SECTION 3.0

Electric Transmission

3.1 Introduction

This section discusses the transmission interconnection between the Mariposa Energy Project (MEP) and the existing electrical grid, and the anticipated impacts that operation of the facility will have on the flow of electrical power in the project region. The following topics are discussed:

- The proposed electrical interconnection between MEP and the electrical grid
- The impacts of the electrical interconnection on the existing transmission grid
- Potential nuisances (electrical effects, aviation safety, and fire hazards)
- Safety of the interconnection
- Description of applicable laws, ordinances, regulations, and standards (LORS)

MEP will be located in northeastern Alameda County, on a 10-acre portion of a 158-acre parcel (know as the Lee Property) south of the Pacific Gas and Electric Company (PG&E) Bethany Compressor Station and 230-kilovolt (kV) Kelso Substation This location was selected, in part, for its proximity to the Kelso Substation, to which MEP will interconnect via a new, approximately 0.7-mile-long, 230-kV transmission line. The existing transmission resources in the vicinity of MEP are owned by PG&E and are part of its service area.

Sections 3.2 and 3.3 discuss the details regarding the transmission alternatives investigated and the results of the transmission interconnection studies.

3.2 Transmission Lines Description, Design, and Operation

MEP will be interconnected with the regional electrical grid by a new, approximately 0.7-mile-long, single-circuit, three-phase, 230-kV transmission line. The proposed 230-kV line will run generally north from the project site, staying east of the Byron Power Cogen Plant, crossing Kelso Road, and staying east of the PG&E Bethany Compressor Station. It will turn west just north of the Kelso Substation, then turn south to the final interconnect point at the Kelso Substation.

Figure 2.1-4, the MEP single-line diagram, shows the proposed MEP switchyard. Figure 3.2-1 presents the proposed transmission route between MEP and the Kelso Substation.

3.2.1 Overhead Transmission Line Characteristics

The proposed interconnecting 230-kV transmission circuit is expected to consist of a single-circuit configuration, supported by eight new, steel monopole structures, ranging in height from 84 to 95 feet, located at appropriate intervals (see Figure 3.2-2).

The proposed line will exit the MEP onsite switchyard from the take-off structures and will connect to the new steel-monopole, single-circuit structures.

3.2.2 230-kV Kelso Substation Characteristics

At this time, PG&E has not provided detailed drawings of the Kelso Substation.

3.2.3 MEP Switchyard Characteristics

The MEP switchyard will use a single 230-kV circuit breaker for the four generating units and a generator step-up transformer for each generating unit. The switchyard and all equipment will be designed for an interrupting capacity of at least 50 kiloamperes. The main buses, as well as the bays, will be designed to carry at least 2,000 amperes on a continuous basis. Figure 2.1-4 provides a single line diagram of the facility.

