# 3.17 Electrical Interference and Hazards

## 3.17.1 Introduction

This section describes existing environmental conditions and analyzes environmental impacts related to electrical interference and electrical hazards that are expected to result from the implementation of the TRTP. The following discussion addresses existing environmental conditions in the affected area, identifies and analyzes environmental impacts for a range of Project alternatives, and recommends measures to reduce or avoid adverse impacts anticipated from Project construction and operation. In addition, existing laws and regulations relevant to electrical interference and electrical hazards are described. In some cases, compliance with these existing laws and regulations would serve to reduce or avoid certain impacts that might otherwise occur with the implementation of the Project.

The information and analysis that is presented in this section has been derived from the *Tehachapi Renewable Transmission Project Electric and Magnetic Fields Specialist Report*, prepared by R.W. Beck (2008). While this section presents the findings of the *Electric and Magnetic Fields Specialist Report*, please refer to that report for more detailed information on Project effects on electrical interference and electrical hazards.

### Scoping Issues Addressed

During the scoping period for the EIR/EIS (August-October 2007), a series of scoping meetings were conducted with the public and government agencies, and written comments were received by agencies and the public that identified issues and concerns. The following issues related to electrical interference and electrical hazards that were raised during scoping are addressed in this section:

- Power line fields generated by the Project will interfere with radio, television, communication or electronic equipment.
- Power line fields generated by the Project will result in induced currents or shock hazards to the public.
- Power line fields generated by the Project will interfere with cardiac pacemakers.
- Project structures would be affected by wind and earthquakes.

Issues and concerns related to potential public health impacts due to electric and magnetic fields (EMF) generated by the Project were also raised at the scoping meetings. This section does not consider potential health risks associated with EMF exposure, specifically exposure to magnetic fields, as there is no consensus in the scientific community regarding health risks associated with EMF exposure and, therefore, conclusions regarding this concern cannot be reached in this analysis. However, information regarding research on EMF associated with utility facilities is presented in Section 5.3.1 (Magnetic Field Concerns) to allow an understanding of the issue by the public and decision-makers.

### Summary and Comparison of Alternatives

Table 3.17-1 on the following page presents some key factors related to electrical interference and electrical hazards for each alternative. It is important to note that the “Environmental Issues” indicated in Table 3.17-1 are not impact statements, but rather selected information items that provide a comparison between the alternatives. Specific impact statements that have been identified for the Project and alternatives, in accordance with the significance criteria introduced in Section 3.17.4.1 (Criteria for Determining Impact Significance), are described in Sections 3.17.5 through 3.17.7.

**Table 3.17-1. Summary Comparison of Environmental Issues – Electrical Interference and Hazards**

| Environmental Issues | Alternative 1 (No Project/Action) | Alternative 2 (SCE's Proposed Project) | Alternative 3 (West Lancaster) | Alternative 4 (Chino Hills) | Alternative 5 (Partial Underground) | Alternative 6 (Max. Heli. Construction in ANF) | Alternative 7 (66-kV Subtransmission) |
|---|---|---|---|---|---|---|---|
| Interferes with radio/television/com munications/ electronic equipment (Impact EIH-1) | Interference would be generated by building or upgrading other transmission infrastructure in lieu of the Project. | No substantial interference with implementation of mitigation. | Interference would occur over a slightly longer line route than Alternative 2. | Interference would occur over a shorter line route than Alternative 2. | Same as Alternative 2. except underground portion would not generate interference. | Same as Alternative 2. | Same as Alternative 2 except underground portion would not generate interference. |
| Causes induced currents or shock hazards (Impact EIH-2) | Induced currents or shock hazards would be generated by building or upgrading other transmission infrastructure in lieu of the Project. | No substantial induced currents or shock hazards would occur with implementation of mitigation. | Induced currents or shock hazards would occur over a slightly longer line route than Alternative 2. | Induced currents or shock hazards would occur over a shorter line route than Alternative 2. | Same as Alternative 2 except underground portion would not result in induced currents or shock hazards. | Same as Alternative 2. | Same Alternative 2 except underground portion would not result in induced currents or shock hazards. |
| Interferes with cardiac pacemakers (Impact EIH-3) | Interference would be generated by building or upgrading other transmission infrastructure in lieu of the Project. | EMF may impact operation of some older model pacemakers; however, the interference is of short duration and is not considered harmful. | Same as Alternative 2. | Interference with cardiac pacemakers would occur over a shorter line route than Alternative 2. | Same as Alternative 2 except underground portion would not result in cardiac pacemaker interference. | Same as Alternative 2. | Same as Alternative 2 except underground portion would not result in cardiac pacemaker interference. |
| Introduces hazards related to wind or earthquake (Impact EIH-4) | Hazards would be introduced by building or upgrading other transmission infrastructure in lieu of the Project. | No substantial hazards related to wind or earthquake would occur, as structures would be designed such that failure related to wind conditions would be highly unlikely and with dynamic loading under variable wind conditions that generally exceed earthquake loads. | Same as Alternative 2. | Same as Alternative 2 except that hazards would occur over a shorter line route. | Same as Alternative 2 except underground portion would not result in wind or earthquake hazards. | Same as Alternative 2. | Same as Alternative 2 except underground portion would not result in wind or earthquake hazards. |

