SECTION 5.0

Electric Transmission

This section discusses the transmission interconnection between the SVEP 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. To better understand the impacts of the proposed SVEP on transmission and power flows, the discussions in this section focus on those areas that allow a critical review of the electrical transmission and interconnection. More specifically, this analysis will contain discussions of:

- The proposed electrical interconnection between SVEP and the electrical grid
- The proposed electrical transmission line
- 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)

The SVEP is located in an industrial area unincorporated Riverside County, California. This location was selected, in part, for its proximity to the Southern California Edison's (SCE's) Valley Substation. The SVEP 115-kilovolt (kV) transmission line will be directly connected to SCE's transmission system through the Valley Substation. The interconnection to the substation will be constructed by using the 115-kV south bus at the Valley Substation.

5.1 Transmission Interconnection

SVEP will link to the power grid through the SCE Valley Substation by two three-phase 115-kV solid dielectric above-ground transmission circuits. The proposed 115-kV route will exit north from SVEP and run 600 feet, crossing the railroad track to a single transmission tower to be located adjacent to the Valley Substation in SCE's transmission corridor. Figure 5.1-1 shows the location of SVEP in relationship to the Valley Substation. Figure 5.1-2 is a one-line diagram showing the connection of SVEP with SCE's transmission system. Figure 5.1-3 is a typical monopole conductor support tower design that could be used for the tower that will be adjacent to the Valley Substation.

5.2 System Impact Study

5.2.1 System Impact Study Design

Southern California Edison has completed a System Impact Study for the SVEP (see Appendix 5A). The study looked at the proposed 115-kV connection of the SVEP with the Valley Substation and modeled the effects on the regional transmission system (SCE eastern area) of adding generation from the SVEP.

The study included certain base case assumptions and examined two critical load conditions for SCE's eastern area. The basic assumptions for both load condition simulations were:

- Maximum generation from qualified generation facilities in SCE's eastern area
- High East-of-Colorado River/West-of-Colorado River (EOR/WOR) power flow
- High power flow into the Devers 500-kV Substation

The two critical loading conditions simulated were:

- Year 2007 peak load
- Year 2008 off-peak load

These conditions were modeled to assess transmission system operation under stress, and to estimate the extent of potential transmission congestion before and after the SVEP.

The Feasibility Study was conducted by applying the California Independent System Operator (CAISO) reliability criteria. To further test the reliability of the system under stress, the CAISO requires SCE model scenarios to assume that one or more transmission system components are temporarily inoperable. Outage contingencies modeled include the following:

For transmission lines:

- N-1 – Single contingency, or loss of one transmission line or one 500/230-kV transformer bank
- N-2 – Double contingency, or loss of two lines or one line and one 500/230-kV transformer bank

For 500/230-kV transformer banks:

- Short-term overload
- Long-term overload

Feasibility Study modeling included the following: (1) the pre-project condition, a base case with all transmission facilities in service, all existing interconnected generation facilities operating, and assuming all new generation projects that have requested interconnection and that have a senior queue position to SVEP are constructed and operating; and (2) the post-project condition, which is the base case modeled as if the SVEP were already constructed and in operation.

The system model assumed the following for specific, planned system additions that are either planned or under construction:

- Palo Verde-Devers No. 2 500-kV line in service
- Desert Southwest Transmission Project in service (Midpoint Substation, Blythe I & II generation)
- Four west-of-Devers 230-kV lines upgraded
- Rancho Vista 500/230-kV substation in service
- Oak Valley 230/115-kV substation and Jurupa 230/66kV substation in service
- Devers-Mirage 115-kV system in "split" configuration

