with section 2.2.4.

Community notification practices

- Potentially noise affected neighbours contacted at the earliest possible time before any site work begins. As a minimum it is expected that all potentially affected sensitive noise receptors be given 48 hours notice prior to the commencement of construction activities
- Potentially noise affected neighbours informed about the nature of the construction stages and the duration of noisier activities – for example, excavation and rock-breaking
- Implementation of noise controls, such as walls to be built first that will reduce noise, temporary noise walls, or use of silenced equipment
- Keeping potentially noise affected neighbours up to date on progress
- Providing contact details on a site board at the front of the site, and maintain a complaints register suited to the scale of works
- Asking about any concerns that potentially noise affected neighbours may have and discuss possible solutions, and

- Providing copies of noise management plans, if available, to potentially noise affected neighbours.

Operational practices

- Where practical, undertake the noisiest works during the recommended standard hours
- Turn off plant that is not being used
- Examine and implement where feasible and reasonable, alternative work practices which generate less noise – for example, use hydraulic rock splitters instead of rock breakers, or electric equipment instead of diesel or petrol powered equipment
- Examine and implement where feasible and reasonable, the use of silenced equipment and noise shielding around stationary plant (such as generators), subject to manufacturers' design requirements
- Ensure plant is regularly maintained, and repair or replace equipment that becomes noisy
- Ensure road plates are properly installed and maintained
- Arrange the work site to minimise the use of movement alarms on vehicles and mobile plant
- Locate noisy plant away from potentially noise affected neighbours or behind barriers, such as sheds or walls, and
- Where there are no overriding project constraints, program works so as to not affect any residence or other sensitive land use for more than a total of six nights in any four week period.

Involvement of workers in minimising noise

- Avoid dropping materials from a height, dropping or dragging road plates
- Talk to workers about noise from the works at the identified land uses and how it can be reduced, and
- Use radios and stereos indoors rather than outdoors.

Handling complaints

- Keep staff who receive telephone complaints informed regarding current and upcoming works and the relevant contacts for these works
- Handle complaints in a prompt and responsive manner
- Where there are complaints about noise from an identified work activity, review and implement, where feasible and reasonable, actions additional to those described above to minimise noise output, and
- Providing all complaints to the NT EPA Pollution Hotline within 24 hours upon receiving a complaint.

NT EPA authorised officers for example will unlikely take any formal regulatory action if all feasible and reasonable measures have been taken and this normally includes complying with the above checklist measures. Alternatively, if an assessment by

authorised officers concludes that sufficient measures have not been taken or are not being adhered to, proponents may be issued with an authorised officer direction, pollution abatement notice and/or a penalty infringement notice under the WMPC Act (see section 2.2.4) to formalise compliance with the WMPC Act which may also involve the assigning of mandatory noise limits.

3.3.5.2 Quantitative noise assessment – construction noise

This second method of assessing noise involves NT EPA authorised officers using an SLM to determine the noise levels emanating from a project. It can also be used by proponents to determine their level of compliance. Further guidance on what is required when this type of assessment is undertaken is provided in Guidance Document Number Two of this guideline.

Where noise from construction works has been assessed as being above the recommended construction assigned noise levels, proponents will be required to apply all feasible and reasonable work practices to minimise noise. For proposed works, proponents must also inform potentially affected parties of the activities to be carried out, the expected noise impacts and duration.

For proposed works, monitoring should be carried out at the most noise-affected sensitive noise receptor land uses (that is, where noise levels are likely to be the highest). If monitoring is carried out as a result of a complaint, noise levels will be monitored at the complainant(s) location as discussed below.

Quantitative assessment at affected residential premises

When determining the relevant recommended construction assigned noise level in the tables covered in section 3.3.4 the rating background level (RBL) is used.

As discussed above in section 3.2.5.1 the RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours).

As a guide, the difference between the internal noise level and the external noise level is typically 10 dB with windows open for adequate ventilation.

The noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence. In this sense, the location of the measurement point is consistent with section 3.2.6.

Quantitative assessment at other affected sensitive land uses (other than residences)

For other affected sensitive land uses such as schools these land uses internal and external noise assessments can be made. Internal noise levels are to be assessed at the centre of the occupied room; external noise levels are to be assessed at the most affected point within 50 m of the area boundary.

Where internal noise levels cannot be measured, external noise levels may be used. A conservative estimate of the difference between internal and external noise levels is 10 dB for buildings other than residences. Some buildings may achieve greater performance, such as where windows are fixed (that is, cannot be opened).

Quantitative assessment at affected commercial and industrial premises

The sampling location for category 1 and category 2 external recommended assigned construction noise levels in Table 3.10 should be assessed at the most-affected occupied point externally to the affected premises.

For category 3 recommended assigned construction noise levels cited in Table 3.10, proponents for proposed projects must undertake special investigations to determine suitable noise levels on a project-by-project basis. The recommended 'maximum' internal noise levels in *AS 2107 Acoustics – Recommended design sound levels and reverberation times for building interiors* may assist in determining relevant noise levels (Standards Australia 2000).

Proponents should assess construction noise levels for projects and consult with occupants of commercial and industrial premises prior to lodging planning approval applications where it is required.

During construction, proponents should regularly update the occupants of the commercial and industrial premises regarding noise levels and hours of work.

Quantitative assessment at affected residences from ground-borne noise

The recommended assigned construction noise levels cited in Table 3.11 are normally to be assessed at the centre of the most affected habitable room. Where external measurement is undertaken the external noise levels are assessed as per the above quantitative assessment for affected residential premises. Mitigation options to deal with ground-borne noise may include extensive community consultation to determine the acceptable level of disruption and the provision of respite accommodation in some circumstances, not just restriction of work hours. The level of mitigation of ground-borne noise would depend on the extent of impacts and also on the scale and duration of works. Any restriction that the relevant authority (consent, determining or regulatory) may impose on the days when construction work is allowed should take into account whether the community:

- has identified times of day when they are more sensitive to noise (for example, Sundays or public holidays), and
- is prepared to accept a longer construction duration in exchange for days of respite.

3.3.6 Examples of feasible and reasonable practices applied on construction sites

A new large pipeline – construction methods and the best pipeline route were chosen to minimise noise for residents and businesses. Two construction methods were used: 'micro tunnelling' together with temporary noise barriers in residential areas, and 'trenching' in non-residential areas. Also, where possible, the pipeline was laid in industrial areas or reserves away from sensitive land uses.

Construction project near a waterway – the contractor trialled three different types of piling: impact piling, push piling and secant piling. Secant piling, which involved installing reinforced concrete piles by drilling a hole into the ground and then filling with concrete to interlock with the neighbouring pile. Secant piling was chosen over impact or push piling, due to its lower vibration impact on the community, although it was not considered the most effective construction method.

A new pedestrian bridge over a main road – the bridge footings were constructed during standard hours and night-time works were limited to two non-consecutive nights of operating a crane to lift the pre-fabricated bridge sections into position.

Use of alternatives to ‘beeper’ style reversing alarms – to minimise noise impacts from reversing alarms, especially during out of hours, a major infrastructure constructor required contractors to supply and use mobile equipment fitted with reversing alarms that are not the ‘beeper’ style alarms. An example is a broadband style alarm, sometimes referred to as a ‘quacker’ alarm.

A multi-storey building – given the proximity to neighbouring residences, the contractor installed temporary barriers along the property in consultation with the affected neighbours.

A permanent roadside barrier at early stage of the construction – the regulator’s previous experience and knowledge indicated that most of a permanent noise barrier could be built before construction works progressed, despite contrary advice from the proponent. Negotiations between the regulator and proponent led to a revised design of the permanent barrier, construction of the permanent barrier in stages with defined timeframes, and also construction of a temporary barrier using plywood.

3.3.7 Case studies

The NSW *Interim Construction Noise Guideline July 2009* contains a number of cases studies which illustrate the various ways to manage noise impacts from construction works by applying the approaches contained in this framework guideline. Table 12 of that guideline summarises the case studies and the approaches utilised. The case studies covered include: targeted community consultation; night-time ‘in-tunnel’ blasting; managing ground-borne noise; major road construction; a major infrastructure upgrade; and night-time essential maintenance works.

3.4 Entertainment Venue Noise

3.4.1 Background

Loud music from entertainment venues can be a problem, especially late at night.

The amplification of music, voice and instrumental music, together with applause and other audience responses from open-air entertainment noise for example can result in excessive and offensive noise at neighbouring or nearby premises, particularly where these are residential premises.

The aim of this section is to protect residents from levels of music noise from indoor venues and outdoor entertainment venues (see section 3.4.3 for definitions) that may affect sensitive noise receptors while recognising the community’s demand for a wide range of musical entertainment.

It establishes **recommended project specific assigned noise levels** and controls over entertainment venue noise which balance the rights of people living in areas around music entertainment venues not to be disturbed by unreasonable levels of music noise, with the rights of people seeking musical entertainment at indoor or outdoor entertainment venues. This also includes the rights of operators not to be unduly impacted by the encroachment of residential developments.

This balanced approach is thus essential in relation to the regulation of entertainment venue noise which on the one hand supports a viable music entertainment industry and on the other protects residents from unreasonable noise disturbance. The objective is to ensure that entertainment venues co-exist amicably with their residential neighbours.

The approach also acknowledges that music entertainment venues make a significant contribution to the local economy and provide important opportunities for emerging and established local musicians as well adding significant social and cultural value to the NT community.

The following activities (or beneficial uses) are to be protected at sensitive noise receptor locations from excessive entertainment venue noise:

- the ability to have a normal conversation, and
- the ability to sleep after 11.30 pm (note the special times applying for days preceding public holidays and New Year's Day).

3.4.2 Application of this section

The section deals with both indoor and outdoor entertainment venue noise. This section however, does not apply to music from domestic premises (see section 3.1 of this guideline for guidance on domestic music noise); nor does it apply to noise from patrons leaving or arriving at entertainment venues and includes car park noise and small crowd noise.

3.4.3 Definition of indoor entertainment and outdoor entertainment venues

The definition of indoor entertainment venues includes a public premises with a facility for music to be played indoors and includes, but is not limited to hotels, cabarets, night clubs, reception centres, skating rinks, restaurants, cafes, health and fitness centres, recording and rehearsal studios, theatres, amusement parks, amusement parlours, retail stores, shops, public halls or clubs.

The definition of outdoor entertainment venues includes a public premises, not being an indoor entertainment venue where music is from sports and other large outdoor arenas that are used for open-air concerts. Such venues are less numerous than indoor venues and operate infrequently.

3.4.4 Other relevant terms used in this section

- **Beneficial uses** – means a use of the environment or any element or segment of the environment which is conducive to public benefit, welfare, safety or health and which requires protection from the effects of noise i.e. protection of amenity
- **Base noise level** – means a noise level which is a limit that applies in some circumstances for indoor entertainment noise where in calculating noise levels it is found background noise levels to be unusually low. In these circumstances the **recommended project specific assigned noise level** that will apply will be the base noise level in each of the time periods referred to in Table 3.12
- **C-weighted** - means frequency-weighted as specified in Australian Standard 1259-1982 -Sound Level Meters, published by the Standards Association of Australia
- **Day period/Evening period/Night period** – see Table 3.12
- **“F”** - means the time-weighting characteristics of a sound level meter as specified in Australian Standard 1259 – Sound Level Meters, published by the Standards Association of Australia
- **Project specific effective noise level** - means the level of indoor or outdoor entertainment venue noise from a premises measured in a sensitive noise receptor (see section 3.4.9.1 for location of measurement point)
- **L_{A90}** - means the A-weighted sound pressure level which is exceeded for 90 per cent of the time interval considered and is one of two measure that determines background noise levels for the day/evening period
- **L_{OCT10}** – means the C-weighted or Linear sound pressure level for a specified octave band that is exceeded 10 per cent of the time interval considered and is what is

used to determine project specific effective noise level for the night period for indoor entertainment venues

- **L_{Oct90}** - means the C-weighted or Linear sound pressure level for a specified octave band that is exceeded for 90 per cent of the time interval considered and is also a measure that determines background noise levels for the night period
- **Linear** - means the sound pressure level when no frequency weighting is applied
- **L_{Aeq}** - means equivalent continuous A-weighted sound pressure level and is the value of the A-weighted sound pressure level of a continuous steady sound that has the same acoustic energy as a given time-varying A-weighted sound pressure level when determined over the same measurement time interval
- **Public premises** – means any premises which is not used exclusively for domestic purposes
- **Recommended project specific assigned noise levels** – means the noise levels as limits that apply for specific indoor and outdoor entertainment noise sources, and
- **“S** - means the time-weighting characteristics of a sound level meter as specified in Australian Standard 1259 – Sound Level Meters, published by the Standards Association of Australia, and
- **Sensitive noise receptor** – see section 5 (Glossary) for definition.

3.4.5 The ‘Agent of Change Principle’

To provide the balanced approach to entertainment venue noise management the NT EPA has adopted the “agent of change” principle. The “agent of change” is the person or developer/entity that creates a change by building a residential development close to a venue with music or is a venue that introduces music close to residential or other sensitive noise receptor uses.

The agent of change principle determines responsibility for entertainment music noise management. That is, where changed conditions are introduced into an environment, (for example through a new use, or changed operating conditions), the reasonable expectations of the existing land users should be respected. This applies to both venue operators and residents.

- For an existing sensitive noise receptor (normally a resident), this means the continued protection of amenity (see section 5 for definition of amenity) in the event of a change to an existing entertainment venue’s operation or the development of a new venue. In these circumstances, the burden of any remedial or mitigation measures, such as noise attenuation or modified operating practices, falls upon the venue operator – the agent of change, and
- For an existing entertainment venue operator, this means that where a venue is currently compliant with relevant noise attenuation standards and its operation does not change, new residential or other noise sensitive development (nominally within a 50 metre radius of an existing entertainment venue) should not lead to new compliance costs for the venue operator. The onus of any remedial or mitigation measures in this instance, falls upon the new resident, owner or developer – the agent of change.

The agent of change principle ensures the following:

- It recognises that entertainment venue music is an important part of the Territory's culture and economy
- It protects existing music entertainment venues from the encroachment of noise sensitive residential uses (sensitive noise receptors)
- It ensures that noise sensitive residential uses are satisfactorily protected from unreasonable levels of live music and entertainment noise, and
- It ensures that the primary responsibility for noise attenuation rests with the agent of change.

3.4.5.1 How the “agent of change” principle is to be applied in the Northern Territory

The agent of change principle can be incorporated as a requirement in a development application, a new liquor licence or a change to the conditions on a liquor licence or it can be a requirement in an instrument issued under the *Waste Management and Pollution Control Act* (see section 2.2.4).

3.4.6 Operating periods for indoor and outdoor entertainment venue noise

Table 3.12 defines the recommended times for the day/evening and night operating periods for indoor and outdoor entertainment venues that are to be used to determine the **recommended project specific assigned noise levels** (limits) for the time periods listed in Table 3.12.

