ProPG: Guidance for the Assessment and Management of Noise from Dog Kennels

ANC ACOUSTICS & NOISE CONSULTANTS

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1. Scope

This document provides guidance for the assessment and management of noise from dog kennels affecting noise sensitive receptors (NSRs). The guidance applies to noise sensitive uses, including but not limited to, residential dwellings, schools, hospitals, places of worship, and other premises where noise may adversely affect occupants.

The following kennel types/facilities are covered by this guidance:

- boarding kennels/dog hotels;
- breeding kennels;
- daycare facilities;
- dog schools/training/agility facilities;
- animal rescue kennels;
- farm kennels (for working dogs);
- hunt kennels; and
- veterinary practices/scientific premises.

Dog barking, whining, yelping and howling is hereon referred to as 'dog vocalisation' to capture wider dog sounds.

The following noise sources are included:

- dog vocalisation when dogs are located inside a building, which forms part of the facility during the daytime and night-time periods; and
- dog vocalisation when dogs are located in external exercise areas of the facility or being exercised.

For larger premises, noise from any associated traffic generation, industrial or commercial sources such as ventilation or heating plant etc., should be assessed using other methodologies appropriate to the type of source.

2. Introduction

This guide has been prepared by members of the Association of Noise Consultants' Noise from Dog Kennels Working Group (WG).

The principal authors of the guide were:

- Phil Evans, Savills (Chair of the WG)
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Other ANC members were involved in the working group and assisted during the drafting.

Background Information

According to industry estimates, there are currently between eight and nine million dogs in the UK and there is evidence that numbers are increasing. Dog kennelling and dog-daycare facilities provide an essential service for dog owners and aid the responsible keeping of animals. However, poorly designed and poorly managed facilities, or those located in highly sensitive environments, can give rise to adverse community response and result in statutory nuisance action against kennel owners.

From research by Brosnan and Pritchard (2016) [1], the number of dog boarding kennels in the UK and Ireland was estimated to be over 4,500, with an additional 1,000 animal welfare establishments. One of the key issues reportedly affecting such establishments was, as expected, dog barking, but including whining, howling and yelping [2]. It was reported that barking may be audible over extended distances, giving rise to potential disturbance at up to 500 m [3]. A number of dogs may contribute to an extended barking frenzy, which may result in adverse impacts at neighbouring dwellings [4 & 5].

The National Noise Attitude Survey 2012 [6], found that 82.6% of respondents heard dog noise and of these: 28.1% were bothered, annoyed or disturbed to some extent; 13.0% were moderately, very or extremely bothered, annoyed or disturbed; and 5.4 % were very or extremely bothered, annoyed or disturbed. Of the 21 categories listed within the 'When you are at home' category, under 'Neighbour Noise', dog noise received the highest levels of reported annoyance. While the category was simply labelled 'Dogs - and not specific to dogs barking or kennels – it nonetheless provides a useful indication of the level of human annoyance that can be associated with dog related noise.

Based upon the issues associated with dog kennels, there is a clear need for guidance as to how the noise issues should be addressed. A number of guidance documents have been produced. These are not nationally applied, however, and a consistent assessment methodology, assisted by a range of objective criteria, plus consideration of context, would help in both the planning, design and management phases of these facilities, and any complaint investigations.

With regard to applicable general legislation, the Animal Welfare Act [7] was implemented in 2007. The Act both streamlined and strengthened the legislation, to ensure greater protection for all animals under human care or supervision. It extended existing powers to introduce secondary welfare legislation, leading to new licensing conditions for dog and cat boarding establishments. New regulations, entitled The Animal Welfare (Licensing of Activities Involving Animals) (England) Regulations 2018 [8], require dog and cat boarding establishments to obtain an animal activities licence to be allowed to operate their business. The accompanying guidance, 'Guidance notes for conditions for providing boarding in kennels for dogs', does mention noise but not in sufficient detail to assist in noise assessments.

With regard to noise specific legislation, for England, Wales and Scotland, The Environmental Protection Act 1990, Part III Statutory Nuisances and Clean Air, Section (S) 79. Statutory nuisances and inspections therefore and S. 80. Summary proceedings for statutory nuisances [9] are directly applicable to noise nuisance cases. For Northern Ireland, The Clean Neighbourhoods and Environment Act (NI) 2011 S. 63 and 65 [10] are applicable. The above legislation is relevant at the time of publishing but, as is the case for any evolving topic, current versions/legislation should always be referred to.

This guide seeks to:

- outline current relevant legislation that applies to noise from dog kennels;
- consider the noise sources associated with dog kennels and seek to explain why the main source, dogs barking (vocalisation), is the most disturbing;
- provide kennel noise source terms/measurements of dog vocalisation to inform assessments of proposed facilities;
- provide a review of existing guidance;
- provide proposed methods of assessment for the main source (dogs vocalisation) and other sources;
- recommend suitable baseline data, attended monitoring, and measurement procedures as part of the assessment process;
- provide a range of assessment criteria to determine the significance of effects;
- provide elements which form contextual considerations;
- consider options for mitigation including the design and siting of new kennels; and
- provide guidance on preparation of a kennel noise management plan.

A list of references is provided in Section 10, together with a bibliography of other documents reviewed and considered when developing this guidance.

3. Literature Review

A literature review has been carried out by the WG to summarize the available research, documents and guidance available, in order to assist the preparation of this good practice guidance document.

The review covered noise impact assessment reports, available measurement data, enforcement appeal decisions, published research and planning guidance documents, plus various notes relevant to dog kennel noise. A summary of the findings is given in tabular form in Appendix A, and the relevant documents can be found in the list of references.

In terms of noise impact assessments, different acoustic consultancy organisations have adopted their own approaches. The Brosnan & Pritchard paper, published by the Institute of Acoustics, provides a good summary of the methods adopted in a sample of 14 company reports available up to 2016. These reports appeared in the public domain, as a result of planning application submissions in the UK and Ireland.

Many of the consultants applied BS 4142 2014+A:2019: *Methods for rating and assessing industrial and commercial sound* [11] assessment methods relative to background sound levels, despite the 1997 standard specifically stating that it was not applicable to dog barking noise, and that the 2014 scope excludes 'domesticated animals'.

Other organisations have referred to the following:

- World Health *Organization Guidelines for Community Noise 1999* [12];
- BS 8233:2014 *Guidance on sound insulation and noise reduction for buildings* [13];
- South Holland District Council's (SHDC) Supplementary Planning Guidance;
- Location of Premises for the Boarding & Breeding of Dogs & Other Animals [14;

One consultant used CIEH guidance intended for clay target shooting. All these different approaches were adopted in the absence of targeted guidance available at the time.

Despite the 2016 publication date, the WG considers the range and types of criteria adopted in the Brosnan & Pritchard review document to be consistent with current assessment methods.

Brosnan & Pritchard also conducted a survey of the wide range of approaches adopted by local authorities in the UK and Ireland, when assessing planning applications for boarding kennels. Whilst these also included BS 4142 methods, WHO guidance and SHDC guidance, planning controls involving minimum separation distances, night-time noise limits, management practices and 'no nuisance' conditions were introduced in the absence of official guidance.

Other organisations, such as the Animal Welfare Regulations and the Royal Environmental Health Institute of Scotland, tended to concentrate on providing advice on noise management plans and separation distances between kennels and residential locations, rather than providing guidance on how to assess noise from dog facilities.