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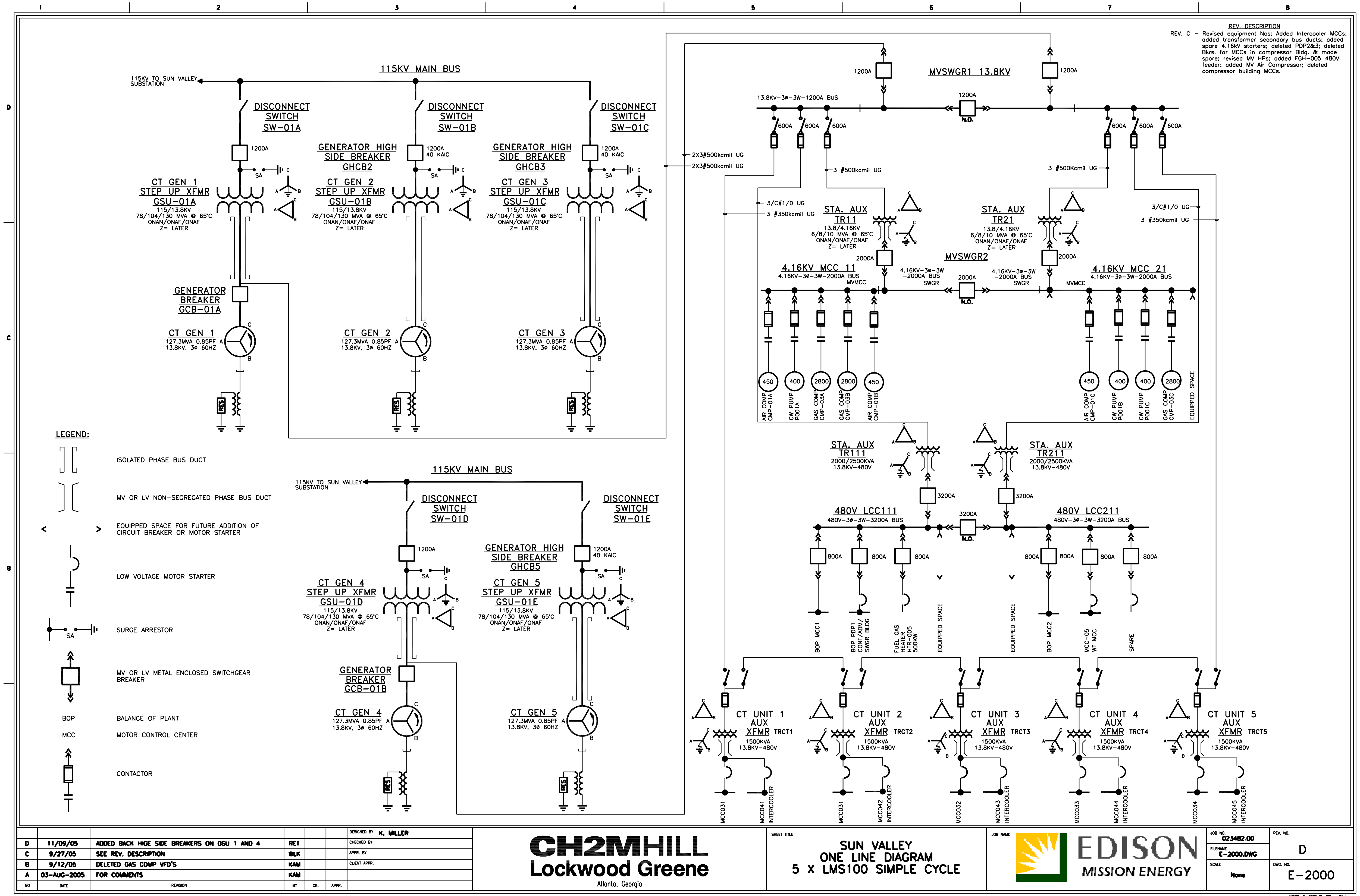

