Exhibit AA

Electromagnetic Frequencies from Transmission Lines

Biglow Canyon Wind Farm
December 2025

Prepared for

Portland General Electric Company

Prepared by

TETRA TECH

Table of Contents

List of Tables

List of Figures

Acronyms and Abbreviations

AC	alternating current
ACSR	aluminum conductor steel reinforced
BCWF or Existing Facility	Biglow Canyon Wind Farm
BIGL or Project Developer	BIGL bn, LLC
CAFE	Corona and Field Effects Program
Certificate Holder or PGE	Portland General Electric Company
Council or EFSC	Oregon Energy Facility Siting Council
dB	Decibels
ELF	extremely low frequency
EMF	electromagnetic field
EMR	electromagnetic radiation
FCC	Federal Communications Commission
gen-tie	generation tie
GHz	gigahertz
GPS	Global Positioning System
Hz	hertz
kHz	kilohertz
kV	kilovolt
LiDAR	light detection and ranging
m	meter
mG	milligauss
MHz	megahertz
MW	megawatt
OAR	Oregon Administrative Rules
POI	point of interconnect
RFA	Request for Amendment
Site Certificate	Site Certificate on Amendment 3
Solar Components	photovoltaic solar energy generation and battery storage
TV	television

1.0 Introduction

The Portland General Electric Company (PGE or Certificate Holder) submits this Request for Amendment (RFA) 4 to the Site Certificate on Amendment 3, issued October 31, 2008 (Site Certificate) for the Biglow Canyon Wind Farm (BCWF or Existing Facility) to add photovoltaic solar energy generation and battery storage (Solar Components) to the operating BCWF.

BCWF, owned and operated by PGE, is located within an approved site boundary comprising approximately 25,000 acres, approximately 4.5 miles northeast of the town of Wasco in Sherman County, Oregon. The BCWF operates under the Site Certificate on Amendment 3, issued October 31, 2008 (Site Certificate), from the Oregon Energy Facility Siting Council (Council or EFSC) as administered by the Oregon Department of Energy. BCWF currently consists of 217 wind turbines, with a maximum blade tip height of 445 feet, and a peak generating capacity of 450 megawatts (MW).

In RFA 4, PGE proposes to add up to 125 MW alternating current (AC) generating capacity from photovoltaic solar arrays and 125 MW in battery storage capacity (Solar Components) in approximately 1,445 acres of land (Solar Area) sited within the existing BCWF site boundary Solar Micrositing Area (RFA 4 Site Boundary[1]).

The Solar Micrositing Area is approximately 1,924 acres and provides a conservative estimate of the maximum area needed for development, micrositing, and temporary disturbances from the Solar Components during construction, rather than the anticipated temporary and permanent disturbance footprint. Within the Solar Micrositing Area, the Certificate Holder has identified a reduced footprint where Solar Components will be concentrated (Solar Area, 1, 445 acres). Solar Components will include solar arrays, inverters, battery energy storage system facilities and their subcomponents (i.e., inverters), a collector substation, approximately 600 feet of a new 230-kilovolt generation tie transmission line, medium voltage collector lines, operations and maintenance structures, site access roads, internal roads, perimeter fencing, facility entry gates, and temporary laydown areas. The maximum generating capacity from the Solar Components will be 125 MW AC, and the infrastructure will be fenced within the Solar Micrositing Area and will cover up to 1,445 acres (Solar Area).

PGE will own and operate the Solar Components as a part of the BCWF (together, Amended Facility or Facility), which, to date, have been developed by BIGL bn, LLC (BIGL or Project Developer). BIGL, in its capacity as the project developer, supports PGE in this RFA 4 and may construct and temporarily operate the Solar Components on behalf of PGE under a Build-Transfer Agreement.

This Exhibit AA was prepared to meet the submittal requirements in Oregon Administrative Rule (OAR) 345-021-0010(1)(aa). Analysis in this exhibit demonstrates that the Solar Micrositing Area complies with applicable Site Certificate conditions and the standard in OAR 345-021-0010(1)(aa).

[1] Note, as described in further detail in Section 4.1.1.2 of the RFA 4 Division 27 document, the Solar Micrositing Area is the equivalent of the RFA 4 Site Boundary.