Table 3.12: Operating periods for indoor and outdoor entertainment venues

Day - column one	Operating period – Day/ Evening – column two	Operating period – Night – column three
Monday – Friday	7am – 11.30 pm	11.30 pm – 7am
Saturday	8am – 11.30 pm	11.30 pm – 8am
Sunday	9am – 11.30 pm	11.30 pm – 9am
Days preceding public holidays	8am – 12pm (midnight)	12pm (midnight) – 8am
New Year's Day	8am – 12pm (midnight)	12:30am – 8am

For later operating times it will be up to proponents to satisfy that music from a venue will be inaudible within all sensitive noise receptors' habitable rooms¹¹.

3.4.7 The recommended project specific assigned noise levels for indoor entertainment venue noise

The **recommended project specific assigned noise levels** for indoor entertainment venues are listed in Table 3.13. Different **recommended project specific assigned noise levels** have been set for the day/evening and night periods because different protections for activities (beneficial uses) are warranted in these periods. As mentioned

¹¹ See section 3.1.2.1 for the definition of a habitable room.

above a stricter **recommended project specific assigned noise level** is applied for the night period so sleep is not disturbed. During the day/evening period, **project specific assigned noise levels** are set so that activities such as talking, reading and watching television can occur without undue interference.

The **project specific effective noise level** (the actual noise measured at a sensitive noise receptor) for indoor entertainment venues is:

- for the day/evening period, the L_{Aeq} measured in dB(A), and
- for the night period, the L_{OCT10} measured in dB.

Table 3.13: Recommended project specific assigned noise levels for indoor entertainment venues

Time	Recommended project specific assigned noise levels
Day/Evening period	$L_{A90} + 5$ dB(A)
Night-time	$L_{OCT90} + 8$ dB.

L_{A90} and L_{OCT90} measure the background level and are measured in accordance with section 3.4.9.3.

3.4.8 The recommended project specific assigned noise levels for outdoor entertainment venue noise

The **recommended project specific assigned noise levels** for outdoor entertainment venues are listed in Table 3.14. The **recommended project specific assigned noise levels** for outdoor entertainment venues are higher than those set for indoor entertainment venues because of the different activities to be protected. Although outdoor entertainment events occur less frequently they are more intrusive. The activity that needs to be protected in this section is normal conversation. That is, the community in a residential area should be able to conduct a normal conversation without raising the level of their voices.

Table 3.14: Recommended project specific assigned noise levels for outdoor entertainment venues

Time	Recommended project specific assigned noise levels
Day/Evening period	55 dB(A) when located indoors with doors closed and windows open only if it is the only means of ventilation
Night period	The noise from the outdoor venue premises shall not be audible within any habitable room

Time	Recommended project specific assigned noise levels
	in any residential premises for the night period as detailed in column three of Table 3.12.

The **project specific effective noise level** for outdoor venues is the L_{Aeq} measured in dB(A).

3.4.9 Methods used to assess entertainment venue noise

This section specifies the procedures for measuring **project specific effective noise levels** and determining the **recommended project specific assigned noise levels** (limits) for indoor venues and outdoor entertainment venues.

3.4.9.1 Location of measurement point

The measurement point to measure the **project specific effective noise level** shall be located within a habitable room of a noise sensitive receptor with doors closed and windows open only if it is the only means of ventilation.

3.4.9.2 Common measurement and analysis procedures

- All measurements of music noise or background noise shall be made using 'F' or 'S' time-weighting
- The measurement shall be made of at least 15 cumulative minutes of music audible at the measurement point
- Significant extraneous noise shall be excluded, and
- The measurement shall be made at a time when the greatest intrusion of music noise into the sensitive noise receptor is likely to occur.

3.4.9.3 Assessment specific to indoor entertainment venues

Day/evening period

- The **project specific effective noise level** for the day/evening period shall be determined as an L_{Aeq} , and
- The **base noise level** for the day/evening period is 32 dB(A).

Night period

- The **project specific effective noise level** for the night period shall be determined as L_{OCT10} values of selected octave bands from the range of octave bands with centre frequencies 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz and 4 kHz. The octave bands selected shall be those for which the music noise contributes significantly to the octave band sound pressure level. Measurements shall only be taken when the selected octave band level correlates with the music noise, and
- The **base noise levels** for the night period are specified in Table 3.15 below.

Background levels

- The background level shall be the L_{A90} level, for the day/evening period, and the L_{OCT90} level, for the night period that represents the background level at the time when the **project specific effective noise level** was measured

- The background level shall be measured within the noise sensitive receptor or at another point where the background level is representative of the background level occurring within the sensitive noise receptor, and
- The background level determined at the time of assessment of a premises may have contributions from noise sources that require reduction. In this case the appropriate project specific assigned noise levels for the music noise shall be re-determined from the background level when noise levels (limits) for these other sources are achieved.

Table 3.15: Base noise limits for night period

Frequency (Hz)	63	125	250	500	1k	2k	4k
Base noise limit (dB)	40	30	20	20	15	10	10

Figure 3.3 summarises the process to be undertaken when determining the **recommended project specific a**

3.4.10 Noise management for outdoor events – guidance to proponents on planning for outdoor events

The following information provides guidance and can be used by proponents of outdoor events to assist them with planning so as to minimise noise impacts associated with outdoor events.

While a number of steps can be taken to reduce the adverse impact of concert noise, such as the location of the stage, direction of the speakers and the reduction in low-frequency (bass) sounds, the noise levels may still be considered as intrusive. Noise in excess of the recommended assigned noise levels can be expected at outdoor concert venues capable of providing the facilities required for such significant community events within the NT.

Suggested issues for consideration in the planning phase of outdoor events include, but are not limited to:

- the hours of operation of the planned event
- the location of potentially noise-affected premises and predicted noise levels at those locations
- the planned location and orientation of stages, public address or audio systems
- inclusion of noise mitigation measures near noise sensitive receptors (such as noise barriers), and
- reducing the level of noise throughout the duration of the event, particularly low frequency noise (bass) to prevent the sound penetrating houses if the planned event occurs at night.

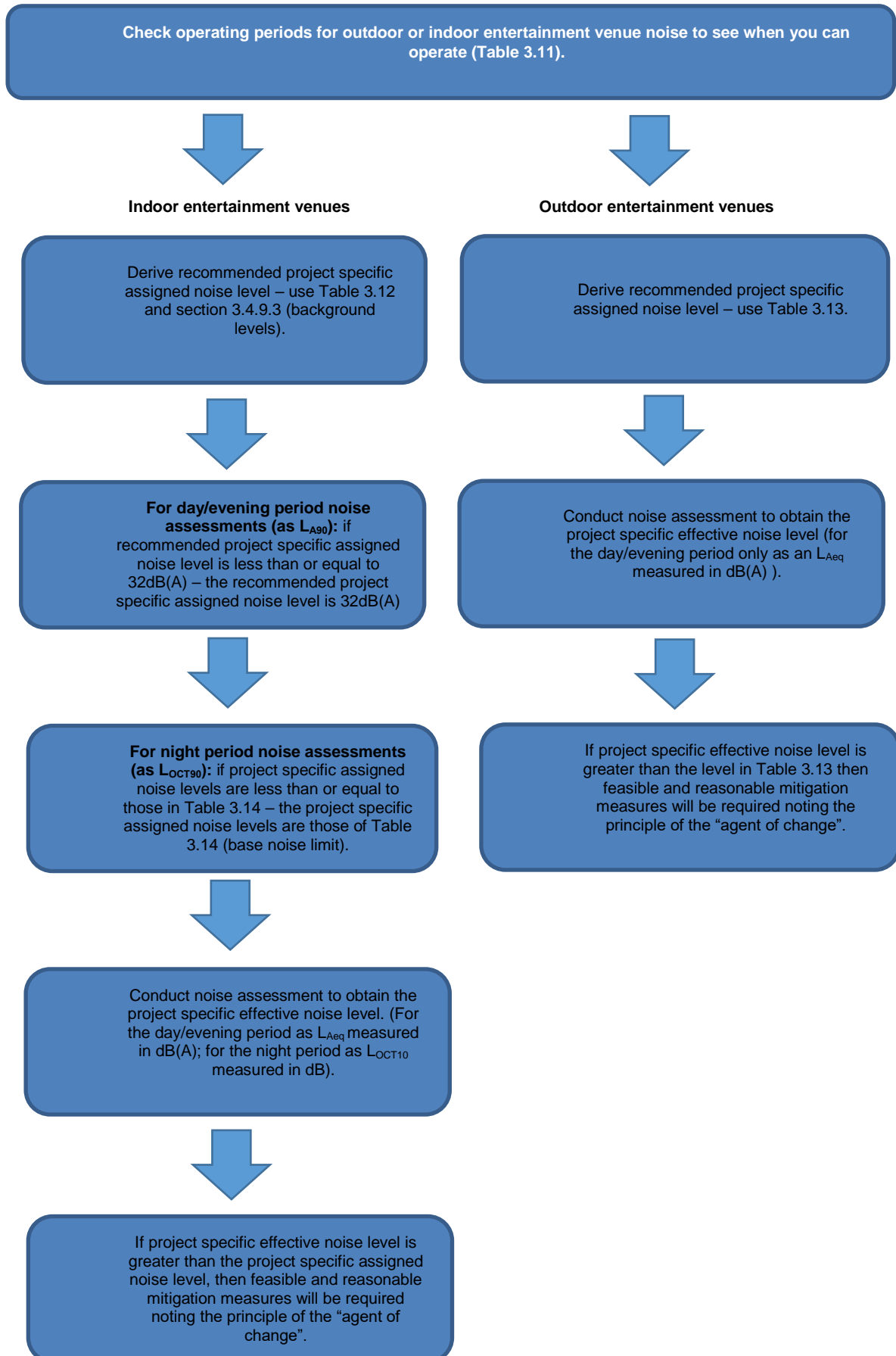
As per other sections in this guideline a Noise Management Plan should ordinarily be developed for outdoor events. The Noise Management Plan for the event should include all of the elements outlined in Guidance Document Number One.

It is also recommended that all potentially affected residents and other sensitive receptors be sent a notification which includes:

- a small version of the site plan
- a description of the planned event
- the time the event starts and finishes
- the times for any sound testing to take place
- a description of the proposed measures that will be implemented to minimise noise from the event, and
- the name and phone number of the person to whom a complaint may be made about noise emissions associated with the event.

This letter should be distributed to all potentially affected parties at least one week prior to the event. Please be aware that letter-box drops have the potential to not reach all intended recipients, partly due to delivery staff being unwilling to deliver this information to letterboxes marked with 'no junk mail' stickers. The preferred method for delivery is in an addressed envelope marked "to the resident" or "to the occupier".

Figure 3.3: Determining the recommended project specific assigned noise levels and project specific effective noise levels for entertainment venue noise



3.5 Vibration and Blasting

Where occupants can detect vibration in buildings, this may potentially impact on their quality of life or working efficiency. This section has been developed to protect the health and wellbeing of the community via the introduction of **recommended assigned noise levels** for vibration.

The sources of vibration covered in this section of the guideline include:

- construction and excavation equipment
- rail and road traffic, and
- industrial machinery.

This section does not cover:

- ‘motion sickness’ effects of low-frequency vibration (i.e. below 1 Hz, usually encountered only in some forms of transportation)
- occupational vibration within any workplace administered by NT Worksafe and covered under the *NT Work Health and Safety (National Uniform Legislation) Act* and subordinate legislation
- ground-borne noise (see section 3.3 of this guideline)
- vibration-induced damage to heritage structures - the vibration limits set out in the German Standard *DIN 4150-3: Structural Vibration – Part 3 Effects of vibration on structures* can be used
- vibration-induced damage to other structures or building contents - the vibration limits set out in the British Standard *BS 7385-1:1990 – Evaluation and measurement of vibration in buildings* (and referenced in Australian Standard 2187.2 – 2006 *Explosives – Storage and use – Use of explosives*). Guide for measurement of vibration and evaluation of their effects on buildings; can be used, and
- blast-induced vibration effects (including overpressure), which are adequately addressed by the Australian and New Zealand Environment and Conservation Local government guideline *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration* (ANZECC 1990)¹².

3.5.1 Recommended assigned noise levels for vibration

The **recommended assigned noise levels** for continuous, impulsive and intermittent vibration to be applied in the NT is contained in sections 2.3 and 2.4 of the publication titled, *Assessing Vibration: a technical guideline*, DEC (NSW) February 2006.

¹² The *Guidelines for Ground Vibration and Airblast Limits for Blasting in Mines and Quarries* from the Victorian Department of Economic Development, Jobs, Transport and Resources (and referenced below) provides practical application of the ANZECC 1990 publication. The Victorian guidelines do not apply to control of impacts at commercial or industrial premises where less stringent standards may be appropriate in accordance with the measurement of noise as per this guideline.

They should be applied when assessing the effects of human exposure to vibration from industry, transportation and machinery. They are not intended to cover emissions from blasting, or vibration in vehicles or in special-purpose moving structures (e.g. amusement rides).

3.5.2 Vibration measurement and prediction

Measuring vibration is a specialised area and differs from the assessment of non-vibration sources as covered in section 3.3.5 of this guideline. In the NT, the procedures contained in section 4 of the above DEC publication are recommended to be used when measuring and predicting vibration.

3.5.3 Human comfort vibration

Human comfort vibration from construction works, including continuous, intermittent or impulsive vibration from construction, but excluding blasting, can be assessed in accordance with section 2.5 “*Short-term works*” of the 2006 DEC publication.

3.5.4 Mitigation of vibration impacts

Section 3 of the 2006 DEC publication contains a series of vibration mitigation measures which can be applied when the actual or predicted vibration levels exceed the **recommended assigned noise levels** covered in section 3.5.1 above.

Additional information on vibration mitigation can be obtained from the NT EPA publication titled, *Guidelines to prevent pollution from building sites* (section 10).

3.5.5 Environmental impact assessment requirements for noise and vibration

The Queensland Department of Environment and Heritage publication titled, *EIS information guideline – noise and vibration*, provides information to be included in environmental impact assessments under the NT Environmental Assessment Act. For example, it includes information on the receiving environment and potential impacts and mitigation measures that should be considered.

Environmental impact assessments must consider but not be limited to this guideline’s coverage of the types of noise relevant to the assessment in question.