FIGURE 5.1-2
LOCAL SYSTEM SINGLE LINE DIAGRAM
SUN VALLEY ENERGY PROJECT
ROMOLAND, CALIFORNIA

CH2MHILL

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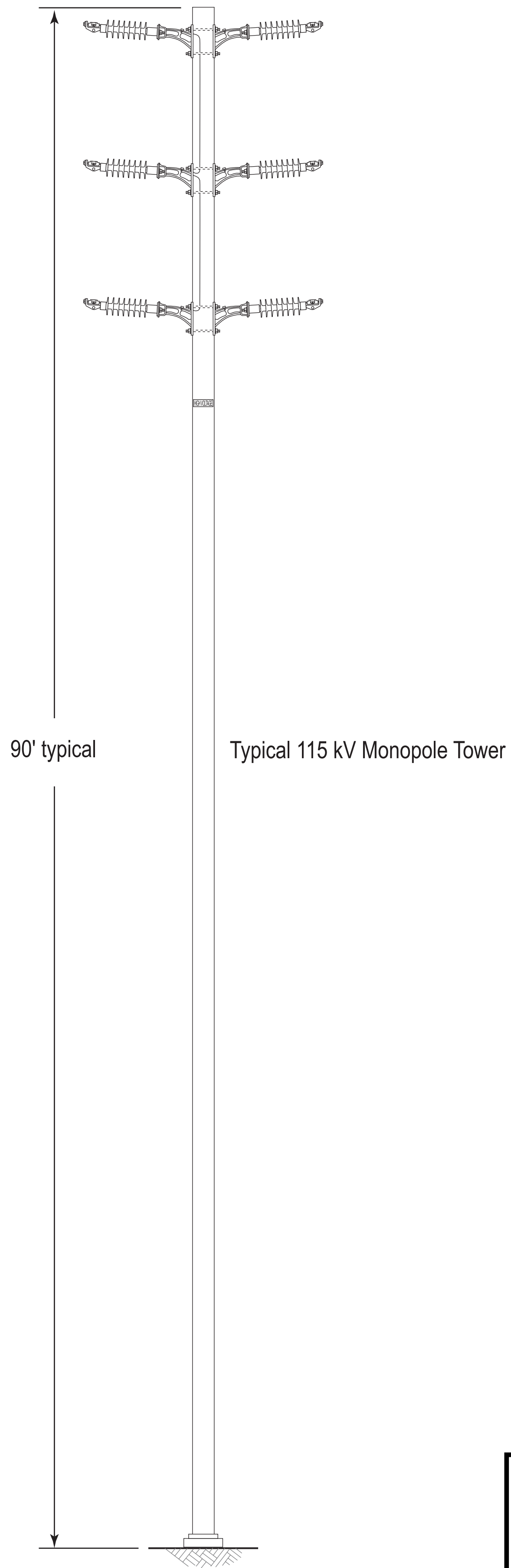

FIGURE 5.1-3
TYPICAL 115 kV
MONOPOLE TOWER
SUN VALLEY ENERGY PROJECT
ROMOLAND, CALIFORNIA

CH2MHILL

The model assumed the existing system arrangement, per the CAISO's Controlled Transmission Expansion Assessment.

5.2.2 Feasibility Study Model Results

5.2.2.1 2007 Peak Load Case

Under the 2007 Peak Load scenario, with no contingencies modeled there would be no overloads with the addition of SVEP. Contingency modeling shows that, with a single contingency, adding the SVEP to the system would increase the pre-SVEP overload on the Etiwanda-San Bernardino 230-kV transmission line from 125 to 129 percent. Under two different double-contingency scenarios, overloads to the Etiwanda-San Bernardino 230-kV transmission line would increase from 143 to 147 percent with the SVEP.

5.2.2.2 2008 Off-Peak Case

Under the base case with the addition of the SVEP, there would be an overload on the Serrano-Valley 500-kV line that would be triggered by generation projects senior in the queue to SVEP and to which SVEP would contribute. The power flow on this line would increase from 101 to 113 percent with the addition of the SVEP.

Under single-contingency outage scenarios, there could be overloads on seven transmission lines with the addition of SVEP (Table 5.2-2). Two of these overloads (Devers-Vista No. 1 and No. 2) would be triggered by SVEP. The others are pre-project overloads.

TABLE 5.2-1
Single Contingency Overloads Modeled with SVEP, 2008 Off-Peak Case

Outage Contingency	Overloaded Facility	Pre-Project loading (%)	Post-Project Loading (%)	Project Effect (%)
N Gila-Imperial Vly 500 kV	Serrano-Valley 500 kV	115	128	13
Serrano-Valley 500 kV	Devers-Vista No. 1 230 kV	110	118	8
Serrano-Valley 500 kV	Devers-Vista No. 2 230 kV	110	118	8
Serrano-Valley 500 kV	Etiwanda-San Bernardino 230 kV	122	130	8
Serrano-Valley 500 kV	Etiwanda-Vista 230 kV	120	128	8
Mira Loma-Olinda 230 kV	Mira Loma-Walnut 230 kV	111	114	3
Barre-Villa Park 230 kV	Barre-Lewis 230 kV	143	146	3

Source: SCE System Impact Study

Under 20 double-contingency scenarios, there could be overloads on eight transmission lines with the addition of SVEP. Table 5.2-1 shows the most serious overload for each of the eight lines. Two of the overloads (Devers-Vista No. 1 and No. 2) would be triggered by SVEP. The others are pre-project overloads.

