



Guideline

Assessment of environmental noise emissions

Activities regulated under the:

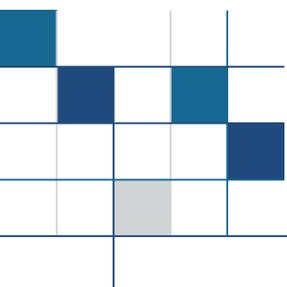
Environmental Protection Act 1986

Environmental Protection Regulations 1987

Environmental Protection (Noise) Regulations 1997

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Draft for consultation



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1. Purpose

The *Guideline: Assessment of environmental noise emissions* (the guideline) ensures adequate information is provided to the Department of Water and Environment Regulation (the department) for assessing applications with noise emissions, as regulated under the *Environmental Protection Act 1986* (EP Act).

2. Scope

The guideline provides direction on how the department interprets and applies the legislation it administers.

Department guidelines are not mandatory considerations; rather, their purpose is to assist applicants to provide information in a manner that ensures efficient and effective assessment of their application.

Applications that do not align with the appropriate guidelines may result in protracted assessment timeframes and, if the information provided is not sufficient for the department to complete an assessment, the application may be declined or refused.

The guideline applies to applications for a works approval or licence (including amendments) under Part V Division 3 of the EP Act with an identified environmental noise emission component. References to 'noise emissions' in this guideline should be considered in the context of 'environmental noise' (see Glossary).

This guideline informs applicants:

- what information should be included in an application involving noise emissions
- on criteria and considerations for the assessment of noise emissions
- how to use a screening tool to assess whether a detailed noise emission assessment is required
- how to undertake detailed noise emission assessment and noise modelling.

This guideline also provides technical support for:

- environmental impact assessments of proposals under Part IV of the EP Act
- consideration of noise emissions from premises that are not prescribed premises. Note that generally such assessments would be required by authorities other than the department, such as local government authorities. The applicant should consult the relevant authority regarding this guideline and any additional requirements.

The information in this guideline is general in nature. The department conducts all assessments on a case-by-case basis, considering the site-specific characteristics of the proposal.



The guideline does not discuss how the department assesses the risk of noise emission impacts for the proposed activity using the applicant's information. The department will follow its regulatory risk assessment framework to assess the proposal and provide a decision report.

Occupational safety and health is regulated by the Department of Mines, Industry Regulation and Safety and as such is not considered in this guideline.

The guideline does not directly apply to noise emission impacts on fauna. No assigned levels have been developed for fauna. Assessment of impacts on fauna will be considered on a case-by-case basis.

The definitions and acronyms used in this document are listed in the Glossary.

3. Context

The guideline should be read in conjunction with other relevant department policies, guidelines and procedures on our website (see the Related documents section for links). The department's application forms also indicate what information is required for applications with an identified environmental noise emission component.

If a proposal is in an area where ambient standards and limits have been defined under an Environmental Protection Policy (EPP), the EPP will take precedence over this guideline for those emissions or pollutants covered by the EPP.

4. Legislation

4.1 Environmental Protection Act

The EP Act provides for the prevention, control and abatement of pollution and environmental harm in Western Australia (WA), in accordance with the (EP Act s.4A):

- precautionary principle
- polluter pays principle
- principles of intergenerational equity
- conservation of biological diversity and ecological integrity
- waste minimisation principle.

In accordance with the above-listed principles and s.51 of the EP Act, all reasonable and practicable measures should be taken to prevent or minimise emissions. Under s.51 of the EP Act it is an offence for occupiers of premises not to take these measures.

Under s.51 of the EP Act the occupier of any premises must comply with any prescribed standards. Under s.123 of the EP Act standards may be prescribed in regulations. The prescribed standards for certain noise emissions are set by the Environmental Protection (Noise) Regulations 1997 (Noise Regulations).



Noise emissions that exceed the prescribed standards are in breach of s.51 of the EP Act. Some provisions in the Noise Regulations allow certain noise emission sources in certain contexts to exceed the prescribed standards (see section 7.2 of the guideline). Under s.60(3)(a) of the EP Act conditions on works approvals and licences may specify standards more stringent than those prescribed.

Part V Division 1 of the EP Act has general provisions for the regulation of pollution and environmental harm. EP Act s.49 states 'A person who causes pollution or allows pollution to be caused commits an offence'. Furthermore, any person who emits, or causes an unreasonable emission to be emitted, from any premises commits an offence. Unreasonable noise is defined under EP Act s.3(3) and how unreasonable noise relates to the prescribed standards is addressed under r.5 of the Noise Regulations.

Section 49 of the EP Act creates the obligation that any person is not to cause, or enable to be caused, pollution or unreasonable emissions. Section 79 of the EP Act also provides for unreasonable noise emissions from equipment at any premises.

Part V Division 3 of the EP Act provides the department with mechanisms for regulating noise emissions, by way of conditions on works approvals and licences applied to prescribed premises.

An application that cannot demonstrate compliance with the prescribed standard or other standards set by the Noise Regulations may be declined or refused.

4.2 Noise Regulations

The Noise Regulations apply to the noise emissions from any premises, including prescribed premises. The Noise Regulations:

- set the prescribed standards for noise emissions based on assigned levels at the location of the receiver
- set requirements for the measurement, assessment and control of noise emissions.

The Noise Regulations also:

- set the prescribed standard for air-blast levels for blasting
- set standards and requirements for construction noise at construction sites that cannot meet the assigned levels
- set standards and requirements for other activities that generate noise emissions and may be exempt from the prescribed standards.

An overview of the Noise Regulations, with a focus on the application to prescribed premises, is provided in section 7.2 of the guideline. This includes references to additional information on the regulation of environmental noise emissions.



5. Environmental objectives

This guideline aligns with the Western Australian Environmental Protection Authority (EPA) *Environmental Factor Guideline – Social surroundings* and *Environmental Factor Guideline – Human health*.

The EPA's objectives for social surrounds and human health are:

- to protect social surroundings from significant harm
- to protect human health from significant harm.

'Environmental value' is defined in the EP Act as 'a beneficial use, or an ecosystem health condition'. 'Beneficial use' is defined in the EP Act to include any portion of the environment conducive to public benefit, amenity, safety, health or aesthetic enjoyment that requires protection from the effects of emissions or environmental harm. The EPA's social surroundings and human health objectives recognise the link between noise emissions and environmental values supported by an acceptable noise environment.

The department's objective in relation to environmental noise emissions, including vibration, aligns with the EPA's objectives by ensuring that an applicant whose proposal emits noise can manage the proposal to comply with:

- the Noise Regulations; and/or
- other standards or noise levels set out in this guideline for noise emissions not set out in the Noise Regulations.

6. Noise

6.1 Definition

The EP Act s.3(1) defines that noise includes 'vibration of any frequency, whether transmitted through air or any other physical medium'.

Noise is commonly recognised as an emission of sound (being transmitted through air) but may also include ground or structure-borne vibration.

Environmental noise is defined as noise emitted from all sources except noise at the industrial workplace.

6.2 Sources of noise emissions

Many activities can produce noise emissions. Activities that produce noise emissions and which the department regulates under Part V of the EP Act can include:

- bulk handling activities such as vessel loading
- construction activities
- intensive agriculture industries such as abattoirs, piggeries and saleyards
- manufacturing activities such as those involving asphalt, bricks, cement and chemicals



- power generation
- processing materials such as ore, sands, coal, oil and gas, and building material
- waste management such as disposal, incineration, recycling and treatment.

Other noise emissions that may be regulated by the department or other authorised regulatory authorities, such as police or local government authorities, and occur from any premises include:

- audible warnings
- blasting
- commissioning and operation of fixed and mobile plant
- domestic noise from lawnmowers and stereos, for example
- industrial and commercial operations, including construction
- recreational activities such as motor sports, shooting and entertainment venues
- transport operations involving helicopters, trains and other vehicles, for example.

6.3 Impacts of noise emission

Noise emissions can impact environmental values, amenity and human health, including causing stress and sleep loss, and can affect cardiovascular health and educational performance. Noise emissions in the form of vibration can impact amenity.

7. Factors and standards

7.1 Factors considered in assessments

Noise emissions are considered by the department in relation to their potential impact on environmental values such as amenity and human health. In determining the risk posed by noise emissions, the department considers:

- the context of the noise emissions, including:
 - background noise
 - time of day and activity of the receiver
 - distance, topography and meteorological conditions between the emitter and receivers
 - the types of receptors, including current and potential future receptors
 - contributing and cumulative noise emission sources
- the nature of the noise emissions, including:
 - the characteristics of the noise emission
 - received noise/vibration levels



- how the noise emission is perceived by the receivers
- the control and management of the noise emissions, including:
 - whether the noise management measures set out in a detailed noise emission assessment are acceptable, reasonable and practical
 - whether the noise management measures are likely to be effective in reducing noise levels to meet the Noise Regulations or other standards and noise values outlined in the guideline
- known or demonstrated compliance:
 - by the occupier and premises with the provisions of the EP Act
 - with the Noise Regulations or other standards and noise values outlined in the guideline
 - with the screening and detailed noise emission assessment process set out in the guideline.

7.2 Summary of the Noise Regulations

An overview of the Noise Regulations is provided in Table 1. Regulations not addressed in Table 1 are not relevant to prescribed premises.

A summary of additional information on the application of the Noise Regulations to any premises, in the form of other factsheets and guidelines on the department’s website, is provided in Table 2.

Table 1: Overview of the Noise Regulations relevant to prescribed premises

Regulation	Topic	Summary
Part 1 – Preliminary		
2	Definitions	Defines terms used in the regulations
3	Exemptions from the Noise Regulations	Lists noise emission sources not covered by the regulations, including trains, aircraft and the propulsion and braking systems of motor vehicles operating on a road
Part 2 – Allowable noise emissions		
4 and 5	Relation to EP Act	Defines excess noise as pollution, unreasonable emission or unreasonable noise
7	Prescribed standard	Requires that a noise emission: <ul style="list-style-type: none"> ● not exceed assigned noise levels ● be free of annoying characteristics ● not significantly contribute to an exceedance of assigned noise levels
8	Assigned noise levels	Specifies allowable levels for different receiving premises and times of day



Regulation	Topic	Summary
9	Noise characteristics	Defines tonality, modulation and impulsiveness
10	Changes of zoning	Provides for non-conforming uses and changes of land zoning when determining assigned levels
11	Airblast levels	Sets prescribed standards for noise from blasting
13	Construction sites	Provides for noise management from construction work that cannot meet assigned levels
17	Standard cannot reasonably be met	Provides an approval process for noise that cannot reasonably meet prescribed standards
Part 3 – Noise measurement		
19 to 23	Noise measurement	Specifies measurement procedures and equipment requirements
Schedules		
1	Classification of premises	Defines noise receiving premises as industrial, commercial or noise sensitive
3	Determination of influencing factor	Specifies how influencing factor is calculated for assigned levels for noise sensitive premises
4	Measuring equipment	Specifies performance requirements for meters

Table 2: Summary of other Noise Regulation publications

Document name	Summary
Noise Regulation Fact Sheet Regulation 11 – Blasting operations	Addresses airblast levels from blasting and how Noise Regulation 11 is applied
Noise Regulation Fact Sheet Regulation 12 – Rural premises	Addresses noise from farming vehicles on rural premises and how Noise Regulation 12 is applied
Noise Regulation Fact Sheet Regulation 13 – Construction sites	Addresses construction work noise from construction sites, how Noise Regulation 13 is applied and the requirement for noise management plans
Noise Regulation Fact Sheet Regulation 14 – Residential equipment	Addresses noise from specified equipment at domestic premises and how Noise Regulation 14 is applied
Noise Regulation Fact Sheet Bass or 'Doof Doof' music	Addresses low-frequency noise in music and how provisions of the EP Act are applied



Document name	Summary
Audible reversing alarms: consideration for use	Addresses alarms used for safety purposes and tonal and broadband options
Guide to management of noise from motor sport venues	Addresses provisions of the Noise Regulations and EP Act as they apply to specific activities, including noise emissions that comply with an approved noise management plan where relevant
Guide to management of noise from shooting venues	
Guide to management of noise from sporting, cultural and entertainment venues	
Draft Guide to management of noise from waste collection and other works	

The following sections of the guideline outline the scope of the Noise Regulations as they apply to applications under Part V of the EP Act. The scope of the Noise Regulations, as they apply to prescribed premises, have been addressed as follows:

- Sections 7.2.1 and 7.2.2 – Operational noise (incl. Noise Regulations 7-10)
- Section 7.2.3 – Airblast levels from blasting (Noise Regulation 11)
- Section 7.2.4 – Construction noise: (Noise Regulation 13)
- Section 7.2.5 – Standard cannot be reasonably met (Noise Regulation 17)
- Section 7.2.6 – Noise emissions not addressed by Noise Regulations
- Section 7.2.7 – Other types of receptors
- Section 7.2.8 – Noise measurement.