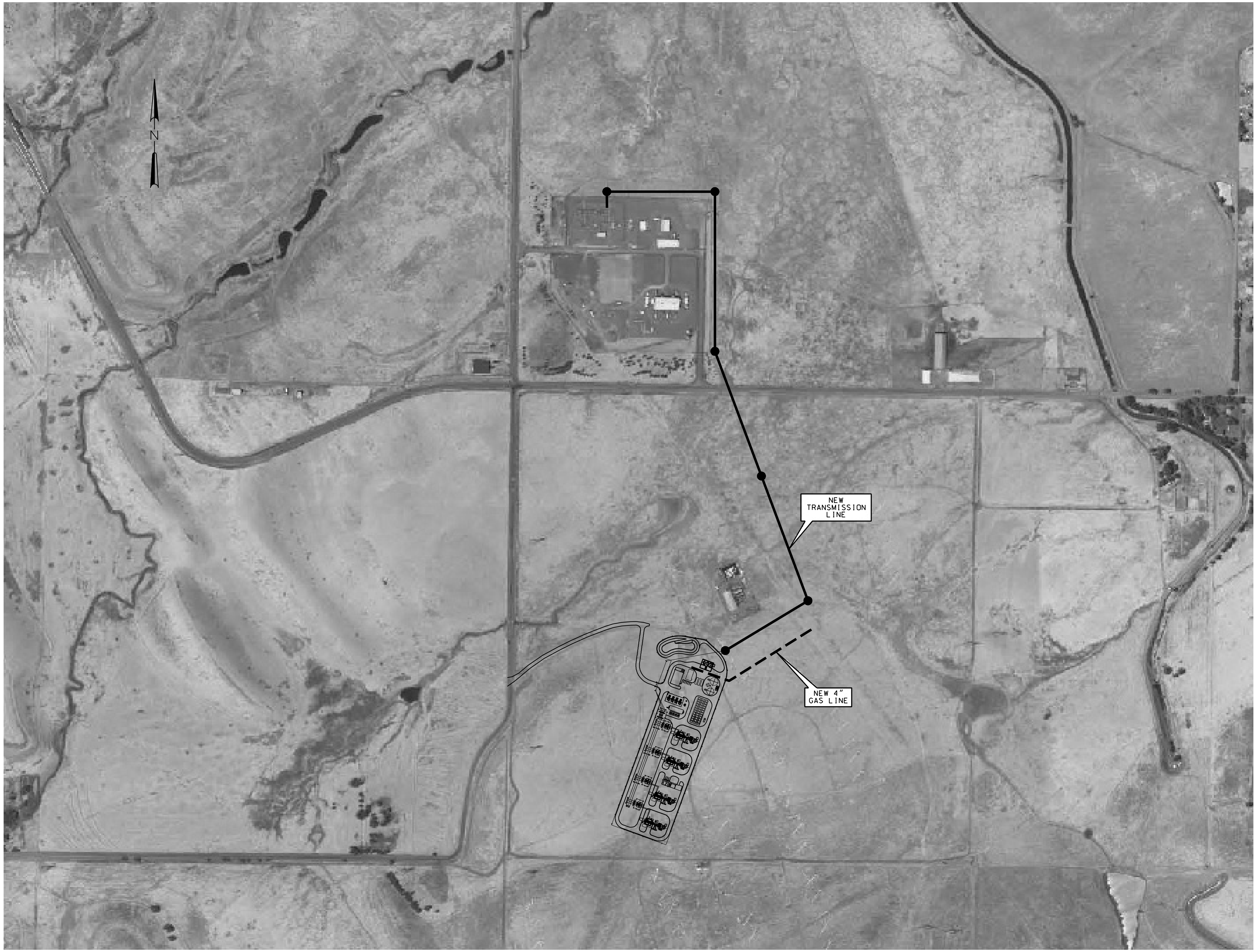
Startup and standby power will be supplied through the generator step-up transformers and four auxiliary transformers. Auxiliary controls and protective relay systems for the MEP switchyard will be located in the power plant control building.

3.3 Transmission Interconnection Studies

Mariposa Energy, LLC, as DGC Kelso CT, filed an Interconnection Request (IR) with the California Independent System Operator (CAISO) on April 4, 2008. However, as part of its Generator Interconnection Process Reform (GIPR) program, CAISO is reforming its process for conducting System Impact Studies (SIS) for new power generation facilities. While the Federal Energy Regulatory Commission's (FERC) Large Generator Interconnection Procedures (LGIP) have been in place since 2003 and outline the procedures to ensure open access to the transmission system, the large number of IRs (stemming partly from the increased interest in renewable power) has led to delays in the interconnection review process and a need for reform.

On May 15, 2008, CAISO requested permission from the FERC to implement proposed reforms to the process and filed a revised version of its proposal on June 27, 2008 (CAISO, 2008). Among the goals of the reform process are:

- Clear the backlog of all IRs existing in the CAISO queue
  - Reduce the number of projects through increased IR financial commitments or project viability tests
  - Apply group study principles to the remaining projects
- Develop procedures to ensure a more efficient interconnection of resources that more closely match system needs
- Provide interconnection applicants with reasonable cost and timing certainty
- Better integrate transmission planning with the generation interconnection process



NOTE:
TRANSMISSION LINE & GAS LINE ROUTINGS, AS SHOWN, ARE CONCEPTUAL.