The methodology for environmental impact assessment (where relevant) must include but not be limited to:

- project description (includes identification of sensitive noise receptors/environmental values identification)
- applicable noise criteria (includes assigned noise levels for all relevant noise types)
- noise and vibration modelling (includes meteorological conditions and atmospheric effects, model description, noise sources, modelling scenarios (sensitivity analysis), predicted noise levels, predicted low frequency noise levels, blasting (ground vibration, air blasts)
- noise and vibration assessment (includes baseline assessment, assessment of all construction, operational and transportation noise impacts on the surrounding sensitive receptors/environmental values; any vibration impacts from construction and operation)
- cumulative noise assessment of other developments both on the project site and in the vicinity of the project site
- mitigation measures (includes details of the proposed noise management and monitoring measures), and
- compliance management (includes roles and responsibilities, training, monitoring and inspections, non-conformances, community notification and complaints management, audits, review of management plans).

4 Further Help

4.1 Northern Territory Contacts

For information and assistance on noise issues in the Northern Territory see contact details below.

Northern Territory Environment Protection Authority

Website: <http://www.ntepa.nt.gov.au/>

Email: pollution@nt.gov.au

Pollution Hotline: 1800 064 567

General queries – ask for the noise regulation section: (08) 8924 4218

4.2 Reference Material

4.2.1 Standards

AS 1055 – Acoustics - Description and measurement of environmental noise

AS 1217 – Methods of measurement of airborne sound emitted by machines

AS 1259 – Acoustics - Sound level meters

AS 1633 – Acoustics - Glossary of terms and related symbols

AS 1949 – method of measurement of airborne noise emitted by vessels in waterways,
ports and harbours

AS 2012 – Method for the measurement of airborne noise from agricultural tractors
and earth moving machinery

AS 2021 – Building siting and construction against aircraft noise intrusion

AS 2107 - Acoustics - Recommended design sound levels and reverberation times for
building interiors

AS 2187 – Explosives – Storage, transport and use

AS 2363 – Acoustics – Assessment of noise from helicopter landing sites

AS 2377 – Acoustics – Methods for the measurement of rail bound vehicle noise

AS 2436 – Guide to noise control on construction, maintenance and demolition sites

AS 2659 – Guide to the use of sound measuring equipment

AS 2670.2-1990: Evaluation of human exposure to whole-body vibration –part 2:
Continuous and shock induced vibration in buildings (1 to 80 Hz)

AS 2702 – Acoustics - Methods for the measurement of road traffic noise

AS 2900 – Quantities and units of acoustics

AS 3671 – Acoustics - Road traffic noise intrusion - Building siting and construction

AS/NZS 4476 – Acoustics - Octave-band and fractional octave-band filters

British Standard 7385: Part 2 “Evaluation and measurement of vibration in buildings”

German DIN 4150: Part 3 – 1999 Effects of Vibration on Structure (DIN 1999)

Ground Vibration and Airblast Limits for Blasting in Mines and Quarries- Environmental Guidelines – Victorian Department of Economic Development, Jobs, Transport and Resources

ISO 9613 – Acoustics – Attenuation of sound during propagation outdoors

International Electro-technical Commission Standards IEC 651-1979

International Electro-technical Commission Standards IEC 804-1985

International Electro-technical Commission IEC 61672.1-2004: Electroacoustics – Sound Level Meters – Specifications

Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration (ANZEC 1990)

4.2.2 Other useful references

AEC 1989, *Air Conditioner Noise*, Australian Environment Council, Canberra

Assessing Vibration: a technical guideline February 2006 NSW DEC

Best Available Techniques for Control of Noise & Vibration R&D Technical Report P4-079/TR/1 UK Environment Agency

Bruel & Kjaer 2000, *Environmental Noise*, Bruel & Kjaer Sound and Vibration Measurement A/S, Denmark

enHealth Council 2004, *The Health Effect of Environmental Noise – Other than hearing loss*, report by the enHealth Council for the Department of Health and Ageing, Canberra

Fact Sheet: Interim Construction Noise Guideline, NSW Department of Environment and Climate Change, July 2009

Guidelines for Ground Vibration and Airblast Limits for Blasting in Mines and Quarries from the Victorian Department of Economic Development, Jobs, Transport and Resources

Interim Construction Noise Guideline, NSW Department of Environment and Climate Change, July 2009

Miedema HM, Vos H, de Jong RG. Community reaction to aircraft noise: time-of-day penalty and tradeoff between levels of overflights. *J Acoust Soc Am.* 2000 Jun;107(6):3245–3253.

Miedema HM, Vos H. Noise annoyance from stationary sources: relationships with exposure metric day-evening-night level (DENL) and their confidence intervals. *J Acoust Soc Am.* 2004 Jul;116(1):334-43.

NSW Industrial Noise Policy, NSW Environment Protection Authority, January 2000

NSW Industrial Noise Policy Appendices – Worked Case Studies, NSW Environment Protection Authority, January 2000

NSW Industrial Noise Policy Application Notes:
<http://www.epa.nsw.gov.au/noise/applicnotesindustnoise.htm>

Construction Noise and Vibration Strategy, May 2018 Transport for NSW

EPA 2004 *Ecoaccess Guideline for the assessment of low frequency noise*, Roberts. C, Brisbane, Australia

Noise Guide for Local Government, NSW Environment Protection Authority, May 2013

Noise Measurement Manual, Queensland Department of Environment and Heritage Protection, August 2013

NSW Road Noise Policy (RNP) (DECCW 2011)

Occupational noise-induced hearing loss in Australia by Safe Work Australia (2010)

EIS information guideline – noise and vibration, Queensland Department of Environment and Heritage

RTA Environmental Noise Management Manual (ENMM) (RTA 2001)

State Environment Protection Policy (Control of music noise from public premises) No. N-2 EPA Victoria 1989

Tasmanian Department of Environment, Parks, Heritage and Arts 2008, Noise Measurement Procedures Manual, 2nd Edition

Building Code of Australia/National Construction Code (Australian Building Codes Board, 2016)

The health effects of environmental noise—other than hearing loss by the enHealth Local government (2004)

New Zealand Environment and Conservation Local government guideline *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration* (ANZECC 1990)

WHO 1999 - Guidelines for community noise, World Health Organisation 1999

5 Glossary of Terms and Abbreviations

air blast overpressure – means the maximum air pressure at a specified point caused by the shock wave generated by an explosion and transmitted through the air

ambient sound – has the same meaning as in Australian Standard AS1633-1985 Acoustics - Glossary of terms and related symbols

amenity - is a broad term that generally means the qualities, attributes and characteristics of a place that make a positive contribution to quality of life. Amenity values include both visual amenity, and the ability for people to live and recreate within their surroundings without any unreasonable interference with their health, welfare, convenience and comfort.

- Noise, odour, light, dust, smoke, fumes, aerosols all have the potential to unreasonably interfere with the health, welfare, convenience and comfort of people.
- Natural landscapes and views often contribute to visual amenity, such as areas of high heritage, cultural or social significance due to their natural features or scenic quality.
- Amenity values can be highly subjective. What may have amenity value for one person, may not be valued by another. Similarly, people have different levels of perception or tolerance for things that may impact amenity, such as noise, odour, light, dust, smoke, fumes, and aerosols.

ANEF – means Australian Noise Exposure Forecast and has the same meaning as in Australian Standard AS2021 Acoustics - Aircraft noise intrusion – Building siting and Construction

authorised officer – means an authorised officer under section 70 of the WMPC Act or equivalent definition in any other NT noise regulator's legislation

A-weighted sound pressure level – has the same meaning as in Australian Standard AS1055.1-1997 Acoustics - Description and measurement of environmental noise - General procedures

background level – for a specified time interval T, means the LA90,T sound pressure level for that time interval

blasting – to be assessed in accordance with the *Technical Basis for Guidelines to Minimise Noise Annoyance Due to Blasting Overpressure and Ground Vibration* (ANZEC 1990)

C-weighted sound pressure level – has the same meaning as A-weighted sound pressure level except that the level is calculated using the r.m.s¹³. sound pressure determined by use of the frequency-weighting network "C" in Australian Standard AS1259.1 Sound level meters Part 1: Non-integrating

¹³ Sound **pressure level** is the logarithmic measure of the root mean squared (RMS) **sound pressure** of a sound relative to a reference value.

construction activities – includes building, excavation, construction and demolition activities

(dB) – means decibel, which has the same meaning as in Australian Standard AS1633-1985 Acoustics - Glossary of terms and related symbols. An alternative definition states that it is a measure of sound equivalent to 20 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure, and 10 times the logarithm (to base 10) of the ratio of a given sound power to a reference power

dB(A) – means decibel when stating A-weighted sound pressure level or a measure of A-weighted sound levels

effective noise level – means the level of music from premises measured in a noise sensitive area or at a derived point

environmental nuisance – has the same meaning as in the WMPC Act

evening period for industrial and commercial noise – is the period from 6pm to 10pm

feasible measures – are noise mitigation measures that can be engineered and are practical to build and/or implement, given project constraints such as safety, maintenance and reliability requirements. It may also include options such as amending operational practices (for example, changing a noisy operation to a less-sensitive period or location) to achieve noise reduction

ground-borne noise – noise heard within a building that is generated by vibration transmitted through the ground into the structure from construction works, sometimes referred to as ‘regenerated noise’ or ‘structure-borne noise’. Ground-borne noise can be more noticeable than airborne noise for underground works such as tunnelling. The ground-borne noise levels are only applicable when ground-borne noise levels are higher than airborne noise levels

impulsiveness – means a variation in the emission of noise where the difference in noise levels between the level obtained using the “F” time-weighting characteristic and the level obtained using the “I” time-weighting characteristic (the time-weighting characteristics defined in Australian Standard AS1259.1) is greater than 2 dB

infrasound – means sound with a frequency of 20 Hz and lower

LA10,T – for a specified time interval T, means the A-weighted sound pressure level that is equalled or exceeded for 10% of that time interval

LA10(18hr) – means the arithmetic average of the 18 LA10(1hr) levels for the period between 6am and 12 midnight on any day

LA90,T – for a specified time interval T, means the A-weighted sound pressure level that is equalled or exceeded for 90% of that time interval

LAE – has the same meaning as in Australian Standard AS2363 Acoustics – Measurement of noise from helicopter operations

LAeq,T – for a specified time interval T, means the time average A-weighted sound pressure level, within the meaning given by Australian Standard AS1055.1, for that time interval

LAeq,T (Hel) – has the same meaning as in Australian Standard AS2363 Acoustics – Measurement of noise from helicopter operations

LAmx,T – means the maximum r.m.s. A-weighted sound pressure level during a specified time interval T, as measured using the F time-weighting characteristic as

specified in Australian Standard AS1259.1 Acoustics - Sound level meters - Non-integrating

L_{Amax} (Event) – has the same meaning as in Australian Standard AS2363 Acoustics – Measurement of noise from helicopter operations

L_{Amax} (Hel) – has the same meaning as in Australian Standard AS2363 Acoustics – Measurement of noise from helicopter operations

L_{Apeak} – means the peak A-weighted sound pressure level

low frequency – as characteristic of a noise emission, means a difference of more than 15 dB in the A-weighted sound pressure level and C-weighted sound pressure level over the same time interval

low frequency noise - can be defined as noise that has a dominant content less than 200Hz (has a dominant range between 20 and 200 Hz). Noises below 20Hz as stated above are known as infrasound and are usually not audible but rather felt as a vibration, pulsating sensation or pressure on the ears or chest. Types or activities that may produce low frequency noise include pumps, fans, boilers, ventilation plant, electrical installations and wind turbines

L_{pA} – has the same meaning as in Australian Standard AS1055.1

L_{p,peak} – means the peak sound pressure level measured on a linear scale

modulation – means a variation in the emission of noise that:–

- (a) is more than 3 dB assessed as the L_{pA} level;
- (b) is present for at least 10% of the representative assessment period; and
- (c) is regular, cyclic and audible

night period for commercial and industrial noise – is the period from 2200 to 0700 h (Monday to Saturday) and 2200 to 0800 h (Sundays and Public Holidays)

noise – includes vibration of any frequency, whether transmitted through air or any other physical medium and includes a vibration of a frequency in the range of 0 to 20,000 Hertz

recommended assigned construction noise levels (airborne noise) – for construction noise are normally to be measured and assessed at the residential property boundary that is most exposed to construction noise, and at a height of 1.5 m aboveground level. If the residential property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most affected point within 30 m of the residence. See also specific noise measurement requirements for external and internal noise assessments in section 3.3 when using an SLM

offensive noise – means noise that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:

- (a) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted; or
- (b) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted

project specific assigned noise level – for commercial and industrial noise assessment is the noise limit that applies to a particular project and is the lower of the *project intrusiveness noise level* and *project amenity noise level* as determined in section 3.2 of this guideline

Rating Background level (RBL) – is the background level to be used for noise assessment purposes. It is the overall single figure background level representing each assessment period (day/evening/night) over the whole monitoring period (as opposed to over each 24-hour period used for the assessment background level). The rating background level is the level used for assessment purposes. Where the rating background level is found to be less than 30 dB(A), then it is set to 30 dB(A). For complaint assessments, compliance checks, when determining the effect of background noise on a source noise measurement and for low risk developments the rating back the measured $L_{A90,15\text{minute}}$ level (see section 3.1 of the NSW Industrial Noise Policy)

reasonable measures – selecting reasonable measures from those that are feasible involves making a judgment to determine whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the noise abatement measure. To make such a judgement, consideration may be given to:

- Noise level impacts
 - existing and future levels and projected changes in noise levels
 - number of people affected or annoyed
 - any noise performance criteria required for associated land uses
- Noise mitigation benefits
 - the amount of noise reduction expected including the cumulative effectiveness of the proposed work practices/abatement measures
 - potential ability of the work practices/abatement measures to reduce noise during both the construction and operational stages of the project
 - the number of people protected
- Cost effectiveness of noise mitigation
 - total cost of mitigation measures, taking into account the physical attributes of the site, such as topography and geology, and the cost variation attributed to the project given the benefit expected
 - noise mitigation costs compared with total project costs taking into account capital and maintenance
 - impact of disruption to essential transport and utility networks (for example, main roads, railways, water supply, electricity supply)
 - risk to worker safety during live traffic (road or rail) conditions
- Community views
 - engagement with affected land users when deciding about the aesthetic or other impacts of work practices/abatement measures
 - views of all affected land users not just those making complaints, determined through early community consultation
 - practices/measures with majority support from the affected community.

sensitive noise receptor area – for noise being emitted from a place in the NT, means a place (other than a road or road related area), where a person is affected by the noise. However, a parcel of land held under a territory lease is a sensitive receptor for noise emitted from the parcel only if the noise is emitted from a unit and the affected place is another unit on the same units plan. It is normally a premises used solely or principally as a residential premises or for accommodation located on land zoned, under the Northern Territory Planning Scheme, as Central Business, Township or any one of the Residential Zones (see also section 3.2.5.3)

SLM – means sound level meter

sound pressure level – has the same meaning as in AS1055.1 Acoustics – Description and measurement of environmental noise - General procedures

tonality – means the presence in the noise emission of tonal characteristics where the difference between:–

- (a) the A-weighted sound pressure level in any one-third octave band
- (b) the arithmetic average of the A-weighted sound pressure levels in the two adjacent one-third octave bands is greater than 3 dB when sound pressure levels are assessed as the $L_{Aeq,T}$ levels, where the time period T must be not less than one minute and not more than one hour

vibration transmitted through air – is usually called “sound”, whereas “vibration” is the term reserved for vibration transmitted through other physical media, such as the ground

WMPC Act – means the *Waste Management and Pollution Control Act*

Guidance Document Number One

Noise Management Tools: Using Non-Regulatory and Regulatory Measures To Deal With Noise

1 The spectrum of noise management options

This guidance document describes the range of available noise management tools that may be employed to resolve noise problems. These range from proactive planning strategies to reactive regulatory action. This section also covers the circumstances that each of these can be used.

