



Pre-consultation Guidance: Back-up Electrical Generators

Notes

References in this document are referred to as numbers that have been written in superscript against the text. Explanatory notes are given where necessary at the bottom of a page and referred to by a superscript letter in the text.

1. Introduction

As described in the Environmental Authority's (EA) Operational Policy #9¹, fixed and moveable back-up electricity generation sets ("gensets") that cannot be moved by hand are defined as Controlled Plant under the Clean Air Act 1991. A construction permit (CP) and an operating licence under the Clean Air Act 1991 must be issued by the Environmental Authority (EA) in order to install and operate such a genset.

In order to obtain a CP and OL, an application form and fee must be provided to the Pollution Control Section of the Department of Environment and Natural Resources (PCS-DENR). The application is reviewed and presented to the EA for consideration. The EA has set guideline limits for sound levels and standards for air emissions from gensets that are used to inform its decisions on whether or not to approve an application.

Before purchasing and installing a genset it is strongly recommended that the applicant fully understands the EA's requirements by reading this document and the supporting document on sound level modelling².

2. Genset Air Emissions Standards

In general, modern liquefied petroleum gas (LPG) gensets from reputable manufacturers meet Bermuda's air quality standards and the EA's requirements. Diesel-fired gensets, however, have a greater potential to pollute the air and so must meet the following conditions: 1) they must be fuelled by ultra-low sulphur diesel; and 2) they must be US EPA certified on emissions (or meet an equivalent certification). Proof of US EPA-certification (or equivalent) must be provided with the genset OL and CP application.

3. Sound Level Guidelines

The EA's guideline values are based on those set by the World Health Organisation and those by the Government of California (see reference 1 for further details). Sound levels from a genset should not exceed the guideline values at the exterior wall of a neighbouring building. The sound level guideline values (in units of dBA^a) are shown in Table 1.

^a The "loudness" of sound to the human ear is generally measured in units of dBA (A-weighted decibels).

Land Use Category	Time Period	Sound Level
Residential	Night (10 pm to 7 am)	45 dBA
	Day (7 am to 10 pm)	55 dBA
Office/Commercial	Any time	65 dBA
Industrial	Any time	70 dBA

Table 1. Sound guideline values for different times of the day and land use categories.

Although the daytime and night time residential guideline values are shown, in practice the night-time limit of 45 dBA should be considered only, as gensets are typically used continuously over 24 hours during periods of interrupted mains electricity supply. The EA will apply the night time limit only, unless there is a strong case to do otherwise.

It is the responsibility of the applicant/applicant's agent to undertake an assessment (see Section 5 below) of the likely impacts of sound from the genset to the nearest neighbours before making an application for a CP and/or OL. The assessment should be submitted to DENR along with the CP and/or OL application form/s.

4. Genset Enclosures

Gensets must have at a minimum (i) sound enclosures and (ii) critical-grade silencers. Options for installing sound enclosures and exhaust silences are generally provided by the genset supplier and it is strongly recommended that these options are explored before placing an order for a new genset. The following is an example of the types of exhaust generator silencers that are generally available for gensets:

1. Industrial Grade - Chamber Type: The silencer has an average 12-18 dBA reduction in engine exhaust noise.
2. Residential Grade - Chamber Type: The silencer has an average 18-25 dBA reduction in engine exhaust noise.
3. Critical Grade - Multi-Chamber Type: The silencer has an average 25-34 dBA reduction in engine exhaust noise.
4. Hospital Grade - Multi-Chamber/Absorptive Type: The silencer has an average 35-40 dBA reduction in engine exhaust noise.

A variety of sound enclosures are also available. The specifications and terminology for these enclosures can vary from manufacturer-to-manufacturer and within a product range. Sound-dampening enclosures might be referred to as: "soundproofed version," "weather enclosure," "sound enclosure"; DENR recommends that advice is sought from your supplier to enable identification of the appropriate sound enclosure.

Once the genset make and model, sound enclosure and critical-grade silencer have been identified, the specification sheet for both LPG and diesel gensets usually states the expected sound level. Manufacturers typically measure sound levels at a distance of 23 ft (7 m) at several locations surrounding the genset and calculate the average. The average sound level measured under full load is used as the "starting value" to predict sound levels from a given genset at the nearest neighbours' exterior wall (see below).

5. Assessing the Impacts of Sound from Gensets

The first step in estimating the sound levels from a genset is to find out the sound produced by the generator when it is operating at full load. The second step is to predict how that sound level will change as it propagates from the source to the surroundings.

5.1 Sound Produced By the Generator

This is the sound that is generated by the motor and other components of the generator, which can be reduced in the first instance by using a silencer and sound enclosure (see above).

5.2 Sound Level Modelling

The sound level at a given distance from a generator will depend on the:

- Sound produced by the generator; and
- Sound attenuation (reduction) from natural or man-made features and barriers and due to the distance over which the sound travels.

Sound attenuation and reflection are well understood and suited to being modelled using computer software.

PCS-DENR recommends the use of MAS Environmental's free noise mapping software MASdBmap version 0.5, which is available here: <http://www.masenv.co.uk/dbmap>. PCS-DENR has field-tested this software and found that predictions can be accurate to within ± 2 dBA, depending on the complexity of the situation. DENR has prepared detailed guidance for use of this software in a separate document². A trained analyst should be able to undertake a full modelling exercise in approximately 1 hour (depending on the complexity of the situation). The modelling results can be saved online, with a unique internet address, and images and input parameters can be readily incorporated into a short modelling package to be submitted electronically to support the CP and/or OL application form.

5.3 Using Modelling Results to Inform Designs

The MASdBmap software allows the user to experiment with the location of a genset and to model the effects of features such as walls or buildings on the sound levels at the nearest neighbours'. This flexibility could provide important information to support planning designs or even which genset model to order. It is therefore recommended that sound level modelling be completed prior to or in conjunction with drawing up architects plans for all developments that include a genset.

5.4 Review by DENR

The results of sound modelling should be submitted to PCS-DENR electronically to support applications for CPs and/or OL. A standard format is given in reference 2, DENR will review the packages and advise the applicant as necessary before the application is presented to the EA for consideration.

6. Sound Level Measurement Survey

Sound level measurement surveys measure the sounds from gensets at different locations using purpose-built instruments. Sound level surveys are undertaken in response to complaints, or when it's necessary to demonstrate compliance with Environmental Authority Policy #9.

More details about undertaking sound level measurement surveys can be obtained by contacting PCS-DENR via pollutioncontrol@gov.bm.

7. Further information

Further information is available via email on pollutioncontrol@gov.bm).

References

1. Environmental Authority Operational Policy #9: Emergency Back-Up Electrical Generators: Exhaust Emissions And Exterior Sound Guidelines
2. Department of Environment and Natural Resources (2019). Guidelines for Undertaking Generator Set Sound Modelling