BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF SOUTH DAKOTA

IN THE MATTER OF THE APPLICATION BY CROCKER WIND FARM, LLC FOR A PERMIT OF A WIND ENERGY FACILITY AND A 345 KV TRANSMISSION LINE IN CLARK COUNTY, SOUTH DAKOTA, FOR CROCKER WIND FARM	))))))	EL 17-028

DIRECT TESTIMONY OF

EDDIE DUNCAN

ON BEHALF OF

CROCKER WIND FARM, LLC

Q. Please state your name and business address for the record.

A. My name is Eddie Duncan, and my business address is RSG, Inc., 55 Railroad Row, White River Junction, Vermont, 05001

Q. Can you briefly describe your education and experience?

A. I am Director of the acoustics practice at RSG. I am Board Certified in Noise Control Engineering by the Institute of Noise Control Engineers. I am a member of the Acoustical Society of America where I have served as a member of the Technical Committee on Architectural Acoustics for 10 years. I have 15 years of experience in the field of acoustics with much of that experience measuring, modeling, and analyzing noise from renewable energy sources and power transmission projects. I regularly present papers at professional societies on the topics of noise from renewable energy projects, power transmission project, and modeling and monitoring methodologies.

I hold a M.S. in Environmental Studies from Green Mountain College, where I focused on environmental law and policy, specifically noise pollution policy, and I hold a B.S. in Engineering Science from Rensselaer Polytechnic Institute, where I focused acoustics.

Q. Have you attached a resume or CV.

A. Yes.

Q. Have you previously submitted or prepared testimony in this proceeding in South Dakota?

A. No.

Q. What is the purpose of your direct testimony?

A. The purpose of my testimony is to report the results of a noise compliance assessment of the Project which RSG conducted.

Q. Which sections of the application are you responsible for?

A. I oversaw the noise compliance assessment provided in Appendix D of the application which was used to inform Section 15.3 titled, Existing Noise – Wind Farm, and Section 15.5.3 titled, Noise-Analysis – Wind Farm.

Q. Can you describe the information contained in Section 15.3, Existing Noise-Wind Farm?

A. Yes. Section 15.3 provides a summary of background sound levels and typical sources that were monitored within the project area. It also provides examples of sound levels created by various sources. Typical sound levels expected by construction of the Project are discussed and the noise standard contained within the Clark County zoning ordinance is identified.

Q. Please describe how background sound levels were monitored within the project area.

A. Background sound level monitoring was conducted throughout the area to quantify the existing sound levels around the project. Three locations were monitored to determine existing background sound level. The locations of the three monitoring sites are identified in Appendix D of the application. Monitoring locations were selected to represent different areas and different soundscapes (i.e. unique sound characteristics) within the project.

Background sound level monitoring was conducted with ANSI/IEC Type 1 and Type 2 sound level meters that were set to log, at a minimum, A-weighted sound levels once each second for the entire measurement period. The monitors were installed at the site on November 9, 2016 and collected data continuously for seven days. In addition to sound

level data, wind speed data was collected at each monitor location at microphone height. Additional information on how monitoring was conducted is provided in Appendix D of the application.

Q. What types of sounds were monitored as part of the background sound in the area?

A. Common existing sources of sound in the project area are wind rustling through vegetation, roadway traffic, aircraft overflights, occasional farming operations, and biogenic sources such as birds and insects.

Q. What are the existing background sound levels in the project area?

A. As discussed in Appendix D of the application and summarized in Section 15.3, background sound levels varied both temporally and geospatially in the project area. Background sound levels were similar at two of the three monitor locations with daytime sound levels with daytime equivalent continuous sound levels (L_{EQ}) over the entire monitoring period of 41 to 44 dBA and nighttime L_{EQ} over the entire monitoring period of 36 dBA. The third monitor location, what is referred to as Monitor A in Appendix D, was located at a more agriculturally active location, so the daytime and nighttime L_{EQ} over the entire monitoring period was 50 and 52 dBA, respectively.

Q. Please describe the information contained in Section 15.5.3, Noise-Analysis – Wind Farm.

A. Section 15.5.3 discusses the general types of sounds associated with the construction and operation of the Project. It also provides an overview of the projected sound levels at area residences based on sound propagation modeling that was completed as part of the noise compliance assessment. This Section contains a conclusion that the projected sound levels from the preliminary turbine layouts will not exceed the Clark County noise limit

of 50 dBA at residential receptors.

