RRSA Energy Drive Sound Study

Contents

1 Scope

This document applies to Rolls-Royce Solutions America's Energy Drive Research and Development facility and the planned expansion of the test capabilities. The expansion is intended to allow for testing the new "Core" generator sets, the inclusion the paralleling lag (currently located at Power Drive) and additional outdoor test sites for ongoing product development.

2 Purpose

RRSA is planning a significant expansion to its Research and Development facility at 1711 Energy Drive, Mankato, MN as part of its overall growth plan. Due to the nature of the expansion, there is potential risk in increasing sound propagation from the facility.

The purpose of this document is to state the expected operational sound levels for the Energy Drive Load Bank(s). Specifically, the new load bank, the 16 and 20V core generator sets, and low power range (LPR) units tested outside. Furthermore, in stating the expected sound emission levels, RRSA is demonstrating its intention and ability to meet the Minnesota State statute 7030.0040.

Furthermore, as the site work and much of the equipment will not be completed or available until mid-2026 or later, and it will not be possible to measure the sound emission of the equipment until final installation, RRSA is proposing sound mitigation strategies that can be implemented if the sound values exceed expectations and fail to meet Minnesota State requirements.

3 Requirements

Minnesota statute 7030.0040 lists the following requirements:

Noise Area Classification	Daytime		Nighttime	
	L50	L10	L50	L10
1	60	65	50	55
2	65	70	65	70
3	75	80	75	80

Figure 1 MN Sound Level Limits dB(A)
(Minnesota Administrative Rules, 2026)

Additionally, the classification area is based on the land use of the receiver. RRSA intends to meet the L50 requirement for all planned equipment as this is the stricter requirement. The most stringent sound requirement is the residential zone (Classification 1) directly West of Energy Drive facility. The Sakatah Trail to the West of the Facility is considered a Classification 2 for “recreational activities”. The approximate distances from the respective noise sources to potential receivers are shown in Figure 2. Additionally, the L50 sound requirement is shown at the location of a potential receiver.

Figure 2 Noise Distance Limits
(Beacon Schneider Corp, 2026)

4 Energy Drive Future State

The primary features of the Energy Drive expansion include:

- 5 MW Resistive Reactive load bank
- Enclosed 20V4000X Core unit for up to 4000 kWe
- Enclosed 16V4000X Core unit for up to 3250 kWe

- Expanded outdoor test area for genset paralleling demonstrations and unit test runs. The units run in these locations will be comprised of our (LPR) models and will rotate depending on project status and unit availability. The test pad is intended to support a range between 30 – 900 kWe.

5 Methodology

5.1 Methodology Test Pad Genset Noise

ISO 8528 is the international standard governing Generator Sets and Part 10 details the methodology for measuring airborne generator set noise. The number of microphones used is outlined in the standard and varies between 9 and 19 microphones depending on envelope size. However, the measurement distance between each microphone and the generator set is always 1 meter.

Additionally, most large generator set manufacturers also publish generator set sound values at 7 meters and this is a common parameter for customers to compare and differentiate competitors. RRSA also measures its generator sets at this distance utilizing 8 points surrounding the generator set at 7 meters.