7.2.1 Operational noise (Noise Regulations 7-10)

Noise Regulation 7 sets the prescribed standard for noise emissions based on the assigned levels in Noise Regulation 8. The prescribed standard requires that noise levels are considered with regards to the type of premises receiving noise, time of day and assigned levels set out in Table 1 of Noise Regulation 8(3).

Noise Regulation 9 defines intrusive and dominant noise characteristic of noise and how they must be considered with regards to Noise Regulations 7 and 8.

Noise Regulation 10 defines how any non-conforming uses and changes of land zoning are to be considered.

Type of receiving premises



Assigned noise levels are determined depending on the type of premises receiving the noise as per Table 1 of Noise Regulation 8(2). Three types of premises are defined in Schedule 1 of the Noise Regulations:

- Noise sensitive premises (e.g. residences, schools)
- Commercial premises (e.g. shops, offices)
- Industrial premises (e.g. factories, mines).

Noise descriptors

Assigned noise levels are specified in Noise Regulation 8 for the above types of receiving premises using the terms defined in Table 3.

Table 3: Statistical indicators and definitions for assigned noise levels

Parameter	Definition
$L_{A \max}$	Level not to be exceeded at any time, depending on the time of day
$L_{A 1}$	Level not to be exceeded for more than 1% of representative assessment period
$L_{A 10}$	Level not to be exceeded for more than 10% of representative assessment period

In Table 3:

- a 'representative assessment period' means 'a period of time of not less than 15 minutes, and not exceeding four hours, determined by an inspector or authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission'. For proponents the choice of representative assessment period used for assessment purposes must be carefully considered and justification provided
- the $L_{A \max}$ assigned level limits the maximum level of the noise emission
- the $L_{A 1}$ assigned level limits the level and duration of short duration noises. For example, a noise exceeding this level is allowed to be present for not more than 36 seconds (1 per cent) of a one-hour representative assessment period
- the $L_{A 10}$ assigned level limits the level and duration of more continuous noises. For example, a noise exceeding this level is allowed to be present for not more than six minutes (10 per cent) of a one-hour representative assessment period
- all levels are specified using a slow time-weighting characteristic.

Noise sensitive premises - highly sensitive area

A noise sensitive premises is split under Noise Regulation 8 into two receiving areas:

- a 'highly sensitive area', comprising a 'building used for a noise sensitive purpose,' such as a house, and its grounds up to 15 m from the building; or



- an area 'other than highly sensitive area' that is part of the noise sensitive premises but further from the building, such as paddocks on a farm (see Figure 1).

Noise Regulation 8 defines a 'building used for a noise sensitive purpose', typically a dwelling, school or hospital. Noise Regulation 8 defines a 'building used for a noise sensitive purpose' (typically a dwelling, school or hospital) and specifies criteria for the inclusion of various building types.

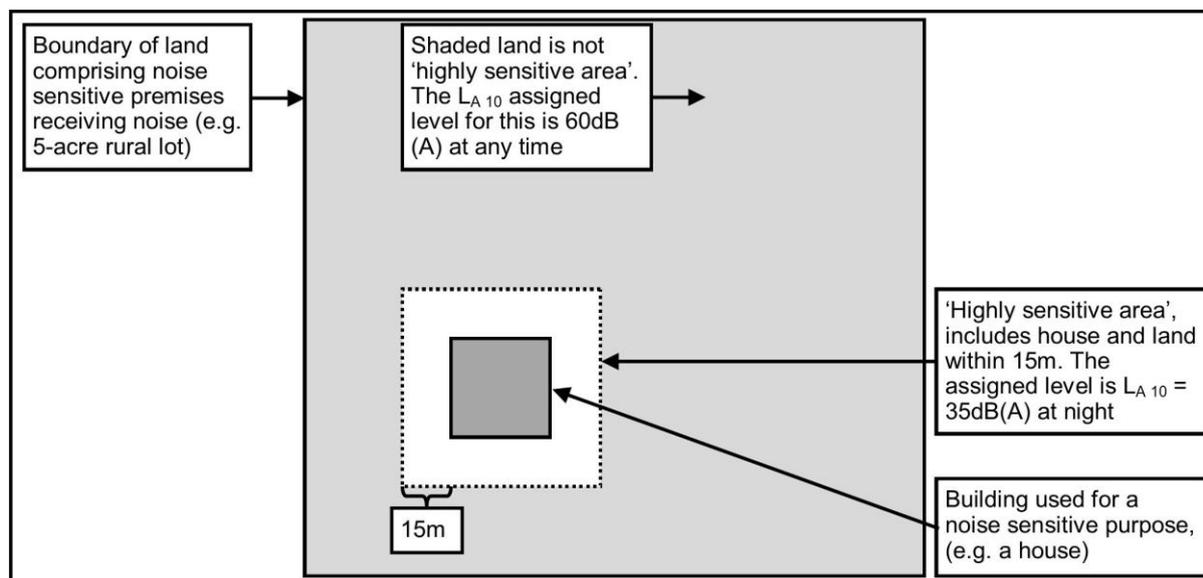


Figure 1: Noise sensitive premises showing 'highly sensitive area'

Influencing factor

A higher level of protection is required for highly sensitive areas where human activity such as sleeping is undertaken. The protection provided is related to the expectation of the occupants, given the uses of the surrounding area and the relevant time of day. For the highly sensitive area, assigned noise levels are set by calculation of an 'influencing factor', which considers the presence of commercial or industrial land uses and major or secondary roads within 450 m of the receiving point. Higher proportions of industrial and commercial land, and the presence of major roads, have the effect of increasing the influencing factor and hence the assigned levels (see Table 1 of the Noise Regulations).

The influencing factor calculation is in accordance with Schedule 3 of the Noise Regulations.

Noise Regulation 10 makes allowance for a non-conforming industry on land that is not zoned for industrial use, by taking the land to be 'industrial' or 'commercial' when the influencing factor is calculated for a nearby noise sensitive receiver. Further, when land around an industrial area is rezoned from commercial/industrial to noise sensitive use, this can cause a reduction in the assigned levels that industry must meet.

Noise Regulation 10 makes some provision for the remaining industries by allowing them to retain the higher assigned levels from the previous zoning of the surrounding land for the influencing factor calculation. The recognition of the higher influencing



factor is not automatic. Noise emitters must make application under Noise Regulation 10 for acknowledgement of the higher influencing factor.

Time of day

The assigned noise levels for the highly sensitive area vary with the time of day to recognise the type of activity likely to be occurring. The daytime period on Sundays and public holidays starts at 9am, compared with 7am on all other days.

Noise sensitive premises - not the highly sensitive area

The assigned levels for the part of the noise sensitive premises that is not highly sensitive, are set out in Table 1 of the Noise Regulations with higher levels than for the highly sensitive area and without reference to the influencing factor or time of day. Compliance is required in both the highly and non-highly sensitive areas. However, given a specific receiver, one of the criteria is likely to be the limiting factor.

Noise sensitive premises - status of some premises

For prescribed premises, subject to Noise Regulation 8 and Schedule 1 of the Noise Regulations, certain circumstances or arrangements may occur that need to be considered when determining the sensitivity of a building or other premises. Such circumstances and arrangements will be considered on a case-by-case basis and may include buildings:

- where the title includes matters regarding noise emissions
- owned by an applicant that may be sublet to an employee or other tenant
- unoccupied at the time emissions occur by agreement.

Commercial and industrial noise receivers

The assigned levels for commercial and industrial premises receiving noise are set out in Table 1 of the Noise Regulations without reference to the influencing factor or time of day. The assigned levels for a commercial receiver are identical to the assigned level for the non-highly sensitive area of a noise sensitive premises. Industrial receivers within the Kwinana Industrial Area are afforded higher levels than for industrial receivers outside the Kwinana Industrial Area.

7.2.2 Operational noise - other matters

Cumulative noise

Noise Regulation 7 requires noise emissions to not 'significantly contribute to' an exceedance of the assigned levels. Noise Regulation 7(2) specifies that noise emissions 'significantly contribute to' a level of noise that exceed a value which is 5 dB below the assigned level at the point of reception.

If the overall noise exceeds assigned levels as a result of other industrial/commercial activities, the department's position is that the applicant can demonstrate compliance by meeting the '5 dB below' requirement. However, if exceedance of the assigned levels is being caused by natural sources, such as wind in trees, fauna activities or the ocean, or from general ambient sources not emitted from premises or from public



places that may or may not be considered a premises (e.g. road traffic), the department would not expect the '5 dB below' criterion to be met.

For an application for new industry or expansion of an existing one which is part of a large industrial estate, the department would require the applicant to achieve noise targets set below the '5 dB below' level (e.g. targets set by an Industrial Area Council) in order to contain cumulative noise and meet the EPA's objectives.

Vehicle and traffic noise

The exemption from the Noise Regulations of 'emissions from the propulsion and braking systems of motor vehicles operating on roads' under Noise Regulation 3 does not apply to vehicles operating within any premises as the vehicles are not on a 'road that is open to or used by the public'.

Similarly, an access road that is only used for the purposes of the premises may not meet the definition of a 'road', and the Noise Regulation 3 exemption may not apply. In such a case, for prescribed premises, advice may be sought from the department as to whether or not the noise emissions are covered by the Noise Regulations.

Vehicle operations covered by the Noise Regulations should be included in the assessment of operational noise against the prescribed standard. Noise emissions from the propulsion and braking systems of motor vehicles operating on roads are addressed in section 7.2.6 of this guideline.

Noise buffers

Under s.51 of the EP Act noise emissions from any premises are required to comply with prescribed standards regardless of 'who was there first'. This prevents a noise emitter from using another person's premises as a noise buffer. Ideally, a noise emitter would have ownership of the land where compliance with the prescribed standards is not achieved and is thus required as a buffer.

Care must be taken where a relaxation of assigned levels is assumed to be available (e.g. creating an assumed 'buffer' on a receiving premises), but may not be available at some point in the future. This can happen in the situation where a noise receiver on a rural lot has the ability to erect a new dwelling closer to the industry, thereby creating a 'highly sensitive area' in a location where the industry assumed compliance only with the assigned levels for a non-highly sensitive area.

The department recognises that buffers can be created through planning mechanisms that limit potential noise sensitive development within the buffer and would seek to be satisfied that the buffer is effective in these cases. The buffer size in such a case would be dependent on existing noise emitting industry reducing its noise footprint as far as reasonably practicable, by implementing relevant noise reduction measures.

Proposal may cause changes to assigned levels

A prescribed premises application may of itself cause an increase in the influencing factor (and hence the assigned levels) at nearby noise sensitive receptors if the presence of a new industry changes the land use to industrial/utility. This may lead to



an increased presence of industrial/utility land within 450 m of the noise receiver, resulting in increased assigned levels.

For example, a mineral sands mining application results in the reclassification of land adjacent to a rural residence to 'industrial', thereby increasing the influencing factor. In extreme cases this situation may lead to an impact from noise emissions even though compliance with the new (elevated) assigned levels is demonstrated. In such cases, the department requires:

- the increase in influencing factor to be identified as representing part of the impact of the application
- noise management measures to be aimed at ensuring received noise levels are below the new, elevated assigned level as far as practicable, to minimise the overall noise impact.

7.2.3 Airblast levels from blasting (Noise Regulation 11)

Blasting is subject to the provisions of the EP Act and the Noise Regulations. It is within the definition of prescribed activities that include 'mining', such as Category 8 Mineral sands mining and Category 9 Coal mining. No other definitions for prescribed activities incorporate the activity of blasting.

For example, the prescribed activity Category 5 Processing or beneficiation of metallic or non-metallic ore does not refer to mining or blasting in the activity description.