Successful noise management is based on a spectrum of considerations and options. At one end of the spectrum is prevention of noise impacts using long-term strategic approaches that aim to avoid or minimise noise impacts before they occur. At this end of the spectrum effective land use planning has a key role in helping to prevent potential noise impacts, both at the strategic planning level for an area and at a project-specific level.

At the other end of the spectrum is the need to remedy existing noise impacts that are unacceptable and causing disturbance to the community. To this effect, the NT has laws which provide regulatory tools for managing noise impacts from new and existing noise-producing activities.

Non-regulatory approaches which lie in the middle of the spectrum also have an important role to play in managing existing local noise problems and should be encouraged for use by the responsible regulatory authority before applying regulatory mechanisms.

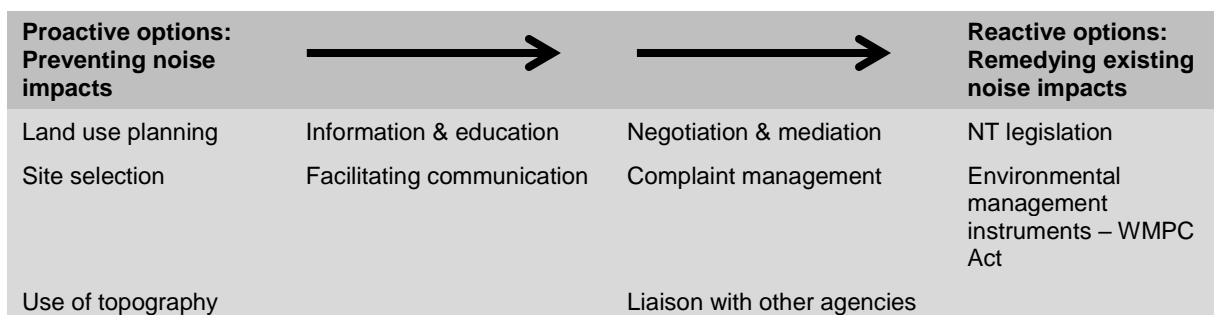
Figure 1 illustrates the spectrum of options available to prevent and manage noise impacts. Options located in the middle of the spectrum can be used both to prevent noise impacts and to manage existing problems.

The following sections discuss the challenges and the range of proactive and reactive measures that can be used to resolve noise problems and follows the spectrum of noise management options.

Many of the noise mitigation measures discussed in this section can be applied at the planning stage for a new area or development as well as in dealing with existing situations.

The primary obligation to mitigate noise impacts on neighbouring properties lies with the person making the noise, but where noise mitigation options have been exhausted the only practical means to reduce noise impacts may be to incorporate mitigation measures into new noise sensitive developments that are receiving the noise.

Figure 1: The spectrum of noise management options



Zoning
 Site & building layout
 Building insulation & construction methods
 Use of industry best practice guidelines

1.1 Noise control at each stage of land use development and planning

1.1.1 Background

By guiding development to the right locations and where necessary, specifying design and layout issues, planning authorities can help to prevent and minimise the consequences of noise. Planning instruments have an important role to play in helping to limit the overall number of people exposed to the potential adverse effects of noise.

Developments which are likely to generate a significant level of noise do not generally make good neighbours with noise sensitive land uses such as housing, hospitals, educational establishments, offices, places of worship, nursing homes and some livestock farms.

Planning instruments can, where relevant, indicate the range of uses which are likely to be permitted in an area affected by existing or potentially high levels of noise, as well as the noise mitigation measures a planning authority will expect to be applied to new development. Planning authorities may also discourage noisy development in areas that are relatively undisturbed by noise.

The following issues may be relevant when planning authorities are considering noise issues during the preparation of a planning instrument:

- avoidance of significant adverse noise impacts from new developments
- applying assigned noise levels reasonably
- use of mitigation measures to manage noise impacts, and
- protection of the amenity of quiet areas.

Where appropriate, relevant and enforceable mitigation measures can and should be implemented through development planning conditions.

In the NT, development applications (DAs) are submitted to Development Assessment Services (DAS), which then provides a recommendation to the Development Consent Authority (DCA), the determining body under the *Planning Act*. The consent authority is to take the matters listed in section 51 of the *Planning Act* into account when making a determination on a DA. This includes, among other things, the potential impact on the existing and future amenity of the area and that includes potential noise impacts.

DAS at times refers the DA to the NT EPA which may request the preparation of a supporting noise management plan to be included as a condition in the DA, to ensure the protection of amenity from noise. The plan must be prepared by a person suitably qualified in the assessment of environmental noise. The NT EPA considers persons who are full members of the Australian Acoustical Society or equivalent listed in the directory of Members Areas of Professional Practice under Environmental Noise to be suitably qualified.

1.1.2 The three stages of development

There are generally three major stages of development and planning where potential noise impacts should be considered and managed.

1.1.2.1 The initial planning stage

A green field (undeveloped) site offers the greatest management flexibility in zoning industrial and noise-sensitive land uses. This is the point where compatibility of different land uses should be considered. During the initial planning stage it may be possible to identify a potential for land-use conflict due to noise. The NT EPA guideline titled *Recommended Land Use Separation Distances* provides additional advice on how to manage impacts of industrial emissions on sensitive land uses by advocating for adequate separation distances to avoid land use conflict situations.

The land should be zoned appropriately taking potential conflicts into account and then, in the development phase, to produce management strategies to address these. Clear goals for new noisy activities (industry) can be developed that provide an equitable share of noise while protecting the amenity of nearby (planned or existing) residential areas.

For undeveloped industrial estates an equitable share of the total noise emitted for the estate can be allocated among the industrial lots within the subdivision. Some industries create more noise than others and this may be accommodated by resitting noisy industries at a site on the estate away from adjacent residential areas resulting in the overall noise for the estate to be reduced.

1.1.2.2 The subdivision stage

When a commitment has been made to locate residential and industrial land use areas close to one another but subdivision development has not started, there is an opportunity to design the internal subdivision layout to minimise noise impacts. This may apply to new residential or industrial developments. Noise mitigation strategies that can be used at this stage of development include:

- using the natural topography to prevent line of sight between the noise source and residential areas and thus block direct propagation of noise
- locating activities that are not noise sensitive, such as commercial areas and parkland, between residences and the noise source
- orienting dwellings so that living areas face away from noise sources
- defining areas affected by noise where building and subdivision design needs to, and
- incorporate noise mitigation.

1.1.2.3 The building design stage

Noise control measures can be applied to buildings to ensure that internal noise levels are acceptable. It is far more cost effective to install appropriate noise insulation at the building stage, rather than adding it later to a finished building. Internal noise can be minimised by:

- locating living areas away from the area most exposed to a noise source
- using thick or double-glazed windows, solid walls and doors, and window and door seals, and
- carefully selecting the location for installation of noise sources, such as air conditioners and water heaters.

Similar approaches can be used to prevent noise escaping from properties that generate noise. Consideration of the impact of a new building's noise sources (e.g. an air conditioning unit) is important to minimise impacts on current or future neighbours.

Site layouts for premises with noisy activities should consider using building structures to shield noisy operations and should locate areas of access to the site or buildings away from noise sensitive areas.

As with many environmental considerations, noise issues are best addressed early in the development assessment process¹⁴.

1.1.3 Acoustic reports as a noise planning tool

Acoustic reports are noise impact assessments made by professional acousticians and have an important role to play in both preventing and remedying noise problems. It is often advisable for people who are planning activities that have the potential to cause noise impacts to seek professional advice on how to prevent, minimise or control noise impacts.

Requesting an acoustic report as part of the development assessment process can help the consent authority in its decision making and ensure that appropriate control measures are integrated into the development.

An acoustic report may be needed in situations where:

- it is required by a planning instrument or an endorsed policy
- it is a requirement of the Environmental Assessment Act
- a new development is proposed that will create significant noise (e.g. new industry, or commercial premises with refrigeration, air conditioning or exhaust equipment)
- a new noise-sensitive development is proposed in an area where existing noise sources are present (e.g. an existing industrial site, main road or rail line is located nearby)
- a new development will generate a significant amount of traffic, and
- complaints are received about noise from an existing activity.

It is recommended that a suitably qualified and experienced acoustic practitioner (e.g. a member of the Australian Acoustical Society, the Institution of Engineers, the Association of Australian Acoustical Consultants or a person with other appropriate professional qualifications) prepare acoustic assessment reports.

Information provided in an acoustic report should include at least the following:

- the name and qualifications or experience of the person(s) preparing the report
- the project description, including proposed or approved hours of operation
- relevant guideline or policy that has been applied

¹⁴ See also the principle of the “agent of change” in section 3.4 of this guideline.

- results of background and any other noise measurements
- meteorological conditions and other relevant details at the time of the measurements
- details of instruments and methodology used for noise measurements (including reasons for settings and descriptors used, calibration details)
- a site map showing noise sources, measurement locations and potential noise receivers
- noise criteria applied to the project
- noise predictions for the proposed activity
- a comparison of noise predictions against noise criteria
- a discussion of proposed mitigation measures, the noise reduction likely and the feasibility and reasonableness of these measures, and
- how compliance can be determined practically.

1.2 Dealing with the community

1.2.1 Consultation

Often the most effective ways to avoid complaints about noise is for the person making the noise to consult with the affected community, particularly where noise impacts appear to be unavoidable. People consulted about an activity that may affect them are often more tolerant about the impact when their concerns have been recognised.

1.2.2 Communication between neighbours

At a neighbourhood and workplace level, people should be encouraged to discuss their noise problems in the first instance with the person or business making the noise. Communication may be all that is required to reach a mutually satisfactory solution.

Often people causing the noise do not realise they are being noisy and are happy to work with affected parties to solve the problem.

People may feel anxious about approaching neighbours, but it may be that noisy neighbours are not aware they are causing a disturbance. Talking about the noise early on can help make neighbours aware of the problem and be more considerate in the future.

1.2.2.1 Tips for talking to your neighbour about a neighbourhood noise problem

Before you approach your neighbour, plan what you are going to say. If you are pleasant and keep calm then they are more likely to respond positively.

Pick the best moment — try to find a time when you can remain calm and your neighbour will listen to, understand and resolve your concern.

The best approach might be to explain how the noise disturbs your need for peace, relaxation or sleep, and how this makes you feel. Try to focus on what you are hearing, rather than what your neighbour is doing.

You could suggest a reasonable action that may help solve the problem by asking 'would you be willing to...?' If talking to your neighbour does not resolve the problem, or if you feel intimidated and worried they may be aggressive, you do have other options available (see below).

1.2.2.2 How to prevent neighbourhood noise problems

People can become extremely upset by noise they have no control over. Noise can aggravate stress, particularly if sleep is disturbed, as fatigue can result in heightened sensitivity and irritability. Here are some things you can do to keep the peace in your neighbourhood:

- Let your neighbours know in advance if you are going to be doing something noisy like having a party, doing building work or using a chainsaw etc. Most people appreciate the courtesy and will be less likely to complain. They can also get away from the noise if they really need to. Those notified about the noise should be given the opportunity to provide feedback on the noisy activity. Any feedback received should then be considered and accommodated
- Notification should:
 - be given at least 48 hours prior to undertaking the noisy activity
 - include the contact details of someone who can be contacted about the noise
- Be mindful of your neighbours when playing amplified music or using power tools etc., even outside the recommended prohibited times (see section 3.1 of the framework guideline). Remember, offensive noise can occur at any time
- Keep the noise in your backyard or on your balcony down so it won't disturb your neighbours, especially during the evening and at night
- Avoid revving your car's engine repeatedly when you turn on your car's ignition. Also, remember to turn the car stereo down when coming home late at night and try not to slam doors
- Choose quiet models when buying equipment such as air conditioners, hot water heat pumps, pool pumps and rainwater tank pumps
- Think about the impact on your neighbours when installing this equipment. Place air conditioners and hot water heat pumps away from your neighbour's bedroom and living room windows or have the equipment acoustically shielded to ensure neighbours are not affected. For more information see the Australian Institute of Refrigeration, Air-conditioning and Heating guidance at:

www.fairair.com.au/Calculator.Noise.aspx
- Enclose pool and spa pumps to muffle the noise so it does not reach your neighbours and run pumps only when necessary within the permitted times (see Table 3.1 of the framework guideline)
- Choose quiet models when purchasing or hiring garden equipment such as leaf blowers, string trimmers, edge cutters and lawn mowers, and
- If possible, use a broom or a rake instead of a leaf blower. If you must use a leaf blower, don't start too early, use it for short periods and avoid revving it repeatedly. These devices are often much quieter but just as effective when used at around half the maximum power.

1.2.3 Education as part of the NT EPA's compliance approach

Education of the community can be an important aspect of noise management to assist in avoiding or reducing noise conflicts. The NT EPA can use this option as a cost effective measure to resolve noise conflicts.

Greater community understanding of an issue can help to promote tolerance of surrounding neighbourhood activities and an understanding of generally accepted activities and what can be done if a conflict arises. An education program may deal with a particular noise issue in a local area and as an option explanatory written material provided to residents.

An education campaign by the NT EPA or other regulator can target:

- noise generators in the community to outline their responsibility to other members of the community, and
- existing or future noise receivers to explain the types of noise that may arise in the area and what level, duration and frequency of noise might be expected.

1.3 Contacting the Community Justice Centre

The Community Justice Centre (CJC) is a government-funded, independent organisation that specialises in settling differences between neighbours without the need to enter into complicated legal processes. The CJC is an appropriate place for example to resolve residential neighbourhood noise issues, such as noise from fixed domestic equipment (e.g. pool pumps and air conditioners).

One of the processes the CJC may suggest is a mediation process. This is where you meet with the people who are making the noise, together with a CJC representative, to try and solve the noise problem amicably. This process does not cost anything, and has a high success rate.

Informal mediation could take place between the person making the noise and the person or people affected, with for example, the NT EPA providing the mediator. The aim is to reach a mutually acceptable agreement that avoids the need for more formal mediation or for regulatory intervention.