300 0 300 600
Scale: 1 INCH = 300 FEET

FIGURE 3.2-1
TRANSMISSION LINE ROUTING DIAGRAM
Mariposa Energy Project
Alameda County, California

CH2MHILL

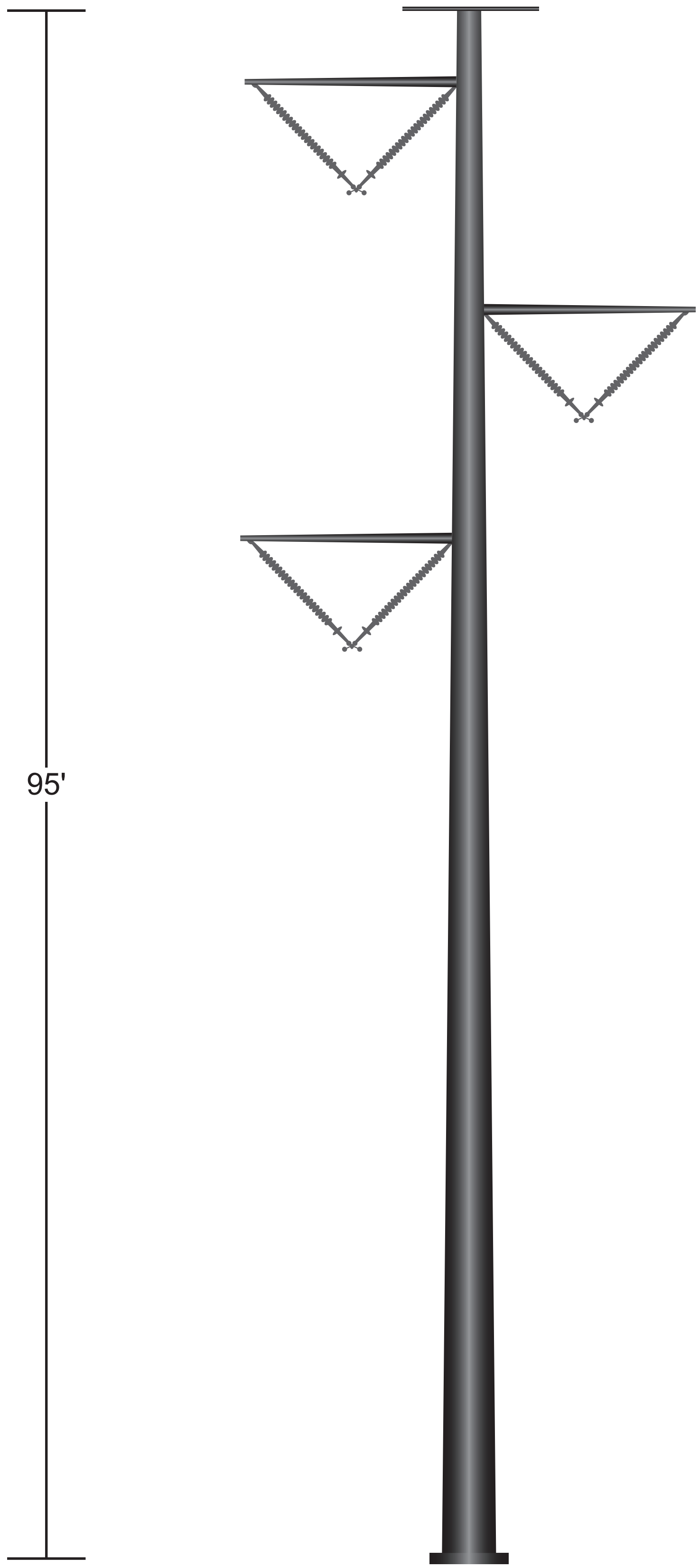


FIGURE 3.2-2
TYPICAL MONOPOLE TRANSMISSION TOWER
Mariposa Energy Project
Alameda County, California

While CAISO's reform proposal is under consideration by the FERC, it will not accept new SIS requests or process existing requests not meeting certain criteria. Under CAISO's proposal to the FERC, projects such as MEP, having requested interconnection studies before June 2, 2008, have been grouped into the "Transition Cluster." These projects will be eligible to sign a study agreement for the pertinent SISs in the fourth quarter of 2008 and will obtain the Phase I study results in summer of 2009.[1]