Note: In Decision D.06-01-042, dated January 26, 2006, the CPUC was "unable to determine whether there is a significant verifiable relationship between EMF exposure and negative health consequences". In the absence of any defined standards for determining health risks from EMF, a comparison of health impacts between the alternatives cannot be made and is not presented in this table.

## 3.17.2 Affected Environment

Corona, gap discharges, and audible noise from transmission lines consist of high frequency energy; however, they are transmitted at a low power level as compared to radio and television broadcasts. Therefore, these transmissions attenuate within a short distance from the transmission line. The affected environment is along the entire length of the transmission line but for a narrow width.

### 3.17.2.1 Radio/Television/Communication/Electronic Equipment Interference

Corona discharges form at the surface of a transmission line conductor when the electric field intensity on the conductor surface exceeds the breakdown strength of air. The breakdown of air generates light, audible noise, radio noise, ozone, conductor vibration and causes a dissipation of energy (EPRI, 1982). The Institute of Electrical and Electronic Engineers (IEEE) has published a design guide (Radio Noise Subcommittee, 1971) that is used to limit conductor surface gradients so as to avoid corona levels which would cause electronic interference.

Gap discharges occur when an arc forms across a gap in loose or worn line hardware and can also be a source of high frequency energy. It is estimated that over 90 percent of radio and television interference problems for electric transmission lines are due to gap discharges. Line hardware is designed to be problem-free, but wind motion, corrosion, and other factors can create a gap discharge condition. When identified, gap discharges can be located and remedied by utilities by tightening loose fittings or replacing worn hardware.

Electric fields from power lines do not typically pose interference problems for electronic equipment in businesses since the equipment is shielded by buildings and walls. However, magnetic fields can penetrate buildings and walls, thereby interacting with electronic equipment. Depending upon the sensitivity of equipment, the magnetic fields have been found to interfere with electric equipment operation. Review of this phenomenon in regard to the sensitivity of electrical equipment identifies a number of thresholds for magnetic field interference. Interference with cathode ray tube (CRT) type computer monitors can be detected at magnetic field levels of 10 mG and above, while large screen or high-resolution CRT monitors can be susceptible to interference at levels as low as 5 mG. Other specialized equipment, such as medical equipment or testing equipment can be sensitive at levels below 5 mG. Equipment that may be susceptible to very low magnetic field strengths is typically installed in specialized and controlled environments, since even building wiring, lights, and other equipment can generate magnetic fields of 5 mG or higher.

The most common electronic equipment that can be susceptible to magnetic field interference is old CRT computer monitors. Magnetic field interference results in disturbances to the image displayed on the monitor, often described as screen distortion, "jitter," or other visual defects. In most cases it is annoying, and at its worst, it can prevent use of the monitor. This type of interference is a recognized problem in the video monitor industry. As a result, there are manufacturers who specialize in monitor interference solutions and shielding equipment. Possible solutions to this problem include: relocation of the monitor, use of magnetic shield enclosures, software programs, and replacement of CRT monitors with current technology liquid crystal displays that are not susceptible to magnetic field interference.