OAR 345 Division 22 does not provide an approval standard specific to Exhibit AA. This exhibit also includes the submittal requirements outlined in the Specific Standards for Transmission Lines under OAR 345-024-0090:

> *(1) Can design, construct and operate the proposed transmission line so that alternating current electric fields do not exceed 9 kV per meter at one meter above the ground surface in areas accessible to the public;*
>
> *(2) Can design, construct and operate the proposed transmission line so that induced currents resulting from the transmission line and related or supporting facilities will be as low as reasonably achievable.*

1.1 EMF Background Information

Electromagnetic fields (EMFs) occur both naturally and because of the generation, transmission, and use of electric power. The earth itself generates steady-state magnetic and electric fields. Electromagnetic fields are present around any conductors or devices that transmit or use electrical energy; as a result, exposure to EMF is common from an array of electrical appliances and equipment, building wiring, and electric distribution and transmission lines. The electrical power system in the United States is an AC system operating at a frequency of 60 hertz (Hz)[2], resulting in "power frequency" or "extremely low frequency (ELF)" EMF.[3] While electric and magnetic fields are often referred to and thought of collectively, each arises through a different mechanism and can have differing effects.

Electric fields around transmission lines are produced by the presence of an electric charge, measured as voltage, on the energized conductor. Electric field strength is directly proportional to the line's voltage; that is, increased voltage produces a stronger electric field. The strength of the electric field is inversely proportional to the square of distance from the conductors; the electric field strength declines as the distance from the conductor increases. The strength of the electric field is measured in units of kilovolts (kV) per meter (m) or kV/m. Electric fields are readily weakened or blocked by conductive objects such as trees or buildings. The direction of force within the electric field alternates at a frequency of 60 Hz, in direct relation to the charge on each conductor. However, the overall transmission line voltage, and therefore the overall strength and reach of the electric field, remains practically steady and is not affected by the common daily and seasonal fluctuations in usage of electricity by customers.

Magnetic fields around transmission lines are produced by the movement of electrical charge, measured in terms of amperage, through the conductors. Like the electric field, the magnetic field

[2] Hertz is a measure of cycles per second. In a 60-Hz transmission system, the charge and direction of current flow on each conductor will cycle from positive to negative and back to positive 60 times per second. The direction of force in the electric and magnetic fields will also cycle in direct relation to the charge and direction of flow on the conductor.

[3] The electric transmission system in the U.S. operates at 60 Hz, while in Europe and other parts of the world, the systems operate at 50 Hz; both produce fields that are referred to as power frequency or ELF EMF.

alternates at a frequency of 60 Hz. Magnetic field strength is expressed in units of milligauss (mG)[4]. The magnetic field strength is directly proportional to the amperage; that is, increased current flow resulting from increased power flow through the line produces a stronger magnetic field. As with electric fields, the magnetic field is inversely proportional to the square of the distance from the conductors, declining in strength as the distance from the conductor increases. Magnetic fields are not blocked or shielded by most materials. Unlike voltage, the amperage and the resulting magnetic field around a transmission line fluctuate daily and seasonally as the usage of electricity varies and the resulting amount of current flow varies.

Each AC three-phase circuit carries power over three conductors. One phase of the circuit is carried by each of the three conductors. The AC voltage and current in each phase conductor is out of sync with the other two phases by 120 degrees, or one-third of the 360-degree cycle. The fields from each of these conductors tend to cancel each other out because of this phase difference. However, since the conductors are separated from each other, when a person stands under a transmission line, one conductor is somewhat closer than the others and will contribute a net uncanceled field at the person's location.

1.2 EMF Standards

Transmission line projects in Oregon must comply with the electric field standard found in OAR 345-024-0090, which requires that the applicant design, construct, and operate the proposed transmission line so that AC electric fields do not exceed 9 kV/m at 1 meter above the ground surface in areas accessible to the public. There is no similar Oregon design standard for magnetic fields.

2.0 Facility EMF – OAR 345-021-0010(1)(aa)(A)

OAR 345-021-0010(1)(aa) Exhibit AA. If the proposed energy facility is a transmission line or has, as a related or supporting facility, a transmission line of any size:

OAR 345-021-0010(1)(aa)(A) Information about the expected electric and magnetic fields, including:

2.1 Analysis Area – OAR 345-021-0010(1)(aa)(A)(i)(ii)(iii)

OAR 345-021-0010(1)(aa)(A)(i) The distance in feet from the proposed center line of each proposed transmission line to the edge of the right-of-way;

Response: The size of the right-of-way (i.e., distance from the proposed center line of each proposed transmission line to the edge of the right-of-way) is 150 feet.

[4] Magnetic field strength may also be measured in terms of the Tesla, an International System unit of measurement. 1 Gauss = 0.0001 Tesla, or 1 Tesla = 10,000 Gauss; 1 Gauss = 1,000 mG.

OAR 345-021-0010(1)(aa)(A)(ii) The type of each occupied structure, including but not limited to residences, commercial establishments, industrial facilities, schools, daycare centers and hospitals, within 200 feet on each side of the proposed center line of each proposed transmission line;

Response: The Solar Area gen-tie line is a 230-kV overhead transmission line approximately 600 feet long. There are no occupied buildings, residences, or other sensitive receptors within 200 feet of the center line of this proposed gen-tie line. The areas and buildings within 200 feet of the primary segment of the proposed Solar Area gen-tie line are all associated with the Solar Components or the existing BCWF and there are no existing or proposed buildings, residences, or other sensitive receptors..