For an applicant before the California Energy Commission (CEC), the GIPR represents an obstacle to data adequacy, as the CEC's rules under Title 20, California Code of Regulations, Section 1704 and Appendix B stipulate the information requirements for a 12-month thermal power plant license applicant. One of these requirements is a "completed system impact study" as required by Appendix B(b)(2)(E). In a recent case, however (Marsh Landing Generating Station, 08-AFC-3), the CEC Staff proposed an interpretation of the information requirements that would allow for the SIS to be conducted by a third party, as long as this party were to use CAISO data files (Memorandum from Melissa Jones, Executive Director, California Energy Commission, to the Commissioners, July 10, 2008). Mariposa Energy, LLC has performed a third-party transmission screening assessment for MEP, which is included as Appendix 3A.

3.4 Transmission Line Safety and Nuisances

This section discusses safety and nuisance issues associated with the proposed electrical interconnection.

3.4.1 Electrical Clearances

Typical high-voltage overhead transmission lines are composed of bare conductors connected to supporting structures by means of porcelain, glass, or plastic insulators. The air surrounding the energized conductor acts as the insulating medium. Maintaining sufficient clearances, or air space, around the conductors to protect the public and utility workers is paramount to the safe operation of the line. The required safety clearance required for the conductors is determined by considering factors such as the normal operating voltages, conductor temperatures, short-term abnormal voltages, windblown swinging conductors, contamination of the insulators, clearances for workers, and clearances for public safety. The line will conform to the minimum clearances specified in the California Public Utilities Commission (CPUC) General Order 95 (GO 95). Electric utilities, state regulators, and local ordinances may specify additional (more restrictive) clearances. Typically, clearances are specified for the following:

- Distance between the energized conductors themselves
- Distance between the energized conductors and the supporting structure
- Distance between the energized conductors and other power or communication wires on the same supporting structure, or between other power or communication wires above or below the conductors

[1] Projects having a System Impact Study Agreement due date before May 1, 2008 are called the "Serial Group" and their studies will be completed during 2008.

- Distance from the energized conductors to the ground and features such as roadways, railroads, driveways, parking lots, navigable waterways, and airports
- Distance from the energized conductors to buildings and signs
- Distance from the energized conductors to other parallel power lines

The transmission interconnection for MEP will be designed to meet appropriate national, state, and local clearance requirements.

3.4.2 Electrical Effects

The electrical effects of high-voltage transmission lines fall into two broad categories: corona effects and field effects. Corona is the ionization of the air that occurs at the surface of the energized conductor and suspension hardware due to high electric field strength at the surface of the metal during certain conditions. Corona may result in radio and television reception interference, audible noise, light, and production of ozone. Field effects are the voltages and currents that may be induced in nearby conducting objects. A transmission line's inherent electric and magnetic fields cause these effects.

3.4.2.1 Electric and Magnetic Fields

Operating power lines, similar to energized components of electrical motors, home wiring, lighting, and other electrical appliances, produce electric and magnetic fields, commonly referred to as an electromagnetic field (EMF). The EMF produced by the alternating current electrical power system in the United States has a frequency of 60 hertz, meaning that the intensity and orientation of the field changes 60 times per second.

Electric fields around transmission lines are produced by electrical charges on the energized conductor. Electric field strength is directly proportional to the line's voltage; that is, increased voltage produces a stronger electric field. At a given distance from the transmission line conductor, the electric field is inversely proportional to the distance from the conductors, so that the electric field strength declines as the distance from the conductor increases. The strength of the electric field is measured in units of kilovolts per meter. The electric field around a transmission line remains 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 level of current flow, measured in terms of amperes, through the conductors. The magnetic field strength is also directly proportional to the current; that is, increased amperes produce a stronger magnetic field. The magnetic field is inversely proportional to the distance from the conductors. Thus, like the electric field, the magnetic field strength declines as the distance from the conductor increases. Magnetic fields are expressed in units of milligauss. The amperes and, therefore the magnetic field around a transmission line, fluctuate daily and seasonally as the usage of electricity varies.

