

## **EXHIBIT I: NOISE EMISSIONS AND COMMUNICATION INTERFERENCE**

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As stated in Arizona Administrative Code R14-3-219:

*“Describe the anticipated noise emission levels and any interference with communication signals, which will emanate from the proposed facilities.”*

## **BACKGROUND AND EXISTING CONDITIONS**

This section discusses potential noise, radio and television interference, and electric and magnetic fields associated with a 230kV transmission line. Corona discharge from electrical transmission lines generates audible noise, and radio and television interference. Current and voltage associated with electric transmission lines transmit energy and produce magnetic and electric fields.

### **CORONA**

Corona is a luminous discharge that emanates from an energized conductor due to ionization of the surrounding air and is caused by a voltage gradient, which exceeds the breakdown strength of air. Corona is a function of the voltage gradient at the conductor surface. This voltage gradient is controlled by engineering design and is a function of voltage, phase spacing, conductor diameter, conductor bundle, height of conductors above ground, line geometry, and meteorological conditions. In particular, irregularities on the surface of the conductor such as nicks, scratches, contamination, insects, and water droplets increase the amount of corona discharge. Consequently, during periods of rain and foul weather, corona discharge increases. This corona activity contributes to a small increase in power loss and is the source of transmission line audible noise and radio and television interference. For the various transmission line designs considered for the Abel-Moody 230kV Transmission Project, the maximum calculated voltage gradient at the conductor surface is 15.4kV/cm, a value approximately 15 to 20 percent lower than corona inception and extinction levels. Successful operation of 230kV transmission lines with similar gradients indicates that the Abel-Moody 230kV Transmission Line would only create modest corona effects.

### **AUDIBLE NOISE**

#### **Transmission Lines**

Audible noise associated with transmission lines is a result of corona discharge and is a function of line voltage. The amount of audible noise is directly related to the level of corona activity, which in turn is affected by the conductor's physical condition and contamination and meteorological conditions, most notably rain. Transmission line audible noise is characterized by crackling, frying, sputtering, and low frequency tones, which are best described as humming sounds. Audible noise from transmission lines primarily occurs during foul weather conditions. Audible noise increases during dust storms or rain events, although it is generally masked by the background noise of rain and wind. In dry or fair weather conditions, the conductors operate below the corona-inception level and noise is typically inaudible or only slightly audible at the edge of the transmission line right-of-way.

For a double circuit 230kV transmission line on a steel pole in the vertical conductor configuration, the calculated audible noise values at the edge of the right-of-way are:

- Fair Weather Range – 6.4 to 35.9 db(A)
- Wet Conductors 50-Rain – 46.1 db(A)
- Heavy Rain L5-Rain – 55.9 db(A)

The line noise will be minimal at the edge of the right-of-way during fair weather. Considering the relatively few hours of audible noise producing weather that occurs in the PSA, the location of the proposed Project alignments primarily in non-residential land use areas and the calculated audible noise levels during foul weather, no serious audible noise problems are expected even during foul weather.

Ambient noise within the PSA includes noise from transportation along major and minor roads, aircraft, agricultural activity, and industrial activity. Noise from construction activities would be audible, particularly to the closest residents in the subdivisions along the proposed alternatives. This construction noise, however, would not be considered to be a major impact, because construction would occur during daytime hours when tolerance to noise is higher and likely to be considered only a nuisance. Except for Maricopa County, all jurisdictions within the PSA have noise ordinances that restrict stop and start times for construction noise. Construction would also be temporary, lasting only a few days at a time in any one location. Night-time construction would be limited in residential areas to comply with noise ordinances in Mesa, Gilbert, Queen Creek, and Pinal County.

### **Substation**

For the proposed RS-24 Substation, transformers are expected to be the major source of audible noise. The predominant noise from a transformer is a hum, comprised of sound in the frequency range of 75 hertz (“Hz”) to 1200 Hz, within the frequency range of the human ear. The transformer sound level is specified at the time of purchase and the specified sound level is controlled by the design and manufacturing of the transformer. The specifications for a transformer require a design that is in compliance with the sound level limits specified by industry standards, governing regulations, or local ordinances. Disconnect switches and circuit breaker operations create momentary, but very infrequent noise.

Knowledge of the sound level limits before the equipment is purchased ensures that the noise measured at the substation boundary will conform to any ordinance applicable to residential, commercial, or industrial areas adjacent to the substation. Electrical apparatus designs and in rare instances the applications of sound abatement apparatus inside the substation are used to meet the noise level requirements.