Formal mediation may be appropriate where underlying issues contributing to the conflict also need to be resolved. The CJC or a professional mediator may be able to help in these situations. Individuals can contact the CJC requesting mediation. The CJC can write to the person allegedly making the noise and if that person is willing, the CJC can arrange for a CJC mediator to conduct a mediation session at a Local Court nearest to the complainant's location.

Key strategies for successful mediation include the following:

- Remaining impartial and staying focused on solving the problem
- Looking for areas where both sides agree
- Listening actively and acknowledging what is being said
- Recognising and understanding emotions. Don't let emotional outbursts affect the mediation process
- Be open to others' perceptions of the problem
- Trying to build rapport with all sides, and
- Focussing on possibilities, being flexible, and thinking laterally. With objections why not ask: 'Why not'?

For information on your nearest CJC, visit www.cjc.nt.gov.au.

1.4 Other noise management options

1.4.1.1 Voluntary environmental audits

Voluntary audits can be undertaken by operators so that they can learn about how to comply with the legislation, codes of practice or environmental policies, and help identify ways an activity can be improved in order to protect the environment and to minimise waste.

1.4.1.2 Environmental audits required by the NT EPA under the WMPC Act

Environmental audits provide an opportunity to identify the environmental impacts of an activity or business that may need to be improved. Audits have an important role to play in educating people and improving the environmental performance of commercial and industrial premises.

1.4.2 Environmental management plans

Environmental management plans can be used to establish clear goals and encourage best management practices. These plans can be most useful when mitigating an environmental impact through the use of the best management practices. In some situations it may be appropriate for the NT EPA or DCA to require a proponent to develop an environmental management plan that includes a noise management plan as part of the planning process, or as part of an environmental audit, environmental impact assessment or entertainment venue noise (see section 3.4 of the framework guideline). More information on Noise Management Plans is provided in section 5.6 below in situations where noise generated from an activity that has the potential to not comply with the WMPC Act.

1.4.3 Contract specifications

Conditions set in contractual agreements can help to avoid or minimise noise impacts and can be used where local government is using contractors to provide services. For example, contract specifications for the management of noise impacts should be applied to garbage collection contracts. The contract should include clauses specifying suitable collection times, the location where compactors can be operated or bottles can be smashed, complaint handling processes, etc. Contractors for road works could also be required to comply with a local government noise policy or by law for example.

1.4.4 Working with other regulators

The NT EPA liaises with other regulators to clarify the role of each regulator in managing noise problems. This reduces duplication and helps to resolve difficult and ongoing noise problems in the most efficient and effective way. An example of this is where complaints are received about licensed premises where the NT EPA involves the NT Liquor Commission and other regulators.

1.5 Noise management plans

Where a person proposes to undertake an activity that will generate noise that has the potential to not comply with the WMPC Act or the recommended assigned noise levels included in this guideline, they should submit a Noise Management Plan to the NT EPA.

A Noise Management Plan submitted to the NT EPA must contain:

1. details of person/entity proposing to make the noise
2. a site plan including neighbouring land-use details
3. details of noise emissions which cannot comply with this guideline, including anticipated noise levels (L_{Aeq} , L_{Amax}), duration(s) and timing

4. reasons/justification for the carrying out of noise emissions which cannot comply with this guideline
5. details demonstrating how noise emissions will be managed to minimise impacts on any noise sensitive receptors, including reference to any relevant standards such as:
 - (a) 'AS 2436 Guide to Noise and Vibration Control on construction, Maintenance and Demolition Sites'
6. demonstration that all affected, or potentially affected noise sensitive receptors have been:
 - (a) consulted regarding the proposed noise emissions at least two weeks prior to the noise event occurring
 - (b) provided with a description of the expected noise emission, including time and date of noise emission
 - (c) provided the opportunity to provide feedback
7. demonstration on how feedback from affected, or potentially affected noise sensitive receptors has been considered and incorporated into proposed noise emissions management and the Noise Management Plan
8. a noise monitoring programme that details:
 - (a) monitoring frequency
 - (b) monitoring locations
 - (c) actions that will be undertaken should monitored noise emission levels exceed anticipated noise levels
9. a consultation programme that includes procedures for communicating changes in planned events to all affected, or potentially affected noise sensitive receptors
10. a complaint response process, which includes a requirement to keep a complaints register where the following details will be recorded:
 - (a) contact details of all complainants
 - (b) the time and date the complaint is received
 - (c) a description of the complaint
 - (d) a description of the activities occurring which gave rise to the complaint
 - (e) any action taken as a result of the complaint
11. the name of a person who will be responsible for implementing the noise management plan, and
12. the name and phone number of the person to whom a complaint may be made about noise emissions associated with the Noise Management Plan.

Further information on when a Noise Management Plan will be required specifically in relation to construction sites is contained in section 10 of the NT EPA publication titled, *Guidelines to Prevent Pollution from Building Sites* and is available at:

https://ntepa.nt.gov.au/data/assets/pdf_file/0010/284680/guideline_prevent_pollution_building_sites.pdf

Noise Management Plans may be submitted to:

NT Environment Protection Authority
GPO Box 3675
Darwin NT 0801
Or via email to: pollution@nt.gov.au

Information on Noise Management Plans for entertainment venue noise is covered in section 3.4.10 of the framework guideline.

Upon receiving a Noise Management Plan the NT EPA will review the plan and either provide feedback to be incorporated into the plan, or issue an 'Acknowledgement of Receipt'.

1.6 Applying for a noise abatement order

Under section 53D of the *Summary Offences Act* a person occupying a premises impacted by undue noise may apply to the Local Court for a noise abatement order to be taken out against the person causing noise, or the occupier/owner of the premises from which the noise is coming from.

If the Local Court is satisfied that an alleged undue noise exists, the Local Court may issue a noise abatement order requiring the noise to be stopped, abated or to only occur within specified hours.

1.7 Lodging a complaint with the NT EPA

Where attempts to resolve a noise complaint amicably have been unsuccessful, affected persons may lodge a noise complaint to the NT EPA for noise types that NT EPA regulates (see Table 2.1 of the framework guideline).

The NT EPA can provide an impartial and fair assessment of what level of noise is reasonable, taking into consideration the nature of the activity, the surrounding area and number of people likely to be affected.

Complaints can be made to the NT EPA via a number of ways including:

1. the internet: by completing and submitting the NT EPA Pollution Reporting Online Form which can be found at <https://ntepa.nt.gov.au/waste-pollution/hotline/pollution-report-form>
2. email: pollution@nt.gov.au
3. phone: 1800 064 567, or
4. mail to:

NT Environment Protection Authority
GPO Box 3675
Darwin NT 0801.

Noise complaints can be accompanied by a noise log which outlines the characteristics of the noise emissions (timing, duration, volume) and how the noise is impacting on you (Appendix A).

1.7.1 NT EPA complaints management process

Informal approaches are often preferable to taking formal regulatory actions as they use fewer regulator resources. Where neighbours have not sought to resolve the problem themselves, the best first step for NT EPA officers and other noise regulators may be to facilitate communication amongst parties in noise disputes. Ways to do this range from informal discussion to more formal negotiation and mediation processes that seek to resolve a dispute.

This approach may be useful where, for example, the volume of music needs to be reduced or where the time or location that people play loud musical instruments causes conflict. In this type of situation it may be possible to negotiate days and times that are acceptable to both the complainant and the person making the noise.

The NT EPA encourages the public to try to resolve any noise issues via for example through discussion with the person responsible for the excessive noise, or mediation through the Community Justice Centre.

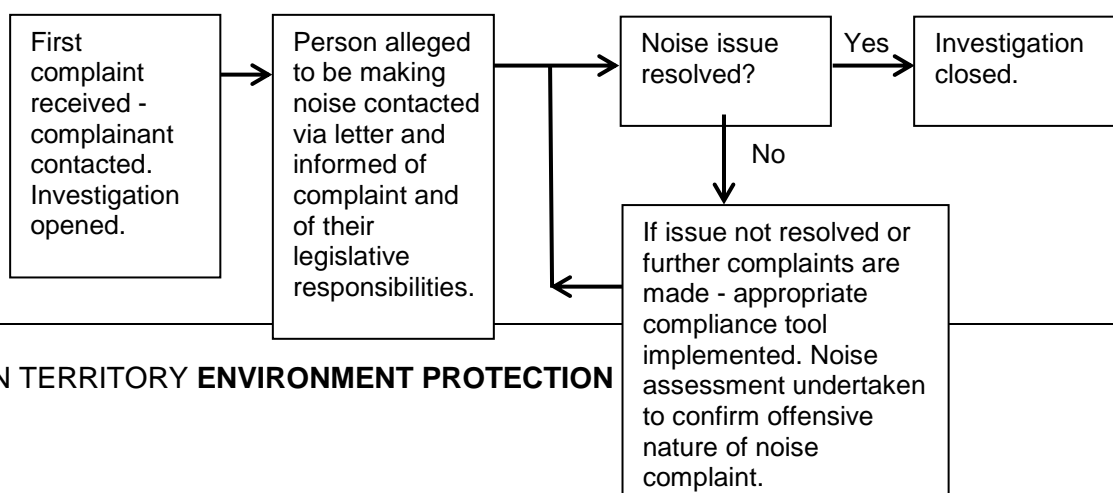
If this fails to resolve the noise issue, and a complaint is lodged with the NT EPA by the person affected by the noise the NT EPA will investigate complaints in the following manner:

- **first complaint** - the NT EPA sends out a letter advising the alleged noise producer of their responsibilities under the Act and inviting them to contact the NT EPA to discuss the matter (in most cases the matter can be resolved at this stage)
- **if the issue has not been resolved or a second complaint is received** - if the complaint is validated by the NT EPA through a noise measurement (see guidance document number 2 of this guideline), a warning letter or infringement notice may be issued, and/or depending on the circumstances, a direction or PAN may be issued, and
- **subsequent complaints** - these will be dealt with accordingly. It should be noted that a breach of an authorised officer's direction or PAN is a serious offence. If the noise continues to be a problem, it could lead to prosecution in court.

Note: The above approach is adopted for guidance only and serious cases, such as complaints regarding a one off event, may justify immediate application of a strict approach to enforcement.

Figure 2 below outlines the typical NT EPA investigation process followed when a noise complaint is received, following after the complainant has made unsuccessful attempts to resolve the issue amicably in accordance with the informal approaches covered above.

Figure 2: Investigation of noise complaints



1.7.2 Keeping a noise log

Where a noise complaint is made, the NT EPA at times may recommend complainants start keeping a noise log which details when the noise is occurring and its impacts. The log will enable the NT EPA to understand the characteristics of the noise emissions that are annoying (e.g. timing, volume, frequency) and will aid in investigating and resolving the complaint. The log will also help the NT EPA understand more about the noise issue (such as how long it's been going, when it occurs), which will also be valuable in resolving the issue. A log may also be needed as a source of evidence, should a regulatory tool need to be issued in relation to the noise (see section 2.2.4 of the framework guideline).

The NT EPA recommends that the noise log is kept for a minimum period of 1 week.

1.7.3 Affected person in a sensitive noise receptor

The NT EPA will generally only investigate and take action in relation to excessive noise if an affected person in a sensitive receptor area lodges a formal complaint.

An affected person is the occupier of a sensitive noise receptor ¹⁵category subjected to noise which exceeds the recommended assigned noise levels as covered in section 3 of the framework guideline.

To be an affected person, a person must:

- in the case of leased or privately owned land, be the legal occupier of that land and the noise must originate from an activity being undertaken outside that land, or
- in the case of unleased or public land (excluding roads, footpaths and cycle ways), be legally present on that land. The noise may originate from an activity being undertaken on or outside that land.

This definition of an affected person excludes people who are in a position to control the activity causing the noise or who have other means available to them to address the problem. The following are generally not considered to be affected persons:

- the occupier of a parcel of land who is affected by noise from an activity being undertaken on that parcel of land (because the occupier is in a position to control the activity)
- the occupier of a unit in a units plan, such as a person living in an apartment block, who is affected by noise from common areas of the complex because that person is, through the body corporate, in a position to control the activity (such people are, however, considered to be affected by noise from activities being undertaken in another unit in the complex)
- the occupier of a parcel of land held under a Territory lease who is affected by noise from another occupier on the same Territory lease (e.g. two people living in an untitled dual occupancy or people living in untitled units), and
- any person who is, on the land but is not the legal occupier. Examples include:

¹⁵ See section 5 of the framework guideline for the definition of sensitive noise receptor

- customers on commercial premises, as they can ask the proprietor (who is the legal occupier) to take action or they can take their business elsewhere
- employees within their employers lease boundary, or
- any person on a road, footpath or cycleway, as they are in transit or can readily move elsewhere.

1.7.4 What the NT EPA will take into account when investigating noise complaints

As covered in section 2 of the framework guideline NT EPA authorised officers utilise a number of environmental management instruments to effect compliance with the WMPC Act.

The NT EPA will take the following into account when investigating a noise complaint and deciding upon the appropriate course of action to take:

- the characteristics of the noise (timing, amplitude (i.e. volume), duration, frequency, modulation, impulsiveness)
- how the noise may be impacting on the amenity of the area
- number of complaints received
- whether the noise exceeds any of the limits/standards stated in this guideline, and by how much
- background noise levels (without the noise being present)
- whether the generator of noise emissions has taken all feasible and reasonable measures¹⁶ to prevent their noise emissions impacting on any noise sensitive receptors (such as the use of best practices noise mitigation practices, or prior notification of noise)
- government authorisations for the activity (e.g. development permits)
- historical use issues
- existing land use(s), including surrounding land use
- actions the complainant has taken to resolve the noise issue amicably, and
- actions the complainant has taken to mitigate the noise impacts on themselves (such as closing the window).

1.8 Guidance on managing existing noise problems

This section deals with the management of existing noise problems through action that is feasible and reasonable.

There are three main areas where noise mitigation measures can be applied:

¹⁶ The terms “feasible” and “reasonable” are defined in section 5 of the framework guideline.

1. at the source
2. in the transmission path, or
3. at the noise receiver.

Control of noise at the source is always the preferred method of noise control as it reduces the impact on the entire surrounding area.

Noise path control or mitigation at the receiver usually requires measures that block the transmission of noise such as erecting barriers or making architectural modifications to building facades. As the benefit from these measures would only apply to a limited area, in general, this should only be done after endeavouring to control noise at the source.

Selecting the right approach to noise mitigation will depend on the nature of the noisy activity, the location of noise receivers, the cost and viability of various solutions, the degree of noise mitigation required, any special characteristics of the noise, and individual site considerations. Often a mixture of noise control measures works best.

