Exhibit SAD1-10

Memorandum

To: Salisbury AD 1 Project File

From: Jason Ross, Director of Noise and Vibration

Date: September 28, 2018
Project #: 58073.00
Re: Section 248 Sound Assessment

INTRODUCTION

Salisbury AD 1, LLC ("Salisbury AD 1") proposes to construct and operate an anaerobic digester ("AD") project at the Goodrich Farm in Salisbury, VT. The project received a Section 248 Certificate of Public Good ("CPG") from the Vermont Public Utility Commission ("PUC" or "Commission") on April 8, 2016 ("the As-Approved Project").[1] Lincoln RNG is no longer pursuing development of the project, and will transfer the CPG to Salisbury AD 1, subject to the Commission's prior approval. Salisbury AD 1 has revised the As-Approved Project's design in various respects ("the Proposed Modifications"), resulting in the Final Project. This study evaluates whether the Final Project would result in incremental impacts above the As-Approved Project such that it would cause an undue adverse impact under Section 248(b)(5).

Sources of sound considered previously by the As-Approved Project included 1) vehicles, 2) the biogas production plant including a long arm vertical mixer used to feed the fermenter tank and enclosed mechanical equipment such as motors, gearbox, and pumps, and 3) the upgrade unit which is an enclosure with compressors inside. The sound study for the As-Approved Project concluded that sound from the stationary equipment would be 36 dBA at the nearest residence 800 feet away and that this would be below the World Health Organization (WHO) nighttime noise guideline of 40 dBA (which was applied in the Section 248 review of the Vermont Technical College Biodigester Project, Docket No. 7965). *See Exh.* LRNG-DS-15.

This sound assessment evaluates sound based on the Final Project Design (Attachment C) which includes the following additional sound-generating equipment: the combined heat and power (CHP) building, and a backup generator. This sound assessment also includes the Final Project's flares. Flares were also proposed in the As-Approved Project, but were not included in the prior sound assessment. The following presents the sound prediction methodology, sound level prediction results and assessment according to applicable criteria, and conclusions. Information on sound level concepts has been included in an Appendix to this memorandum.

METHODOLOGY

The methodology used to assess potential effects of sound from the operation of the Final Project includes identifying noise-sensitive receptors in the study area, predicting future sound emissions from the operation of the Final Project, assessing the potential for undue sound conditions, and evaluating the need for mitigation, if necessary.

Operational sound from the Final Project has been predicted using Cadna-A sound prediction software, which is an internationally-accepted sound prediction program that implements the International Standards Organization 9613-2 sound propagation standard. This model takes into account the sound emissions of equipment, ground cover, terrain,

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[1] *See* Docket #8596.

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and intervening objects such as buildings. The following summarizes the sound emissions and locations of the proposed equipment for the Final Design based on the Project Layout Comparison Plan (Exh. SAD1-3):

- CHP sound emissions are based on measurements conducted at a CHP used for a similar biodigester project at "Jordan Farm" with a Siemens SFE-36SL engine which is a smaller sized engine than what is proposed for this project. The CHP also includes sound attenuation from an exhaust silencer and sound generated by radiator fans, exhaust fans, and an engine gas chiller. The total maximum sound emissions of the CHP is 96 dBA at 3 feet.
- A Kohler 500REOZJ emergency generator with a sound enclosure (Level 2) which generates a maximum sound pressure level of 93 dBA at 3 feet.
- Small utility flares generate a maximum sound pressure level of 64 dBA at 3 feet based on measurements for a similar project.
- A biogas upgrade enclosure including compressors that generates a maximum sound pressure level of 85 dBA at 3 feet.
- The long arm vertical mixer associated with a Weltec Biopower biogas plant, which was proposed for the As-Approved Project, generates a maximum sound pressure level of 66 dBA at 3 feet. The digesters for the Final Project design are assumed to generate a similar sound level.

It has been assumed that all equipment except for the emergency generator would operate simultaneously and continuously during the day and night. Since it assumed that all equipment operates continuously, maximum sound levels have been predicted, If the CHP unit is not operating then the emergency generator would operate instead of the CHP along with all other equipment. Therefore, two conditions have been assessed; one including the CHP and one including the emergency generator.

During the Project's operation, food waste would be delivered via haul trucks, and pumped or dumped directly into the hydrolyzer. The operation of on-site vehicles such as food waste delivery trucks would generally be short-term events occurring only during the day. Since sound from these vehicles would be similar to existing sound from trucks traveling on Shard Villa Road, but substantially farther away from residences, it would not cause an undue adverse sound condition.

Sound Level Predictions

Sound levels have been predicted at four off-site residential receptor locations on Shard Villa Road (i.e., not including on-farm trailers or homes). Maximum sound levels have been reported; however, since these sources of sound are generally continuous the results are also representative of energy-equivalent (Leq) sound levels. Therefore, the maximum sound levels reported are considered a worst-case condition. As shown in Table 1 and Figure 1, maximum sound levels from the Final Project, including all of the proposed sound-generating equipment without the emergency generator would range from 32 to 33 dBA with a maximum sound level of 33 dBA at the nearest receptors (R1, R2, and R3). With the emergency generator operating instead of the CHP, the maximum sound levels would range from 37 to 38 dBA with a maximum sound level if 38 dBA at the nearest receptors (R1, R2, and R3).