Considerable research has been conducted over the last 30 years on the possible biological effects and human health effects from EMF. This research has produced many studies that offer no uniform conclusions about whether long-term exposure to EMF is harmful. In the absence of conclusive or evocative evidence, some states, including California, have chosen not to specify maximum acceptable levels of EMF. Instead, these states mandate a program of prudent avoidance whereby EMF exposure to the public would be minimized by encouraging electric utilities to use cost-effective techniques to reduce the levels of EMF.

3.4.2.2 Audible Noise and Radio and Television Interference

Corona from a transmission line may result in the production of audible noise or radio and television interference. Corona is a function of the voltage of the line, the diameter of the conductor, and the condition of the conductor and suspension hardware. The electric field gradient is the rate at which the electric field changes and is directly related to the line voltage.

The electric field gradient is greatest at the surface of the conductor. Large-diameter conductors have lower electric field gradients at the conductor surface and, hence, lower corona than smaller conductors, everything else being equal. Also, irregularities (such as nicks and scrapes on the conductor surface) or sharp edges on suspension hardware concentrate the electric field at these locations and, thus, increase corona at these spots. Similarly, contamination on the conductor surface, such as dust or insects, can cause irregularities that are a source for corona. Raindrops, snow, fog, and condensation are also sources of irregularities.

3.4.2.3 EMF, Audible Noise, and Radio and Television Interference Assumptions

It is important to remember that EMF, audible noise, and radio and television interference near power lines vary with regard to the line design, line loading, distance from the line, and other factors.

Electric fields, corona, audible noise, and radio and television interference depend on line voltage and not the level of power flow. Because line voltage remains nearly constant for a transmission line during normal operation, the audible noise associated with the 230-kV lines in the area will be of the same magnitude before and after the project.

Corona typically becomes a design concern for transmission lines having voltages of 345-kV and above. Since MEP will be connected at 230-kV voltage level, it is expected that no corona-related design issues will be encountered.

The magnetic field is proportional to line loading (amperes), which varies as demand for electrical power varies and as generation from the generating facility is changed by the system operators to meet changes in demand.

Construction and operation of MEP, including the interconnection of the facility with PG&E'S transmission system, are not expected to result in significant increases in EMF levels, corona, audible noise, or radio and television interference.

3.4.2.4 Induced Current and Voltages

A conducting object such as a vehicle or person in an electric field will experience induced voltages and currents. The strength of the induced current will depend on the electric field strength, the size and shape of the conducting object, and the object-to-ground resistance. When a conducting object is isolated from the ground and a grounded person touches the object, a perceptible current or shock may occur as the current flows to ground. The mitigation for hazardous and nuisance shocks is to ensure that metallic objects on or near the right-of-way are grounded and that sufficient clearances are provided at roadways and parking lots to keep electric fields at these locations low enough to prevent vehicle short-circuit currents from exceeding 5 milliamperes.

Magnetic fields can also induce voltages and currents in conducting objects. Typically, this requires a long metallic object, such as a wire fence or aboveground pipeline that is grounded at only one location. A person who closes an electrical loop by grounding the object at a different location will experience a shock similar to that described above for an ungrounded object. Mitigation for this problem is to ensure multiple grounds on fences or pipelines, especially those orientated parallel to the transmission line.

The proposed 230-kV transmission interconnection line will be constructed in conformance with CPUC GO-95 and Title 8 California Code of Regulations (CCR) 2700 requirements. Therefore, hazardous shocks are unlikely to occur as a result of project construction, operation, or maintenance.

3.4.3 Aviation Safety

Federal Aviation Administration (FAA) Regulations, 14 Code of Federal Regulations (CFR) Part 77, establish standards for determining obstructions in navigable airspace and set forth requirements for notification of proposed construction. These regulations require FAA notification for construction over 200 feet above ground level. In addition, notification is required if the obstruction is lower than specified heights and falls within restricted airspace in the approaches to public or military airports. For airports with runways longer than 3,200 feet, the restricted space extends 20,000 feet (3.3 nautical miles) from the runway. For airports with runways measuring 3,200 feet or less, the restricted space extends 10,000 feet (1.7 nautical miles). For heliports, the restricted space extends 5,000 feet (0.8 nautical miles).