Noise Regulation 11 sets specific airblast levels for blasting activities that apply in place of the prescribed standards in Noise Regulation 7. The airblast levels account for the impulsive nature and level of low-frequency noise emissions associated with blasts. Because of the nature of airblasts, the airblast level criteria are set with different parameters than the assigned levels under Noise Regulation 8.

Further information on Noise Regulation 11 is available in the Noise Regulation Factsheet Regulation 11 – Blasting operations on the department's website.

Applications relating to prescribed premises that involve blasting must demonstrate that airblast levels can be managed to comply with Noise Regulation 11.

See section 7.2.6 of the guideline with regards to vibration-based noise emissions from blasting.

7.2.4 Construction noise (Noise Regulation 13)

Noise Regulation 13 makes provision for 'construction work' to be carried out on a 'construction site' without meeting the prescribed standards in Noise Regulation 7 subject to requirements specified by Noise Regulation 13. The Noise Regulations define a 'construction site' as 'premises or a public place on which the sole or principal activity is the carrying out of construction work'.

'Construction work' is a defined term under Noise Regulation 13 and includes the erection, alteration and demolition of any building or structure, site earth works, installing boreholes, pipework and pile driving.



Noise Regulation 13 prescribes different provisions for construction noise undertaken within or outside of the hours of 7am and 7pm on any day which is not a Sunday or public holiday.

When activities at a prescribed premises meet the definition of a 'construction site', the activities are required to comply with the prescribed standard or the provisions of Noise Regulation 13. An applicant should demonstrate how any works will be managed to comply with either the assigned levels or the provisions of Noise Regulation 13 as appropriate. Construction or maintenance work on an operating prescribed premises is only subject to Noise Regulation 13 where the premises meets the definition of a 'construction site'.

If construction works are to be undertaken outside the hours prescribed by Noise Regulation 13 a detailed noise emission report needs to be prepared that includes the development of a draft noise management plan in accordance with Noise Regulation 13(3)(c).

Under Noise Regulation 13 the preparation of a noise management plan for construction noise can be required at any stage of the works.

Further information on Noise Regulation 13 is available in the *Noise Regulation Factsheet Regulation 13 – Construction sites* on the department's website.

7.2.5 Standard cannot be reasonably met (Noise Regulation 17)

The department expects all proposals will be designed to meet the prescribed standards and all applications will demonstrate compliance. In some instances, prescribed standards cannot be reasonably and practicably met.

Noise Regulation 17 provides for the occupier of any premises to apply to the Minister for Environment for approval to emit noise that exceeds or varies from the prescribed standards in certain circumstances. Persons considering applying under Noise Regulation 17 must discuss this with the department before proceeding.

7.2.6 Noise emissions not addressed by Noise Regulations

Noise Regulation 3 lists noise sources that the Noise Regulations do not apply to. These noise sources are related to safety and emergency work, or noise sources not readily amenable to be regulated as noise emissions from a 'premises', such as transportation noise. Some noise sources that the Noise Regulations do not apply to may be relevant to an application for prescribed activities.

Noise emissions that the Noise Regulations do not apply to are still subject to the general provisions of the EP Act, such as s.49 and s.79.

Applicants should demonstrate that any other noise emissions can be managed to not unreasonably impact receptors. Other noise emission sources should be identified and assessed against the relevant procedures set out in the guideline below.



Unreasonable cumulative noise

In some cases, compliance with the '5 dB below' requirement under Noise Regulation 7 may still result in the cumulative noise level resulting in an unacceptable impact on receptors. This may result in a breach of the general provisions of the EP Act. For some industrial estates, the cumulative noise emission may exceed the assigned levels even when individual noise emitters may be compliant with the '5 dB below' requirement. In this case, the department expects that the EPA's objectives for noise will be met, as far as practicable, by the applicant:

- avoiding any detectable increase in the overall noise emission levels from the industrial estate
- achieving a noise emission level consistent with overall noise emissions from the industrial estate coming into full compliance with the assigned levels.

Ground vibration

The EP Act includes vibration within the definition of noise. Noise emissions in the form of vibration from any premises are subject to the general provisions of the EP Act. Vibration may be perceived as a building shaking or as 'regenerated' noise when vibration travels through the building structure and is re-radiated into the room as air-borne noise.

There are no prescribed standards in the Noise Regulations that directly apply to vibration; however, regenerated noise from sources not exempt from the Noise Regulations can be assessed against the prescribed standards. Otherwise with regards to the Noise Regulations, vibration may occur from construction works, regulated under Noise Regulation 13(6), and vibration must be addressed in any relevant noise management plan.

In relation to vibration caused by blasting (Noise Regulation 11, see section 7.2.3 of the guideline), the following criteria apply:

- 7am–6pm on any day:
 - no vibration level resulting from blasting at any premises/public place received at any other premises exceeds a peak particle velocity of 10 mm/s
 - vibration levels for nine of any 10 consecutive blasts, regardless of interval between blasts, on any premises or public space when received at any other premises must not exceed a peak particle velocity of 5.0 mm/s.
- 6pm–7am on any night:
 - no vibration level resulting from blasting at any premises/public place received at any other premises exceeds a peak particle velocity of 1.0 mm/s
 - vibration levels for nine of any 10 consecutive blasts, regardless of interval between blasts, on any premises or public space when received at any other premises must not exceed a peak particle velocity of 0.5 mm/s.



Vibration caused by other activities, including construction work or by the passage of trains and aircraft, are to be managed to meet human annoyance criteria. These human annoyance criteria for vibration are generally more stringent than vibration levels that cause building damage. The department's approach to the human annoyance criteria for vibration are detailed in Appendix E.

Reversing and start-up safety warning devices

Audible reversing alarms are commonly used to warn nearby persons of reversing vehicles at mine sites, construction sites and commercial/industrial premises. Most alarms operate by emitting a pulsing 'tonal' noise, often described as a 'beep-beep' noise. Alarms may also be used as start-up/movement alarms for some fixed plant.

At prescribed premises, the department expects applicants to address noise emissions from audible alarms for construction and operational phases, and include a commitment to alternatives to tonal alarms where safe and practicable.

Further information on safety warning devices fitted to motor vehicles is available in *Audible reversing alarms: consideration for use* on the department's website. This is produced jointly by the Department of Mines, Industry Regulation and Safety and the department.

Other operations

Some proposals involve other operations that the Noise Regulations do not apply to, such as aircraft operations on a proposed airstrip or helipad. Such emissions may still require assessment and management. The department should be contacted for advice on noise criteria and assessment methods in such cases.

Vehicle, road and rail noise

Where a proposal needs to consider noise emissions from the propulsion and braking systems of motor vehicles operating on roads and trains, the department provides the advice detailed in Appendix F.

7.2.7 Other types of receptors

Indoor noise levels

In a case that is not covered by the Noise Regulations, where the department seeks the achievement of acceptable indoor noise level standards for steady-state or quasi-steady-state noise emissions, the applicant would generally be expected to refer to criteria listed in Table 1 of AS/NZS 2107:2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors*.

Where emissions are not steady-state or quasi-steady-state the department may refer to other L_{eq} , L_{max} or statistical criteria on a case-by-case basis. Applicants should discuss criteria for non-steady-state noise emissions with the department before embarking on an assessment.

Camps for construction or operational staff

Where camps for construction or operational staff are located on the same premises as the prescribed activity, the prescribed standard does not apply as the noise emissions must be received on a premises other than the premises or public place



where the noise was generated. In these cases, the department expects that at a minimum accommodation will be designed to achieve the following noise targets, based on indoor levels inside the accommodation sleeping areas:

- L_{Aeq} 40 dB(A)¹ for general construction and operational noise
- $L_{A\ max}$ 50 dB(A)² for temporary works or operations such as piling.

If the construction camp is on separate premises impacted by noise emissions from construction work associated with the application, the department would apply Noise Regulation 13 with a view to achieving the indoor noise criteria listed in Table 1 of AS/NZS 2107:2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors*.

Camps for operational staff should be off the prescribed premises where practicable and designed to achieve compliance with the assigned levels.

Amenity and naturally quiet areas

Noise emissions have the potential to unreasonably interfere with the amenity of an area. Amenity refers to the quality of being pleasant and agreeable. The department recognises that in some cases certain areas of high amenity value need additional protection and noise levels more stringent than the prescribed standards may be required.

The department will consider more stringent noise levels for amenity purposes and naturally quiet areas with regard to the:

- environmental values of the area
- nature of activities in the area
- existing ambient noise levels
- emitted noise levels and any intrusive or dominant characteristics.

7.2.8 Noise measurement

Noise Regulations 19–23 and Schedule 4 of the Noise Regulations sets requirements for measuring noise and sound measuring equipment. Noise measurement must follow the standards set by the Noise Regulations when used to demonstrate and monitor for compliance with the prescribed standards. Further information on noise measurement is provided in Appendix B – Detailed noise emission assessment.

¹ The L_{Aeq} value aligns with the maximum L_{Aeq} value recommended for mining camp sleeping areas, and hotel/motel/hostel sleeping areas near major roads (AS/NZS 2107:2016).

² The $L_{A\ max}$ value is 5 dB above the level recommended in the WHO *Guidelines for community noise* (WHO, 1999)² for the general public, above which level noise events should be limited if possible, in order to minimise sleep disturbance. The 2018 WHO *Guideline for community noise* (WHO, 2018) 'recommends that all CNG (1999) indoor guideline values and any values not covered by the current guidelines should remain valid'. WHO also note 'the current guidelines (2018) complement the NNG (night noise guidelines) from 2009'. Both the earlier WHO documents refer to 45 dB $L_{A\ max}$ at night.



8. Assessment overview

The department’s assessment process allows some noise emissions to be ‘screened out’ from further analysis and assessment. Section 9 – Screening analysis details the steps for screening out emissions.

If an emission is not screened out, a detailed noise emission assessment should be completed. This process is outlined in section 10. Guidance on controls for noise emissions that may be considered for proposals that undergo detailed analysis is provided in Appendix D – Noise amelioration. Sections 10 and 11 of the guideline provide guidance on reporting requirements for the screening and detailed noise emission assessment. Figure 2 depicts the assessment pathway.

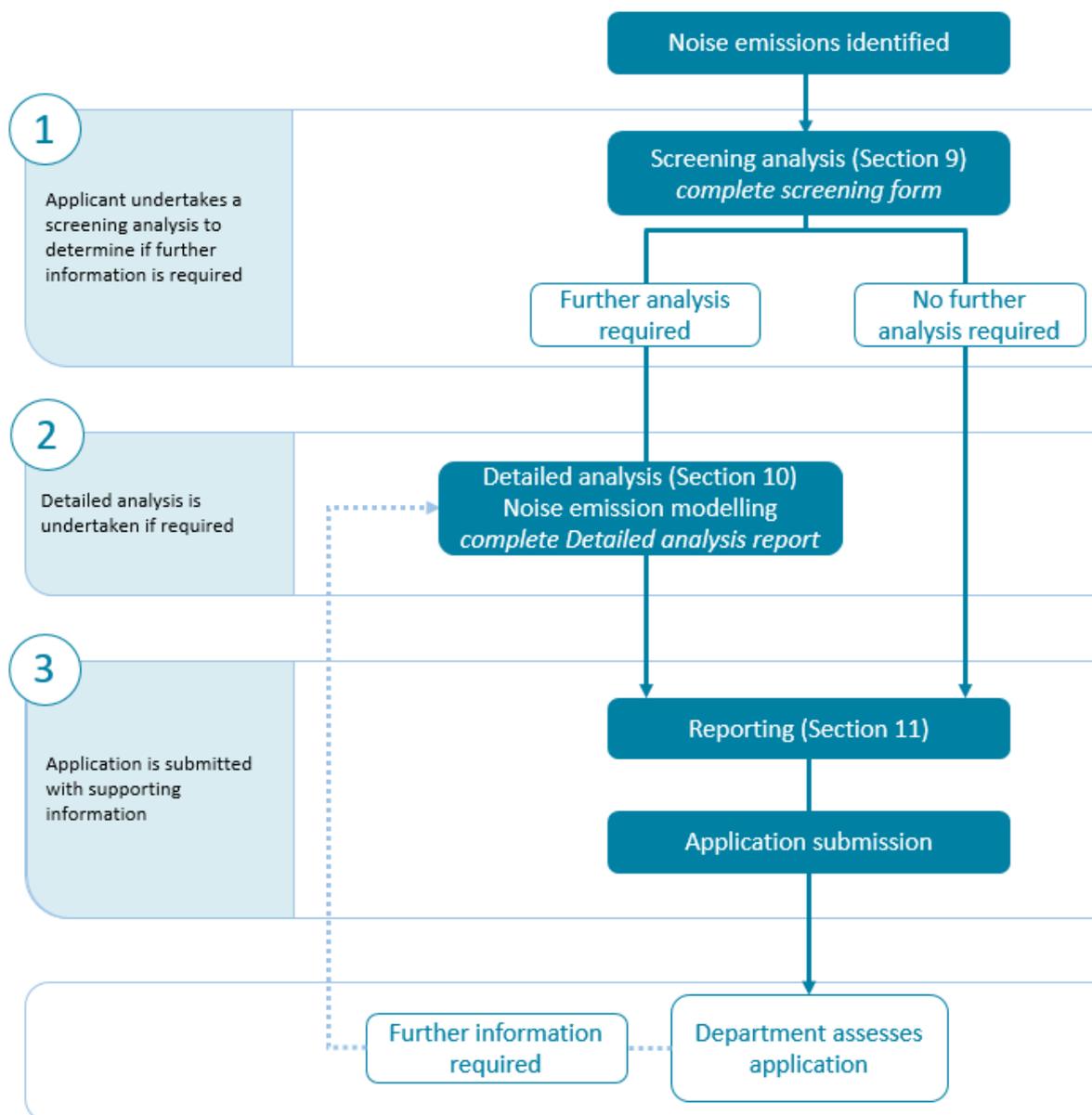


Figure 2: Overview of the assessment pathway.