OAR 345-021-0010(1)(aa)(A)(iii) The approximate distance in feet from the proposed center line to each structure identified in (A);

Response: There are no structures identified within 200 feet of the proposed line.

2.2 Modeling Results – OAR 345-021-0010(1)(aa)(iv)

OAR 345-021-0010(1)(aa)(A)(iv) At representative locations along each proposed transmission line, a graph of the predicted electric and magnetic fields levels from the proposed center line to 200 feet on each side of the proposed center line;

Response: Table AA-1 shows calculated electric field values for the proposed Solar Area gen-tie line. Table AA-2 shows calculated magnetic field values for the proposed Solar Area gen-tie line.

Table AA-1. Calculated Electric Field Values

Line Description	Figure	Electric Field (kV/m)		
		Left	Peak Value	Right
Solar Area gen-tie	AA-1	0.039 (200 feet left of centerline)	3.42, 24 feet left (west) of centerline	0.055 (200 feet right of centerline)

Table AA-2. Calculated Magnetic Field Values

Line Description	Figure	Magnetic Field (mG)		
		Left	Peak Value	Right
Solar Area gen-tie	AA-2	1.97 (200 feet left of centerline)	73.58, 4 feet left (west) of centerline	2.03 (200 feet right of centerline)

The analysis results of the Bonneville Power Administration Corona and Fields Effect Program, Version 3 (CAFE) model presented in Table AA-1 demonstrate that the proposed 230-kV gen-tie lines, considering the Solar Are as well as influence from existing overhead transmission lines, can be constructed and operated such that the AC electric field will not exceed 9 kV/m at 1 meter above the ground surface, as required by OAR 345-024-0090(1). The modeling assumptions related to the collector line are intentionally conservative, producing worst-case EMF results. EMF levels under normal operating conditions will be lower than indicated by this analysis.

See Figure AA-1 for the electric field graph for the Solar Area gen-tie line. See Figure AA-2 for the magnetic field graph for the Solar Area gen-tie line. The analysis results for the gen-tie line are provided in Attachment AA-1