The nearest public airport to MEP is Byron Airport. Byron Airport is a general aviation airport and has runways that are 4,500 and 3,000 feet long. The nearest runway is about 2.3 nautical miles (2.7 miles) from MEP; therefore, MEP falls within the restricted airspace and FAA notification is required.

Since the MEP structures, including transmission structures, will be less than 200 feet tall and other larger transmission structures currently exist in the immediate vicinity, the FAA air navigation hazard review is not likely to find that the project could cause a hazard to air navigation. However, because MEP is located in the restricted airspace of the Byron Airport, an FAA Notice Criteria evaluation was performed for the highest proposed transmission tower (95 feet above ground level, top elevation of 210 feet above mean sea level) and is provided in Appendix 5.12A. Based on the results of this evaluation, an FAA Form 7460-1, Notice of Proposed Construction or Alteration was filed (Appendix 5.12B).

3.4.4 Fire Hazards

The proposed 230-kV transmission interconnection will be designed, constructed, and maintained in accordance with applicable standards including GO-95, which establishes clearances from other manmade and natural structures as well as tree-trimming requirements to mitigate fire hazards. PG&E will maintain the transmission line corridor and immediate area in accordance with existing regulations and accepted industry practices that will include identification and abatement of fire hazards.

3.5 Laws, Ordinances, Regulations, and Standards

This section provides a list of applicable LORS that apply to the proposed transmission line, substations, and engineering.

3.5.1 Design and Construction

Table 3.5-1 lists the LORS for the design and construction of the proposed transmission line and switchyard.

TABLE 3.5-1
Design and Construction LORS for the Proposed Transmission Line and Switchyard

LORS	Applicability
Title 8 CCR, Section 2700 et seq. “High Voltage Electrical Safety Orders”	Establishes essential requirements and minimum standards for installation, operation, and maintenance of electrical installation and equipment to provide practical safety and freedom from danger.
GO-52, CPUC, “Construction and Operation of Power and Communication Lines”	Applies to the design of facilities to provide or mitigate inductive interference.
ANSI/IEEE 593, “IEEE Recommended Practices for Seismic Design of Substations”	Recommends design and construction practices.
IEEE 1119, “IEEE Guide for Fence Safety Clearances in Electric-Supply Stations”	Recommends clearance practices to protect persons outside the facility from electric shock.
IEEE 998, “Direct Lightning Stroke Shielding of Substations”	Recommends protections for electrical system from direct lightning strikes.
IEEE 980, “Containment of Oil Spills for Substations”	Recommends preventions for release of fluids into the environment.

3.5.2 Electric and Magnetic Fields

The LORS pertaining to EMF are listed in Table 3.5-2.

TABLE 3.5-2
Electric and Magnetic Field LORS

LORS	Applicability
Decision 93-11-013, CPUC	CPUC position on EMF reduction.
GO-131-D, CPUC, “Rules for Planning and Construction of Electric Generation, Line, and Substation Facilities in California”	CPUC construction application requirements, including requirements related to EMF reduction.
ANSI/IEEE 544-1994, “Standard Procedures for Measurement of Power Frequency Electric and Magnetic Fields from AC Power Lines”	Standard procedure for measuring EMF from an electric line that is in service.

3.5.3 Hazardous Shock

Table 3.5-3 lists the LORS regarding hazardous shock protection that apply to the transmission interconnection and the overall project.

TABLE 3.5-3
Hazardous Shock LORS

LORS	Applicability
8 CCR 2700 et seq. “High Voltage Electrical Safety Orders”	Establishes essential requirements and minimum standards for installation, operation, and maintenance of electrical equipment to provide practical safety and freedom from danger.
ANSI/IEEE 80, “IEEE Guide for Safety in AC Substation Grounding”	Presents guidelines for assuring safety through proper grounding of AC outdoor substations.
NESC, ANSI C2, Section 9, Article 92, Paragraph E; Article 93, Paragraph C	Covers grounding methods for electrical supply and communications facilities.