Other useful documents in the public domain include the Sales et al. research into noise levels inside kennels [15], and the Causeway Coast & Glens Borough Council's (CC&GBC) technical guidance document on the Assessment of Noise from Dog Kennelling & Boarding Establishments in Northern Ireland [16].

The SHDC document provides a method for assessing the suitability of locations for dog boarding and breeding establishments, with open air runs. The SHDC document describes an activity $L_{Aeq,T}$ noise level and states that it represents one medium sized dog, in the open air, barking at a distance of 10 m for a cumulative period of 10 minutes in a 60-minute period. This thereby enables predictions to be conducted for any number of dogs at any given distance. The activity $L_{Aeq,T}$ noise level appears to have been based on measured data, and is considered by the WG to be a good basis for assessment.

The Sales et al. document covers a research study into reverberant sound levels inside kennels, housing between seven and 40 dogs. These kennels included shelters, training sites and research centres and the measurements were made at 0.6 m height in an empty pen alongside occupied pens, but it is unclear as to the relative locations of the dogs and the measurement positions. The document notes that maximum sound pressure levels above 100 dB(A) were measured at all sites. Typical night-time $L_{Aeq,2\text{-}min}$ levels varied between 58 and 75 dB(A), occasionally reaching 95 – 100 dB(A), and typical daytime levels were higher, reaching up to 105 $L_{Aeq,\ 2\text{-}min}$. To establish these values, 2 minute periods of maximum sound pressure levels and L_{Aeq} sound levels were measured consecutively for one or more periods of 24 hours.

The CC&GBC document details a method for predicting the annoyance effect of characteristic barking from proposed dog kennels and boarding establishments, so that Environmental Health Officers can evaluate planning applications. In the document a source noise value of 95 dB L_{AFmax} is considered acceptable outdoors, increasing to 100 dB L_{AFmax} indoors where larger dogs are to be housed or could be housed. To prevent adverse impacts at the NSRs, the document proposes that during daytime kennel operation, the maximum L_{Amax} sound levels at the NSRs should not exceed the existing background L_{A90} levels. For early morning, late evening and night time kennel operation, the L_{AFmax} sound levels at the NSRs should be at least 10 dB below the L_{A90} levels.

4. Source Data and Measurement Procedure

4.1 Source Noise

In order to conduct predictions of dog vocalisations, it is necessary to start with appropriate source noise levels, which can be based on direct measurements or library data available in relevant literature. It should be noted, however, that the library data for dog vocalisation activities varies considerably and can be significantly affected by a number of factors including size and breed of dog the dogs' welfare and stress levels and the dogs' environment including the effects of other dogs.

All measurement and library source data should be used carefully.

Some consultants rely on their own previously measured source noise data, or conduct measurements for site specific situations, whereas other consultants prefer library data. The use of library data over site measurements would err on the side of prudence, in cases where measurements are not representative, such as the kennel not full of dogs, better behaved dogs than usual, smaller or quieter dogs than usual, etc.

Where it is not practical to record direct measurement data, then an approach based on literature guidance such as the SHDC method, can be used, particularly in the case of a kennel housing a large variety of dogs, with a relatively transient population. As briefly described in Section 3, the SHDC method provides a research based noise level for a typical barking dog at a known distance for a known time period, which can be factored up for number of dogs and type of dog etc.

Some allowance needs to be included in the source noise term for the number of minutes of barking per reference time period and/or total barking events per dog, along the lines of a percentage 'on-time' correction.

The SHDC source data uses an on-time value for dog barking of 10 minutes per hour, by multiplying the number of dogs by a factor of 0.6, so as to assume that not all dogs on site are barking at the same time. In the two example calculations given in the SHDC document, the assumed 1/1 octave frequency band spectrum for one dog is increased by the number of dogs, multiplied by 0.6, to give the source noise term.

Reference 17 by one of the Authors of this ANC document, in a review of Local Authority dog kennel assessments, showed dog barking varying between 10 and 30 minutes per hour during the daytime and night-time periods. In the author's assessment, it was considered that 30 minutes of barking each hour (either continuous or intermittent) could be an excessive 'design case' and onerous on applicants wishing to build dog kennels. Obviously different 'on-times' can have a significant effect on the source noise term.

The CC&GBC technical guidance document considers that the L_{Aeq} unit does not 'characterise or represent the highly intermittent and impulsive nature of dog barking sound, as these are smoothed out over longer duration measurements', and notes that other approaches suggest limiting the 'on-time' to 5 minutes in the 1-hour reference period. Appendix 1 to the same document, setting out the Council's proposed assessment method for predicting the annoyance effect of dog barking, does not specify an 'on-time' correction and it does not it apply penalties for intermittency or impulsiveness.

The ANC Working Group considers that an on-time based on 10 minutes of barking in a 60-minute period is a good indicator for the assessment requirement. This can be adapted to the circumstances being investigated, such as the 10 to 30 minutes period mentioned

above under the reference 17 discussion, although the consultant should justify the reason(s) for the adaptation of this indicator. It can also be followed up by a review of completed assessments, once the guidelines have been in practice for a period of time.

In order to determine whether the SHDC data is realistic or not, one member of the ANC WG conducted an extensive set of measurements at a boarding kennels facility over a 4 day period.

The measurement location was on an area of grass within the courtyard of the boarding kennel facility. The open mesh fronted barrack style kennels formed an 'L' shape around the sound level meter position and, whilst the dogs were at various line of sight distances, an average measurement distance of approximately 8 m was considered appropriate. Ten dogs were within the vicinity and varied in terms of both breed type and size offering a good mix of dogs for analysis. The kennels did not contain any significant other acoustic features such as absorptive panels, partial barriers or glazing which may have required additional interpretation of the measured data.

The sound level meter was left unattended and set to record consecutive 15 minute measurements over the 4 day period. The total measurement period was about 75 hours, giving 299 samples that included three overnight periods, plus early morning, midday and afternoon feeding sessions. The sound level meter measured $L_{Aeq,15min}$, L_{AFmax}, $L_{A90,15min}$ with some 1/1 octave band frequency content from 8.0 Hz to 16.0 kHz for both the L_{Aeq} and L_{A90} parameters. The L_{A90} values assisted in identifying any other noise sources such as idling engines, grass cutting or generators which could be removed from the assessment. Fortunately, none of these extraneous sources were present. The boarding kennel's management was asked to note any incidences of unusual external or other site noise, but no unusual incidents were reported during the measurement period.

After careful analysis of the data and selecting the top 15% of samples, where the highest $L_{Aeq,15min}$ values coincided with the highest L_{AFmax} values, the number of data values was reduced to 31, and these values were considered to represent normal dog barking during daytime hours.

A graph of the sub data set for 10 dogs vocalising at 8 m distance is shown in Figure 1 in terms of 1/1 octave frequency band content. When these data are log averaged and corrected for distance (r) using a 10 log r/r_0 relationship, and corrected for number of dogs (n) using a 10 log n relationship, the resulting unweighted frequency spectrum for one dog barking at 10 m distance is provided in Table 1 below. This produces a level of 65 dB $L_{Aeq,T}$ at 10 m distance, with a corresponding maximum value of 90 dB L_{AFmax} at 10 m distance for 1 dog.