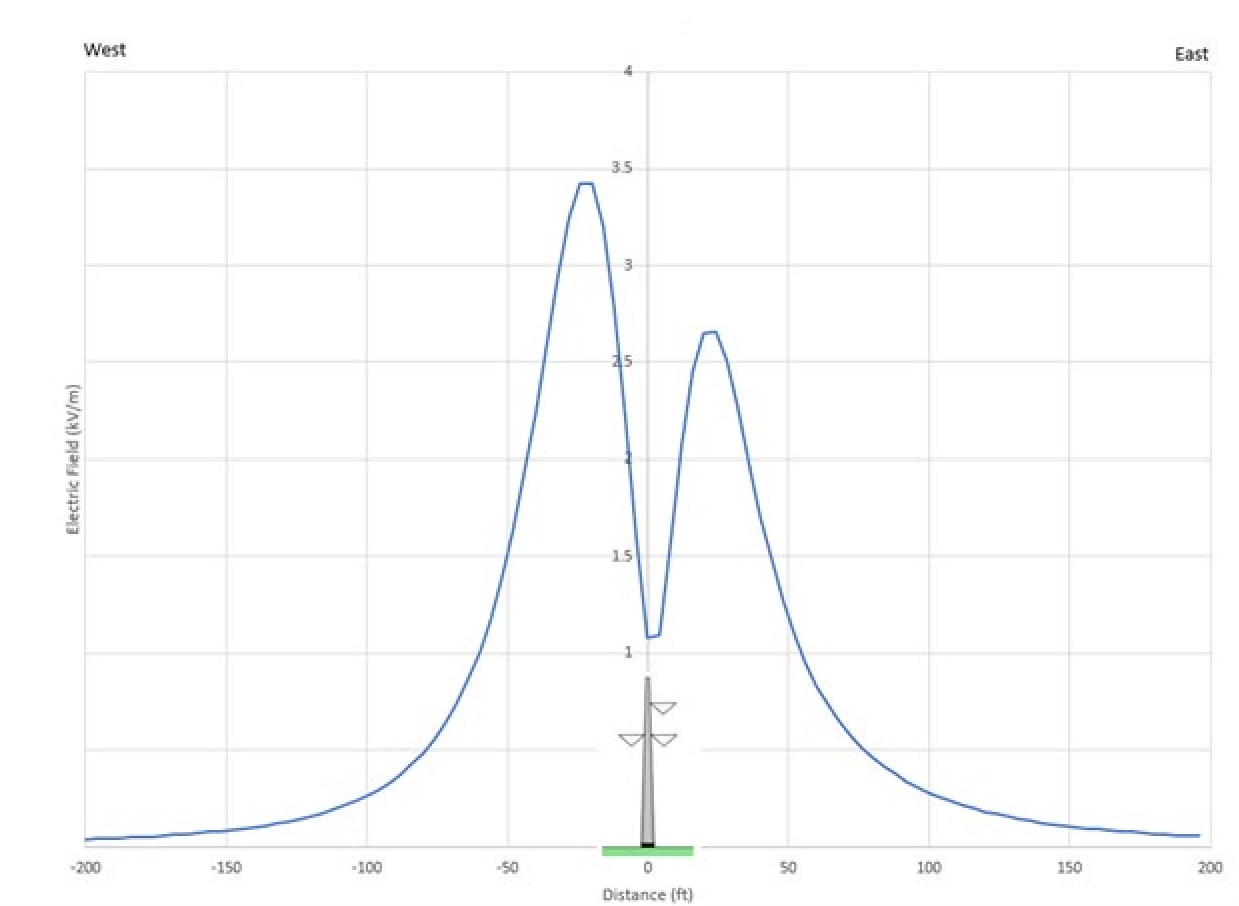


Figure AA-1. Biglow Canyon Solar Area Gen-Tie Electric Field

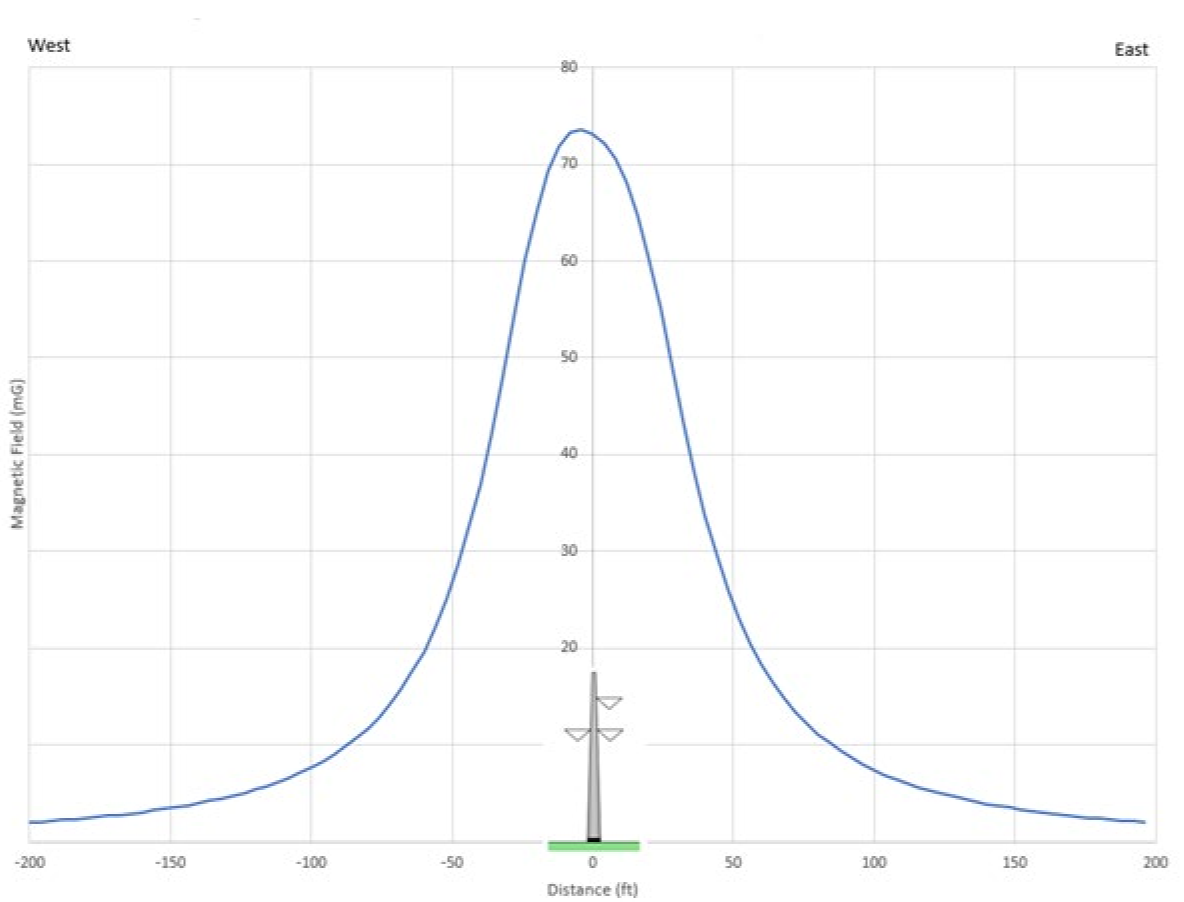


Figure AA-2. Biglow Canyon Solar Area Gen-Tie Magnetic Field

2.3 EMF Calculation Methods – OAR 345-021-0010(1)(aa)(vi)

OAR 345-021-0010(1)(aa)(A)(vi) The assumptions and methods used in the electric and magnetic field analysis, including the current in amperes on each proposed transmission line;

Response: The following assumptions are used for the calculation of the electric and magnetic field analyses of the route to the POI. The planned 230-kV gen-tie line configuration is shown in Figures AA-3 and AA-4.

