

5.18 Corona and Induced Current Effects

5.18.1 Environmental Setting

Corona

The corona effect is the physical manifestation of discharged electrical energy into very small amounts of sound, radio noise, heat, and chemical reactions with air components. It is a phenomenon associated with the electrical gradient at the surface of all energized electrical materials but is especially common with high-voltage power lines.

The amount of corona produced by a power line is a function of several factors including; line voltage, conductor diameter, conductor locations in relation to each other, power line elevation above sea level, condition of conductors and hardware, and local weather conditions. Corona is less noticeable for lines that are operated at lower voltages (i.e., subtransmission and distribution lines). The electric field gradient is greatest at the conductor surface. Larger-diameter conductors have lower electric field gradients at the conductor surface and, therefore, lower corona noise than smaller-diameter conductors. Corona typically becomes a design concern for power lines that are overhead at voltages of 230 kV and higher (i.e., transmission lines). The corona effect would not be a design concern for underground and submarine portions of power lines, regardless of voltage level, since the energized conductors are fully enclosed in a semi-conducting layer within the insulated cables that serve to equalize the electrical gradient at the surface of the components.

Induced Currents

Electric currents can be induced in metallic objects located within the electric fields created by power lines. An electric current can flow when an object has an induced charge and a path to ground is presented. The amount of induced current that can flow is important to evaluate from a safety perspective because of the potential for electrical shocks to people and the possibility of electric arcs that could form across small gaps between conductive surfaces. These arcs can have secondary effects such as ignition of flammable materials in the vicinity of the arc. In addition induced currents are evaluated for their potential to lead to corrosion of metallic objects from the discharge of the induced current to ground.

From a safety perspective the National Electrical Safety Code (NESC) specifies that transmission lines be designed to limit short circuit current from vehicles or large objects near the line to no more than 5 milliamps (mA). CPUC General Order 128, Rules for Construction of Underground Electric Supply and Communication Systems, specifies the construction materials, clearances and depths for the proposed transmission line, and CPUC General Order 95, Rules for Overhead Electric Line Construction Section 35, covers all aspects of design, construction, operation, and maintenance of overhead electrical power lines and fire safety hazards. The Public Utilities Code, the CPUC General Orders and the NESC also address shock hazards to the public by providing guidelines on minimum clearances to be maintained for practical safeguarding of persons during the installation, operation, or maintenance of transmission lines and their associated equipment.

5.18.2 Environmental Impacts and Assessment

The CEQA Guidelines do not provide significance criteria for evaluating significant impacts from corona or induced current effects. Corona and induced current from high-voltage power lines can cause environmental impacts through:

- Audible noise
- Radio and television interference
- Computer interference
- Disturbance of cardiac pacemakers
- Ignition of flammable materials
- Corrosion of buried metallic objects

The project would include a new, single-circuit 230 kV transmission line of approximately 3.5 miles in total length, including approximately 2.5 miles in the San Francisco Bay and the remainder underground in paved city streets. The line would include an overhead transition of new 115 kV cables to interconnect the new Potrero 230 kV Switchyard and the existing 115 kV Potrero Switchyard; corona effects associated with the overhead transition could create audible noise impacts. During wet or foul weather conditions (such as rain or fog), the conductor will produce the greatest amount of corona noise and have the greatest potential to be noticeable. The audible corona noise level caused by the new 115 kV components at the Potrero Switchyard was not quantified. However, circuits operating at 115 kV typically cause noise at levels comparable to the ambient baseline noise levels, which as noted in Section 5.12 (Noise), would include the existing equipment at the Potrero Switchyard. The corona noise impacts would thus be less than significant.

Although corona can generate high frequency energy that may interfere with broadcast signals or electronic equipment, this is generally not a problem for transmission lines. The Institute of Electrical and Electronic Engineers (IEEE) has published a design guide (IEEE, 1971) that is used to limit conductor surface gradients so as to avoid corona levels which would cause electronic interference. Corona or gap discharges related to high frequency radio and television interference impacts are dependent upon several factors, including the strength of broadcast signals, and are anticipated to be very localized if they occur. Individual sources of adverse radio/television interference impacts can be located and corrected on the power lines. Conversely, magnetic field interference with electronic equipment such as computer monitors can be corrected through the use of software, shielding or changes at the monitor location. As a result, impacts from corona, radio/television interference, and magnetic fields would be less than significant.

Induced currents and voltages on conducting objects near the proposed transmission line would not pose a threat in the environment if the conducting objects are properly grounded. Project construction and operation would meet or exceed CPUC General Order 95 and General Order 128 standards and work would be done in accordance with PG&E's Code of Safe Practices. PG&E would identify other underground utilities during final design, evaluate their proximity and their potential for induced current and/or corrosion. PG&E would coordinate with the utility-system owner to determine whether steps are necessary to reduce the potential to induce current or cause corrosion (p.2-37 of PG&E, 2012a). Grounding would be incorporated into PG&E's design plans, and as a result, impacts would be less than significant. Likewise, induced currents would not significantly increase the risk of fuel ignition in the area.

The electric fields associated with the Proposed Project's transmission line may be of sufficient magnitude to impact operation of a few older model pacemakers resulting in them reverting to an asynchronous pacing (IEEE, 1979). Substantial adverse effects would not occur with prolonged asynchronous pacing; periods of operation in this mode are commonly induced by cardiologists to check pacemaker performance. However, the transmission line's electric field would be shielded along the entire proposed route by being placed underground, which would eliminate any above ground electric field so that it would not impact operation of older model pacemakers. No mitigation measures would be required or recommended.