Table 1 - Unweighted Spectrum Distance corrected for 1 dog at 10m

Hz	31.5	63	125	250	500	1000	2000	4000	8000	L_{Aeq}
dB	42.9	37.7	35.1	48.3	62.5	63.0	55.5	43.4	30.6	65.2

The above assessment indicates that the published level of 66 dB L_{Aeq} at 10 m distance, provided by the SHDC guidance, is a reasonable one. The same assessment by the ANC member also considered that a modal value for of 92 dB L_{AFmax} at 8 m distance was a reasonable starting point. 92 dB L_{AFmax} at 8 m distance is equivalent to 90 dB L_{AFmax} at 10m distance.

4.2 Measurement Procedure

Where it is considered more appropriate to use direct measurement data, then this document provides guidance on the collection of site-specific data. Such cases include small kennels providing relatively long term boarding with known breeds, kennels used for breeding the same type of dogs, or facilities intended for behavioural training, all of which tend to have lower levels of dog barking than anticipated by the prediction approach.

An alternative approach is to play pre-recorded dog barking noise within the facility, calibrated to the levels measured at the original facility. Appropriate play back and amplification equipment is required for this, but it has the benefit of control over the source characteristics and noise levels, allowing appropriate levels to be measured and observed off site at the receptors. This approach is discussed further in Section 6.

It should be noted that the measurement method may depend on the purpose and scope of the assessment, and an outline approach may not be applicable or suitable for all situations. Measurement locations and durations should be determined on a case-by-case basis, taking into account the specific characteristics and conditions of the dog kennels and the surrounding environment. It is also recommended that the consultant liaises with the relevant local authority to agree the required measurement programme and assessment methodology. Table 2 below briefly sets out the suggested equipment and measurement requirements for measurements of source terms and baseline levels at affected NSRs.

Table 2 – Measurement Equipment and Requirements

Topic	**Measurement of L_{Aeq} Source Levels**	**Measurement of L_{AFmax} Source Levels**	**Measurement at NSRs**
Scenario	For example, to determine source noise levels associated with a potentially quieter than typical facility, such as behavioural training.	For example, to determine maximum source levels associated with a specific dog breed.	For example, where an assessment of an existing facility is preferred to predicted values from guidance.
Instrumentation	Class 1 sound level meter to BS EN 61672-1:2003 Class 1 calibrator to BS EN 60942:2018		
Measurement parameters	$L_{Aeq,\ 15\text{-}min}$ in octave bands from 63 Hz to 8 kHz should be sufficient in most cases.	L_{AFmax}	$L_{Aeq,\ 15\text{-}min}$ N.B. a shorter measurement duration may be appropriate at times particularly at night.
	Audio recordings can provide very useful information, as can other indices such as the L_{A90} which can help with the identification of other events or sustained noise sources throughout the measurement period.		

Conditions and interference	Measures should be taken to reduce interference from weather conditions, including wind and rain, such that no significant interference on recorded measurements is introduced		
	Measures should be taken to reduce any effects upon the dogs and vocalisation associated with the presence of the person carrying out the monitoring.	L_{AFmax} levels should be representative of peak vocalization periods. Appropriate animal welfare and health and safety protocols should be observed when dogs are in an agitated state.	Measures should be taken to reduce any effects upon the dogs and vocalization associated with the presence of the person carrying out the monitoring.
Location (for outdoor measurements)	Where possible/practicable, measurements should be taken with a direct line of sight to dogs. The average distance between typical locations of dogs and the measurement position should be 10 m. Measurements should be made at a height of 1.2 m above the ground and at least 3 m away from reflective surfaces.		Follow guidance provided in BS 4142, Section 6.2.
Location (for indoor measurements)	Cf. Measurement of Sound Levels in Buildings – ANC Guidelines – June 2020, Version 1.0.	Cf. Measurement of Sound Levels in Buildings – ANC Guidelines – June 2020, Version 1.0.	N/A
Measurement duration	As appropriate to the situation to obtain a representative source term of dog vocalisation.	As appropriate to the situation to obtain a representative source term of dog vocalization.	Duration should be appropriate to the circumstances and operating hours of the kennels. If full boarding over weekends, then the survey should span the weekend and a few weekdays. If weekday, daytime only, then a shorter survey should be sufficient.
			Measurements should be carried out under good, prevailing weather conditions.

The table is divided into four columns, with columns two and three dealing with measurements at the source location and column four dealing with measurements at the NSR. Examples of the scenarios are given in each case, together with suggested measurement units and frequency content, suitable measurement locations (outdoor & indoor), measurement duration periods, weather conditions and dog stimulation issues. Reference is made to the required standard of measurement equipment, with the ANC documents entitled 'Environmental Sound Measurement Guide' and 'Measurement of Sound Levels in Buildings' providing useful measurement advice.

5. Prediction Approach

Figure 2 provides a flow chart of the main issues that need to be considered in the prediction process. The flow chart starts with source noise data, which can be in different formats, and be dependent on the location of the dogs, either inside a building or outside in the run areas, and finishes with the predicted reception point noise levels. Two routes are shown depending on whether an internal or external noise source is being considered, and the different source noise formats include:

- overall sound power levels;
- sound pressure levels at a known distance;
- multiple distributed noise sources;
- single point noise sources; and
- single area noise sources.

The consultant will need to understand and validate the form of the source data and how the data is applicable to the situation under investigation. The data can be measurements from a similar facility, in the case of a planning application, or an existing facility, in the case of a complaint investigation. In all cases, the assessor should provide justification that the data is considered suitable and explain any modifications that may be needed.

In the case of internal noise sources, the attenuation properties of the building structure or enclosure need to be included, before the attenuation provided by the source to receptor distance propagation, topography, and intermediate screening of receptors are taken into account.

Some allowance, as described in Section 4, needs to be included in the source noise term for the number of minutes of vocalisation per reference time period (the 'on-time') and/or total number of vocalisation events per dog.

Further considerations should include:

- the relationship between the number of dogs and the amount vocalisation that each individual dog produces – does a calm dog influence other dogs to be calm, and does an excitable dog influence other dogs to be excitable? This may be a difficult question to answer, at the numerical stage of the assessment process, and the assessor may feel that it is more appropriate to tackle the problem in the context or uncertainty stages of the assessment process.
- The nature of the facility can have a significant impact on the extent of dog vocalisation assumed. Training classes for example cannot take place if there is any significant level of vocalisation. Conversely, an unmanaged doggie day care facility might create constant vocalisation, whilst a well managed facility with round the clock staffing could have much less vocalisation. Again, this could be addressed by modification of the source data and/or be considered under the context and uncertainty aspects.
- There is believed to be a rough correlation between breed size and vocalisation noise (bark) level. It needs to be understood, however, that dogs have traditionally been bred for a purpose. In some breeds, a loud vocalisation, or a propensity to vocalise a lot, is in the dog's nature/training regardless of size, and the opposite is equally true. If the facility is known to be used for a particular breed, then this will need to be considered.

Internal Sources

Where the development comprises internal facilities for dogs, the source noise data must be processed appropriately for the internal room acoustics. The intention will nearly always be to derive a representative external noise level, which is then propagated to NSRs in the surrounding environment. The prediction of noise from internal sources to external receptor locations should follow standard acoustic procedures, which are not within the scope of this document.

The result of this will essentially be an external source or series of sources with different positions and areas. External sources are discussed below.