Based on the Applicant’s experience with designing similar substations, no serious problems with audible noise are anticipated from the construction and operation of the proposed RS-24 Substation, or from the improvements to the Abel and Moody substations.

### **RADIO INTERFERENCE**

High voltage transmission line radio frequency noise is not expected to be noticeable outside the immediate vicinity of the transmission lines. Radio interference is most likely to affect the amplitude modulation (“AM”) broadcast band; frequency modulation (“FM”) radio is rarely affected by transmission lines. Only AM receivers located immediately adjacent to the transmission line have the potential to be affected by radio interference, and the effect may only be significant during rainy weather.

The radiated noise field intensity diminishes with increasing frequency. At frequencies above 30 megaHertz (“MHz”), the radiated noise field intensity is so low it is difficult to detect. Therefore, FM radio reception and cellular telephone communication are above the frequency range where radio interference has been experienced with previous projects, and no objectionable interference is expected with any of the proposed Project alignments. At the frequency range of FM radio or above, any rare instance of interference would generally be due to microsparks, which can be identified and corrected.

SRP utilizes field intensity instrumentation capable of measuring radiated noise and interference from 150 kiloHertz up to 1 gigaHertz. These instruments are used for investigating reports of unusual relatively high transmission line noise, as well as for compiling ambient noise level data.

The Applicant is ready to address radio interference resulting from construction and operation of the proposed transmission line with corrective measures, such as smoothing nicks on the conductor surface or tightening hardware, which can be implemented to eliminate radio interference complaints. In addition to any transmission repairs, relevant corrective actions may include adjusting or modifying receivers; adjusting, repairing, replacing or adding antennas; antenna signal amplifiers; filters or lead-in cables; or other corrective actions. Based on the design parameters and physical configuration of the proposed facilities for the Abel-Moody 230kV Transmission Project, no objectionable noise and interference with radio signals is anticipated.

### **TELEVISION INTERFERENCE**

Television signals are broadcast at frequencies from 54 MHz to approximately 700 MHz, with the FM radio band falling between channels 6 and 7, so television interference is not expected, and historically the number of cases of TVI has been small and limited. Similarly, television interference results from microsparks, which can be identified and corrected. However, based on the design parameters and physical configuration of the proposed facilities, no objectionable noise interference with television communication signals is anticipated.

The Applicant is ready to address television interference resulting from construction and operation of this transmission line with corrective measures that can be implemented to eliminate television interference complaints.

### **ELECTRIC AND MAGNETIC FIELD (EMF) EFFECTS**

Electric and magnetic fields are produced by power lines and these fields will induce voltages and currents on nearby conductive objects. These fields exist around overhead and underground power lines, house wiring, computers, power tools, appliances, and anything that carries or uses electricity.

The proposed Abel-Moody 230kV Transmission Line will be a source of electric and magnetic fields along the transmission line right-of-way. The strength of the electric field is a function of the line voltage. The magnetic field is directly proportional to the conductor load current, and is affected by the line geometry, direction of power flow, circuit phasing, and the distance from the conductors. These fields decrease with distance from the line.

With regard to electric fields, the Applicant will meet the provisions of the National Electric Safety Code (“NESC”). The transmission line will be designed to limit the steady-state current on conductive objects due to the electric field to five milliAmperes or below. The NESC limit applies to the largest anticipated truck or vehicle under the line, short-circuited to ground.

Magnetic field profiles will vary depending on the structure design (single or double circuit and conductor arrangement), the amount of power being transmitted, and the height of the conductors above ground. The magnetic field profiles for all structure and design options being considered would not present a safety issue meriting consideration in the selection of structure design type. The fields associated with the Project’s transmission lines are anticipated to be comparable to other already existing transmission lines of this voltage in the state.

There has been extensive study of electric and magnetic fields and health effects, and the weight of scientific evidence does not support the conclusion that these fields are a human health hazard. Two major reports reflecting these findings are the U.S. National Academy of Sciences report in 1996 and the National Institute of Environmental Health Sciences report in 1999.

**REFERENCES**

IEEE/ANSI Standard C2-2007. National Electrical Safety Code.

National Academy of Sciences 1996. Possible Health Effects of Exposure to Residential Electric and Magnetic Fields. National Research Council.

National Institute of Environmental Health Sciences 1999. Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields. 1999.