### 3.17.2.2 Induced Currents and Shock Hazards

Power line fields can induce voltages and currents on conductive objects, such as metal roofs or buildings, fences, and vehicles. Transmission lines are designed to limit the short circuit current, from conductive items beneath the line, to a safe level (less than 5 milliampere). When a person or animal comes in contact with a conductive object, a perceptible current or small electric shock may occur. These small electric shocks cause no physiological harm; however, they may present a nuisance.

### 3.17.2.3 Cardiac Pacemakers

An area of concern related to electric fields from transmission lines has been the possibility of interference with cardiac pacemakers. There are two general types of pacemakers: asynchronous and synchronous. The asynchronous pacemaker pulses at a predetermined rate. It is generally immune to interference because it has no sensing circuitry and is not exceptionally complex. The synchronous pacemaker, however, pulses only when its sensing circuitry determines that pacing is necessary. Interference from transmission line electric field may cause a spurious signal on the pacemaker's sensing circuitry. However, when these pacemakers detect a spurious signal, such as a 60 Hz signal, they are programmed to revert to an asynchronous or fixed pacing mode of operation, returning to synchronous operation within a specified time after the signal is no longer detected. Cardiovascular specialists do not consider prolonged asynchronous pacing a problem, since some pacemakers are designed to operate that way. Periods of operation in this mode are commonly induced by cardiologists to check pacemaker performance. So, while transmission line electric fields may interfere with the normal operation of some of the older model pacemakers, the result of the interference is not harmful, and is of short duration (EPRI, 1985 and 1979).

### 3.17.2.4 Wind and Earthquake Hazards

Transmission line structures used to support overhead transmission lines must meet the requirements of the California Public Utilities Commission, General Order No. 95, Rules for Overhead Electric Line Construction. This design code and the National Electrical Safety Code (NESC) include loading requirements related to wind conditions. Transmission support structures are designed to withstand different combinations of loading conditions including extreme winds. These design requirements include use of safety factors that consider the type of loading as well as the type of material used, e.g., wood, steel or concrete. Failures of transmission line support structures are extremely rare and are typically the result of anomalous loading conditions such as tornadoes or ice-storms.

Overhead transmission lines consist of a system of support structures and interconnecting wire that is inherently flexible. Industry experience has demonstrated that under earthquake conditions structure and member vibrations generally do not occur or cause design problems. Overhead transmission lines are designed for dynamic loading under variable wind conditions that generally exceed earthquake loads. Earthquake conditions could result in damage or faults to underground transmission lines.

## 3.17.3 Applicable Laws, Regulations, and Standards

A number of counties, states, and local governments have adopted or considered regulations or policies related to power line field exposure. Following is a brief summary of the guidelines and regulatory activity regarding electrical interference and electrical hazards.

### 3.17.3.2 Federal Guidelines

#### Radio/TV/Communications/Electronic Equipment Interference

There are no federal regulations with specific numerical limits on high frequency emissions from electric power facilities. Federal Communication Commission (FCC) regulations require that transmission lines be operated so that no harmful communication systems interference is produced (FCC regulations, Section 15.25).

### Induced Currents and Shock Hazards

The NESC specifies that transmission lines be designed to limit the power line field strength at ground level such that the short circuit current from vehicles or large objects near the line will be no more than 5 milliampere (mA). This requirement serves to limit the magnitude of electrical shock that the public could encounter from induced currents on large ungrounded metal objects in the vicinity of transmission lines. Although the NESC is titled as a "National" code it is intended as a guide standard and does not constitute a regulation unless it is adopted and codified by state or municipal governments. In the case of California, the CPUC has issued General Order No. 95 (G.O. 95), Rules for Overhead Electric Line Construction, as the relevant standard for transmission lines.

### 3.17.3.3 State Guidelines

### California Public Utility Commission Guidelines

#### Induced Currents and Shock Hazards

Overhead transmission lines must meet the requirements of the CPUC, General Order No. 95, Rules for Overhead Electric Line Construction. This design code addresses 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 overhead transmission lines and their associated equipment.

#### Wind and Earthquake Hazards

Transmission line structures used to support overhead transmission lines must meet the requirements of the CPUC, General Order No. 95, Rules for Overhead Electric Line Construction. This design code and the NESC include loading requirements related to wind conditions.

### 3.17.3.4 Local Guidelines

No local regulations have been identified pertaining to electrical interference and electrical hazards.