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Table 1. Sound Level Results

ID	Receptor Location	Operations with CHP Sound Level (Lmax, dBA)	Operations with Emergency Generator Sound Level (Lmax, dBA)
R1	574 Shard Villa Rd	33	38
R2	490 Shard Villa Rd	32	37
R3	465-467 Shard Villa Rd (two homes)	33	38

SOUND LEVEL ASSESSMENT

The WHO "Night Noise Limits for Europe" guidelines, which were previously used to assess whether the As-Approved Project would result in undue adverse sound conditions, are a target outdoor night noise guideline (NNG) level of 40 dBA (Leq) to protect the public, including the most vulnerable groups such as children, the chronically ill, and the elderly. As with the As-Approved Project, exterior sound levels from the Final Project would not exceed the WHO guideline.

Maximum sound levels from the Final Project would be approximately 33 dBA or less at the exterior building locations of all residential receptors without the emergency generator and 38 dBA or less with the emergency generator. Sound levels inside of the homes would be even less than the exterior levels presented in Table 2. Therefore, sound generated by the Final Project would not result in an undue adverse sound condition.

CONCLUSIONS

As presented herein, the Final Project design is consistent with the As-Approved Project in that it will not result in undue adverse impacts due to noise. The sound generated by the proposed facility would be below the WHO nighttime noise guideline (40 dBA). We also conclude that the design of the Final Project is not materially different than the As-Approved Project. The As-Approved Project predicted sound levels up to 36 dBA at the closest residential receptors. The predicted sound levels from the Final Project based upon this study including the CHP, emergency generator, and small utility flares would be up to 33 dBA without the emergency generator and up to 38 dBA with the emergency generator. Without the emergency generator, sound levels would be 3 dBA quieter for the Final Project design compared to the As-Approved Project. With the emergency generator, the Final Project design would be 2 dBA greater. Humans cannot typically perceive sound level increases of less than 3 dBA. Therefore, the change in sound conditions with the emergency generator is not materially different than the As-Approved Project

ATTACHMENTS:

1. Figure 1 – Sound Assessment Receptor Locations

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APPENDIX

SOUND LEVEL CONCEPTS

Sound is the rapid fluctuations of air pressure above and below ambient pressure levels. Noise is defined as unwanted or excessive sound. Sound becomes unwanted when it interferes with normal activities such as sleep, work, communication or recreation. How people perceive sound depends on several measurable characteristics including:

Sound Level - Sound level is based on the amplitude change in pressure and is related to the loudness or intensity. Human hearing covers a wide range of changes in sound pressure amplitude. Therefore, sound levels are most often measured on a logarithmic scale of decibels (dB) relative to 20 micro-pascals. The decibel scale compresses the audible range of acoustic pressure levels, which can vary from the threshold of hearing (0 dB) to the threshold of pain (120 dB). Because sound levels are measured in dB, the addition of two sound levels is not linear. For example, adding two equal sound levels results in a 3 dB increase in the overall level. Research indicates the general relationships between sound level and human perception are as follows:

- A 3-dB increase is a doubling of acoustic energy and is approximately the smallest difference in sound level that can be perceived in most environments.
- A 10-dB increase is a tenfold increase in acoustic energy and is generally perceived as a doubling in loudness to the average person.

Frequency - Sounds are comprised of acoustic energy distributed over a range of frequencies. Acoustic frequencies, commonly referred to as tone or pitch, are typically measured in Hertz. Human hearing generally ranges from 20 to 20,000 Hz; however, the human ear does not perceive sound levels from each frequency as equally loud. A frequency filter known as A-weighting is commonly used to evaluate environmental noise to compensate for this phenomenon in perception and sound levels are denoted as “dBA” accordingly.

- Sound levels reported in octave or one-third-octave frequency bands are often used to describe the frequency content of different sounds. Some sources of sound can generate ”pure tones” which is when there is a concentration of sound within a narrow frequency range such as a whistle. Humans can hear pure tones very well and such conditions can be a cause of increased annoyance.

A variety of sound level descriptors can be used for environmental noise analyses. These descriptors relate to the way sound varies in level over time. This study uses the following sound metrics:

- Maximum sound level (Lmax) is the highest value that is generated by a source of sound. Table 1 presents a list of the maximum sound levels of common outdoor and indoor sources.
- Energy-Average Sound Level (Leq), which is a single value that represents the same acoustic energy as the fluctuating levels that exists over a given period of time. Leq is commonly used to describe environmental noise and relates well to human annoyance.
- Day-Night Average Sound Level (DNL) which is representative of a 24-hour period with a 10-decibel penalty for sound levels occurring during the night. Some guidance documents define noise limits in DNL.

Table 1. Sound Levels of Common Outdoor and Indoor Sources

Outdoor Source	Sound Level (dBA, Lmax)	Indoor Source
	110	Rock Band at 5 m
Jet Over Flight at 300 m	**105**	
	100	Inside New York Subway Train
Gas Lawn Mower at 1 m	**95**	
	90	Food Blender at 1 m
Diesel Truck at 15 m	**85**	
Noisy Urban Area-Daytime	**80**	Garbage Disposal at 1 m
	75	Shouting at 1 m
Gas Lawn Mower at 30 m	**70**	Vacuum Cleaner at 3 m
Suburban Commercial Area	**65**	Normal Speech at 1 m
	60	
Quiet Urban Area-Daytime	**55**	Quiet Conversation at 1 m
	50	Dishwasher Next Room
Quiet Urban Area-Nighttime	**45**	
	40	Empty Theater or Library
Quiet Suburb-Nighttime	**35**	
	30	Quiet Bedroom at Night
Quiet Rural Area-Nighttime	**25**	Empty Concert Hall
Rustling Leaves	**20**	
	15	Broadcast and Recording Studios
	10	
	5	
Reference Pressure Level	**0**	Threshold of Hearing

Source: Highway Noise Fundamentals. Federal Highway Administration, September 1980.

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0 100 200 400 Feet

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Legend

Receptor Locations

Figure 1
Sound Assessment Receptor Locations

Source Info