3.5.4 Communications Interference

The LORS pertaining to communications interference are listed in Table 3.5-4.

TABLE 3.5-4
Communications Interference LORS

LORS	Applicability
47 CFR 15.25, “Operating Requirements, Incidental Radiation”	Prohibits operations of any device emitting incidental radiation that causes interference to communications; the regulation also requires mitigation for any device that causes interference.
GO-52, CPUC	Covers all aspects of the construction, operation, and maintenance of power and communication lines and specifically applies to the prevention or mitigation of inductive interference.
CEC staff, Radio Interference and Television Interference (RI-TVI) Criteria (Kern River Cogeneration) Project 82-AFC-2, Final Decision, Compliance Plan 13-7	Prescribes the CEC’s RI-TVI mitigation requirements, developed and adopted by the CEC in past citing cases.

3.5.5 Aviation Safety

Table 3.5-5 lists the aviation safety LORS that may apply to the proposed transmission interconnection and the overall project.

TABLE 3.5-5
Aviation Safety LORS

LORS	Applicability
Title 14 CFR, Part 77, "Objects Affecting Navigable Airspace"	Describes the criteria used to determine whether a "Notice of Proposed Construction or Alteration" (NPCA, FAA Form 7450-1) is required for potential obstruction hazards.
FAA Advisory Circular No. 70/7450-1G, "Obstruction Marking and Lighting"	Describes the FAA standards for marking and lighting of obstructions as identified by FAA Regulations Part 77.
CPUC, Sections 21555-21550	Discusses the permit requirements for construction of possible obstructions in the vicinity of aircraft landing areas, in navigable airspace, and near the boundary of airports.

3.5.6 Fire Hazards

Table 3.5-6 lists the LORS governing fire hazard protection for the proposed transmission interconnection and the overall project.

TABLE 3.5-6
Fire Hazard LORS

LORS	Applicability
14 CCR Sections 1250-1258, "Fire Prevention Standards for Electric Utilities"	Provides specific exemptions from electric pole and tower firebreak and electric conductor clearance standards, and specifies when and where standards apply.
ANSI/IEEE 80, "IEEE Guide for Safety in AC Substation Grounding"	Presents guidelines for assuring safety through proper grounding of AC outdoor substations.
GO-95, CPUC, "Rules for Overhead Electric Line Construction," Section 35	CPUC rule covers all aspects of design, construction, operation, and maintenance of electric transmission line and fire safety (hazards).

3.5.7 Jurisdiction

Table 3.5-7 identifies national, state, and local agencies with jurisdiction to issue permits or approvals, conduct inspections, or enforce the above-referenced LORS. Table 3.5-7 also identifies the responsibilities of these agencies as they relate to MEP construction, operation, and maintenance.

TABLE 3.5-7
National, State, and Local Agencies with Jurisdiction over Applicable LORS

Agency or Jurisdiction	Responsibility
FAA	Establishes regulations for marking and lighting of obstructions in navigable airspace (AC No. 70/7450-1G).
CEC	Jurisdiction over new transmission lines associated with thermal power plants that are 50 MW or more (Public Resources Code [PRC] 25500).
CEC	Jurisdiction of lines out of a thermal power plant to the interconnection point to the utility grid (PRC 25107).
CEC	Jurisdiction over modifications of existing thermal power plants that increase peak operating voltage or peak kilowatt capacity 25 percent (PRC 25123).
CPUC	Regulates construction and operation of overhead transmission lines. (General Order No. 95)
CPUC	Regulates construction and operation of power and communications lines for the prevention of inductive interference. (General Order No. 52)
Local Electrical Inspector	Jurisdiction over safety inspection of electrical installations that connect to the supply of electricity (NFPA 70).
County of Alameda	Establishes and enforces zoning regulations for specific land uses. Issues variances in accordance with zoning ordinances.
	Issues and enforces certain ordinances and regulations concerning fire prevention and electrical inspection.

3.6 References

California Independent System Operator (CAISO). 2008. Generator Interconnection Process Reform (GIPR) Revised Draft Proposal, June 27, 2008. Available at: http://www.caiso.com/1f42/1f42c00d28c30.html.