9. Screening analysis

The screening tool has been developed for applications for a works approval or licence (including amendments) with an identified noise emission component.

9.1 Screening overview

The department has developed a screening analysis to assist applicants to identify low-level noise emissions. The screening procedure requires the Appendix A – Screening form to be completed.

The screening process is a preliminary assessment that addresses:

- distance to the nearest noise sensitive, commercial and industrial premises
- estimated noise levels for proposed operational and/or construction activities
- noise from relevant blasting activities
- possible vibration, aircraft or amenity issues.

Generally, the impact of emissions on human health, amenity and the environment will decrease with distance from the source of emission. The closer an emission source is to a sensitive receptor the more stringent controls and management systems need to be to ensure the potential impacts are acceptable.

Recommended separation distances for screening analysis have been adopted from *Guidance for Assessment of Environmental Factors – Separation Distances between Industrial and Sensitive Land Uses*. For some activities, separation distances may be defined as ‘case by case’ or may not be provided. In these instances, the applicant may consider a comparison with published separation distances for similar activities or contact the department.

Separation distances are used as a trigger for detailed analysis and are not interpreted by the department to indicate a buffer distance that must be met in all cases.

9.2 Screening noise emissions

If the distance between the prescribed premises and the nearest noise sensitive area is within the relevant distance, a detailed noise emission report is required. If the site lies beyond the separation distance, the applicant needs to complete the remainder of the screening form, to identify if there are other noise emissions that trigger the need for a detailed noise emission report.

If blasting is involved during construction or operational activities for Category 8 (mineral sands) or Category 9 (coal mining), an additional blasting-specific screening process (Part 3 of Appendix A – Screening form) needs to be followed. This applies only to airblast noise and not to ground vibration.

If the application meets all screening criteria, the noise emissions can be screened out as ‘not requiring a detailed noise emission assessment’. In this case the applicant is to submit the screening assessment and any supporting information relied upon to undertake that assessment to the department for consideration.



If any screening questions are answered with 'Yes/Unsure', a detailed noise emission report needs to be prepared addressing the relevant noise emissions (see section 10, Appendix B and Appendix C of the guideline).

Where the screening analysis indicates noise emissions are likely to be low level, the department may still request additional information or a detailed analysis in following cases:

- past experience of the department regulating similar premises
- known changes of receptor proximity in future; or
- insufficient supporting information provided to the department.

An exemption may also be provided by the department for a detailed analysis if the applicant considers the risk from emissions to be low even though the separation distance is not met. In these cases, applicants should provide sufficient information with their application to enable the department to understand how the risk was assessed to be low. Such risk assessment should be conducted in accordance with the department's *Guidance Statement: Risk Assessments*.

10. Detailed noise emission assessment

When a screening analysis indicates the emission is not low level, applicants should conduct a detailed noise emission assessment to more accurately estimate impacts. A detailed assessment may also be required when the department disagrees with a screening analysis or needs further information about the potential impact of a noise emission.

Detailed noise emission assessments are carried out to enable a robust technical comparison of predicted noise (or vibration) levels with the objectives (section 5) and relevant standards, criteria and noise levels referred to in the guideline. If noise is assessed against criteria other than those referred to in section 7, the applicant must clearly state the justification for their use.

The following sections provide information for the completion of a detailed noise emission report:

- Appendix B – Detailed noise emissions assessment requirements
- Appendix C – Recommended content for a detailed noise emission report

The detailed noise emission report must be prepared by a suitably qualified person (see Glossary).

All measurements of noise emissions, including measurement methodology, equipment and calibration requirements, undertaken to inform a detailed noise emission assessment must be in accordance with Part 3 and Schedule 4 of the Noise Regulations.

Measurements of noise emissions must consider the placement of measurement equipment with regards to the locations of emission sources and receptors, reflective surfaces and height of microphones above ground level.



Noise measurement instruments must comply with the standards set out in Schedule 4 of the Noise Regulations. Instruments must have been calibrated in an approved laboratory within the two-year period immediately preceding its date of use, to check that its performance meets the standards. Field performance checks must be carried out before and after measurements.

11. Reporting

After the applicant completes the analyses, the relevant reports should be submitted along with the application form and the information set out below.

The screening analysis reporting consists of:

- a statement of the screening analysis outcome
- a completed screening analysis form (Appendix A – Screening form)
- supplementary documentation supporting the outcomes of the screening analysis, including details of special case factors.

The detailed noise emission assessment consists of a detailed analysis consistent with Appendix B – Detailed noise emission assessment presented in the form provided in Appendix C – Recommended content for a detailed noise emission report.

Applicants may need to conduct additional analyses if required by the department, such as confirmation testing of noise modelling or predictions.

Document implementation

This guideline comes into effect on the day it is published. Applications received after publication will be assessed in accordance with the information in this guideline.

The guideline will not generally be used retrospectively, outside the department's normal licensing processes, to reassess existing facilities. However, in situations where there is evidence of unacceptable noise impacts from existing premises, the department may initiate a review of the licence, informed by this guideline, and new controls may be applied through licence conditions.



Related documents

Non-department documents	
Author	Title
Department of Planning, Lands and Heritage	<u>State Planning Policy 5.4 Road and Rail Noise (2019)</u>
Department of Planning, Lands and Heritage	<u>Road and Rail Noise Guidelines (2019)</u>
Environmental Protection Authority (WA)	<u>Environmental Factor Guideline – Human Health (2016)</u>
Environmental Protection Authority (WA)	<u>Environmental Factor Guideline – Social Surroundings (2016)</u>
Environmental Protection Authority (WA)	<u>Guidance for Assessment of Environmental Factors – Separation Distances between Industrial and Sensitive Land Uses (2005)</u>
Standards Australia	<u>Australian Standard (AS 1055:2018) Acoustics – Description and measurement of environmental noise</u>
Standards Australia	<u>Australian Standard (AS/NZS 2107:2016) Acoustics – Recommended design sound levels and reverberation times for building interiors</u>
Standards Australia	<u>Australian Standard (AS 2187:2006) Explosives – Storage and use Part 2: Use of explosives</u>
Standards Australia	<u>Australian Standard (AS 2436:2010) Guide to noise and vibration control on construction, demolition and maintenance sites</u>
World Health Organization	<u>World Health Organisation 1999, Guidelines for community noise</u>

Department documents
<u>Environmental Protection Act 1986 (EP Act)</u>
<u>Environmental Protection Regulations 1987 (EP Regulations)</u>
<u>Environmental Protection (Noise) Regulations 1997 (Noise Regulations)</u>
<u>Guidance Statement: Risk Assessments</u>
<u>Guideline: Industry Regulation Guide to licensing</u>
<u>Guideline: Decision making</u>



Custodian and review

The currency of this document will be continuously evaluated and reviewed no later than three years from the date of issue or sooner as required.

Document details	
Lead group (custodian)	Better Regulatory Practice Branch Environmental Noise Branch Industry Regulation Division
Current version	V0.1.0
Corporate file number	DWERVT5137



Appendix A - Screening form

The General screening section of this form is the first step. Sections 1–4 of the form are activity specific. If any questions in the Screening form are answered Yes/Unsure, a detailed noise emission report is required in relation to that question.

General screening – separation distances		
Separation distance for identified industry in <i>Guidance for Assessment of Environmental Factors – Separation Distances between Industrial and Sensitive Land Uses</i> , or department agreed alternative ¹	_____m	(A)
Distance to nearest noise sensitive receiver/premises	_____m	(B)
Please tick the appropriate box	Yes/Unsure	No
Is the distance (B) less than the separation distance (A)?	<input type="checkbox"/> Continue straight to section 10, Detailed noise emission assessment	<input type="checkbox"/>
Distance to nearest commercial receiver	_____m	(C)
Distance to nearest industrial receiver	_____m	(D)
Tick if receiver is within the Kwinana Industrial Area	<input type="checkbox"/>	

Note 1: Where the separation distance for the industry category listed as ‘case-by-case’ or there is no entry in *Guidance for Assessment of Environmental Factors – Separation Distances between Industrial and Sensitive Land Uses* for the activity the applicant may consider comparison with published separation distances for similar activities or contact the department for further advice.

The screening process continues below. The screening process uses a comparison of separation distances and sound power levels, presented in Plate 1, below, to screen out noise emissions not requiring a detailed noise emission assessment.

For simplicity, the screening process defines:

- ‘day’ as 7am–7pm (Monday–Saturday)
- ‘night’ as any other time.

These definitions cover the extreme assigned level values for noise sensitive receivers only and are not consistent with the time periods specified in Table 1 of the Noise Regulations.



1. Operational noise		
Estimated sound power for all operational noise sources ¹	Day hours	_____dB(A) (E)
	Night hours	_____dB(A) (F)
Please tick the appropriate box	Yes/Unsure	No
Plot the day (E) and night (F) values against the distance (B) on Plate 1 Is the operational noise above either relevant line in Plate 1?	Day hours <input type="checkbox"/> Night hours <input type="checkbox"/>	Day hours <input type="checkbox"/> Night hours <input type="checkbox"/>
Plot both values (E) and (F) against distance (C) on Plate 1 Is the operational noise above the relevant line in Plate 1 for either time period?	<input type="checkbox"/>	<input type="checkbox"/>
Plot both values (E) and (F) against distance (D) on Plate 1 Is the operational noise above the relevant line in Plate 1 for either time period?	<input type="checkbox"/>	<input type="checkbox"/>
2. Construction noise		
Estimated sound power for construction noise sources ¹	Day hours	_____dB(A) (G)
	Night hours	_____dB(A) (H)
Please tick the appropriate box	Yes/Unsure	No
Plot day (G) and night (H) values against distance (B) on Plate 1 Is construction noise more than 10 dB above either relevant line in Figure 1?	Day hours <input type="checkbox"/> Night hours <input type="checkbox"/>	Day hours <input type="checkbox"/> Night hours <input type="checkbox"/>
Plot both values for (G) and (H) against distance (C) on Plate 1 Is construction noise more than 10 dB above the relevant line in Plate 1 for either time period?	<input type="checkbox"/>	<input type="checkbox"/>
Plot both values (G) and (H) against distance (D) on Plate 1 Is construction noise more than 10 dB above the relevant line in Plate 1 for either time period?	<input type="checkbox"/>	<input type="checkbox"/>

Note 1: sound power levels for various generic construction items can be found in AS 2436-2010 *Guide to noise and vibration control on construction, demolition and maintenance sites* (refer to Table A1 and Table B1).