## 3.17.4 Impact Analysis Approach

There remains a lack of consensus in the scientific community regarding possible public health effects resulting from EMF exposure at the levels expected from electric power facilities. There are also no federal or State standards limiting human exposure to EMFs from transmission lines or substation facilities in California. For those reasons, no impact significance determinations are presented for EMF-related concerns. Information is provided in Section 5.3.1 (Magnetic Field Concerns) to allow understanding of the issue by the public and decision-makers.

For electrical interference and electrical hazards, criteria for determining impact significance are provided in Section 3.17.4.1, Applicant-proposed measures are presented in Section 3.17.4.2, and the impact assessment methodology is presented in Section 3.17.4.3. The assessment of potential impacts is provided in Sections 3.17.6 and 3.17.7.

### 3.17.4.1 Criteria for Determining Impact Significance

Electrical interference and electrical hazards identified during Project scoping are both safety and nuisance issues. The significance criteria for these issues consider the regulatory framework discussed above in Section 3.17.3, and are summarized below.

- Criterion EIH1: Action results in harmful interference with radio, television, communications, or electronic equipment (Federal Communication Commission regulations, Section 15.25).
- Criterion EIH2: Action results in induced currents or shock hazards to the public which would not be in compliance with applicable regulations, including: CPUC General Order 95, which provides guidelines on minimum clearances to be maintained for practical safeguarding of persons during the installation, operation, or maintenance of overhead transmission lines and their associated equipment.
- Criterion EIH3: Action interferes with cardiac pacemakers.
- Criterion EIH4: Action introduces hazards related to wind or earthquakes, or fails to comply with applicable guidelines including: CPUC General Order No. 95 (Rules for Overhead Electric Line Construction) and NESC requirements.

Significance conclusions for individual impacts are not required for compliance with NEPA. Therefore, conclusions presented in the following analysis regarding the significance of identified impacts are provided for the purposes of CEQA only.

### 3.17.4.2 Applicant-Proposed Measures (APMs)

SCE has not identified any non-EMF mitigation measures related to electrical interference and electrical hazards. For a discussion of "no-cost" or "low-cost" magnetic field reduction measures, please refer to the discussion in Section 5.3.1 (Magnetic Field Concerns).

### 3.17.4.3 Impact Assessment Methodology

The impact assessment for electrical interference and electrical hazards was conducted through a review of the change in magnetic field level in the environment that would occur due to the construction and operation of the proposed Project. Within the ROW, the proposed transmission line would be the predominant source of EMF and associated electrical interference and hazards. Further, the area within the transmission line ROW is within the control of SCE with regard to development land use restrictions and public access. In areas outside of the ROW, and as the distance from the transmission line increases, there may be other sources of EMF and associated electrical interference and hazards not associated with the Project which affect the level of public exposure to magnetic fields. Therefore, the edge of the transmission line ROW was adopted as the point of reference for characterizing the change in magnetic field strength and assessing Project impacts with respect to electrical interference and hazards.

## 3.17.5 Alternative 1: No Project/Action

Under the No Project/Action Alternative, the proposed Project would not be implemented and, therefore, the impacts associated with the proposed Project and alternatives described in Sections 3.17.6 and 3.17.7 below would not occur. The existing magnetic field due to existing transmission lines would remain unaltered. Impacts related to electronic interference, induced current and shock hazards, cardiac pacemakers, and other hazards would remain as they are with the existing transmission lines in the corridors.

However, in the absence of the Project, other actions would occur. Some wind projects in the Antelope Valley and Tehachapi areas would be postponed or cancelled, or alternatives would be developed to meet the RPS goal by 2010. SCE would need to accommodate the power load by upgrading existing transmission infrastructure or building new transmission facilities along a different alignment. Operation and construction methods, resulting impacts, and regulatory requirements associated with other transmission projects would be similar to those identified for the Project. In the circumstance of the No Project/Action Alternative, it is expected that actions with similar impacts as the proposed Project would take place.

## 3.17.6 Alternative 2: SCE's Proposed Project

### 3.17.6.1 Direct and Indirect Effects Analysis

#### Harmful interference with radio/television/communications/electronic equipment (Criterion EIH1)

#### *Impact EIH-1: The Project would cause radio, television, communications, or electronic equipment interference.*

Electric and magnetic fields from power lines occur at a frequency level that is substantially below the frequency range of communications systems and do not typically pose interference problems for communication equipment as can be seen from the proliferation of cell phone arrays that are mounted directly on transmission line structures.