External Sources

As well as the internal noise break-out discussed above, the sources of the noise will be the dogs' mouths. These are directional sources, but they are likely to be erratically-moving multiple sources and hence, directivity can usually be ignored. The sources will usually be spread over an area, often randomly, and hence it may be useful to provide the source as an area term or multiple non directional point sources. This would need definition based upon the number of dogs likely to be present within the area and their individual source terms. How each facility operates, or is likely to operate, however, should be well understood and the source terms developed accordingly.

The assumed source height above ground can be important, where there are barriers located close to the sources. There is obviously a degree variation in source height, so the assessor will need to select a height which is fair and representative. This might be a middle value, an average value, or a range of values etc. Note, however, that unless barriers are relied upon, and located very close to the sources, small variations in the assumed height are unlikely to make a significant difference to the outcome. The source height should be determined as appropriate for each facility.

Standard methods should be used for calculating the noise propagation, such as ISO 9613-2 [18]. There are well established software packages for the propagation of outdoor noise, but assessors must be competent in their use and application.

The assessor will need to consider how the noise will be perceived at the NSRs and calculated appropriately. Some examples are given below:

- for daytime, residential gardens and ground floor rooms are likely to be important, as well as higher floors in apartments and balconies or other sensitive upper internal or external floor areas;
- barriers at the receptors could be relevant, such as garden fencing, sheds, etc;
- schools or commercial receptor points such as offices may have non-openable windows; and
- for night-time, bedroom windows are likely to be more important than living room windows or external areas such as gardens.

Some issues are contextual ones and these are discussed in Section 7.

The cumulative noise levels from all sources at NSRs need to be appropriately calculated independent of the method used. If, for instance, internal and external facilities are used simultaneously, then the cumulative level from these activities will need to be calculated. If they are used separately, then they should be treated individually. They may of course be used in a half-in/half-out manner, which would also be an important scenario for the assessment process.

Other sources should be considered, if appropriate. Noise output from building services plant attached to the building, for example, is beyond the scope of this guidance and should be assessed using the BS 4142 methodology. Likewise, noise impacts from traffic movements associated with the facility, if potentially significant, should be calculated and assessed using other established methods.

6. Assessment Methodology

Introduction

Having described the prediction approach in the previous section, it is now necessary to provide a means of assessing the predicted or measured noise levels at NSRs against a suitable range of criteria.

The assessment process needs to consider both average L_{Aeq} levels and L_{AFmax} levels from dog vocalisation, with the former being applicable for daytime & night-time impact, and the latter involving an additional assessment method for night-time sleep disturbance.

For the L_{Aeq} method, it is proposed to adopt a BS 4142 type approach, whereby the L_{Aeq} value after correcting for the percentage on time is compared with the existing L_{A90} background sound level. For the L_{AFmax} method, it is proposed to adopt criteria based on a combination of WHO L_{AFmax} guidance, and comparisons with other L_{AFmax} sources that might be present at the time.

Both methods use outdoor sound levels from dogs, within kennel buildings or external exercise areas, to assess the likely effects of sound on people, who might be inside or outside NSRs. The L_{AFmax} method is primarily intended for night-time sleep disturbance, and should be undertaken in addition to the L_{Aeq} levels versus L_{A90} background sound level method.

For the purposes of standardising assessments, daytime should generally be taken as the period 07:00 to 23:00 hrs and night-time as the period 23:00 to 07:00 hrs. In some circumstances, the evening period might require separate consideration in which case daytime applies from 07:00 to 19:00 hrs and evening time applies from 19:00 to 23:00 hrs. Alternative periods may be necessary due to local circumstances but, if so, any deviation from the above should be explained and justified.

L_{Aeq} Levels Versus L_{A90} Background Sound Levels

The method involves comparing the predicted or measured 15 minute L_{Aeq} noise level at the reception point (including the on time correction), with the measured background L_{A90} sound level for the time period being assessed. It is then proposed to adopt a BS 4142 type approach, whereby corrections should then be applied for acoustic features of the dog noise at the NSR, to give a Dog Vocalisation Level (DVL). The acoustic features that need to be considered are:

- Impulsivity – a penalty of up to +9 dB for dog vocalisation that is highly perceptible at the NSR, reduced to +6 dB where the vocalisation is clearly perceptible, and +3 dB where it is just perceptible.
- Intermittency – a penalty of +3 dB for dog vocalisation that is readily distinctive at the receptor point. In this case, it is the intermittency that is being rated and not the overall audibility.
- Other sound characteristics - where it is none of the above but the dog vocalisation still has a distinctive character, up to 3 dB can be added as appropriate (for example this could be continuous pack howling for an extended period).

Based on the above values, there could be a maximum penalty of +15 dB, but this would only be applicable in the most extreme circumstances. The application of these acoustic features should be considered at each NSR.

The outcome of this DVL approach would be a 15-minute DVL for both daytime and night-time, with the 15 minute background L_{A90} level measured and reported in accordance with paragraph 8.1.3 of BS 4142.

The context of each NSR should be considered, as discussed in Section 7, and it may be necessary to assess the background L_{A90} sound level for different periods of the day. As a minimum, daytime and night-time periods should be considered separately, but it may be necessary to assess the evening period as well.

There are occasions when a NSR has been excluded from a NIA assessment and report, owing to a financial involvement with the dog kennels, such as family members living close by and working in the kennels. Such properties could be excluded from the NIA report, although the ownership of the property may change in the future and not have kennel staff. Thus the planning department would need to agree to certain properties being financially involved.

The numerical criteria for the assessment process are summarised as follows:

- For daytime, it is considered that no significant impact would arise if the DVL did not exceed the background L_{A90} sound level by more than around +5 dB(A).
- For night-time, it is considered that no significant impact would arise if the DVL did not exceed the background L_{A90} sound level.
- For the evening period, the baseline environment and context at the NSRs should be considered, and either the +5 dB(A) criterion should be adopted for less sensitive areas, or the 0 dB criterion should be adopted for more sensitive areas.

The above criteria are shown in Table 3, and Figures 3 and 4 allow for areas that have lower background sound levels by providing graphs of permitted DVL levels versus background levels. Figure 3 applies to daytime and Figure 4 applies to night-time.

Table 3 – Target noise levels for no significant impact of DVL (DVL minus Background Sound Level (LA90))

Daytime	≤5
Night-time	0
Evening (less sensitive)	+5
Evening (more sensitive)	0

L_{AFmax} Method

Dog vocalisations at night can result in sleep disturbance, and the DVL/LA90 assessment method does not necessarily address this issue satisfactorily. Thus, as part of a further consideration of impact, it is recommended that predictions or measurements of L_{AFmax} from dog vocalisation (without on time corrections) should be assessed against WHO guidance. BS 4142 does not provide any guidance on L_{AFmax} levels for industrial/commercial noise, so there is no application to dog kennel noise.

WHO guidance, as far as the L_{Amax} metric is concerned, applies to indoor sound levels, with reduced awakenings expected where maximum noise levels are ≤45 dB L_{AFmax}, 10 to 15 times per night. It assumes that partially open windows provide 10 to 15 dB attenuation, and thus the predicted or measured external noise levels from dog vocalisation need to be converted to internal levels, before comparisons with the 45 dB L_{AFmax} guidance. So, taking a worst case situation for the milder weather parts of the year, and assuming windows partially open, then an adverse impact could occur if L_{AFmax} levels from dog vocalisation regularly exceed the 55 to 60 dB range.