Q. Can you describe the types of sounds that may be associated with construction of the Project and when that would occur?

A. Yes. Equipment that may be used to prepare each turbine site include typical site preparation equipment such as loaders, excavators, and dozers. There will be cement deliveries and pours for the foundations, and lift cranes for construction of the towers. Since construction will occur primarily during daylight hours and take place primarily at each tower site which are setback from residences, potential construction impacts will be minimized.

Q. Please describe the types of sound that may be associated with the operation of the project.

A. Wind turbines emit audible sound. The sound can be split primarily into two categories: aerodynamic sound from the flow of air around the blades, and mechanical sound produced by mechanical and electrical components within the nacelle. In modern wind turbines, sound from the nacelle has been mitigated by design to reduce the transmission of internal sound. Thus, the primary source of sound associated with wind turbines is aerodynamic sound from the blades. The Project will also involve a sound from a proposed transformer at the collector substation.

Q. How are sound levels from the operation of the project modeled?

A. Modeling for the Project was conducted in accordance with the standard ISO 9613-2, "Acoustics – Attenuation of sound during propagation outdoors, Part 2: General Method of Calculation." The model takes into account source sound power levels, surface reflection and absorption, atmospheric absorption, geometric divergence, meteorological

conditions, walls, barriers, berms, and terrain. ISO 9613-2 assumes downwind sound propagation between every source and every receiver, consequently, all wind directions including the prevailing wind directions, are taken into account. The acoustical modeling software used for this project was CadnaA, from Datakustik GmbH. CadnaA is a widely accepted acoustical propagation modeling tool, used by many noise control professionals in the United States and internationally.

Sound power level data provided by the manufacturer for each of the potential turbines included in the assessment (Gamesa G126 2.625 MW, GE 2.5-116 LNTE, Vestas V110 STE 2.0 MW, & Vestas V136 3.45 MW) was used as input into the model. The sound power level for each turbine varies with wind speed, so the maximum rated sound power level for each turbine model was used in the assessment with the addition of a 2 dB uncertainty factor typical of manufacturer specifications. Based on the other inputs described above that define the propagation path, a projected sound pressure level is then calculated for each receiver or residence throughout the project area. The analysis includes a separate model run for each potential turbine model/array. That is, there are four model runs presented in the assessment in Appendix D of the application, the G126, the GE 2.5-116 LNTE, the V110 STE, and the V136.

Q. What are the results of the sound propagation model?

A. With all turbines operating at their maximum rated sound power level, all residences are projected to be at an L_{EQ} of 50 dBA or less from the Project, and the average across all residences is 38 to 43 dBA depending on which turbine model/array is selected.

Q. Do the model results comply with the sound level limits set forth in the Clark County Zoning Ordinance?

A. Yes.

Q. Do the model results comply with the sound level limits identified in the Draft Model Ordinance for Siting Wind Energy Systems developed by the South Dakota Public Utility Commission?

A. Yes.

Q. Have you reviewed the list and maps of proposed tower locations in the application?

A. Yes.

Q. How are your comments and conclusions related to each of those locations individually?

A. As designed, the proposed tower locations are based on the turbine model that is selected. My comments and conclusions are based on the aggregate sound levels from all turbine locations used for a turbine model, assuming that all turbines within the project are operating at their maximum rated sound power level, simultaneously.

Q. If any of the turbine locations were to change for a turbine model, would your comments and conclusions change?

A. They may.

Q. Why may your comments and conclusions change?

A. If a turbine was simply removed from the layout, my comments and conclusions would not change. If, however, an additional turbine was included in the layout, or a turbine was moved to a new location, then the projected sound levels at residences near the new turbine location may change.

Q. Do you have any specific concerns about moving tower locations?

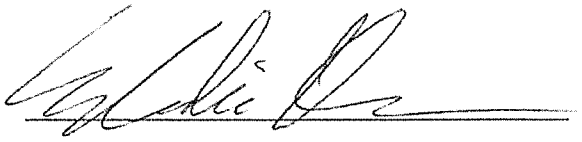
A. My conclusion would not change as a result of a new or moved turbine location provided

that the sound levels at residences do not exceed 50 dBA on an equivalent continuous sound pressure level basis based on the Clark County zoning ordinance and PUC recommended limits for wind energy systems.

Q. Does this conclude your written pre-filed direct testimony?

A. Yes.

Dated this 10th day of October, 2017.



Eddie Duncan