Assumptions for modeling are as follows;

- Environmental parameters – 1 inch of precipitation per hour, 2.0 miles per hour wind speed (for modeling wet-weather conditions)
- Height for both electrical and magnetic field measurements – 1 meter, or 3.28 feet above ground.
- Proposed Solar Area gen-tie line information:
  - Overhead pole height – 80 feet
  - Line amperage – 314 amps, calculated maximum output value of the Northern Solar Area of the Solar Components (125 MW AC).
  - Line voltage – 230-kV phase/phase or 132.79-kV phase/ground
  - Conductor type – single 954 Cardinal Aluminum Conductor Steel Reinforced (ACSR) per phase, 1.196 inches in diameter
  - Ground wire – one overhead ground wire, 0.68 inch in diameter, as shown in Figure AA-3 and Figure AA-4. Two overhead shield wires, 0.5 inch in diameter, as shown in Figure AA-3 and Figure AA-4. Minimum height from ground is 68 feet and is located on the centerline.
  - A phase is located on the lower arm of the transmission structure at 28 feet minimum height and 19 feet left of centerline.
  - B phase is located on the lower arm of the transmission structure at 28 feet minimum height and 19 feet right of centerline.
  - C phase is located on the upper arm of the transmission structure at 41 feet minimum height and 19 feet right of centerline.
  - Elevation of the site is estimated at 1,500 feet above sea level.

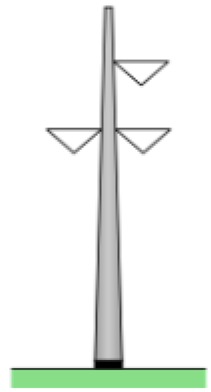


Figure AA-3. Depiction of 230-kV Gen-Tie Line Configuration

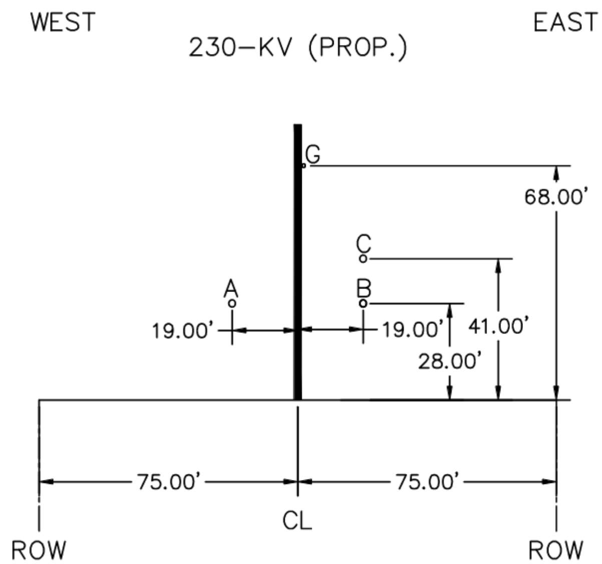


Figure AA-4. Proposed 230-kV Gen-Tie Line Configuration

3.0 EMF Mitigation Measures – OAR 345-021-0010(1)(aa)(A)(v)

> *OAR 345-021-0010(1)(aa)(A)(v) Any measures the applicant proposes to reduce electric or magnetic field levels;*

Response: The Certificate Holder does not propose any measures to reduce electric or magnetic field levels at the Solar Micrositing Area.

4.0 EMF Monitoring Program – OAR 345-021-0010(1)(aa)(A)(vii)

OAR 345-021-0010(1)(aa)(A)(vii) The applicant's proposed monitoring program, if any, for actual electric and magnetic field levels; and

Response: No program for monitoring actual EMF levels before or after construction is proposed.

5.0 Radio and TV Interference – OAR 345-021-0010(1)(aa)(B)

OAR 345-021-0010(1)(aa)(B) An evaluation of alternate methods and costs of reducing radio interference likely to be caused by the transmission line in the primary reception area near interstate, U.S. and state highways.

Response: The Certificate Holder summarizes the different types of interference below and alternative methods and costs of reducing interference.