1.8.1 Mitigation measures – ways to reduce noise impacts

A range of proportionate and reasonable specific measures that can be used to control the source of or limit exposure to noise include the following:

Engineering - reduction of noise at point of generation (e.g. by using quiet machines and/or quiet methods of working); containment of noise generated (e.g. by insulating buildings which house machinery and/or providing purpose built barriers around the site); and protection of surrounding noise-sensitive buildings (e.g. by improving sound insulation in these buildings and/or screening them by purpose-built barriers)

Lay-out - adequate distance between source and noise-sensitive buildings or areas; screening by natural barriers, other buildings, or non-critical rooms in a building

Operational - limiting operating time of source; restricting activities allowed on the site and specifying an acceptable and reasonable noise limit. The implications of restricting hours of operation for the economic efficiency and operational capacity of a business over the longer term will need to be considered

Work sequencing - programming and phasing construction or extraction activities to limit noise impact; use of acoustic screens around plant; limiting vehicle noise through speed control, road surfacing and driving style;

Baffle mounds – particularly relevant to mineral and landfill workings where they can be constructed from the top soil, sub-soil and over-burden which need to be removed and stored

Acoustic fencing - an alternative to baffle mounds or used on top of a mound to increase acoustic protection

Alternatives to vehicle reversing alarms - include flashing lights during the night (but these may also cause a nuisance if not operated with care), radar-operated safety devices, audible “warble” devices, TV camera systems, and reduced level audible warnings for night time use

Off-site road traffic noise – restriction of truck movements to particular times or particular routes; low-noise road surfaces and road surface maintenance

Rail traffic - low-noise rolling stock; low-noise tracks; and sensitive location of depots

Equipment selection – setting noise limits for specific items of plant and equipment, e.g. those with certain tonal noise characteristics

Acoustic double glazing and secondary glazing for existing development - this is unlikely to be appropriate as a response to noise caused by a new development. The use of double glazing and secondary glazing is not an alternative to other measures to control noise emissions or a means of legitimising higher noise limits.

Appendix A: Noise Log

<i>This log should detail when the noise occurs (date/time) as well as steps taken to resolve the issue. An investigation into the noise may not be initiated unless a Log is provided.</i>					
Date	Time	Source	Description	What you were doing at time it occurred	How your amenity was impacted

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Guidance Document Number Two

The Science of Sound

1 Background

This guidance document provides some of the basics in noise science.

How people perceive noise depends on at least three physical characteristics – the magnitude of the noise, the frequency of the noise and its duration. The descriptors or indicators used to describe noise are designed to bring together these features in a way that reflects how they impact on people in combination.

Whilst each of these characteristics can be measured discretely, the *effect* of the noise is subjective and varies between individuals, making it difficult to quantify. Ascertaining the effect of a noise on an individual is a little like judging the difficulty of a workout involving different weights and exercises. Whilst simple conclusions can be drawn relating to one characteristic of a workout (e.g. a heavy weight is harder to lift than a lighter weight), it becomes harder to make these judgements the more variables come in to play (e.g. was it harder for someone to lift the heavy weight for five seconds or the lighter weight for ten seconds?).

2 What is the difference between sound and noise?

Sound is produced by small fluctuations in air pressure. As an example, the sound from a drum results from fluctuations in air pressure caused by the movement or vibration of the drum hide. The human eardrum is able to perceive these fluctuations with great sensitivity.

The loudness of a sound is predominantly related to the size of the fluctuations, but is also related to their frequency, or the rate at which they are produced.

Noise is defined by the World Health Organization (WHO) as unwanted sound. Physically, there is no difference between sound and noise. The difference is one of human perception and is subject to individual variability.

Noise in the context of environmental management is synonymous with 'sound' or 'acoustic energy' and is taken to include mechanical vibration. However, 'noise' and 'sound' generally refer to acoustic energy in the atmosphere and 'vibration' refers to acoustic energy in condensed media such as the ground, water and built structures.

2.1.1 Measuring noise

The loudness of sounds can range from those which the human ear can just detect (the threshold of hearing) to those that exceed a threshold of pain. Given that sound is produced by changes in air pressure, the international standard unit of acoustic pressure is based on that for pressure measurement, the micropascal (μPa).

The range between the faintest audible sound and the loudest sound the human ear can stand is so large (20 μPa to 63 million μPa) that it would be cumbersome to express sound pressure fluctuations in these units. Although air or sound pressure is measured in pascals (Pa) it is expressed as a sound pressure level (L_p), the unit of which is the more commonly known decibel (dB), which is a logarithmic scale used to compress the range of audible sound pressure.

The logarithmic scale is different to a linear scale. A doubling of the sound pressure, say from 20 μPa to 40 μPa , produces an increase of 6dB. In subjective terms, a 3dB increase is often described as a just noticeable difference.

The relationship between sound pressure and L_p is as follows:

$$L_p \text{ (dB)} = 10 \log(p^2 / p_{\text{ref}}^2) = 10 \log(p / p_{\text{ref}})^2 = 20 \log(p / p_{\text{ref}})$$

Where L_p = sound pressure level (dB)

p = sound pressure (Pa)

$p_{\text{ref}} = 2 \times 10^{-5}$ - reference sound pressure (Pa)

2.1.2 Some useful rules of thumb

The following tables are useful references when providing a qualitative description to related changes in sound pressure levels dB(A).

Table 1: Subjective effect of changes in noise levels

Change in level of dB	Subjective effect
3	just perceptible
5	clearly perceptible
10	twice as loud

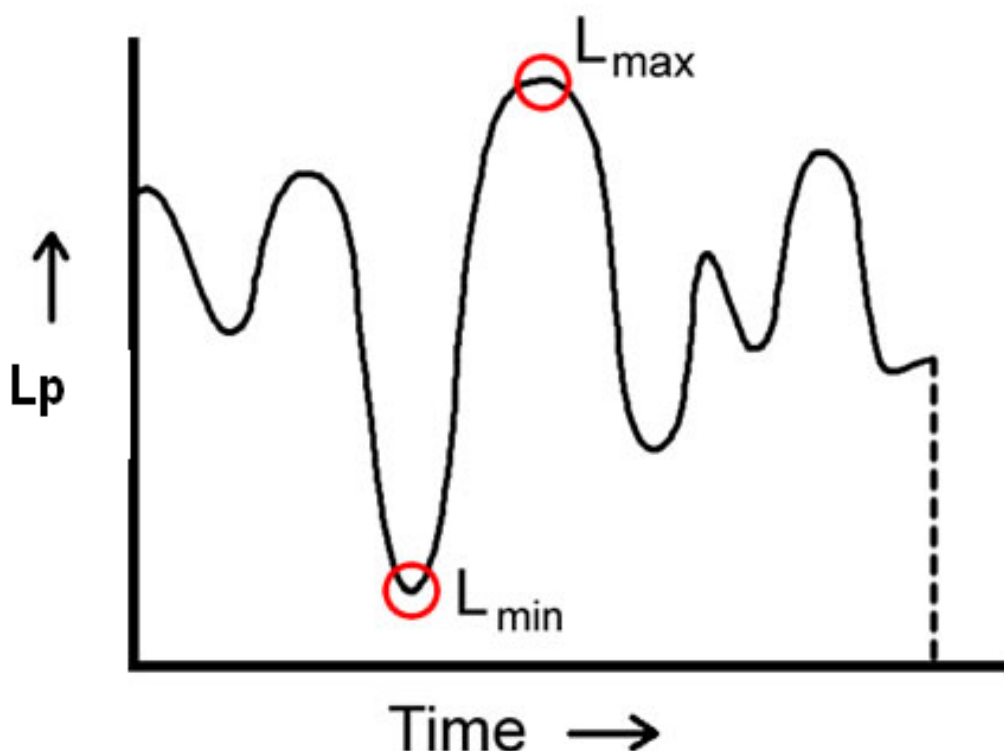
Table 2: Estimated community response

Amount in dB(A) by which the rating level exceeds the recommended assigned noise levels referred in the framework guideline.	Estimated community response	Subjective effect
	Category	Description
0	None	No observed reaction
5	Little	Sporadic complaints
10	Medium	Widespread complaints
15	Strong	Threats of community action
20	Very strong	Vigorous community action

2.1.3 Noise descriptors used in noise assessment

The parameters frequently used for measuring noise include L_{Amin} , L_{Amax} , L_{Aeq} and L_{A90} . Most contemporary sound level meters record multiple noise parameters at the same time.

L_{Amin} and L_{Amax} refer to the equivalent minimum and maximum values recorded by the SLM during a noise assessment (see Figure 1). As discussed in greater detail in the following sections of this guideline, L_{Amax} is often compared to the L_{A90} (background) to describe the likely impact of non-steady noise such as fluctuating or impulsive noise.

Figure 1: L_{Amin} and L_{Amax} 

L_{AmaxT} is the A-weighted L_p obtained by using 'fast' time response and arithmetically averaging the visual maximum levels of the noise under investigation, unaffected by extraneous noise, during the measurement period. This parameter is usually used for impact and/or intermittent noises, as this parameter does not account for a more constant noise.

It is used to measure and quantify maximum noise level events. The L_{AFmax} as it is the maximum sound pressure level of an event measured with a sound level meter satisfying AS IEC 61672.1-2004.

L_{AmaxT} is generally only used where noise assessment is carried out using a non-integrating (analogue or digital) SLM and where the SLM does not have the capacity to calculate the statistical (i.e. $L\%$ sound pressure levels).

L_{AeqT} is the A-weighted equivalent continuous L_p of the sample time T . The $L_{Aeq,T}$ is also known as the 'time average sound pressure level' or the 'level of noise equivalent to the energy average of noise levels occurring over a measurement period'. This is the current default descriptor for environmental noise measurement. It is used widely throughout the world for measuring noise sources and it is an extremely versatile parameter.

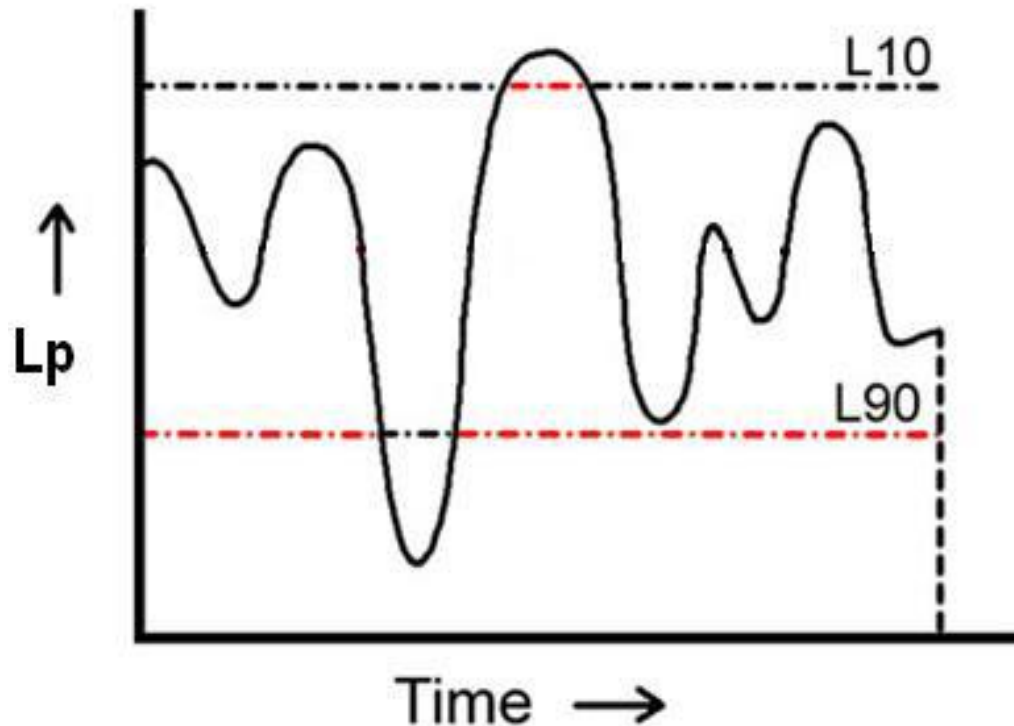
The **L_{Aeq} descriptor** is used for both the intrusiveness noise level and the amenity noise level. The L_{Aeq} is determined over a 15-minute period for the project intrusiveness noise level and over an assessment period (day, evening and night) for the project amenity noise level.

L_{peak} is not the same as the Maximum Sound Level. The Peak, referred to as the L_{peak} or sometimes L_{pk} , is the maximum value reached by the sound pressure. There is no time-constant applied. This is the true peak of the sound pressure wave. This parameter is

commonly seen within the development conditions of mines and used to regulate blasting operations.

Percentile levels are commonly used when measuring environmental noise. This is represented by L_n , where n may be a value from 1 to 99. L_n represents that noise level exceeded for $n\%$ of the measurement time. Common percentiles used are shown in Figure 2.

Figure 2: Common percentiles



L_{A90} is the sound pressure level that has been exceeded for 90% of the time. This level is taken to be the background sound pressure level over a relevant period of measurement using 'A' frequency weighting and fast time weighting.

It is also used to derive the **rating background noise level** that provides a single figure that represents the background noise level for noise assessment purposes covered in section 3 of the framework guideline.

$L_{A_{bg,T}}$ is also known as the 'background sound pressure level', (also known as the average minimum sound pressure level) and is the A-weighted L_p obtained using 'fast' time response and arithmetically averaging the visual minimum levels of the noise under investigation, unaffected by extraneous noise, during the measurement period.

In cases where $L_{A_{bg,T}}$ has been referenced in development approvals or legislation, it is to be taken as $L_{A90,T}$. ($L_{A_{bg,T}} = L_{A90,T}$ (unaffected by extraneous noise)).

L_{A10} is the sound pressure level exceeded for 10 % of the time of the measurement duration.

L_{OCT10} is the C-weighted or Linear sound pressure level for a specified octave band that is exceeded for 10 per cent of the time interval considered.

L_{OCT90} is the C-weighted or Linear sound pressure level for a specified octave band that is exceeded for 90 per cent of the time interval considered.

Rounding

Noise levels used in noise assessments for are to be rounded to the nearest integer.