3. Blasting		
Please tick the appropriate box	Yes/Unsure	No
Is the blasting source from a prescribed premises with a definition that includes mining and is the nearest sensitive receiver (B) within 1500 m?	<input type="checkbox"/>	<input type="checkbox"/>
4. Vibration, aircraft or amenity issues		
Please tick the appropriate box	Yes/Unsure	No
Is the prescribed premises potentially going to create any: <ul style="list-style-type: none"> • Emissions of vibration; • Emissions from aircraft; and/or • Impacts to any special amenity or naturally quiet areas? 	<input type="checkbox"/>	<input type="checkbox"/>

Instructions for indicative noise prediction using Screening Plate 1
<ol style="list-style-type: none"> 1. Identify a concentration point of noise emissions on the proposed site. 2. Estimate total A-weighted sound power level for all noise sources on site: <ol style="list-style-type: none"> a) Separate levels for noise sources operating during daytime and night time may be required. b) Estimation of sound power levels may require the assistance of an acoustic consultant. c) Estimations do not include noise control measures. 3. Identify all nearby premises not owned by the applicant and estimate their distance to the source point on site. 4. Plot distance to the nearest premises against sound power level (day and night time) on Plate 1. 5. If plotted points are below the relevant line on Plate 1 for the type of receiver, noise is likely to be low level. If plotted points are on or above lines, a Detailed noise emission assessment is required (refer to section 10)

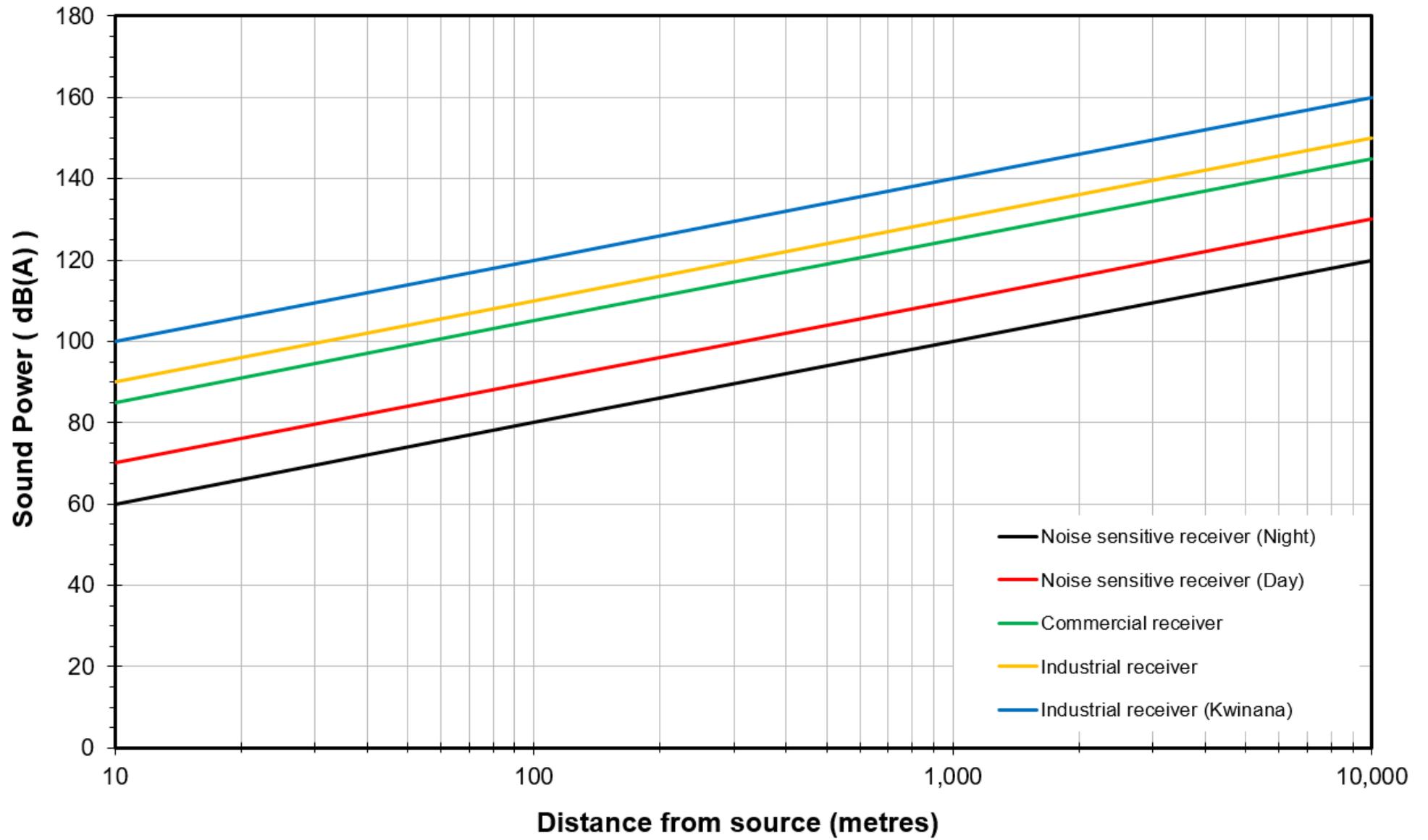


Plate 1: Screening criteria for sound power levels



Appendix B - Detailed noise emission assessment

1 Operational noise

This section presents detailed technical guidance for the assessment of operational noise, including:

- ambient noise measurements at receiving premises (where required)
- prediction of noise emission levels
- presentation of data.

1.1 Ambient noise

Ambient noise represents noise from all sources, near and far. When measured in the absence of noise associated with the application the ambient noise can be referred to specifically as 'background noise'.

The measurements of ambient noise have the purposes of:

- identifying the impact and increase on existing ambient levels resulting from proposed noise
- identifying likely noise exceedances resulting from cumulative effects of existing ambient and proposed noise
- enabling assessment of the potential for masking of tonal, modulation or impulsive components of proposed noise by existing ambient noise.

Measurements of existing ambient noise do not include noise associated with the application. The measurements need to be carried before the commencement of construction or operation of the proposal, or during a shutdown.

If the application refers to an expansion of existing operations, ambient measurements will need to include noise from the existing operations. Operating periods of the existing operations need to be logged and reported.

The recommended procedure for ambient noise measurements is set out below.

Locations

- Location(s) representative of the noise environment should be selected at or near the nearest residence(s) or other affected premises.
- One measurement location may suffice if the ambient noise environment does not vary significantly across the area of interest.

Measurement Methods

- Procedures should be in accordance with Clause 6 of AS 1055:2018 *Acoustics – Description and measurement of environmental noise*.



- Road and rail transport related ambient noise should be measured in accordance with the *Road and Rail Noise Guidelines*.

Measurement considerations

- Noise levels are to be logged continuously at one or multiple locations.
- Measurements should cover a reasonably representative period of at least one week, that takes into account the variability of the proposed emissions because of operating schedules and activities over daytime, evenings, nights, Sundays and public holidays (as relevant).
- The measurement period should contain days representative of the typical quietest ambient noise in the area of interest.
- Specific consideration should be given to seasonal sources that may impact the measured levels. Natural sources might include seasonal frog or insect noise for example. Awareness of seasonally variable anthropogenic sources may also be relevant to some locations depending on the nature of surrounding industry.
- The Slow Time Weighting should be used for statistical levels.
- Sample periods should be a minimum of 15 minutes, or maximum of one hour.
- Continuously logged data may be supplemented with data taken over shorter overall measurement periods.
- In cases where the audibility of tonal, modulation or impulsive components may be marginal, a one-third octave band spectrum of the lowest typical background noise must be presented for the relevant time period.

Meteorological factors

- Relevant factors are to be logged during measurements (e.g. wind speed and direction, temperature lapse rate if practicable).
- If logging is not practicable, 'spot' measurements need to be taken and supplemented with other data (e.g. from the Bureau of Meteorology or the department).

Data reporting

Noise level data should be presented graphically and include:

- noise level as $L_{A 1}$, $L_{A 10}$, L_{Aeq} and $L_{A 90}$ as a minimum requirement
- a maximum of one week of data on A4 sized page
- in cases where the audibility of intrusive characteristics of the noise from the proposed operations may be marginal, L_{Aeq} and $L_{A 90}$ one-third octave band spectra of the logged sample period with the lowest levels for the relevant time period
- meteorological data
- operating times of existing operations on the subject site



- the identification of all major ambient noise sources, with particular attention given to sources that may ‘significantly contribute’ to an exceedance of the assigned level (e.g. such identification should be undertaken as far as practicable, by spectral or audio analysis).

Details of the measurement location(s) must be included, specifying:

- addresses and local government area where the prescribed premises and receivers are situated
- an aerial photograph and map of the area
- Geographic Information System (GIS) coordinates, where cadastral data are not used as premises boundaries.

1.2 Noise emission predictions by modelling

The expected operational noise levels associated with an application can be estimated using computer noise modelling, or by ‘hand’ calculations. The modelling must be done by a competent person, following the principles outlined below.

In summary, the noise modelling will require:

- inputting of topographical data over the area of interest, and including any pits, noise barriers or significant buildings
- modelling of noise sources in terms of the sound power level of an equivalent point source, line source or plane source, and locating each source or group of sources on the map at a given height above ground level
- nominating types of ground cover
- assigning ‘worst-case’ meteorological conditions
- the computation of received sound levels over the map area and presentation of the data as a series of noise contours or single-point sound levels.

These aspects are discussed in more detail below.

Software

- The ‘SoundPLAN’ software implementing the CONCAWE algorithm has been commonly used for noise modelling industrial proposals in Western Australia. The default meteorological conditions described below have been developed for this application.
- Equivalent software and alternative algorithms may be used to model industrial sources, but justification needs to be provided. Modelling inputs including meteorological conditions, should be selected and justified with a view to producing comparable modelling outputs to the above SoundPLAN implementation.
- The method described by ISO 9613:1996 may also be used for the purpose of modelling. Note the method does not allow the input of specific meteorological conditions but does predict for moderate temperature inversions under downwind conditions. In applying the ISO method, it is expected the model



inputs and options will be selected with a view to achieving comparable modelling output to the SoundPLAN implementation of CONCAWE mentioned above.

- For modelling noise from sources other than industrial proposals, reference should be made to the algorithms or methods referred to in this document for that source. If no specific method is identified for the noise source under consideration, the department should be consulted before undertaking the prediction calculations.

Topographical data

- The area of interest must be selected to cover all noise sensitive or receiving locations where noise emissions may exceed the assigned levels.
- Ensure grid point and radial line spaces provide sufficient detail.
- Coarse resolution in ground contours affecting model accuracy needs to be noted in the report; 1 m contours are most appropriate.
- Details of pits, bund walls or noise barriers (including significant buildings) included in the model need to be recorded and documented.
- Ground absorption parameters need to take summer conditions into modelling consideration, when the ground is generally hard with minimal cover.

Noise sources - sound power levels

- Major noise sources associated with proposed activities need to be accurately identified on a map and specify the equipment type at given height above ground level.
- Point source (or line or plane source) sound power levels need to be determined for each source in an octave or one-third octave band format.

Note: It is crucial the data have a realistic basis in terms of both the original source measurements and subsequent calculations to determine source sound power levels. Where sound power levels are calculated from measurement data the measurement methodology, data and calculations are to be provided.

The following important data sources and assumptions should be reported:

- original data source and sound power levels, as A-weighted and one- or one-third octave band levels, based on:
 - manufacturer guaranteed levels; or
 - realistic measured levels
- factors used for scaling from original data (e.g. from equipment of different size, operating speed)
- relevant operating conditions for modelled equipment
- construction of any buildings proposed to house the equipment
- specific noise control measures incorporated in any noise source or building



- noise level (e.g. L_{max} , L_1 , L_{10}) of source represented
- sources included in each noise source grouping
- location and height of each source group.

Assumed sound power levels for various sources should be representative of the specific equipment which is, or is likely to be, used. In many cases manufacturers' sound power data is available and can be relied upon. Where alternatives to the available manufacturers' sound power levels are utilised the reasoning for the alternative levels is to be clearly explained.

Where manufacturer-specific data is unavailable, generic reasonably achievable sound power levels for sources of that kind can be considered. While proposals should strive to employ equipment towards the lower end of the range of typical sound power levels, unrealistically low or high sound power levels should not be used for noise modelling for the purpose of this guideline. Where compliance is marginal and reliant on the use of specific low noise equipment the model, acoustic treatments and verifiable sound power levels of the equipment are to be stated and supported with appropriate documentation.