It may also be necessary to compare the dog vocalisation L_{AFmax} levels with the existing L_{AFmax} levels from other external sources that might be present, with a 5 dB difference being the maximum exceedance for a significant impact. In this case, the prominence of the dog vocalisation levels relative to the other noise sources is the critical factor, since an occasional dog vocalisation alongside a busy main road should not be an issue. Again, context needs to be considered, including the frequency content of other noise sources.

Other Noise Sensitive Receptors

The above methods apply to the external façade location or the internal room location, but there may be situations where private gardens or amenity spaces require assessment for the daytime and evening periods. For such cases, the extent to which the DVL increases the existing ambient noise level ($L_{Aeq,T}$) needs to be investigated first. Depending on context, there may then be a need to consider fixed reference levels, such as the WHO outdoor level guidance of 55 dB $L_{Aeq,16hour}$ for serious annoyance and 50 dB $L_{Aeq,16hour}$ for moderate annoyance.

Conversion of an Existing Building to a Dog Kennels

For the case where an existing structure is being converted into a dog kennel facility, and the sound insulation of the structure is unknown or complex, an approach adopted by one member of the WG involved the use of pre-recorded dog vocalisations within the premises. This procedure required the installation of speakers in each kennel to simulate the presence of barking dogs. Pre-recorded dog vocalisation data was then played through each speaker and the volume adjusted to ensure that the L_{Aeq} and the L_{AFmax} levels were comparable with the SHDC dog barking noise source data.

Should the consultant adopt this method, then the resulting noise levels should be measured at the noise-sensitive receptors during both daytime and night time periods, unless the recordings cannot be detected outside the building façade at a short distance. The report needs to provide, however, a detailed description of the methods employed and the rationale behind them.

7. Context

Context is an important part of any assessment and is particularly important in the assessment of noise from dogs. BS 4142 offers useful advice, much of which is also relevant to this guidance. In the commentary to Section 11 of BS 4142, it states:

"The significance of sound…depends upon both the margin by which the rating level… exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context."

The numerical assessment stage is what BS 4142 describes as the *"initial estimate"* of impact, clearly recognising that the assessment continues, and is dependent on a range of factors, many of them subjective. This section considers many similar aspects of context. The following factors are likely to be the most important aspects of context in most situations. It is up to the assessor to discuss and justify what is relevant for each location, i.e. for each NSR being assessed.

1. The absolute sound level

An area with high levels of noise, which residents already find disturbing or stressful, could be made worse by persistent or even intermittent audible vocalisation, even if the comparative initial estimate suggests a lower impact.

Conversely, many commercial dog facilities are located in rural areas far from any busy roads, where there are exceptionally low background levels (20 dB L_{A90} or less is not uncommon for night-time). An initial estimate might suggest significant adverse impact, but in reality, the noise may be effectively negligible inside a bedroom.

BS 4142 does not dictate what constitutes a high or low background noise location, and the assessor should use their judgement and justify their views. WHO level values and/or BS 8233 type values, adjusted appropriately for the assessment period/s and character, provides some guidance, however, although this generally applies to steady noise sources.

2. The character and level of the residual sound compared to the character and level of the specific sound/DVL.

It is unlikely that the sound of dogs vocalising could be considered as "anonymous" or "without character". There may be situations, however, where the vocalising could be more or less disturbing based on the characteristics of the residual noise climate.

Transient events will often have little effect on the background sound level. Dog vocalisation, for example, is unlikely to contribute to the L_{A90} background sound as long as it occurs for less than 90% of the measurement time period. This could mean a lot of existing barking being effectively ignored by the assessment process.

The same situation can apply to other transient events such as animals on farms or other commercial settings, wild animals, intermittent traffic, etc. The dog vocalisation under investigation would normally have a significant effect, however, on the $L_{Aeq,T}$ and L_{AFmax} levels used in the initial estimate. The initial estimate of impact on a continuously quiet area, versus the impact on an area with up to 90% of the existing noise climate being barking or other transient events might be very similar, but the actual impact in the context of the latter situation is likely to be far less.

3. The sensitivity of the receptor

Under the same point, BS 4142 discusses the sensitivity of the receptor as being dependent on whether the receptor has habitable rooms exposed to the noise under investigation, enhanced sound insulation built in, or ventilation allowing windows to remain shut, etc. In the foreword, BS 4142 also refers to *"local attitudes to the source of the sound and the character of the neighbourhood"*. This might be particularly pertinent to dog vocalisation, but is a critical element for the assessment. The following paragraphs provide guidance:-

- **The character of the area**
  The character of the area means the ability of the existing acoustic environment to accommodate any noise generated by the kennel facility without giving rise to adverse amenity impacts, when taking into account the nature of receptors. If the environment is a busy, urban setting with high ambient noise levels and frequent incidences of highly characteristic noise, then dog vocalisations are likely to have a lower impact than in a relatively quiet residential or rural setting.

- **The legitimacy of the use**
  A kennel facility which does not have permission to operate may result in the local community being more sensitive to dog vocalisations, and more resistant to changes such as retrospective planning applications.

- **Past reputation**
  Residents may have been sensitised by a poorly managed facility. They may, for instance be resistant to a new operator, despite assessments suggesting low impact. Conversely, a well operated facility which has never caused significant disturbance may have the support of locals in the case of expansion plans.

- **Implementation of best practicable means (cf. Section 9)**
  A long established facility which appears to be implementing noise control measures, but has short periods of excitable dog vocalisation, such as at feeding time, might be considered less disturbing than a facility where the operator is making less effort to control noise.

4. The time(s) of day/week/year

Consideration may need to be given to the difference between constant vocalisation every day (and night) of the week, and a situation where vocalisation can occur for significant but limited periods. An obvious example would be excitable feeding times, where barking occurs for perhaps 20 minutes twice a day. In terms of context, this may, dependent upon the time of day, have less impact than all day vocalisation.

The final comment in this section is illustrated by the ANC Technical note on BS 4142 [19]:

"There is no theoretical limit to how the context can or should influence the impact assessment, but any alteration of the conclusions of an assessment due to the context should be sufficiently explained and justified for the specific circumstances in question."

In other words, context is a crucial element of the assessment process. It is not a method for making an assessment suit the needs of the stakeholder in question, however. The process is likely to be subjective and perhaps debatable, so all contextual assumptions and conclusions should be fully explained and justified.

8. Uncertainty

It is good practice to consider the uncertainty that can arise through various aspects of any assessment method. There are degrees of uncertainty associated with the instrumentation used for monitoring, measurement techniques, the variables influencing measurement results such as transmission path and weather conditions, source terms in the modelling/calculation approach, and the subjective response of residents to the noise source.

Uncertainty due to instrumentation has been significantly reduced with the advancement of modern instrumentation, field calibration checks on sound level meters (before and after each measurement period), and all instrumentation within acceptable laboratory calibration intervals. Furthermore, the meter(s) and calibrator(s) should have traceable laboratory calibrations, with generally annual calibrations for calibrators and biannual calibrations for sound level meters.

Care must be taken to check that the measurement positions are representative of the noise climate at the NSR.