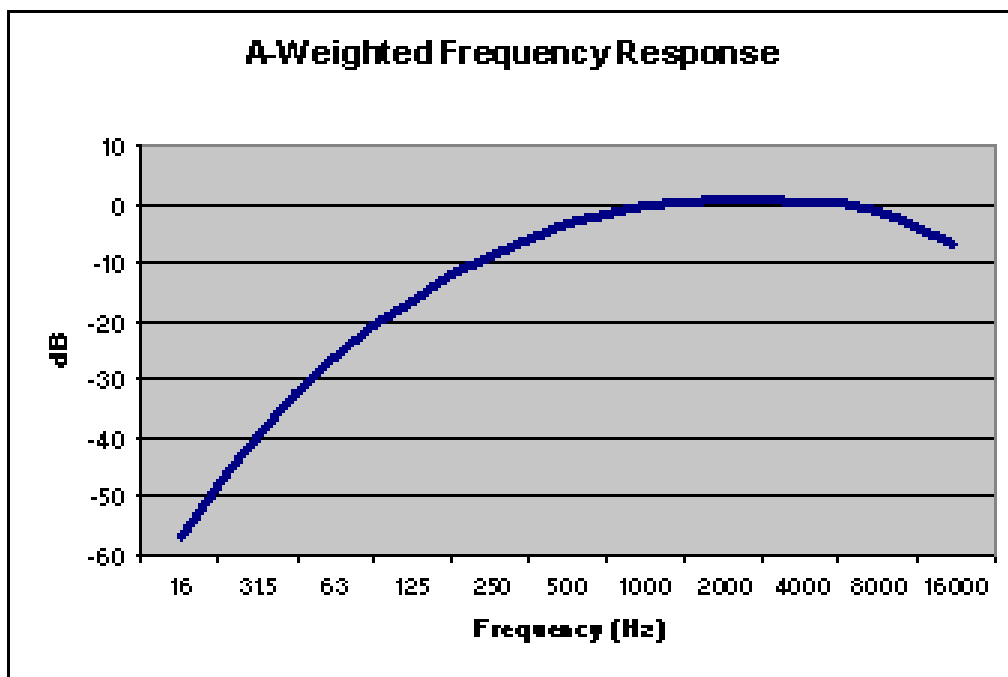
2.1.4 Frequency weightings relevant in the setting up of SLM

The frequency of a sound is the rate at which the fluctuations are produced per second. Practically all sounds contain a mixture of frequencies. The mix of frequencies affects the perceived loudness. A high-frequency sound (e.g. screeching or whistling) at the same acoustic pressure as a low-frequency sound (e.g. thunder) will be perceived to be louder. This is because the human ear is most sensitive to mid-range and high frequencies and is less sensitive to the lower frequencies. To ensure measured levels approximate the human response, a weighting scale is used.

2.1.4.1 A- weighting

The most common weighting used in environmental noise measurement is A-weighting. It is known as the 'A' scale and the units are referred to as 'A-weighted decibels' and written as dB(A). The dB(A) scale discriminates between sounds in much the same way as people do i.e. the A-weighting represents the way the human ear is more sensitive to mid-range frequencies and less sensitive to high and low frequencies. Defined in the sound level meter standards (IEC 60651, IEC 60804, IEC 61672, ANSI S1.4), a graph of the frequency response can be seen below, see Figure 3.

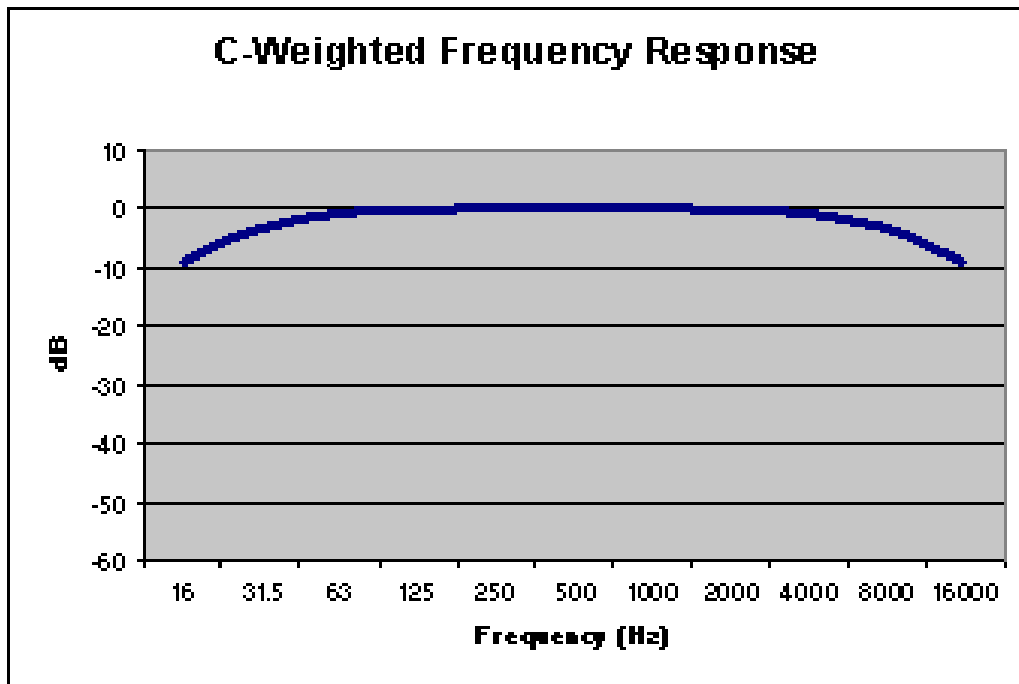
Figure 3: A- weighted Frequency Response



2.1.4.2 C-Weighting

The response of the human ear varies with the sound level. At higher sound pressure levels, the ear's response is flatter, as shown in the C-Weighted Response below. Although the A-Weighted response is used for most applications, C-weighting is also available on many SLMs. C-weighting can be used for Peak measurements and low frequency noise. It is often used in entertainment noise measurement, where high pressure low frequency noise is common. The C-weighting is also commonly used for sounds with impulsive characteristics such as fire-arms; shooting ranges; and pile driving. C-weighted measurements are expressed as dB(C), see Figure 4.

Figure 4: C- weighted Frequency Response



2.1.4.3 Z-Weighting

Z-weighting is a flat frequency response of 0.5Hz to 20kHz ± 1.5 dB. This response replaces the older "Linear" or "Unweighted" responses. Z-weighted measurements are expressed as **dB(Z)**. Z-weighting has recently been used to measure explosive sounds and in the assessment of low frequency noise.

For most noise assessments A-weighting will be used.

2.1.4.4 Time weighting

Sound level measurements using any grade of SLM can be **Fast**, **Slow**, or **Impulse** time weighted. The **Impulse** time weighting is about four times faster than **Fast**, with a short rising time constant but a slow falling one. **Fast** corresponds to a 125 ms time constant. **Slow** corresponds to a 1 second time constant. **Impulse** has a time constant of 35ms.

2.1.4.5 Ambient noise level

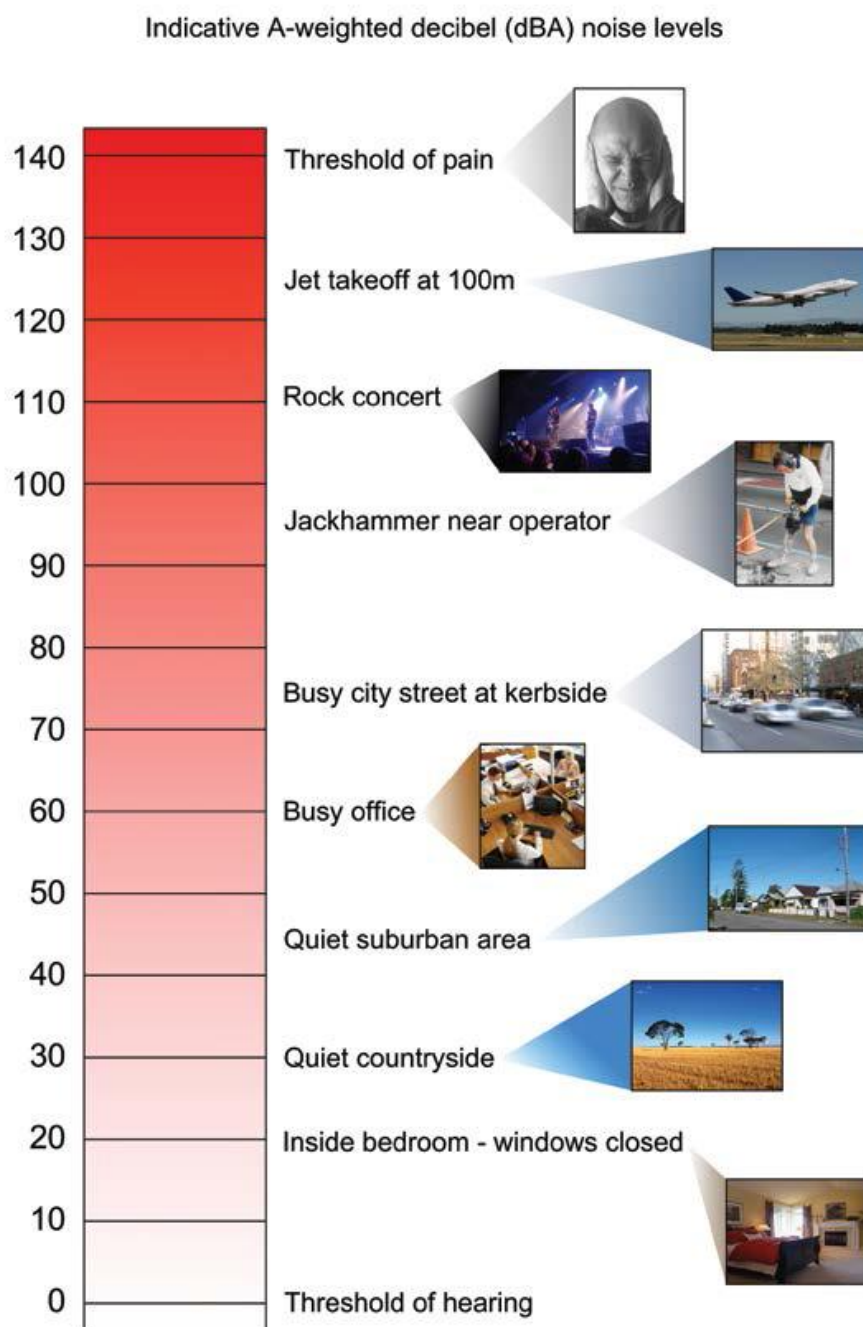
The ambient noise level is defined as the totally encompassing sound in a given situation at a given time, composed of sound from all sources near and far, measured using the equivalent continuous sound pressure level (L_{Aeq}) noise descriptor.

2.1.4.6 Rating level

The rating level can be defined as a specific noise level plus any adjustment for the character of the noise (tonal and/or impulsive) determined over the reference time interval.

Some examples of typical sound pressure levels in dB(A) are shown in Figure 5. All further reference to noise levels in this guideline will be in dB(A) unless noted otherwise.

Figure 5: Examples of common sound pressure dB(A) levels



2.2 Assessing noise with Sound Level Meters (SLM)

Specific guidance on assessing noise has been provided for each of the noise categories covered in section 3 of the framework guideline. This section provides general guidance on the use SLMs to measure noise, and is applicable to anyone that undertakes noise measurements in the NT. Noise measurements taken by NT EPA officers that are properly trained to use noise equipment.

As stated in section 3 of the framework guideline SLMs are used to measure noise levels when:

- determining an acceptable noise level for inclusion in a planning approval or an Authorised Officer Direction or Pollution Abatement Notice

- testing whether a particular noise complies with a level prescribed in a planning approval or notice
- gathering evidence to support an offensive noise test
- quantifying how loud the noise is
- for inclusion of predicted noise levels in modelling
- assessing how loud it is relative to the background noise (i.e. “intrusive noise”)
- determining the presence of annoying characteristics such as tones
- supporting a prosecution or disputed Penalty Infringement Notice
- quantitative assessments for construction noise,
- undertaking entertainment venue noise assessments, or
- undertaking noise assessments for industrial or commercial noise.

2.2.1 Measuring equipment

2.2.1.1 Types of SLMs

SLMs used for the procedures specified in this guideline must comply with either Type 1 or Type 2 precision as described in Australian Standard AS 1259. The ‘Type’ precision is normally indicated in the meter specification documentation. Sound level meters used for environmental noise measurements are normally Type 1 meters but this is not necessarily a strict requirement.

Type 2 meters can be used provided that the requirements of the measurement are within the meter’s specifications. In particular, the noise floor (i.e. the inherent noise of the instrument) of a Type 2 meter may be above the quiet ambient noise level in some areas. Type 1 meters generally exhibit lower noise floors than Type 2 meters. In any case of dispute, measurements taken with a higher precision instrument will take precedence over measurements taken with a lower precision instrument, all else being equal.

It should be noted that Type 1 meters are generally intended for laboratory and precision use and Type 2 meters are intended for field use. It is likely that the precision of field measurements made with a Type 1 meter will be limited more by the environmental conditions than by the precision of the meter.

The measurement of noise for the purposes of this guideline must be taken by a SLM that complies with *Australian Standard AS 1259-1990 Acoustics—Sound Level Meters* and has been tested in the previous 24 months by a National Association of Testing Authorities of Australia registered laboratory and certified by the laboratory to be accurate within relevant tolerances allowed for a Type 0, 1 or 2 SLM in *Australian Standard AS 1259-1990* or *International Electro-technical Commission Standards IEC 651-1979* and *IEC 804-1985*.

Other equipment may be used in conjunction with a SLM when taking a noise measurement provided that the overall accuracy of the measurement, as certified by a National Association of Testing Authorities of Australia registered laboratory in the previous 24 months, is no less than that acceptable for a Type 2 SLM.

2.2.2 Laboratory calibration and maintenance

The sound level meter and portable sound level calibrator must be calibrated at least every two years by a calibration laboratory, as specified in AS 1055.1— 1997.

2.2.3 Field calibration checks

The performance of the sound level meter when in use shall be checked periodically with a portable sound level calibrator, pistonphone or other portable checking device appropriate to the sound level meter, and immediately before and after measurements are made.

For extended measurement periods, these checks should be performed before and after each measurement sequence.

If the instrumentation system registers a calibration discrepancy equal to or greater than ± 1 dB between consecutive checks, any measurements in the interval between the two checks shall be considered invalid.

2.2.4 General procedures

When using SLMs the following procedures must be followed when measuring a source noise level (continuous), ambient noise level (continuous) or background noise level.

If the measurement is taken outside:

- (a) the microphone of the sound level meter must be at a height of 1.2 to 1.5 metres above any horizontal acoustically reflecting surface, and, if it is practicable and relevant, at a distance of at least 3.5 metres from any vertical acoustically reflecting surface
- (b) the axis of maximum sensitivity of the microphone of the sound level meter must be directed towards the noise source
- (c) a wind shield approved by the sound level meter manufacturer must be used
- (d) the wind velocity at the measurement place must not exceed 5 metres per second
- (e) care must be taken to avoid any effect on the measurement of extraneous noise, acoustic vibration or electrical interference, and
- (f) steps must be taken, as determined by the Authority or another administering agency, to take account of any significantly varying meteorological patterns in the locality.