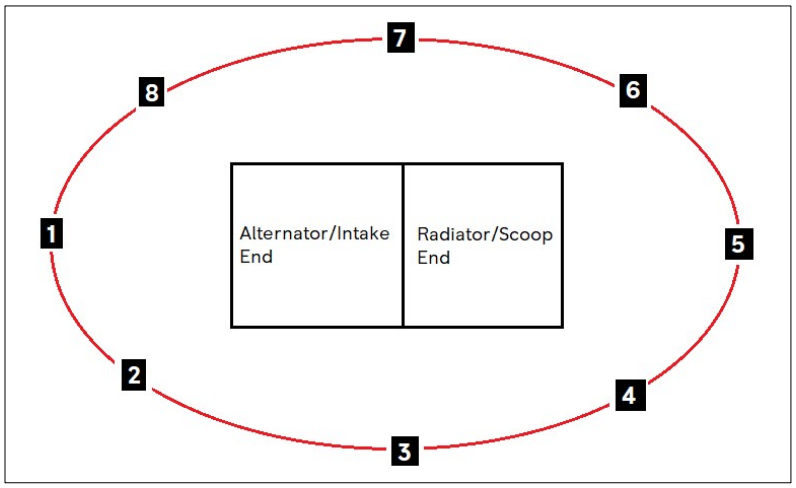

Figure 3 7-meter test diagram

Therefore, RRSA has extensive sound data for all its “LPR” product line as it routinely measures airborne noise following both the ISO 8528 – 10 “1-meter” standard and the industry standard “7-meter”.

This knowledge can be used to estimate the sound beyond 7 meters by utilizing the sound propagation inverse square law:

$$dB_2 = dB_1 + 20 * log_{10}(\frac{R_2}{R_1})$$

(Sound Propagation - the Inverse Square Law, 2026)

Given RRSA’s extensive data on its generator sets and the planned rotation of the units on the outdoor test pad, this is a reliable method for predicting the sound levels regardless of which generator set(s) is operating.

5.2 Methodology Core Units

The 16V and 20V Core units are new engines and generator set designs. Therefore, RRSA has no current sound data on the units or enclosures and will not have the ability to measure any data until after the first unit is built up, which is currently planned for mid-2026. However, RRSA has experience and sound measurements with the existing 16V and 20V product models and third-party enclosures. This data can be used in combination with predicted values to estimate the sound values of these units.

5.3 Methodology Load Bank

The load bank will be new to RRSA and will not be delivered until 2027, and the supplier does not have sound data available. However, the load bank design will be very similar to the load banks used at Power Drive, so RRSA can make estimates for the new Load Bank based on measured values from Power Drive.

6 Sound Estimates

6.1 Test Pad Estimates

RRSA targets 74-76 dB(A) at 7 meters (23 ft) for its maximum sound attenuation enclosure on its LPR generator sets and meets this limit (or better) currently on all LPR genset models. Since the outdoor test pad is intended for the LPR generator sets, RRSA can ensure that the 7-meter average sound emission of any generator set installed on the test pad will be at most 76 dB(A).

Figure 2 shows the nearest residential zone is approximately 190 ft from the closest genset source. At this distance, and expected maximum sound level, RRSA expects that the noise level will be 57.6 dB(A). Likewise, utilizing the distance shown in figure 2, RRSA expects that the sound level observed on the Sakatah Trail will be 56.6 dB(A). These values are shown in Figure 4.

6.2 Core Unit Estimates

RRSA partners with housing manufacturers to build the enclosures for its S4000 products and frequently conducts sound testing as part of Factory Acceptance Testing of the completed enclosed unit and to demonstrate compliance with customer noise requirements. These units are typically designed to meet 80 – 85 dB(A) at 7-meters and history has shown that these enclosures can meet this requirement.

Utilizing the distances from Figure 2 and the expected sound level of 80 dB(A) from the core units, RRSA expects the noise level to be 58.3 dB(A) at the nearest residential zone receiver and 60.1 dB(A) to the nearest receiver on the Sakatah Trail.

6.3 5 MW Load Bank Estimate

The new load bank for Energy Drive will be very similar to the load banks currently used by Power Drive test bays 1 and 3. These load banks have vertical discharge and sound attenuating panels to minimize noise emission, and this design will carry over to the Energy Drive load bank. Furthermore, the noise emission of Test Bay 3 was measured, and the 7-meter sound value was less than 78 dB(A).

As shown in Figure 4, RRSA expects the sound level from the load bank to be 57.3 dB(A) to the nearest receiver (Residential and Sakatah Trail).