Note: Industrial machinery tends to emit more noise as it wears, and this needs to be taken into consideration when assuming sound power levels. For example, boilers and furnaces may have increased gas firing to compensate for the drop in heat transfer efficiency because of fouling over time and need to be assessed at end-of-run conditions. Fuel firing rates tend to be correlated with noise emission.

Noise sources - statistical parameters

In developing a noise model, the statistical indicators representing predicted source sound power levels and received sound levels need to be specified and justified to enable comparison to the relevant assigned levels.

The applicant should:

- specify the choice of statistical indicator (e.g. L_{max} , L_1 , L_{10}) that the sound power levels represent in the model

Example: A model dominated by short duration noisy operations might represent $L_{A\ max}$ or $L_{A\ 1}$ received noise levels, while a model dominated by continuous sources would represent $L_{A\ 10}$ received noise levels

- specify the choice of representative assessment period (15 minutes up to four hours) that is reflected in the model

Example: A noise source that dominates when it operates for 1.5 minutes every hour is present for 2.5 per cent of a one-hour representative assessment period, and the received noise level would need to meet the $L_{A\ 1}$ assigned level. The choice of representative assessment period needs to be justified.

- for an existing operation that is being expanded, consider determining the relationship between these parameters at receiving locations by



measurements of the noise variability of the operations and adjusting the noise model accordingly

- determine which statistical parameter of the received noise ($L_{A \max}$, $L_{A 1}$ or $L_{A 10}$) represents the worst case for comparison with the assigned levels, and base the assessment on this model, clearly documenting the basis. Where multiple statistical parameters are relevant to compliance, all relevant parameters should be modelled and reported.

In relation to the above, the following should be noted:

- sound propagation data used in the CONCAWE algorithm predicts an average attenuation representative of a range of meteorological conditions. In some situations, the use of L_{\max} or L_1 source sound power levels may well be needed to represent an $L_{A 10}$ level at the receiving locations under 'worst-case' conditions
- at regions further away from the source, differences between the $L_{A \max}$ and $L_{A 10}$ are likely to diminish.

Meteorological conditions

The meteorological conditions selected for the model can have a significant effect on the result. While the proposed operations are required to be managed such that compliance can be achieved at all times, the selection of suitable meteorological conditions is essential to enable the model to demonstrate this.

The 'default meteorological conditions' for noise modelling in Table 4 below have been developed for the SoundPLAN implementation of the CONCAWE algorithm and can be used to approximate the typical worst-case weather conditions for enhancement of sound propagation. Where alternative software and algorithms are utilised, equivalent meteorological conditions should be implemented and justified with a view to producing consistent modelling outcomes.

Table 4: Default 'worst-case' meteorological conditions for noise modelling

Parameter	'Day' 0700–1900	'Night' 1900–0700
Wind speed	4 m/s	3 m/s
Temperature inversion lapse rate	0 °C /100 m	2 °C /100 m
Pasquill stability (CONCAWE)	E	F
Temperature	20 °C	15 °C
Relative humidity	50%	50%



Note: Wind speeds greater than those in Table 4 may elevate background noise levels from local vegetation and can dominate the noise emission.

The default meteorological conditions were developed from analysis of wind speed and temperature inversion lapse rate data obtained on the Swan Coastal Plain, and may be inappropriate for modelling in highly arid regions where temperature inversion lapse rates can be considerably higher at night time. If the applicant considers the default 'worst-case' conditions unrepresentative, site-specific worst-case data can be used for noise modelling. This requires comprehensive meteorological data recorded at or near the subject site over a period of at least one year.

The wind directions selected for the model must cover the worst-case situation, as well as the prevailing wind direction, even if the worst-case wind direction may only occur for a small portion of the time.

The model must include either:

- four models, each with the wind blowing from a different quarter; or
- a composite model with the results from wind blowing from 'all' directions included on the one map

The diagrams of the model output must be labelled to identify the modelled meteorological conditions.

1.3 Model adjustment

Calibration and verification of noise models

For a model representing a future or existing operating scenario, a series of calibration or verification measurements may need to be conducted to check the accuracy of the model.

The following modifications to noise models may be proposed by the applicant:

- calibration adjustments to the noise model for a future scenario, based on data from a detailed sound propagation study conducted at the subject site before construction or operations have commenced
- verification adjustments of the noise model for an existing operation, based on data from field verification measurements.

Calibration and verification adjustments need to be based on a methodology accepted by the department and clearly documented. Major adjustments must not be applied to the model predictions. Field studies that show a significant departure from the model predictions and/or indicate a systemic failure within the acoustic model will require investigation and re-evaluation.

Adjustments for noise characteristics

The Noise Regulations require the emission to be 'free' from the characteristics of tonality, modulation and impulsiveness. Regulation 9 specifies technical



requirements for an emission to be considered free from tonality, modulation and impulsiveness. The emission cannot be considered to be free from the characteristics if they can be reasonably and practicably removed (other than by attenuating the overall level).

It is a requirement to document:

- if any of these characteristics are likely to be present
- if so, how they can be practicably removed.

If it is not practicable to remove the characteristics, the following adjustments to the measured/predicted noise levels are required for the emission to be considered free:

- for tonality and modulation: + 5 dB(A) for each characteristic present
- for impulsiveness: + 10 dB(A).

Noise contours/noise levels predicted for individual locations are to be presented initially without adjustments for noise character. Adjustments for noise containing tonality, modulation or impulsiveness also need to be included by adding the adjustment to the predicted (or measured) noise emission levels. Adjustments are not to be subtracted from the assigned levels.

1.4 Influencing factor

The assigned levels for highly sensitive areas of noise sensitive premises rely on an influencing factor which is determined in accordance with Schedule 3 of the Noise Regulations. The assessment report must set out the calculation of influencing factors and must show the following in detail:

- all noise sensitive premises for which an influencing factor has been calculated
- land areas taken to be Type A or Type B
- any assumptions made about significant areas of land within the 100 m or 450 m circles for which the land use zoning may be unclear
- major or secondary roads and relevant traffic flow data, the traffic flow data should relate to the portions of the road within the two circles
- where an application causes a change in the land use which affects the influencing factor, the influencing factor with and without the application must be stated.

Note: For the purpose of assessing noise emissions from a proposal when received at a highly sensitive area, the location within the highly sensitive area which results in the lowest influencing factor must be considered. The influencing factor is most sensitive to the occurrence of a major road within 100 m from the receiving location. If the major road falls within 100 m it will contribute 6 dB to the influencing factor, but if it falls outside 100 m (but within 450 m) it will contribute only 2 dB. The assessment is therefore to consider a 2 dB contribution if any part of the highly sensitive area is within 450 m of the major road, and more than 100 m from it.



Note: Where the influencing factor is affected by mining operations in accordance with schedule 3 clause 2(3) of the Noise Regulations, only the land occupied by the mining operation and not the entire lot on which the operations are located, is to be taken to be Type A land for the purpose of calculating the influencing factor.

1.5 Comparison of noise predictions with assigned levels

Comparisons with relevant noise criteria can be presented by individual noise receiver and/or by area. Further information can be found below.

Individual noise receiver

Predicted noise levels determined in accordance with this guideline are compared to assigned levels, or other standards referred to in section 7 of the guideline. The following steps are to be followed, for the highly sensitive area on a noise sensitive premises:

- Determine the influencing factor in accordance with Schedule 3 of the Noise Regulations.
- Determine the assigned noise levels ($L_{A \max}$, $L_{A 1}$, $L_{A 10}$) for the following time periods:
 - 7am–7 pm Monday to Saturday (day)
 - 7pm–10pm Monday to Saturday (evening)
 - 9am–10pm on Sunday or a public holiday (Sunday)
 - 10pm–7am every day or to 9am on a Sunday or public holiday (night).
- Determine the predicted $L_{AS \max}$, $L_{AS 1}$ or $L_{AS 10}$ levels for the operation, for each of the four time periods. It is acceptable to focus on a single level and time of the day if these can be shown to represent the worst case. For example, the $L_{AS 10}$ noise model compared with the $L_{A 10}$ assigned level at night may represent the worst case.
- Adjust the predicted noise levels to account for any received tonal, modulation or impulsive characteristic which cannot be practicably removed at the source.
- Compare the adjusted predicted levels with the assigned levels and tabulate any levels exceeded.

Where the adjusted predicted levels are below but within 5 dB of the assigned levels, the combined contributions of the emission noise and ambient noise will need to be considered. If the combined contributions exceed the assigned levels, the predominant ambient noise sources will need to be identified:

- if the ambient noise is predominantly from natural sources and traffic, the emission is considered to comply with the assigned levels.
- if the ambient noise is predominantly from industrial or commercial sources, the applicant's noise emission must be reduced to a level that is 5 dB below the assigned level.



- if the ambient noise is predominantly from an industrial estate where there is a noise target for individual industries, the applicant's noise emission should be reduced to the target level.

Note: This type of procedure is also to be followed when predicted noise levels are compared to other criteria applicable at a specific receiving location.

Comparison over area

Where the propagation of noise may affect multiple recipients, it is appropriate to present the assessment of predicted levels in the form of noise contours over a geographical area.

The assessment must follow the same steps as for the individual noise receptor. However, the applicant must provide maps and/or aerial photographs overlain by contours of the predicted levels.

In these cases, applicants are encouraged to develop graphical presentations which may involve a map showing noise criteria as allowable noise 'zones', possibly overlain by maps of predicted levels. Tabulated results comparing adjusted predicted noise levels to the assigned levels for critical/representative receivers are also encouraged.

A full discussion of the results is to be included in the report.

1.6 Amelioration options

In some cases compliance with the relevant standard requires the addition of a noise amelioration option, the addition of a local barrier for example.

To demonstrate compliance with statutory noise levels, noise reduction measures need to be incorporated in the noise model and presented alongside the model without the measures incorporated. The noise control assumptions may be crucial in the overall noise management of the project and need to be documented. Particularly in an assessment report by an acoustical consultant, it is important to detail sufficient information to enable the applicant to present the noise reduction measures in the form of commitments that can be reflected in licence conditions.

Considerations regarding noise amelioration options are presented in Appendix D.



2 Construction noise

2.1 Construction noise management under Noise Regulation 13

Proposed activities resulting in 'construction noise' on a 'construction site' as defined under Noise Regulation 13 (see section 7.2.4), will require a detailed noise emission report if not screened out (Appendix A – Screening form) in the screening process.

If the assigned levels are not met, the conditions under Noise Regulation 13 would apply. The conditions and the situations under which they apply are listed in Table 5 (note: a tick means the condition applies).

Table 5: Noise Regulation 13 requirements for applications involving construction noise from on-site construction work.

Noise Regulation 13 requirement	Work within hours (0700–1900) Monday–Saturday	Work outside hours or on Sunday/ public holiday
Work is carried out with good noise control practice in accordance with section 4 of AS 2436-2010	✓	✓
Equipment used is the quietest reasonably available	✓	✓
Work is done according to NMP approved by delegate CEO	If required by delegate CEO	✓
Notification of affected occupiers is given 24 hours in advance of the work	-	✓
Justification made for out-of-hours work being reasonably necessary	-	✓

Noise emissions must meet assigned levels in the Noise Regulations unless the requirements of Noise Regulation 13 are met, in which case the assigned levels do not apply.

Report requirements

In the detailed noise emission report you must include:

- a description of main stages of proposed construction activity, identification of activities potentially resulting in high levels of noise/vibration
- work hours for relevant stages and activities
- noise level predictions for major construction activities, modelled as set out in Appendix B, section 1.2 Noise emission predictions by modelling
- a draft noise management plan in accordance with Noise Regulation 13.



At the works approval stage, where the screening assessment has identified a need for a detailed construction noise assessment and noise management plan, the plan must be finalised and approved before the works can commence.

2.2 Construction traffic

Where noise from construction traffic is relevant to a proposal a detailed noise emission assessment should be carried out following the procedure in Appendix B, section 5 Transport noise.

3 Blasting

The department notes that a detailed noise emission assessment predicting the impacts of blasting (airblast overpressure and ground vibration levels) poses difficulties because of site factors and blast design characteristics. Estimations of airblast and ground vibration impacts therefore are to be made on a conservative basis in the assessment, using the formulae referred to in sections 3.1 and 3.2 below.