Every effort should be made to reduce the uncertainty of the baseline sound level measurements. This can be achieved through selection of appropriate survey durations. Furthermore, representative baseline sound levels should be post processed for the most appropriate periods, and the most appropriate statistical parameter, so as to provide precautionary and robust assessments. For example, this could be the 25th percentile amount of all data collected during the surveyed period for the proposed hours of operation, excluding periods of rain and high wind. It is recommended that meteorological conditions are observed and reported over the measurement period(s), with particular attention to wind speed, wind direction and rainfall.

Calculation/assessment uncertainty considerations can be assisted, where possible by peer review of all baseline data, model input data, model results and subsequent calculations, and by using the appropriate level of precision at each stage of the assessment process.

The noise criteria promoted in this guidance document reflect the results of the literature review discussed in Section 3, and the considerable experience of the Working Group, but the subjective response to any assessment results will be dependent on a wide range of factors. Further guidance on uncertainty is provided in Section 10 of BS 4142.

9. Design & Management of Dog Kennel Facilities

This section provides guidance for dog kennel facilities in terms of the design and construction of kennel buildings, and the manner by which dog vocalisation can be minimised by means of a Noise Management Plan (NMP). The measures described below may not be necessary for all facilities, but the need for control should be considered through an appropriate risk assessment at the planning stage.

Building Design Considerations

New kennels

The following aspects should be considered, as appropriate to each facility and where necessary to reduce noise breakout:

(a) Kennel buildings to be located as far as possible from NSRs, and orientated to provide maximum shielding of the outdoor exercise areas to the NSRs.

(b) Individual cages and exercise areas to be located at centre of building so that they are surrounded and shielded by other parts of the kennel complex such as offices, reception room, toilets etc.

(c) Companies selling individual kennel units tend to offer cages which are primarily partially enclosed naturally ventilated compartments, intended to separate the dogs from each other, and are not designed with acoustics in mind. In these situations, full height partitions can be used between individual cages, with high attenuation roof structures or false ceilings. Other companies offer fully enclosed cages which can provide some potential noise reduction at source.

(d) Where appropriate/necessary and effective, external exercise areas should be surrounded by a solid imperforate fence with an acoustically specified height/mass to provide the required mitigation.

(e) Main kennel building should be, for example, constructed of solid masonry or double layer timber walls, with double glazed windows and a solid roof with good sound insulation properties. Solid masonry or twin leaf timber stud should provide in excess of 40 dB Rw.

(f) Noise from building services equipment & kennel ventilation plant should be assessed using BS 4142.

(g) Where necessary, all vents or openings in the building facades should be fitted with suitable attenuation measures, and all main access doors should be solid core or well glazed with a minimum mass/unit area of 20 kg/m².

(h) Acoustic absorptive panelling can be fitted to the underside of ceilings to help reduce reverberant sound.

(i) Ideally kennelled dogs should not be able to see or hear external exercise areas or access routes to such areas.

Existing dog facilities with expansion plans or where improvements are needed

The following design considerations are suggested for controlling noise emissions, bearing in mind that lightweight structures such as existing agricultural buildings or other out-buildings, in isolation, are unlikely to provide sufficient acoustic insulation :-

(a) Existing roof to be upgraded with additional mass layers or suspended ceiling.
(b) Existing walls to be upgraded to double layer cavity constructions.
(c) Existing windows and doors to be upgraded acoustically.
(d) Each cage to have separate doors/flaps to central corridor
(e) Screen dogs from passing road traffic, visitor arrivals and movement of staff.
(f) Locate any building extensions on the side of the existing building furthest from the nearest NSRs.
(g) External runs to be located as far as possible from the nearest NSRs, with acoustic shielding provided by the existing buildings and extensions.
(h) Surround external exercise area with a solid imperforate fence and an acoustically specified height/mass to provide the required attenuation.

Noise Management Plans

When planning applications are submitted to local authorities, environmental health officers often request NMPs to supplement the information provided on kennel design and construction. This is often in addition to the noise assessment report but is necessary because most kennels will have an external dog exercise area as well as the internal accommodation areas.

Since dogs vocalisations in the external exercise area are likely to generate higher noise levels than from the internal accommodation areas, management control is essential in minimising dog vocalisation levels if the noise assessment indicates that disturbance at nearby NSRs is likely.

A good NMP should include the following measures, where appropriate for the specific facility:

(a) Dogs should be confined to their individual cages at night between the hours of 21:00 and 07:00.
(b) A staff member should live on site at night and attend any dog barking during this period.
(c) Dog cages to be securely locked at night and any stimulants removed, i.e. lights turned off. Windowless inner sleeping areas to control dog sleeping patterns may be required. This approach avoids dogs waking early and becoming active in the early sunrise summer months. Dark sleeping areas enable the kennel owners to control how dogs perceive morning time. Sometimes low level background music may be beneficial as a calming influence.
(d) Staff should not disturb dogs at night unless there is an emergency.
(e) Community liaison should occur so that local residents can raise concerns etc. NMPs should include details of a letter drop to local residents with a 24 hour contact number. This will allow complaints to be immediately answered and rectified on site if possible. Environmental Health Officers generally appreciate businesses with a proactive complaints management procedure.

(f) A complaint response system should be introduced, i.e. all complaints should be logged and actions taken to be noted.

(g) Dogs should be exercised singularly or in pairs whenever possible and necessary within the context of the facility.

(h) Dogs should be fed separately in their own cages.

With regard to item (a), a dog breeding situation may require puppies to be housed with their mothers for a period of time. Daytime and night-time period definitions can vary between local authorities & night-time confinement may be conditioned under the planning permission. With regard to items (g) and (h), dogs that know each other well may be housed with 2 to 4 dogs per pen and exercised accordingly. This may occur when a number of dogs are from one family so they live together, and any separation would not be advantageous or humane.

It is worth noting that planning departments can grant temporary planning permission. If a planning application exceeds target noise levels and the Environmental Officer is undecided, applicants can apply for time-limited permission (e.g. one year) with a noise management plan. This approach is especially relevant for dog schools/training/agility facilities, where setup costs are typically lower than for kennels.

10. References

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11. BS 4142 2014+A:2019: Methods for rating and assessing industrial and commercial sound.
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18. BS ISO 9613-2:2024 - Acoustics — Attenuation of sound during propagation outdoors — Part 2: Engineering method for the prediction of sound pressure levels outdoors.
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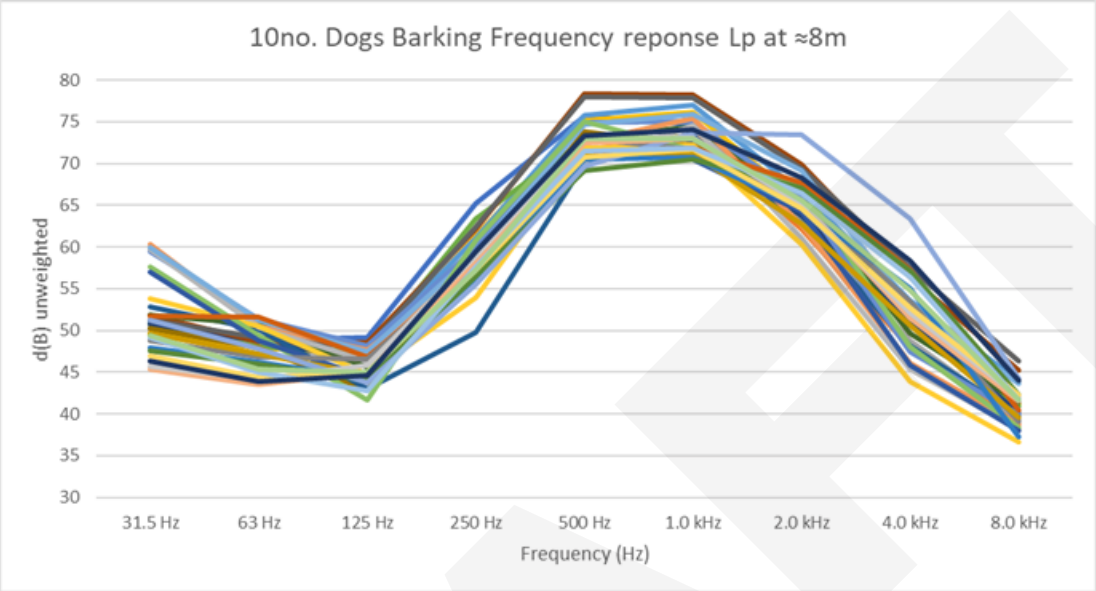