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 it occurs. 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. Mitigation Measures EIH-1a and EIH-1b are recommended to reduce the potential impacts of interference.

*Mitigation Measures for Impact EIH-1*

**EIH-1a** **Limit the conductor surface electric gradient.** As part of the design and construction process for the Project, SCE shall limit the conductor surface electric gradient in accordance with the Institute of Electrical and Electronic Engineers Radio Noise Design Guide.

**EIH-1b** **Document and resolve electronic interference complaints.** After energizing the transmission line, SCE shall respond to, document, and resolve radio/television/electronic equipment interference complaints received. These records shall be made available to the CPUC for review upon request. All unresolved disputes shall be referred by SCE to the CPUC for resolution.

*CEQA Significance Conclusion*

Mitigation Measures EIH-1a and EIH-1b would limit the conductor surface gradient so the electric field intensity on the conductor does not exceed the breakdown strength of air, which would avoid generation of corona noise at levels that cause electronic interference, and would resolve and document all interference complaints. As such impacts related to radio, television, communications, and electronic equipment interference would be less than significant (Class II).

## Induced currents or shock hazards to the public (Criterion EIH2)

### *Impact EIH-2: The Project would cause induced currents and shock hazards in joint use corridors.*

Induced currents and voltages on conducting objects near the proposed transmission lines represent a potential significant impact that can be mitigated. These impacts do not pose a threat in the environment if the conducting objects are properly grounded. Mitigation Measure EIH-2 would ensure conducting objects are properly grounded.

#### *Mitigation Measure for Impact EIH-2*

**EIH-2 Implement grounding measures.** As part of the siting and construction process for the Project, SCE shall identify objects (such as fences, metal buildings, and pipelines) within and near the ROW that have the potential for induced voltages and shall implement electrical grounding of metallic objects in accordance with SCE's standards. The identification of objects shall document the threshold electric field strength and metallic object size at which grounding becomes necessary. SCE shall install all necessary grounding measures prior to energizing the transmission lines. Thirty days prior to energizing the lines, SCE shall notify in writing, subject to the review and approval of the CPUC, all property owners within and adjacent to the Project ROW of the date the line is to be energized. The written notice shall provide a contact person and telephone number for answering questions regarding the line and guidelines on what activities should be limited or restricted within the ROW. SCE shall respond to and document complaints received and the responsive action taken. These records shall be made available to the CPUC for review upon request. All unresolved disputes shall be deferred by SCE to the CPUC for resolution.

The written notice shall describe the nature and operation of the lines, and SCE's responsibilities with respect to grounding all conducting objects. In addition, the notice shall describe the property owner's responsibilities with respect to notification for any new objects, which may require grounding and guidelines for maintaining the safety of the ROW.

#### *CEQA Significance Conclusion*

Mitigation Measure EIH-2 would ensure that objects with the potential for induced voltages, such as fences, metal buildings, and pipelines, near the proposed rights-of-way would be properly grounded and property owners would be properly notified. As such impacts related to induced currents and shock hazards would be less than significant (Class II).

## Interference with cardiac pacemakers (Criterion EIH3)

### *Impact EIH-3: Project operation would result in electric fields that would affect cardiac pacemakers.*

The electric fields associated with the proposed Project's transmission lines may be of sufficient magnitude to impact operation of a few older model pacemakers resulting in them reverting to an asynchronous pacing. Cardiovascular specialists do not consider prolonged asynchronous pacing to be a problem; periods of operation in this mode are commonly induced by cardiologists to check pacemaker performance. Therefore, while the transmission line's electric field may impact operation of some older model pacemakers, the result of the interference is of short duration and is not considered harmful. No mitigation measures are required or recommended.

#### *CEQA Significance Conclusion*

While the proposed transmission lines would generate electric fields that may impact operation of some older model pacemakers, the resulting interference would be of short duration and is not considered significant or harmful (Class III).