The applicant's Detailed noise emission report must include:

- identification of best practice methods for blasting in AS 2187.2-2006 *Explosives – Storage and use Part 2: Use of explosives*
- draft monitoring and control plan for ground vibration and airblast.

3.1 Airblast levels

If a Detailed noise emission assessment of blasting impacts is required, the formula for 'worst case' estimations in Appendix J7.2 of AS 2187.2-2006 is to be followed.

If the predicted airblast levels exceed prescribed standards (Noise Regulation 11), blast control measures to be taken, at least initially, to ensure compliance need to be included in the detailed noise emission report.

3.2 Ground vibration levels

Ground vibration predictions are carried out for the nearest adjacent premises for a typical blast of the size proposed, using Appendix J7.3 of AS 2187.2-2006. If the predicted ground vibration levels exceed the 5 mm/s peak particle velocity criteria in section 7.2.6, the detailed noise emission report should identify an initial limit on the maximum instantaneous charge.

4 Ground vibration other than from blasting

Ground vibration other than from blasting is to be assessed against the criteria presented in Appendix E. Ground vibration measurement and prediction methods need to be designed to suit the specific circumstances being considered. Applicants are encouraged to discuss proposed approaches with the department before embarking on ground vibration studies for sources other than blasting.



5 Transport noise

Heavy vehicles

The applicant should include the following in the detailed noise emission report:

- estimation of likely truck volumes, routes and times
- analysis of likely noise impacts because of traffic associated with the application
- identification of appropriate management measures.

Where truck noise emissions are covered by the Noise Regulations (such as an access road) the $L_{A\ max}$, $L_{A\ 1}$ and $L_{A\ 10}$ levels should be predicted, based on a typical pass-by, for comparison against the assigned levels. For road traffic increases on roads which already have significant traffic volumes, measurement and prediction assessment in accordance with the *Road and Rail Noise Guidelines* may be appropriate. For roads with low traffic volumes noise impacts from individual truck pass-by may be significant, particularly if occurring at night. In such situations the department will have regard for not only the noise level but also the number of events and the change to the existing environment brought about by the proposal. Appropriate assessment procedures should be discussed with the department. Generally, however, applicants are to present the received $L_{A\ max}$ truck pass-by levels with reference to the number of events during 'day' and 'night' time periods, and the average and 95th percentile maximum noise levels for the current and proposed scenarios.

Light vehicles

An estimation of light vehicle numbers and shift changeover times needs to be included in the detailed noise emission report.

Trains

Where noise from trains is not screened out, detailed noise emission assessment should be made using the procedures in the *Road and Rail Noise Guidelines*. Additional to these procedures, the department expects applicants to predict the received $L_{A\ max}$ train pass-by levels. In doing so reference must be made to the number of events during 'day' and 'night' time periods, and the average $L_{A\ max}$, the maximum $L_{A\ max}$ and 95th percentile $L_{A\ max}$ noise levels. For low numbers of train movements at least the maximum $L_{A\ max}$ value should be provided.

Other transport factors

Where a detailed noise emission assessment is required to consider transport operations not covered by SPP5.4 (such as low frequency noise from freight trains or an airstrip or helipad) guidance should be sought from the department for appropriate assessment methodologies in each case.



6 Other activities

Some activities, because of their occasional nature, are commonly not included in an acoustical model. These may include public address systems, hooters, emergency warning systems and less frequent operations such as steam venting and flaring.

These activities may result in significant noise emissions and need to be included in the noise assessment. Such noise sources should be identified within the application if practicable.

In addressing these types of activities, the following points are to be taken into consideration:

- If noise is infrequent but unavoidable: noise emission predictions and likely impacts are required to be discussed in the report, including emission level, duration and time of day.
- For public address systems and hooters, comment on likely noise impacts, need for appropriate design and considerations of alternatives is provided in the report.
- For audible safety warning devices, such as reversing alarms on mobile equipment, comments on likely noise impacts and potential for alternative systems to minimise impact are required to be discussed in the report.



Appendix C - Recommended content for a detailed noise emission report

The following sections include recommended content for the report only and are not comprehensive. It should be noted that suggested content is intended as guidance, and persons preparing the report are expected to include only relevant sections and cover required information, at their discretion. The department takes no responsibility for points which may have been omitted.

1. Introduction	
1.1 Project description	<p>An adequate description of the project is provided, covering relevant information about:</p> <ul style="list-style-type: none"> • background history, relevant previous studies • noise/vibration issues addressed, scope of work • objectives (optional).
1.2 Site map	<p>A detailed site map is provided, identifying key information about:</p> <ul style="list-style-type: none"> • noise emitter location • noise receiver locations (existing and proposed future residential areas) • major noise sources • topographical data: <ul style="list-style-type: none"> – natural and constructed – development and surrounding land uses which may affect noise propagation • measurement/prediction locations • north point and scale.
1.3 Noise criteria	<p>Relevant noise criteria have been applied and referenced in the project, such as:</p> <ul style="list-style-type: none"> • Environmental Protection (Noise) Regulations 1997 assigned noise levels including influencing factor calculations • <i>State Planning Policy 5.4 Road and rail noise</i>; and/or • <i>Acoustics – Recommended design sound levels and reverberation times for building interiors AS/NZS 2107:2016.</i>



2. Methodology

The Detailed noise emission report must include full documentation of noise measurements, predictions, analysis and recommendations.

2.1 Noise measurements

Noise measurements are performed:

- for ambient noise or when the emitter is existing
- to define noise levels of proposed sources where similar equipment can be measured.

Relevant information to include:

- equipment/instruments used
- measurement durations
- measurement locations
- meter settings (typically A weighted and Slow time response)
- calibration details
- ambient/background measurements (if indicated)
- weather conditions (especially wind speed and direction)
- operational conditions of noise source
- adjustments made for characteristics: tonality, modulation, impulsiveness.

2.2 Noise predictions

Relevant information to include:

- computer noise modelling software used
- sound power levels (A weighted and octave band levels):
 - source of sound power level data
 - adjustments for size/type of equipment
 - assumed noise reduction measures
- noise source locations and heights
- topography settings and selected parameters, such as ground type)
- meteorological conditions:
 - 'worst case' scenario model, if applicable
 - selected parameters
 - appropriate conditions selected
- receiver locations
- adjustments made for characteristics: tonality, modulation, impulsiveness.



3. Analysis and results
The results must be analysed carefully and displayed clearly.
3.1 Noise measurements
<p>Relevant information to include:</p> <ul style="list-style-type: none"> • justification of statistical indicator choice (e.g. L_{A1}, L_{A10}, L_{Amax}, or L_{AeqT} for traffic) • measurement results (including level, duration, date, time) • noise source distance and relevant operation conditions • adjustments made for characteristics: tonality, modulation, impulsiveness.
3.2 Noise predictions
<p>Relevant information to include:</p> <ul style="list-style-type: none"> • justification of statistical indicator choice (e.g. L_{A1}, L_{A10}, L_{Amax}) • individual receiver (point calculation) or multiple receivers (contour maps) • modelled weather condition scenarios with indicated assumptions, such as worst case, calm, wind direction/s) • noise source ranking.
4. Discussion/Recommendations/Conclusions
<ul style="list-style-type: none"> • In the discussion, a comparison of relevant noise criteria to measured/predicted results for compliance. • Recommendations for reasonable and practicable measures to achieve compliance, such as noise control measures, plant design process, operational restrictions, further study). • Recommendations reported in a detailed manner intended for adoption as approval conditions or commitments. • A draft overall noise management plan and strategy is clearly identified.
5. Summary
<ul style="list-style-type: none"> • Scope of work. • Criteria and compliance statement. • Recommended noise control measures. • Other recommendations (e.g. further assessments).



6. Appendices

Relevant documents or data referred to in the report:

- calibration certificates
- ambient noise data
- detailed wind and meteorological data
- sound power level and/or frequency analysis data
- noise contour maps
- draft construction noise management plan and overall project noise management plan.



Appendix D - Noise amelioration

General

The following provides information for consideration when the assessment requires a detailed noise emission report and indicates that noise amelioration is required.

A holistic noise reduction strategy can be considered in the following three contexts.

- At the noise source:
 - good site selection and layout
 - plant design incorporating noise control
 - appropriate management measures to minimise noise emissions.
- In the noise path:
 - location of sources or receivers to increase buffer distances
 - erection of noise barriers.
- At the noise receiver:
 - generally, it is beyond the remit of the applicant to carry out noise control measures at the receiver; however, in extreme cases, the applicant may, by arrangement with a receiver, carry out measures to reduce noise impacts.

See Noise control considerations below for further discussion of noise control measures at the source, path and receiver.

If new technologies are proposed for noise control, the applicant should present noise data on similar plants in other locations, showing sound power levels and details of the practicable noise controls that are in place.

Noise control considerations

The applicant may consider:

- measures to reduce predicted noise levels at affected locations
- measures to reduce the risk of a future noise sensitive uses or buildings being established or constructed in the noise affected area.

Site selection and layout

The site should ideally be selected to make compliance with noise criteria practicably achievable. The applicant may need to provide information on alternative sites that have been considered, justifying the basis for selection of the preferred site.

To ensure that boundary noise requirements can be met, the site layout needs to be considered early in the design process, and clear site layout plans provided.

Consideration should be given to such measures as:

- locating noisy plant away from a boundary abutting a neighbour
- using nearby buildings on the site to screen noisy plant



- facing open sides of buildings away from neighbours
- arranging truck and train movements to maximise screening while on site.

Plant design

The following points are to be considered for plant to be incorporated in proposed prescribed premises:

- The plant should be designed in accordance with best noise control practice.
- The applicant needs to show that all reasonable and practicable measures to minimise noise emissions have been taken (e.g. for fans, vents, stacks, pressure reducing devices, pipework and building envelopes).

This is especially important for applications located in industrial estates with (potential) multiple noise emitting facilities.

If the application involves multiple noise emission sources, the applicant is encouraged to develop noise control scenarios based on 'noise source ranking' using the noise model. This process ranks the individual contribution of each noise source to the noise level received at a given receiver, and allows the overall noise reduction to be estimated if a given noise reduction is applied to any one or more of the major contributors.

If noisy plant items are contained in enclosures, plant rooms or buildings, the following treatment descriptions may be included:

- Typical construction of a building envelope/enclosure, and its noise reduction performance.
- Ventilation arrangements, including minimum insertion loss performance of ductwork, silencers or louvres, and orientation of openings.
- Type and extent of acoustical absorbing material in any sound absorptive treatment.

Management of noise emissions

The applicant should identify staff groups needing to be involved in achieving and maintaining the modelled noise emissions. The responsibilities of each area need to be clearly identified in the submission, and may include the following:

- For plant design staff, overall noise level constraints initially and during plant upgrades need to be known.
- For purchasing staff, clear policy guidelines for procurement of new plant as part of a replacement or upgrade program, to ensure noise levels do not increase over time.
- For operations staff, limitations on plant operating conditions, number and locations of plant items, times of the day or meteorological conditions when restrictions may apply.
- For maintenance staff, implementation of a maintenance program to avoid noise level increase over time.



Note: The applicant is not required to describe these programs in detail; however, the need for such programs, including an outline, is to be clearly identified in the submission for the project.

Noise barriers

While noise controls at the source are considered as the first priority, noise controls in the noise path, such as noise walls, bunds and buildings, can be effective in reducing the noise from multiple sources at once, without disturbing those sources.

If noise barriers are assumed in a noise model, the following details of the noise barrier need to be included in the noise assessment:

- Position.
- Height, relative to a known reference.
- Width/length, and details of gaps, bends or returns in the barrier.
- Details relevant to the final construction of the barrier, such as material, or whether the barrier is assumed to be absorptive on one side.

Noise amelioration at the receiver

The applicant may need to provide ameliorative measures at the receiver, by arrangement, when controls at the source or noise path are not sufficient to achieve acceptable noise levels.

These measures might include:

- providing insulation to an existing dwelling, or to an abutting industrial building
- arranging with occupants to be absent for a period of time while a temporary activity, such as blasting, short-term mining or construction work, takes place.
- arranging to purchase affected properties to secure an effective noise buffer.

If these measures are included in the application, the applicant needs to:

- ensure that agreements are already in place with relevant parties
- facilitate the implementation
- provide details of the measures upon request.