Since a peaking generator like SVEP is unlikely to be operating in a light load scenario such as the one modeled, it may be possible to mitigate the impact with a remedial action scheme.

TABLE 5.2-2
Double Contingency Overloads Modeled with SVEP, 2008 Off-Peak Case

Outage Contingencies	Overloaded Facility	Pre-Project loading (%)	Post-Project Loading (%)	Project Effect (%)
Etiwanda-San Bernardino 230 kV San Bernardino-Vista 230 kV	Serrano-Valley 500 kV	14	127	13
Devers-Vista No. 1 or 2 230 kV San Bernardino-Vista 230 kV	Etiwanda-San Bernardino 230 kV	144	148	4
Serrano-Valley 500 kV San Onofre-Serrano 230 kV	Etiwanda-Vista 230 kV	122	130	8
Barre-Villa Park 230 kV Barre-Lewis 230 kV	Mira Loma-Walnut 230 kV	110	113	3
Etiwanda-San Bernardino 230 kV Etiwanda-Vista 230 kV	Mira Loma-Vista No. 2 230 kV	142	147	5
San Onofre-Santiago No. 1 230 kV San Onofre-Santiago No. 2 230 kV	Barre-Lewis 230 kV	138	141	2
San Onofre-Santiago No. 1 230 kV San Onofre-Santiago No. 2 230 kV	Barre-Ellis 230 kV	132	135	3
Lewis-Serrano No. 1 230 kV Lewis-Serrano No. 2 230 kV	Lewis-Villa Park 230 kV	117	119	2

Source: SCE System Impact Study

5.2.2.3 Short-Circuit Study

The System Impact Study also included modeling of the effects of SVEP on short-circuit duty at substations. The modeling results indicated that new facilities including SVEP would be likely to increase short-circuit duty at 22 substations. The effects attributable to SVEP would take place at Mira Loma Substation and require replacement of two 38.4-kA 500-kV circuit breakers.

5.2.2.4 Subtransmission and Distribution Study

SCE also examined the SVEP’s potential impact on the subtransmission and distribution system. This study is bound separately and included as Appendix 5B. The study concludes that the SVEP would cause no impacts to the subtransmission and distribution system and that no mitigation would be required for this system.

5.2.3 Mitigation

SCE has recommended several measures to mitigate SVEP system impacts. These measures assume that improvements that would be scheduled to be made by projects ahead of SVEP in the queue have been made. Mitigation measures include the following:

- Install two new double-breaker 115-kV line positions at the Valley Substation to terminate the SVEP’s two new 115-kV generation tie lines
- Install one remote terminal unit at Valley Substation

- Install a Special Protection Scheme (SPS) for mitigation of the overloads on Devers-Vista No. 1 and No. 2 230-kV lines for the N-1 contingency effects on the Serrano-Valley 500-kV line
- Replace two 38.4-kA circuit breakers at the Mira Loma Substation

None of the proposed measures to mitigate potential overloads would result in any significant environmental impacts because all of these improvements would take place within the boundaries and fence lines of existing substations.

5.3 Transmission Line Safety and Nuisances

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

5.3.1 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 safety clearance required around the conductors is determined by normal operating voltages, conductor temperatures, short-term abnormal voltages, wind-blown swinging conductors, contamination of the insulators, clearances for workers, and clearances for public safety. Minimum clearances are specified in the California Public Utility 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
- Distance from the energized conductors to the ground and features such as roadways, railroads, driveways, parking lots, navigable waterways, airports, etc.
- Distance from the energized conductors to buildings and signs
- Distance from the energized conductors to other parallel power lines

5.3.2 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 very 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.