If the measurement is taken at an open window of a room:

- (a) the microphone of the sound level meter must be in the middle of the plane of the open window
- (b) the axis of maximum sensitivity of the microphone of the sound level meter must be perpendicular to the plane of the window
- (c) a wind shield approved by the sound level meter manufacturer must be used
- (d) the wind velocity at the measurement place must not exceed 5 metres per second
- (e) care must be taken to avoid any effect on the measurement of extraneous noise, acoustic vibration or electrical interference or noise generated within the premises in which the measurement is taken, and
- (f) steps must be taken, as determined by the Authority or another administering agency, to take account of any significantly varying meteorological patterns in the locality.

If the measurement is taken within a room or at any place determined by the Authority or another administering authority:

- (a) the sound level meter must be held at a position that produces the highest noise level reading in the room or place when at least 1 metre from walls, at least 1.5 metres from windows, and at a height of 1.2 to 1.5 metres above floor level
- (b) a wind shield approved by the sound level meter manufacturer must be used
- (c) care must be taken to avoid any effect on the measurement of any extraneous noise, acoustic vibration or electrical interference or noise generated within the premises in which the measurement is taken, and
- (d) steps must be taken, as determined by the Authority or other administering agency, to take account of any significantly varying meteorological patterns in the locality.

2.2.5 Noise assessment reports

When there is a consent authority or regulatory requirement to produce the results of noise monitoring, a formal noise assessment report must be submitted. It must include but not limited to the following items:

- the type of monitoring test conducted
- any development noise limits on a consent
- the monitoring or measurement location
- the noise instrumentation used (the instrumentation specifications required for compliance monitoring are the same as those required for background noise monitoring)
- the weather instrumentation used
- the weather conditions during noise monitoring and the location of the weather monitoring station used
- the time(s) and duration(s) of monitoring, including dates. In the case of receiver complaints, these should coincide with the time that the noise is considered to be most intrusive. In the case of development-stage monitoring, these should cover the full cycle of activity
- the results of noise monitoring at each monitoring location, including a comparison with the development limits or other regulatory instrument limits
- a statement outlining compliance or non-compliance with the limit
- where non-compliances or a breach of noise limits are found, the reasons for non-compliance should be stated and strategies for management identified, and
- where the noise exceedance is due to excessive noise levels from the development, the strategies to be used to manage the noise exceedance should be identified and stated.

2.2.6 Compliance justification

Where a proponent is required to demonstrate compliance with a noise limit, the methodology relied upon to establish the operational noise levels are to be clearly identified. As a minimum this will involve the techniques used to quantify the noise contribution from the development/activity under consideration, together with the parameters under which the noise limits apply, for example the meteorological conditions prevailing at the time of compliance assessment.

2.2.7 Commercial and industrial noise and the use of SLMs

As stated in section 3.2 of the framework guideline for commercial and industrial noise the NT EPA has adopted the procedures and methods for assessing noise contained within the Noise Policy for Industry 2017. These methods are used to estimate and assess noise impacts. It allows for proposed and actual noise sources to be evaluated in a consistent and transparent manner by the proper use of SLMs. Any measurement, calculation or estimate of noise or any test of a noise source for the purposes of this guideline must be made in accordance with the above policy. Further detailed assistance can be obtained from the NSW Industrial Noise Policy and its appendices.

Guidance Document Number Three

Health effects of noise

1 Background

This guidance document focuses on the lesser known extra-auditory effects of environmental noise and includes sleep disturbance, cardiovascular disease and reduced mental wellbeing.

In the modern world, particularly in urban environments, noise pollution is an everyday occurrence. This isn't to say we should, or do, resign ourselves to its presence. In the majority of cases noise is an annoyance and inconvenience affecting people's quality of life, but it can have some direct and indirect health effects, such as damage to hearing and increased hypertension.

In recent years the effects of noise pollution have become better recognised and understood. Large scale studies for aircraft and road traffic noise annoyance have researched how the population as a whole and individuals in particular, can be affected by noise. It is helpful to conceptualise the effects of noise by considering them in three groups: health effects, amenity effects and productivity and learning effects.

The main outdoor sources of noise according to the World Health Organisation (WHO) are road, rail and air traffic, industries, construction and the neighbourhood. As populations grow, particularly in urban areas, and road, rail and air traffic increases, noise from these sources may become an increasing source of concern (see *Australian surveys of noise exposure* in Guidance Document Number Three).

The direct impact of continued exposure to loud noise on the ear and its contribution to hearing loss has been documented since the sixteenth century. Excessive noise, particularly in occupational settings, can cause damage to the delicate hair cells in the inner ear that are responsible for conducting auditory signals to the brain. Children, adolescents, adults and the elderly may be affected by noise-induced hearing loss.

1.1 Amenity/quality of life effects

1.1.1 Annoyance

Annoyance is the most commonly used outcome to evaluate the effect of noise. Annoyance tends to increase as noise exposure increases, and changes in noise pitch, intermittency or other such features can also increase annoyance. Annoyance manifests itself when the noise disturbs a person's daily life, for example interrupting a conversation or simply being a distraction while resting. Many see noise as an intrusion on their personal privacy, with their sense of annoyance compounded when they are unable to control the intrusion. However, it is not always possible to predict how any particular person might react to a particular level of noise.

1.1.2 Sleep disturbance

Sleep is necessary to restore essential biological processes and maintain good health. Its disruption is detrimental in the long and short term, leading to tiredness, reduced quality of life and poorer daytime performance. It is generally well-recognised that environmental factors such as noise have an adverse impact on quality and amount of sleep. External stimuli are still processed by someone's sensory functions despite a non-conscious perception of their presence. Noise interferes with sleep by triggering awakening, altering sleep patterns, reducing the percentage and total time in rapid eye movement (REM) sleep, increasing body movement and changing cardiovascular responses. These changes may affect mood and performance during the day.

Sleep disturbance is one of the impacts most commonly described by those who live with high levels of noise exposure, and one that can have a substantial impact upon quality of life. People feel strong resentment when they perceive their sleep to be disturbed; indeed this subsequently becomes a major cause of annoyance. There is a well-established evidence base suggesting that extensive noise-induced awakenings have adverse health effects.

Table 1 below is reproduced from the WHO publication *Guidelines for Community Noise* and shows the health effects of various average noise levels. These levels are not to be confused with the recommended assigned noise levels included in section 3 of the framework guideline as the averaging times for impact are different. For example, for optimal sleep and low annoyance, guidelines on community noise recommend an average noise level not greater than 30dBA for continuous noise and a maximum level not greater than 45dBA for single sound events.

A distinction is made between disturbance and annoyance. Someone is disturbed by noise when it prevents or inhibits them from undertaking an everyday activity such as concentrating while reading (distraction), hearing spoken conversation, listening to the radio or sleeping. The feeling of displeasure caused by noise is annoyance. Annoyance is often a result of disturbance but not necessarily, and it can be influenced by socio-psychological factors, such as a bias for or against the facility or person making the noise, or the environmental expectations of an individual.

Whereas disturbance can be assessed analytically, annoyance is measured by social survey questioning, and over the years has been used as a common indicator of overall community noise impact.

Table 1: Health effects of various time averaged noise levels

Specific segment of the environment	Critical health effect(s)	LAeq [dB(A)]	Time base [hours]	L _{Amax} fast [dB]
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors	Speech intelligibility, and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-time	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60
School class rooms & preschools, indoors	Speech intelligibility, disturbance of information extraction, message communication	35	During class	-
Pre-school bedrooms, indoor	Sleep disturbance	30	Sleeping time	45
School, playground outdoor	Annoyance (external source)	55	During play	-
Hospital, ward rooms, indoors	Sleep disturbance, night-time	30	8	40
	Sleep disturbance, daytime and evenings	30	16	-
Hospitals, treatment rooms, indoors	Interference with rest and recovery	As low as possible		
Industrial, commercial, shopping and traffic areas, indoors and outdoors	Hearing impairment	70	24	110

Specific segment of the environment	Critical health effect(s)	LAeq [dB(A)]	Time base [hours]	L _{Amax} fast [dB]
Ceremonies, festivals and entertainment events	Hearing impairment (patrons:<5 times/year)	100	4	110
Public addresses, indoors and outdoors	Hearing impairment	85	1	110
Music and other sounds through headphones/earphones	Hearing impairment (free-field value)	85 Under headphones, adapted to free-field values	1	110
Impulse sounds from toys, fireworks and firearms	Hearing impairment (adults)	-	-	140 Peak sound pressure (not L _{AF,max}) measured 100mm from the ear
	Hearing impairment (children)	-	-	120 Peak sound pressure (not L _{AF,max}) measured 100mm from the ear
Outdoors in parkland and conservation areas	Disruption of tranquillity	Existing quiet outdoor areas should be preserved and the ratio of intruding noise to natural background sound should be kept low		

1.1.3 Health effects

1.1.3.1 Hypertension

The link between noise and hypertension is fairly well established through evidence collected from a number of studies. The most common hypothesis from medical studies is that noise events can place the body under stress, even when a person displays no conscious reaction to the noise. When stressed the body releases hormones which increase a person's heart rate and blood pressure, though the resultant impact will vary from person to person. It is then well understood that high blood pressure can lead to cardiovascular diseases, stroke, chronic renal failure and myocardial infarction (heart attack).

1.1.3.2 Hearing loss

Noise induced hearing loss is not a concern at the levels of noise experienced by neighbours of noise emitting facilities. It is only a potential hazard above noise levels of at least 80 dB(A) and where exposure is over very long periods of time. WHO guidance suggests that hearing impairment is not expected to occur at or below a noise level of 75dB_{LAeq}, even for prolonged occupational noise exposure. This figure refers to noise experienced at the ear.

1.1.4 Mental health

As already mentioned, noise can cause significant annoyance. As a consequence, some have hypothesised that this could lead to mental health issues.

The most widespread subjective response to noise exposure is annoyance – a feeling of irritation and perhaps anger towards an unwanted stimulus. In studies of annoyance data on transport noise, the percentage of highly annoyed individuals began to increase above a noise level of 42dBA. Levels of annoyance can also be moderated by characteristics of the noise and personal attitudes.

Although there is reasonable evidence that exposure to noise can cause psychological symptoms, there is little evidence that it results in serious mental health problems. Determining causal direction can be problematic—noise may lead to mental ill-health, or mental ill-health may lead to heightened reactions to noise or selection effects (such as the inability to move away). Pre-existing disorders may result in greater sensitivity to the noise, an inability to habituate or may exacerbate problems stemming from noise exposure.

1.1.5 Cardiovascular disease

There is some evidence that persistent noise-induced stress increases cardiovascular risk. In particular, studies in laboratories, occupational settings and the wider community have drawn attention to the effects of environmental noise on hypertension, coronary heart disease and myocardial infarction (heart attack). It is thought that unwanted sound triggers stress-response mechanisms—the release of cortisol, adrenalin and noradrenalin—which has cascade effects such as increased blood pressure and constriction of the blood vessels.

The intensity of noise is an important factor in determining whether there will be a measurable impact on the cardiovascular system. Epidemiological studies on exposure to road traffic noise and cardiovascular risk carried out in European and Japanese cities found evidence for the relationship between traffic noise and hypertension only for those exposed to more than 65dBA, and an increased risk of myocardial infarction was found only for noise levels above 60 dBA.

A cross-sectional study of environmental noise and community health among neighbourhoods near Sydney Airport in New South Wales found that respondents

chronically exposed to high aircraft noise (above 70dBA) were more likely to report stress and hypertension compared with those living in a matched suburb unaffected by aircraft noise. See below for information on another airport study conducted near Munich, Germany.

1.1.6 Productivity and learning effects

1.1.6.1 Cognitive impairment in children

Studies, both epidemiological and experimental, have shown negative effects of noise on reading ability and memory development in children. These impacts are magnified when learning activities are undertaken outdoors. Noise has been commonly shown to affect children's central processing and language skills, reading comprehension, memory and attention ability. The effects of noise on primary school children have been well evidenced, and are found to be particularly acute. The effects of noise on secondary school children have been found to be less acute, suggesting that the detrimental effects of noise exposure could diminish with age.

The strong evidence that noise exposure impairs cognitive performance has its strongest effects for central processing and language comprehension among children. Several studies have examined the impact of chronic aircraft, rail and road traffic noise on school children's performance (for example, the Munich Airport Study below). Effects observed in these studies included deficits in sustained attention, poorer auditory discrimination and speech perception, poorer memory of semantic material and poorer reading ability and school performance on national standardised tests.

1.1.6.2 Productivity

The productivity effects of noise are mostly secondary and feed through from the effects mentioned previously in this section. The main ways in which noise is linked with productivity are:

- sleep disturbance impacting upon next day productivity
- productivity impact from the health effects of noise
- links between academic performance and noise, and
- environmental noise and workplace distraction.

1.1.7 Other noise effects

Other effects may occur as a result of vibration (see section 3.5 of the framework guideline for vibration and blasting assessment and regulation). These include: perceptible vibration, secondary rattling of windows, items on shelves and pictures hanging on walls. In addition, the sound radiated from vibrating walls may give rise to indirect effects. These effects may contribute to annoyance. Where occupants can detect vibration in buildings, this may potentially impact on their quality of life or working efficiency.

1.1.8 The Munich Airport study (Germany) – a case study on effects on noise exposure on children

The Munich Airport study carried out in the 1990s was a field study examining the effects of noise exposure on children. The study took advantage of a naturally occurring situation in which the existing Munich Airport was closed down and a new airport opened at another location.

Data for up to 326 third and fourth grade children were collected at both sites across three testing waves. Children near the old airport initially displayed negative effects on

long-term episodic memory and reading comprehension which declined by the third wave of testing. By this stage, children at the new airport were exhibiting deficiencies in long-term memory and reading comprehension.

It was also observed that chronic noise exposure was associated with elevated neuroendocrine and cardiovascular measures (adrenaline and noradrenalin levels and systolic blood pressure), muted cardiovascular reactivity to a task presented under acute noise, deficits in a standardised reading test administered under quiet conditions and diminished quality of life on a standardised index. The study provided strong evidence for a causal link between noise and cognitive and cardiovascular effects.

1.1.9 Australian surveys of noise exposure

Australian community surveys have found that residents are concerned about environmental noise from a wide range of sources. In a survey conducted on behalf of the New South Wales Department of Environment and Conservation in 2004, 46% of respondents in New South Wales thought traffic noise was a problem in their local area, 34% thought that barking dogs was a problem and 21% from neighbour associated noise.

In 2006, Victoria's Environment Protection Authority conducted a community survey to better understand the impact of noise on Victorian communities and assist with future noise management programs. Almost half (49%) of all respondents were disturbed or annoyed by environmental noise and one-quarter (24%) reported noise-induced sleep disturbance at some stage in the past 12 months. Both the 2006 survey and a comparable survey in 1986 found that noise from traffic was the most common source of environmental noise affecting Victorians. In 2006, 70% of respondents heard noise from traffic in their homes and 21% were annoyed by it. The proportion of people exposed to and annoyed by most sources of environmental noise increased between 1986 and 2006.