Appendix E - Ground vibration (other than from blasting)

The department's primary objective is that vibration emissions are to be managed to meet human annoyance criteria. These human annoyance criteria for vibration are generally more stringent than vibration levels that cause building damage.

Applicants may consider conducting building integrity surveys of nearby properties before commencement activities that may cause vibration in case building damage disputes arise.

The human annoyance criteria for vibration are based on a simplified methodology using only the acceleration levels in the vertical vibration direction (which is commonly the most substantial). The 'base' curve for vertical acceleration levels are given in the Base curve for vertical vibration levels table below.

Base curve for vertical vibration levels table

One third octave band centre frequency (Hz)	Root mean square [RMS] (1-sec) acceleration level (mm/s ²)	One third octave band centre frequency (Hz)	Root mean square [RMS] (1-sec) acceleration level (mm/s ²)
1	10	10	6.3
1.25	8.9	12.5	7.81
1.6	8	16	10
2	7	20	12.5
2.5	6.3	25	16
3.15	5.7	31.5	20
4	5	40	25
5	5	50	31.5
6.3	5	63	40
8	5	80	50

The criteria levels are based on multipliers to be applied to the levels in the above base curve. The multiplier criteria levels are given in the Target criteria for ground vibration levels (other than from blasting) table below. The criteria are expressed as 'Target' levels, to be achieved as far as practicable.



Target criteria for ground vibration levels (other than from blasting) table.

Receiving location/time of day	Multiplier to apply to base curve
Building associated with a noise sensitive use	
Night, evening	1.4
Day time, including Sunday, public holiday	2.0
Building not associated with a noise sensitive use	
Office or the like – any time/day	4.0
Workshop or the like – any time/day	8.0

Note: The definitions of receiving locations and times of day are as defined in the Noise Regulations.

The multipliers are based on the experience of the department in dealing with vibration complaints. They apply to continuous or intermittent vibration that is ongoing. For transient sources, such as trains, where there are sufficient measurements made to determine a representative level, the 95th percentile may be used. The maximum level should also be reported.

The above multipliers do not consider the impact of vibration that is likely to be re-radiated into the receiving building at significant levels. This issue should be considered in discussions with the department where relevant.



Appendix F - Road and rail noise

Noise from road and rail covered under State Planning Policy 5.4

Any proposal that triggers State Planning Policy 5.4 *Road and Rail Noise* (SPP 5.4) needs to follow the assessment process of SPP5.4. For example, this may be relevant when the proposal involves construction of a new or upgraded road or railway.

If triggered, SPP 5.4 would require the applicant to prepare a noise management plan for road/rail noise and consult the department. The department assesses such cases on merit and provides advice on the need for practicable minimisation of noise impacts on the community.

If the infrastructure proposal is not assessed by the EPA under Part IV of the EP Act, the applicant may still need to demonstrate to the department that:

- road or rail noise associated with the prescribed premises application can be managed to meet outdoor noise criteria in SPP 5.4
- procedures and measures outlined in SPP 5.4 are followed as far as practicable.

Road and rail operations not covered by SPP 5.4 or the Noise Regulations

Proposals that contribute to an increase of road and rail traffic on existing infrastructure, with no proposed upgrades, are not covered under SPP 5.4.

These proposals need to follow the *Screening for truck and rail noise* as outlined below to determine if a detailed noise emission assessment is required. The department will determine whether the noise increase is likely to warrant consideration of ameliorative measures as part of its assessment of the proposal.

Additional factors considered

In supporting the EPA's objectives for noise, the department has regard to and provides advice on proposals involving potential road and rail noise impacts where the following components are identified:

- Low frequency noise from freight railways.
- Noise from railway tunnels that is re-radiated into adjacent buildings
- Ground vibration from railways.
- Noise impacts from freight railways in greenfield areas.

The department provides advice on and has regard to noise minimisation in the following issues:

- Whether the transport corridor and nearby noise sensitive receivers have been designed to accommodate cumulative amounts of future noise.
- The potential for situation-specific practicable noise minimisation.

The department may be contacted for further information on factors discussed above.



Screening for truck and rail noise

The following screening tool has been developed to indicate where increases in rail noise and road noise, from trucks for example, may present a material increase in noise emissions.

Road and rail transport noise (if SPP 5.4 does not apply)		
Distance to nearest resident	_____m (A)	
Existing traffic movements Average number of traffic movements along the corridor	_____ on average (B)	
Proposed additional traffic movements Average number of traffic movements along the corridor	_____ on average (C)	
Increase of traffic movements in % What is the difference between existing and proposed traffic movements	$((C)/(B)) \times 100 = \text{_____}\%$ (D)	
Plot (D) against (A) on Plate 2 What is the screening trigger level for increased traffic movements from Plate 2	_____ % (E)	
Please tick the appropriate box	Yes/Unsure	No
Does (D) meet the screening trigger level set by (E)?	<input type="checkbox"/>	<input type="checkbox"/>

Instructions for road and rail transport noise screening
<ol style="list-style-type: none"> 1) Find the relevant row representing existing traffic movements in Plate 2. 2) Find the relevant column in Plate 2 representing the distance to the nearest resident (A). 3) Calculate the percentage increase in the traffic movements because of the proposal (D). 4) Compare the percentage increase in the traffic movements because of the proposal (D) with the percentage change indicated in the area in the table, (E). 5) If the percentage increase in the traffic movements because of the proposal is greater than the percentage change indicated in the area in the table, a detailed noise emission assessment is required. 6) If the point is on a line between two colours, use the lower percentage increase. <p>In the case where existing truck movements are less than 50 per day, the proposed increase in movements should be raised with the department to determine whether detailed noise emission assessment may be needed.</p>



Plate 2: Screening table for the assessment of road and rail transport noise not covered in SPP 5.4

Existing traffic movements		Distance to nearest resident [m]										
		20	30	40	50	75	100	150	200	250	300	
Trains	Trucks											
40	3200	> 6 %	> 12 %	> 25 %	> 60 %	> 150 %						
25	2000											
16	1250											
10	800											
6	500											
4	320											
2.5	200											
1.6	125											
1	80											
0.6	50											

Notes to Plate 2:

- 1) Traffic movements are average movements per day without proposal.
- 2) Trains are typical freight trains, comparison is against L_{Aeq, Night} noise criteria.
- 3) Trucks are assumed to dominate traffic noise, comparison is against L_{Aeq, Day} criteria.
- 4) Both assume +2.5 dB(A) facade correction, as in SPP 5.4.
- 5) Red colouring indicates high noise level area, grey indicates lower noise.
- 6) Percentages (%) refer to the percentage increase by proposal traffic over existing traffic.

Worked example of screening process and Plate 2	
Distance to nearest residence:	45 m
Existing traffic movement:	300 trucks/day along main road
Additional traffic movement because of proposal:	50 trucks/day along main road
Increase of traffic movements:	17%
The existing situation is currently classified in the yellow area in Plate 2. The yellow area indicates that an increase greater than 12% from existing traffic movement requires a Detailed noise emission assessment and will be required for this example.	



Glossary

Term	Definition
Ambient noise	The existing noise from all sources, near and far
Assigned level	A noise level determined under regulation 8 of the Noise Regulations
Background noise	Ambient noise measured in the absence of noise associated with an application
Beneficial use	As defined under s.3(1) of the EP Act means a use of the environment, or of any portion thereof, which is: <ul style="list-style-type: none"> a) conducive to public benefit, public amenity, public safety, public health or aesthetic enjoyment and which requires protection from the effects of emissions or of activities referred to in paragraph (a) or (b) of the definition of environmental harm in s.3A(2) of the EP Act; or b) identified and declared under s.35(2) of the EP Act to be a beneficial use to be protected under an approved policy
dB(A) and L_A	The noise level measured in decibels with the 'A' frequency weighting switched in. The A-weighting is an electronic weighting network which approximates the frequency response of the normal human ear by rolling-off a certain amount of the high and low frequencies
dB(Z) and L_Z	The noise level measured in decibels with the 'Z' frequency weighting switched in. The Z weighting essentially defines a linear response and is effectively no weighting at all
delegate CEO	The Chief Executive Officer (CEO) of the department or a person to whom the CEO has delegated his or her powers under the EP Act
Detailed noise emission assessment	The assessment referred to in section 10 and Appendix B of the guideline
DWER	Department of Water and Environmental Regulation (the department)
Environment	As defined under s.3(1) of the EP Act and subject to subsection (2), means living things, their physical, biological and social surroundings, and interactions between all of these.



Environmental harm	As defined under s.3A(2) of the EP Act and means direct or indirect – a) harm to the environment involving removal or destruction of, or damage to native vegetation; or the habitat of native vegetation or indigenous aquatic or terrestrial animals b) alteration of the environment to its detriment or degradation or potential detriment or degradation c) alteration of the environment to the detriment or potential detriment of an environmental values; or d) alteration of the environment of a prescribed kind.
Environmental noise	Noise emitted from all sources except noise at the industrial workplace (source: WHO 1999, <i>Guidelines for community noise</i>)
Environmental value	As defined under s.3(1) of the EP Act means — a) a beneficial use; or b) an ecosystem health condition;
EP Act	<i>Environmental Protection Act 1986 (WA)</i>
EPA	Environmental Protection Authority (WA)
Measured	The noise level has been measured and adjusted in accordance with the Noise Regulations.
Mining	Includes fossicking, prospecting and exploring for minerals, and mining operations (source: <i>Mining Act 1978</i>)
Mining operations	Means any mode or method of working whereby the earth or any rock structure, stone, fluid or mineral bearing substance may be disturbed, removed, washed, sifted, crushed, leached, roasted, distilled, evaporated, smelted, combusted or refined, or dealt with for the purpose of obtaining any mineral or processed mineral resource therefrom whether it has been previously disturbed or not and includes: a) the removal of overburden by mechanical or other means and the stacking, deposit, storage and treatment of any substance considered to contain any mineral b) operations by means of which salt or other evaporates may be harvested c) operations by means of which mineral is recovered from the sea or a natural water supply d) operations by means of which a processed mineral resource is produced and recovered e) the doing of all acts incident or conducive to any such operation or purposes. (source: <i>Mining Act 1978</i>)
NMP	Noise management plan



Noise	Includes vibration of any frequency, whether transmitted through air or any other physical medium (as defined in the EP Act)
Noise level	The level of noise measured in decibels (dB)
Noise Regulations	Environmental Protection (Noise) Regulations 1997
Noise sensitive premises	Premises referred to in Schedule 1 Part C in the Noise Regulations. Excluding industrial/utility/commercial premises
Occupier	Person in occupation or control of premises, or part of premises with several occupiers, whether or not that person is the owner of (parts of) premises (as defined in the EP Act)
Peak level	A measure of the maximum instantaneous sound pressure, being the true peak of the sound pressure wave and not affected by any time constant or averaging circuit/calculator
Practicable	Means reasonably practicable having regard to, among other things, local conditions and circumstances (including costs) and to the current state of technical knowledge
Premises	Residential, industrial or other premises of any kind whatsoever and includes land, water and equipment
Prescribed premises	As defined under s.3(1) of the EP Act means premises prescribed for the purposes of Part V of the EP Act
Representative assessment period	A period of time of not less than 15 minutes, and not exceeding four hours, determined by an inspector or authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission (as defined in the Noise Regulations)
Significantly contribute	An emission is taken to 'significantly contribute to' a level if it exceeds a value which is 5 dB below the assigned level at the point of reception
Social surrounds	As defined under s3(2) of the EP Act for the purposes of the definition of environment, the social surroundings are a person's aesthetic, cultural, economic or social surroundings to the extent that those surroundings directly affect or are affected by physical or biological surroundings.



<p>Suitably qualified person</p>	<p>A person who:</p> <ul style="list-style-type: none"> a) holds a tertiary academic qualification that can be applied to the field of acoustics and the measurement and management of environmental noise b) has a minimum of three years of experience working in the field of acoustics and the measurement and management of environmental noise c) holds membership of grade Member or Fellow in the Australian Acoustical Society or membership of the Association of Australasian Acoustical Consultants, or international equivalent.
<p>Unreasonable emission</p>	<p>As defined under s.49 of the EP Act to mean an emission which unreasonably interferes with the health, welfare, convenience, comfort or amenity of any person.</p>