### Introduction of hazards related to wind or earthquakes (Criterion EIH4)

### *Impact EIH-4: Project structures would be affected by wind and earthquakes.*

**Wind.** Transmission line structures used to support overhead transmission lines must meet the requirements of the California Public Utilities Commission, General Order No. 95, Rules for Overhead Electric Line Construction. This design code and the NESC include loading requirements related to wind conditions. Transmission support structures are designed to withstand different combinations of loading conditions including extreme winds. These design requirements include use of safety factors that consider the type of loading as well as the type of material used (e.g., wood, steel or concrete). Failures of transmission line support structures are extremely rare and are typically the result of anomalous loading conditions such as tornadoes or ice storms. The proposed Project would be constructed on steel lattice towers or tubular steel poles, and failure would be extremely unlikely.

**Earthquake.** Overhead transmission lines consist of a system of support structures and interconnecting wire that is inherently flexible. Industry experience has demonstrated that under earthquake conditions structure and member vibrations generally do not occur or cause design problems. Overhead transmission lines are designed for dynamic loading under variable wind conditions that generally exceed earthquake loads.

#### *CEQA Significance Conclusion*

The proposed Project would be constructed on steel lattice towers or tubular steel poles, where failure as a result of extreme wind conditions would be highly unlikely. Overhead transmission lines are designed for dynamic loading under variable wind conditions that generally exceed earthquake loads. Consequently, the risk that high winds or an earthquake would cause transmission line structures to threaten public safety is less than significant (Class III).

## 3.17.6.2 Cumulative Effects Analysis

The approach to analysis of the cumulative effects of electrical interference and electrical hazards entailed first determining the geographic extent of EMF and their impacts. Next, the existing cumulative conditions related to electrical interference and electrical hazards were reviewed in order to describe how the Project's impacts would change the cumulative conditions in the area of the new transmission lines.

### Geographic Extent

Electric and magnetic fields and their associated impacts occur only within a narrow corridor along the energized conductors of a transmission line and decrease in strength rapidly as distance from the transmission line conductors increases. From the perspective of electrical interference and electrical hazards, the geographic extent of Project impacts is directly along the entire length of the transmission line for the width of the ROW. The areas where there could be cumulative impacts are where the Project is adjacent to other transmission lines.

#### Existing Cumulative Conditions

Along the majority of the Project alignment, new transmission lines are being routed adjacent to existing transmission lines. Immediately along these existing corridors there is a potential for field-related impacts including electronic interference, induced currents and shock hazards, interference with cardiac pacemakers, and structural hazards related to wind or earthquakes.

#### Reasonably Foreseeable Future Projects and Changes

Routing of new transmission lines along existing corridors is a common approach used when siting new facilities. In the future, it is likely that transmission line upgrades or additions will occur along the corridors where the Project would be located. These activities would be expected to have electrical interference and hazards similar to existing transmission lines and the Project. However, as these impacts are similar and mitigable it is anticipated that the foreseeable projects would not result in additional cumulative impacts.

#### Cumulative Impact Analysis

The electrical interference and hazards associated with the Project occur in the immediate vicinity of the transmission line ROW. These impacts would be similar to the impacts of the existing transmission lines which the Project is adjacent to and would not be additive (No Impact). Alternatively, magnetic fields from the Project and other future projects, which entail construction and operation of a new transmission lines adjacent to existing lines, would be additive. In this instance, the magnetic field from the two facilities would interact in a manner such that the cumulative impact would be a change in the magnetic field at the edge of the Project ROW. Depending upon a number of variables, this magnetic field change could result in either an increase or decrease in the field strength.

## 3.17.7 Alternatives 3, 4, 5, 6, and 7

### 3.17.7.1 Direct and Indirect Effects Analysis

#### Harmful interference with radio/television/communications/electronic equipment (Criterion EIH1)

For the routing alternatives or the alternatives using different structure types or construction methods (helicopter construction) the impacts associated with electronic interference would be the same as for the proposed Project. For the underground portion of Alternative 5 (Partial Underground Alternative) and Alternative 7 (66-kV Subtransmission), the technology employed for an underground line is significantly different than for an overhead line. Underground transmission systems do not generate corona and audible noise so there would not be any field-related interference in areas where the line is placed underground. Mitigation Measures EIH-1a and EIH-1b are recommended to reduce the potential impacts of interference for all alternatives (Class II).