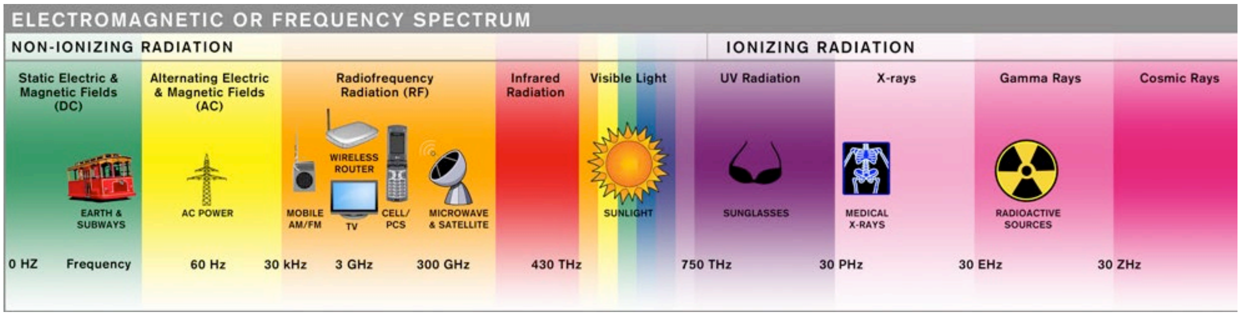
5.1 Background

5.1.1 Electromagnetic Interference

Electromagnetic interference from power transmission systems in the U.S. is governed by the Federal Communications Commission (FCC) Rules and Regulations (FCC 1988). A power transmission line is categorized by the FCC as an "incidental radiation device." It is defined as "a device that radiates radio frequency energy during the course of its operation although the device is not intentionally designed to generate radio frequency energy." Such a device "shall be operated so that the radio frequency energy that is emitted does not cause harmful interference. In the event that harmful interference is caused, the operator of the device shall promptly take steps to eliminate the harmful interference." In this case, "harmful interference" is defined as "any emission, radiation or induction which endangers the functioning of a radio navigation service or of other safety services or seriously degrades, obstructs or repeatedly interrupts a radio communication service operating in accordance with this chapter" (FCC 1988). Oregon does not have regulatory standards for either radio or television (TV) interference.

Modern communications systems all rely on electromagnetic radiation (EMR) to transmit information. AM and FM radio, TV, shortwave radio, cellular telephones, radar, Global Positioning System (GPS) devices and satellite communications, cordless telephones, Bluetooth, and wireless computer networks such as Wi-Fi or wireless local area network all utilize a region of the electromagnetic spectrum known as "radio frequency" EMR, which extends from the very low-frequency end at about 30 kilohertz (kHz) up into the high-frequency microwave range at about

300 gigahertz (GHz). Each type of technology uses a specific segment of the electromagnetic frequency spectrum; older technology such as AM radio is at the low-frequency end, while newer technologies such as GPS and Wi-Fi utilize high-frequency signals. Figure AA-5 provides a visual representation of typical communications frequencies.



Source: EMF & Radio Frequency Solutions. Available at: http://www.emfrf.com/index.php/emf-rf/emf-overview/electromagnetic-spectrum-or-frequency-spectrum.html.

Figure AA-5. Communications Frequency Spectrum

The level of interference can be partially determined by how similar or different the signal frequency is compared to the noise frequency. In general, there is very little interaction between signals of differing frequency; radio signals, TV signals, cellular phone signals, and GPS signals can all coexist in the same space and time without interfering with each other. For interference to occur, frequencies must be similar.

EMR and resulting interference can be an indirect product of electric transmission lines. EMR arises not from the lines themselves, but from the interaction of the strong electric field at the surface of the conductors and other energized components with the surrounding air. Two types of interactions may occur that create electromagnetic interference: corona discharge and gap discharge.

5.1.1.1 Corona Discharge

High-voltage power transmission lines generate a strong electric field at the surface of the conductor, which can be strong enough to split the surrounding air molecules, resulting in the emission of electromagnetic energy in the form of ultraviolet and near-ultraviolet light and broad-band radio frequency EMR (corona discharge also produces audible sound, which is addressed in Exhibit Y; audible sound is not discussed further in this Exhibit). The former can sometimes be seen by humans under the right conditions or with specialized equipment, while the latter can sometimes be heard as electronic “noise,” or interference with radio signal reception. Broadband corona EMR discharge typically occurs in the frequency spectrum from below 100 kHz to approximately 1,000 megahertz (MHz), which overlaps with the frequencies used for AM and FM radio and some TV signals. With sufficient corona activity, low-frequency radio and TV interference can be noticeable within a few hundred feet of the transmission line. These effects are most pronounced directly underneath the line conductors and decrease with distance from the transmission line.