5.3.2.1 Electric and Magnetic Fields

Operating power lines, like the energized components of electrical motors, home wiring, lighting, and all other electrical appliances, produce electric and magnetic fields, commonly referred to as electromagnetic field (EMF). The EMF produced by the alternating current electrical power system in the United States has a frequency of 60 hertz (Hz), 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 (kV/m). 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 (mG). 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 or not. In the absence of conclusive or evocative evidence, some states, California in particular, 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 low-cost techniques to reduce the levels of EMF.

5.3.2.2 Audible Noise

Corona may result in the production of audible noise from a transmission line. 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. Corona typically becomes a design concern for transmission lines having voltages of 345 kV and above. Since the SVEP will be connected at 115 kV, it is expected that no corona-related design issues will be encountered.

The construction and operation of the SVEP, including the connection of SVEP with SCE's transmission system, will not result in any significant increases in EMF levels or audible noise.

5.3.2.3 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 upon 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 (mA).

Magnetic fields can also induce voltages and currents in conducting objects. Typically, this requires a long metallic object, such as a wire fence or above-ground 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 that are orientated parallel to the transmission line.

The proposed 115-kV transmission interconnection will be constructed in conformance with CPUC GO-95 and Title 8 CCR 2700 requirements. Therefore, hazardous shocks are unlikely to occur as a result of project construction, operation, or maintenance.

5.3.3 Aviation Safety

Federal Aviation Administration (FAA) Regulations, 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 any construction over 200 feet high above ground level. In addition, notification is required if the obstruction is lower than specified heights and falls within any 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 mile) at a slope of 25:1. The nearest public airport to the SVEP is the Perris Valley Airport, approximately than 4 miles away and not within the restricted space.

Since the new transmission towers will be less than 200 feet tall, and there are no public or military airports or heliports close enough to the project to trigger additional restrictions, an FAA air navigation hazard review will not be necessary. The structures of the preferred electrical transmission interconnection will pose no deterrent to aviation safety as defined in the FAA regulations.

5.3.4 Fire Hazards

The proposed 115-kV transmission interconnection lines will be designed, constructed, and maintained in accordance with GO-95, which establishes clearances from other man-made and natural structures as well as tree-trimming requirements to mitigate fire hazards. VSE 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 any fire hazards.

5.4 Applicable Laws, Ordinances, Regulations, and Standards

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

5.4.1 Design and Construction

Table 5.4-1 lists the applicable LORS for the design and construction of the proposed transmission line and substations.

TABLE 5.4-1
Design and Construction LORS

LORS	Applicability
GO-128, CPUC, “Rules for Underground Electric Line Construction”	CPUC rule covers required clearances, grounding techniques, maintenance, and inspection requirements.
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.

5.4.2 Electric and Magnetic Fields

The applicable LORS pertaining to EMF interference are tabulated in Table 5.4-2.

TABLE 5.4-2
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.

5.4.3 Hazardous Shock

Table 5.4-3 lists the LORS regarding hazardous shock protection that apply to the project.

TABLE 5.4-3
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.

5.4.4 Communications Interference

The applicable LORS pertaining to communication interference are tabulated in Table 5.4-4.

TABLE 5.4-4
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.

5.4.5 Aviation Safety

Table 5.4-5 lists the aviation safety LORS that may apply to the proposed construction and operation of SVEP.

TABLE 5.5-5
Aviation Safety LORS

LORS	Applicability	AFC Reference
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.	Section 5.3.3
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.	Section 5.3.3
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.	Section 5.3.3

5.4.6 Fire Hazards

Table 5.4-6 tabulates the LORS governing fire hazard protection for SVEP.

TABLE 5.4-6
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 electrical transmission line and fire safety (hazards).

5.4.7 Jurisdiction

Table 5.4-7 identifies national, state, and local agencies with jurisdiction to issue permits or approvals, conduct inspections, and/or enforce the above-referenced LORS. Table 5.4-7 also identifies the associated responsibilities of these agencies as they relate to the construction, operation, and maintenance of SVEP.

TABLE 5.4-7
Jurisdiction

Agency or Jurisdiction	Responsibility
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 facilities that increase peak operating voltage or peak kilowatt capacity 25 percent (PRC 25123).
FAA	Establishes regulations for marking and lighting of obstructions in navigable airspace (AC No. 70/7450-1G).
Local Electrical Inspector	Jurisdiction over safety inspection of electrical installations that connect to the supply of electricity (NFPA 70).
Riverside County	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.