Figure 1: A graphical representation of the sub data set of 10 dogs barking at ≈8m

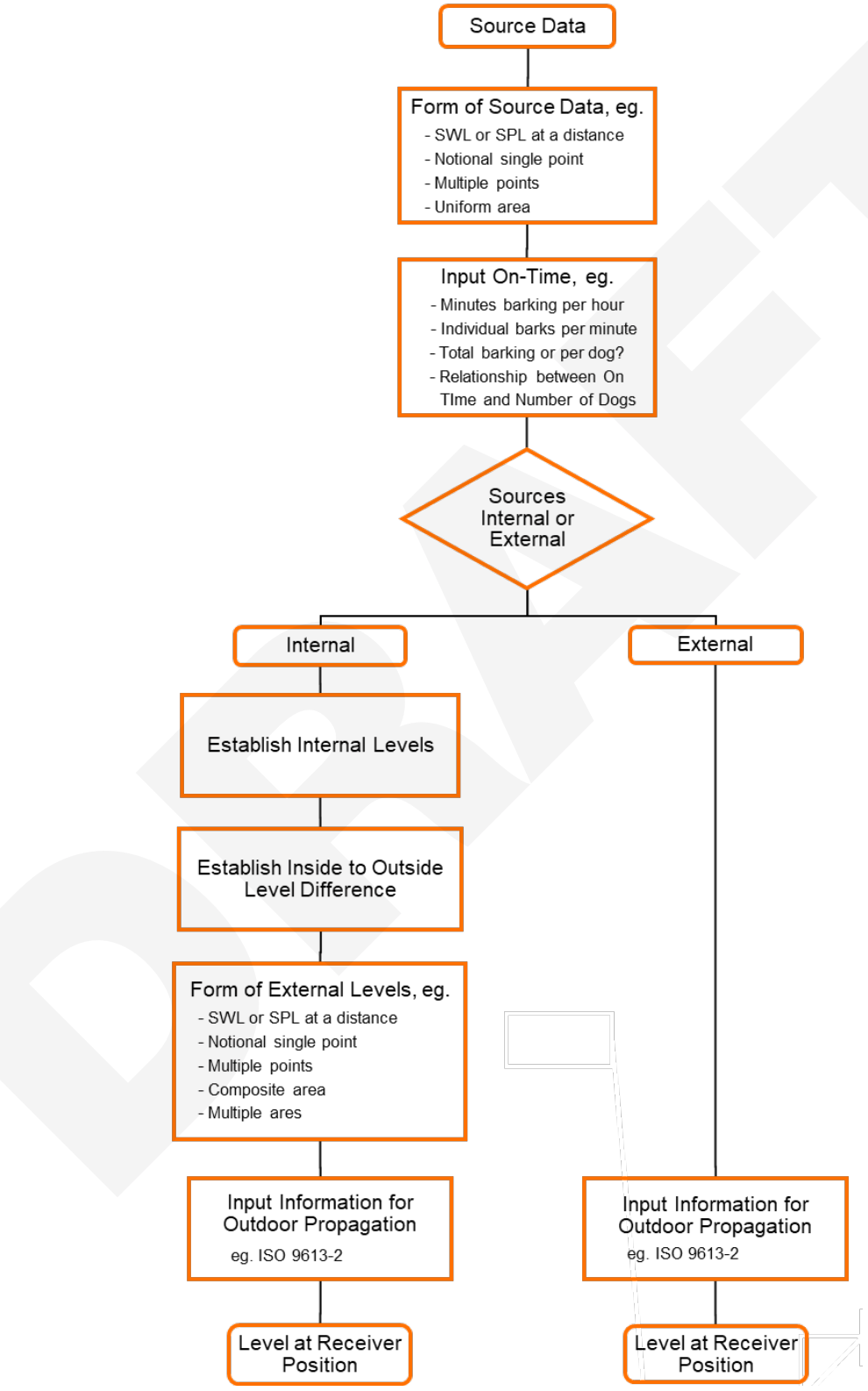

Figure 2 - Flow Chart for Prediction Process

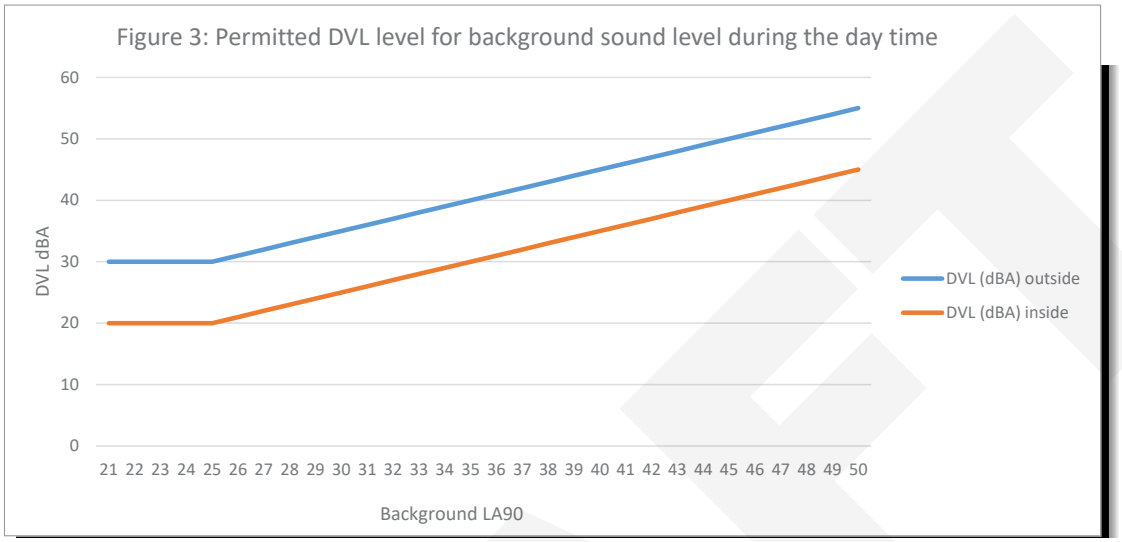

Figure 3: Permitted DVL level for background sound level during the day time

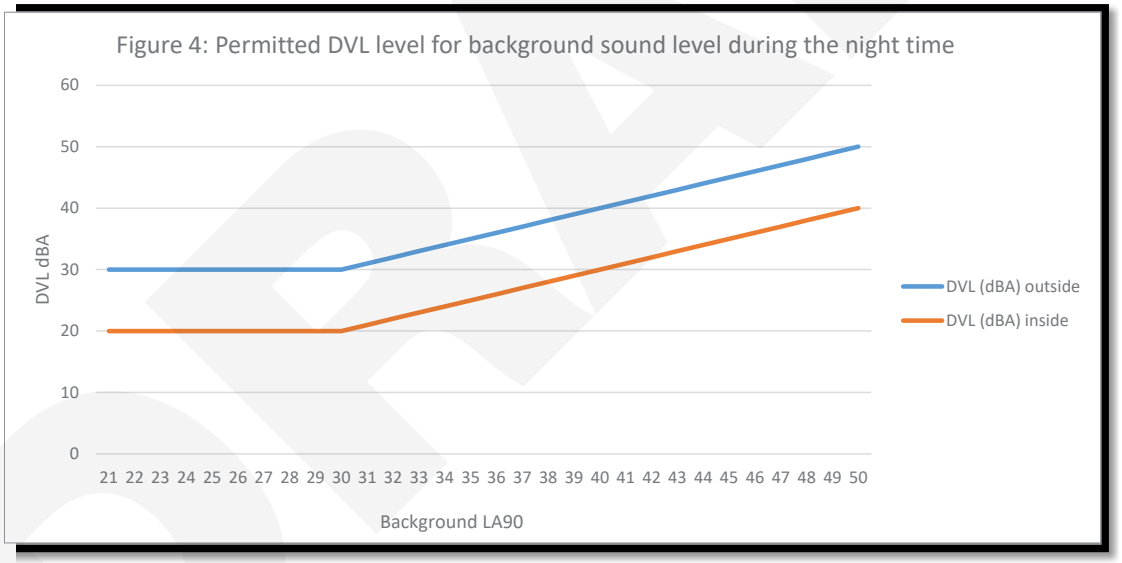

Figure 4: Permitted DVL level for background sound level during the night time

Appendix A - Bibliography

Year	Document	Author	Document Type	Comments
1999	Location of Premises for the boarding and breeding of dogs and other animals	South Holland District Council	Planning Guidance	Provides calculation method for source noise based on number of dogs, prediction method, and criteria that noise does not exceed the background sound level.
1996	Noise in Dog Kennelling	UFAW	Research	Summary of internal measurements within dog kennels. L_{Aeq} levels between 70 and 105 dB and L_{Amax} levels up to 125 dB.
2019	The assessment of dog barking noise from kennels	University of Derby	Research	Collates a summary of approaches adopted by noise consultants.
2014	Commercial Day Boarding Guidance	The Royal Environmental Health Institute of Scotland	Guidance	Separation distances are advised to avoid incompatible development.
2012	The Moray Council v Andrew Deshwar Debidin	Sherrif Susan Adiel Olgilvie Raeburn, QC	Legal Judgement	Council and Consultant on behalf of dog owner carried out assessments; consultant used 55 L_{Aeq} and 45 L_{Amax} events, council used BS 4142. The court ruled in favour of the owner – citing BS 4142 as inappropriate.
Undated	Licensing conditions and guidance for dog boarding kennels	Vale of Glamorgan Council	Guidance	Guidance on management of noise and design of kennels and buildings.
2020	Noise impact assessment	Acoustic Associates	Noise impact assessment	SHDC criteria used based on a measured baseline and source extrapolated to full capacity.

2018	The Animal Welfare Regulations 2018	Guidance	Guidance	Provides guidance with regards to noise management plans and the avoidance of excessive noise levels.
2012	NIA – Proposed residential development	Wardell Armstrong	Noise impact assessment	WHO guidelines used for criteria, with source levels of 100 dB(A) SEL at 1 m and one bark every 2.2 seconds.
2004	Dog noise as a risk factor for hearing loss among police dog handlers	Occupational Medicine	Research	1 minute L_{Aeq} values range typically between 98 – 105 dB with 114-119 L_{Amax} level based on worst-case dog handling activities.
2019	Discussion of consistent and robust means of considering noise from dog kenneling / boarding establishments	Environmental Health representatives	Guidance	Considers BS 4142 to be inappropriate, with L_{Amax} preferred over the use of L_{Aeq}. Source level of 95 dB – 100 dB dependent on size of dogs.