Corona on a transmission line conductor depends on several factors such as operating voltage, conductor diameter, overall line geometry, weather conditions, and altitude. Conductor size, line voltage and line geometry are taken into consideration when designing a transmission line so that the electric fields at the conductor surface are minimized. However, for a high-voltage line, any incidental irregularities on the conductor surface (for example, water droplets, dust, debris, and nicks or scratches in the conductor) act as points where the electric field may be intensified sufficiently to produce corona. Thus, the level of corona activity is elevated during foul weather when raindrops on the conductor surface act as points producing corona.

5.1.1.2 Gap Discharge

A gap discharge occurs when current arcs across a gap between two conductive objects. Gap discharges can produce radio noise in the lower frequencies (AM radio frequencies) and well into the microwave range (analog TV frequencies). These discharges can be produced by loose connections, a problem that more commonly occurs on low-voltage distribution lines but rarely occurs on high-voltage transmission lines (Trinh 2012). Unlike corona discharge, which may occur anywhere along a high-voltage transmission line conductor, gap discharge occurs at mechanical connectors and components that are used to hold the conductors in place. Gap discharge is controlled through proper construction and maintenance practices to ensure all mechanical connectors and components are properly assembled. Because gap discharge is an intermittent, temporary, and readily resolved problem, and results only in localized electrical interference issues, the potential for interference with TV signals or higher-frequency communications is not considered a significant problem.

5.1.2 Radio Interference Effects

The corona-induced broadband EMR from transmission lines can produce interference to AM signals, such as a commercial AM radio audio signal (i.e., radio noise) or the video portion of an older analog broadcast TV station (i.e., TV noise). Technologies that use frequency modulation, such as FM radio stations and the audio portion of older analog broadcast TV signals, are generally not affected by noise from a transmission line. As digital signal processing has been integrated into these communication systems, the potential interference impact of corona-generated radio noise has decreased.

The level of interference caused by radio noise from a transmission line to the reception of a radio signal depends on the location of the radio transmitter, the radio receiver, and the transmission line. A transmission line that is directly between a radio transmitter and a listener's receiver may be more likely to interfere with that listener's reception, whereas a transmission line behind or beside the listener in relation to the transmitter will not necessarily cause interference, depending on the radio receiver's antennae. The radio noise generated by a transmission line is very low in power and decreases rapidly as distance from the line increases. It is experienced only when in close proximity to the transmission line.

In general, complaints related to corona-generated interference are infrequent. Moreover, the advent of cable and satellite TV service, and the federally-mandated conversion to digital TV broadcast in June 2009 have greatly reduced the occurrence of corona-generated interference. Low-frequency corona-induced EMR does not interact with the higher-frequency satellite signals or with wired communication systems, while digital TV receivers are equipped with systems to filter out interference. Many radio stations also broadcast in digital, reducing the likelihood of corona-induced EMR interference. Electric power companies are able to operate very effectively under the present FCC rule because harmful interference can generally be eliminated or effectively mitigated.

Radio noise is measured in units of decibels (dB) based on its field strength referenced to a signal level of 1 microvolt per meter (IEEE 1986). Corona-induced radio noise during fair weather is calculated to be approximately 40 dB (dB-1 microvolt per meter) at the edge of the right-of-way. This is considered an acceptable level (IEEE 1971). When the transmission line is in proximity to roadways (for example, interstate, U.S., and state highways), such as when it passes over these roadways, radio interference may be experienced for short distances while in proximity to the line. Interference may be more noticeable near the line particularly during foul weather, when corona activity is elevated.

No radio interference impacts are expected for the Solar Components.

5.1.3 Interference with Other Electronic Communications

Wireless computer network systems, cell phones, GPS units, and satellite receivers operate at high frequencies in the tens to hundreds of MHz or even GHz. These systems also often use FM or digital coding of the signals so they are relatively immune to electromagnetic interference from transmission line corona. GPS units are used in a wide range of activities, including several important agricultural activities such as monitoring pivot irrigation, tracking wheeled and tracked equipment movements during farming operation, and checking the orientation of aerial spraying aircraft. GPS units operate in the frequency range of 1.2 to 1.6 GHz. Satellite receivers operate at frequencies of 3.4 GHz to 7 GHz and have shown no effect from transmission lines unless the receiver was trying to view the satellite through the transmission tower or conductor bundle of the transmission line (Chartier et al. 1986). Repositioning the receiver by a few feet was sufficient to eliminate the obstruction and reduced signal. Mobile phones operate in the radiofrequency range of about 800 MHz to 1,900 MHz or higher. As a result of the high frequencies used by these devices, modulation and processing techniques, and the typically lower-frequency corona-induced EMR, effects from interference are unlikely.