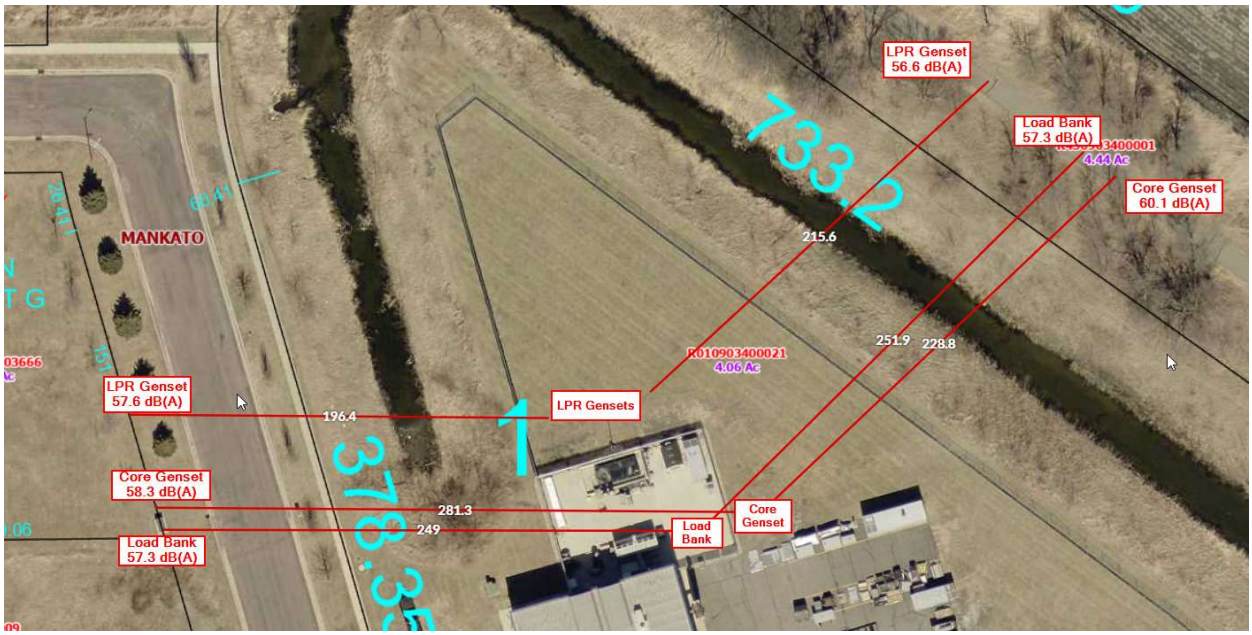

Figure 4 Energy Drive Sound Expectations

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7 Mitigation Strategies

While RRSA provided the above sound estimation to the best of its ability, the actual sound numbers will not be known until after the units and supporting equipment are installed and operational. Therefore, if the actual sound numbers exceed the limit stated in MN state law, RRSA has proposed the following mitigation strategies.

1. No overnight running of any units or equipment that exceed the nighttime limits.
2. Installation of additional sound attenuation panels.
    a. RRSA has experience utilizing sound attenuation panels within its generator set enclosures. These can be utilized with either the generator sets or load bank to further reduce sound propagation when needed.
3. Sound attenuating barriers
    a. Sound attenuation barriers can be constructed to reduce sound emission from enclosure intakes or outlets
    b. Can be built strategically and as needed
4. Direct / redirect sound emission to minimize sound to nearest neighbors and reduce reflected noise
5. Minimize time operating both Core units simultaneously
    a. It is unlikely that both Core units will be operated at the same time. However, if there is a need to operate both at the same time, RRSA will ensure that the overlapped runtime is as short as possible.

8 Summary

RRSA has reviewed the available sound data for the new equipment planned for Energy Drive expansion in combination with historical experience and expects it will comply with the Minnesota sound regulations. Additionally, RRSA has planned mitigation strategies to reduce noise emissions from the new equipment if it exceeds the sound limits specified in Minnesota State statute 7030.0040.

9 References

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