#### Induced currents or shock hazards to the public (Criterion EIH2)

For the routing alternatives or the alternatives using different structure types or construction methods (helicopter construction) the impacts associated with induced currents and shock hazards would be the same as for the proposed Project. For the underground portion of Alternative 5 (Partial Underground Alternative) and Alternative 7 (66-kV Subtransmission), the transmission cables or enclosures are effectively grounded, meaning that there would not be induced current or shock hazard impacts where the line is placed underground. Mitigation Measure EIH-2 would ensure conducting objects are properly grounded for all alternatives (Class II).

#### Interference with cardiac pacemakers (Criterion EIH3)

For the routing alternatives or the alternatives using different structure types or construction methods (helicopter construction) the impacts associated with interference with cardiac pacemakers would be the same as for the proposed Project. For the underground portion of Alternative 5 (Partial Underground Alternative) and Alternative 7 (66-kV Subtransmission), the electric field from the transmission line is effectively blocked. Lacking any above ground electric field there would not be any impacts related to interference with cardiac pacemakers where the line is placed underground. As discussed for the proposed Project, the interference is of short duration and is not considered significant or harmful (Class III).

#### Introduction of hazards related to wind or earthquakes (Criterion EIH4)

For the routing alternatives or the alternatives using different structure types or construction methods (helicopter construction) the impacts associated with wind or earthquake hazards would be the same as for the proposed Project. For the underground portion of Alternative 5 (Partial Underground Alternative) and Alternative 7 (66-kV Subtransmission), there would not be any overhead structures and no impacts related to wind. In addition, there would not be earthquake hazards for the public where the line is placed underground. As discussed for the proposed Project, overhead transmission lines would be constructed on steel lattice towers or tubular steel poles designed for dynamic loading under variable wind conditions that generally exceed earthquake loads and where failure as a result of extreme wind conditions would be highly unlikely. Consequently, the risk that high winds or an earthquake would cause transmission line structures to threaten public safety is less than significant (Class III).

### 3.17.7.2 Cumulative Effects Analysis

The electrical interference and hazards of the routing alternatives or the alternatives using different structure types or construction methods (helicopter construction) are the same type impacts as for the proposed Project and occur in the immediate vicinity of the transmission line ROW and subtransmission line ROW (in the case of Alternative 7). The field-related impacts of the alternatives would not be additive to the field-related impacts of the existing transmission lines which the alternatives are adjacent to so this would not result in cumulative impacts (No Impact).

## 3.17.8 Impact Significance Summary

Table 3.17-2 summarizes the direct and indirect environmental impacts of the proposed Project (Alternative 2) and the other alternatives on electrical interference and electrical hazards. The direct and indirect effects of the Project and alternatives have been fully described in Sections 3.17.6 and 3.17.7 above. Alternative 1 (No Project/No Action) impacts are fully described in Section 3.17.5; however, since no potential future project information is available an impact significance level for Alternative 1 is not included in the table below.

**Table 3.17-2. Summary of Impacts and Mitigation Measures – Electrical Interference and Hazards**

| Impact | Impact Significance | | | | | | | | Mitigation Measures |
|---|---|---|---|---|---|---|---|---|---|
| | Alt. 1+ | Alt. 2 | Alt. 3 | Alt. 4 | Alt. 5 | Alt. 6 | Alt. 7 | NFS Lands* | |
| EIH-1: The Project would cause radio, television, communications, or electronic equipment interference. | N/A | Class II | Class II | Class II | Class II | Class II | Class II | Yes | EIH-1a: Limit conductor surface electric gradient. EIH-1b: Document and resolve electronic interference complaints. |
| EIH-2: The Project would cause induced currents and shock hazards in joint use corridors. | N/A | Class II | Class II | Class II | Class II | Class II | Class II | Yes | EIH-2: Implement grounding measures. |
| EIH-3: Project operation would result in electric fields that would affect cardiac pacemakers. | N/A | Class III | Class III | Class III | Class III | Class III | Class III | Yes | None recommended. |
| EIH-4: Project structures would be affected by wind and earthquakes. | N/A | Class III | Class III | Class III | Class III | Class III | Class III | Yes | None recommended. |

N/A = Not Available

* Indicates whether this impact is applicable to the portion of the Project on National Forest System lands.

+ Potential projects would likely traverse the same geographic regions as either the proposed Project or Alternatives 3 through 7, and subsequently introduce similar types of impacts.