The voltages and currents associated with the transmission line have the potential to induce voltage and current in nearby conductors (e.g., ungrounded metal fences and ungrounded metal irrigation systems). This effect is more likely where ungrounded fences or irrigation systems are parallel and long (one mile or more). These induced voltages could result in a “nuisance” shock to anyone who touches such a fence or irrigation system. These shocks are known as nuisance or “startle” shocks as they will not physically harm someone but may be noticed by some people and provoke a startle reaction. An example of an ungrounded metal irrigation system would be a center pivot system on rubber tires. By contrast, the Vermeer-type metal irrigation system is grounded through its metal wheels and therefore presents less of a shock hazard. The Solar Micrositing Area gen-tie lines will adhere to all pertinent electrical codes to be protective of health and safety.

A GPS unit in farming equipment should work properly within the vicinity of a transmission line. GPS devices continually pull signals from a number of satellites, not just one and may also utilize a fixed base station. A signal may be blocked temporarily if the transmission structure is between the receiver and a weak signal, but it will return as the farm equipment moves past the structure. It is also common for GPS receivers to drop and pick up signals even in the absence of transmission lines and structures. If the base station signal is weak or blocked, additional or alternate locations may improve the signal and performance.

Signal interference occurs when other signals at the same frequency as the satellite signal are present. Multipath occurs when objects such as buildings, structures, or tractor parts reflect a GPS satellite signal, causing the satellite signal to arrive at the receiver later than it would have if it followed a straight line from the satellite. A study commissioned by Electric Power Research Institute found that signal interference is “unlikely” based on the design of GPS receivers and their ability to separate the GPS signal from background noise (Silva and Olsen 2002). Another study compared the accuracy of real-time kinematic GPS receivers at different locations to transmission lines and towers (Gibbings et al. 2001). This study concluded that multipath from transmission towers could result in GPS-initialization errors (e.g., the system reports the wrong starting location) 1.1 percent to 2.3 percent of the time. This study also reported that GPS software was able to identify and correct these initialization errors within the normal startup time. This study reported initialization errors caused by electromagnetic interference from energized overhead transmission lines when the GPS receiver was located outside the vehicle, but concluded that “most, if not all of this effect can be eliminated by shielding the receiver and cables.” Placing the receiver inside the vehicle significantly reduced initialization errors.

5.2 Evaluation of Alternate Methods and Costs to Reduce Interference

Design options for reducing the radio noise from the transmission line include use of larger diameter conductors, or use of more conductors within the conductor bundles. Increasing the distance between phases of the lines (conductor bundles) may also result in a decrease in the radio noise. These line design options have been employed to minimize the generation of radio noise to acceptable levels.

6.0 Conclusion

Exhibit AA demonstrates the Solar Components will ensure public health and safety with respect to EMFs. Also, this Exhibit, together with the data provided in Exhibit DD, demonstrates that the Solar Components’ AC electric fields and induced currents will comply with the Specific Standards for Transmission Lines under OAR 345-024-0090.

7.0 References

BPA (Bonneville Power Administration). Undated. "Corona and Field Effects" Computer Program – Public Domain Software. Bonneville Power Administration, Vancouver, WA.

Chartier, V., R. Sheridan, J. DiPlacido, and M. Loftness. 1986. Electromagnetic Interference Measurements at 900 MHz on 230 kV and 500 kV Transmission Lines. IEEE Transactions on Power Systems, PWRD-1: 140-149.

FCC (Federal Communications Commission). 1988. Federal Communications Commission Rules and Regulations. 10-1-88 ed. Vol. II part 15, 47 CFR, Ch. 1.

Gibbings, P., B. Manuel, R. Penington, and K. McDougall. 2001. Assessing the Accuracy and Integrity of RTK GPS Beneath High-voltage Power Lines. In: 42nd Australian Surveyors Congress 2001: A Spatial Odyessy, 25-28 Sep 2001, Brisbane, Australia.

IEEE (Institute of Electrical and Electronics Engineers). 1971. Radio Noise Design Guide for High Voltage Transmission Lines. IEEE Radio Noise Subcommittee Report-Working Group No. 3. Paper 70TP631-PWR.

IEEE. 1986. IEEE Standard Procedures for Measurement of Radio Noise from Overhead Power Lines and Substations. ANSI/IEEE Std. 430-1986, New York, NY. (see also)

Silva, M., and R. Olsen. 2002. Use of Global Positioning System (GPS) Receivers Under Power-Line Conductors. IEEE Transactions on Power Delivery 17: 938–944.

Trinh, G.N. 2012. Chapter 16, Corona and Noise. In: Electric Power Generation, Transmission, and Distribution. 3rd Edition edited by Leonard L. Grigsby. CRC Press, Taylor & Francis Group LLC, Boca Raton, FL. ISBN: 9781439856284.