2019	Change of use of domestic garage to commercial kennels up to 8 dogs, Castle Farm, Walworth	PINS	Ruling – Appeal decision	WHO criteria applied based on in-site measurements.
2013	Dogs Trust Re-homing centre, Wickhamford, Evesham	Hepworth Acoustics	Noise impact assessment	Criteria based on comparison of existing ambient and background sound levels, $L_{Aeq,\ 1\ hr}$ of 69 dB at 10 m used based on measurements from similar site.
2012	Barkerleigh Boarding Kennels, Whitworth	Miller Goodall	Noise impact assessment	BS 8233 and WHO criteria used, source levels based on measurements taken at site.

2018	Ballymather Road Dog Kennels, Crumlin	Irwin Carr Consulting	Noise impact assessment	BS 4142, WHO and 8233 levels considered including max noise events. Sound power level of 84 dB(A) and 6 min per hour on-time considered.
2021	Moss Side Stables, Cockerham	Martec Environmental Consultants Ltd	Noise impact assessment	SHDC and BS 8233 criteria applied. Source levels 16taken from pr17evious measurements; internal reverberant level of 85 dB LAeq adopted.
2016	Noise assessment for residential planning assessment near existing kennels	Peak Acoustics	Noise impact assessment	BS 8233 and L_{Amax} levels considered as criteria based on measured levels at site boundary.
2021	Planning Noise Advice Document	Sussex	Planning guidance	Proposes the use of BS 4142 with additional reference to BS 8233 and WHO.
2019	Sound impact assessment for the erection of Dog Kennels and Log Store	Soundguard Acoustics	Noise impact assessment	SHDC criteria used for L_{Aeq} with BS 8233 and CIEH Clay target guidance used to assess L_{Amax} levels. Used SHDC method for L_{Aeq} source and own measurements (90 dBA at 10 m) for the L_{Amax} level. Includes a character penalty for impulsivity referencing BS 4142
2019	Farra Road Craigavon Kennels	FR Mark & Associates	Noise impact assessment	BS 8233 / WHO criteria used, based on reverberant level in Kennel of 98 dB L_{Aeq} and 107 L_{Afmax}.

1996	Noise in Dog Kennelling	Universities Federation for Animal Welfare		
2020	Environmental noise assessment for a proposed residential conversion of outbuildings at Chimneys, Creeton Road, Little Bytham, NG33 4PU	Acoustic Associates		
2018	The Animal Welfare (Licensing of activities involving animals) (England) Regulations, Guidance notes for conditions for providing boarding in kennels for dogs	Department for Environment, Food & Rural Affairs		
2019	Draft note of meeting of Environmental Health representatives to discuss a consistent and robust means of considering noise from dog kennelling/boarding establishments	Antrim & Newtonabbey Borough Council		
Ninth Impression 2005	Flakt Woods Guide to Noise Control. 5th Edition	Flakt Woods		
2021	Dog Kennels Noise Impact Assessment Reports - The Challenges & A Way Forward.	Environmental Health Scotland Vol 33, Number 2 Summer 2021		