4.0 SAFETY AND RELIABILITY

4.1 Facility Safety

4.1.1 Natural Hazards

4.1.1.1 Geologic and Hydrogeologic Hazards

The Genesis Solar Energy Project (the Project) is situated within the northeastern portion of Chuckwalla Valley, an east-southeast trending valley in California's Mojave Desert Geomorphic Province. Within this region, geologic hazards are normally associated with issues such as seismicity (ground shaking), slope instability, subsidence, and expansive soils, all of which are caused by sedimentation, volcanic activity, folding, faulting, uplift, and erosion. Seismic hazards related to ground shaking include ground rupture, slope instability, liquefaction, seismic compaction, tsunamis, and seiches. Because there are no open water bodies located in the vicinity of the Site or the off-site linears associated with the Project, tsunami and seiche hazards do not exist for the Project. With the exception of tsunamis and seiches, these hazards are discussed in greater detail in Section 5.5, Geological Resources.

Although the Site is not located in a very seismically active area, it may be subjected to ground shaking from movement along one or more of the sufficiently active or well-defined faults in the adjacent, more seismically active areas such as the Salton Trough, the Transverse Ranges, or Central Mojave Block. The Riverside County General Plan, Safety Element (Riverside County, 2008) indicates the Site and off-site linears associated with the Project are in an area of moderate ground shaking risk. Based on the available data, the Project is subject to low to moderate seismic ground shaking hazard.

The site is not located within a State of California Earthquake Fault Zone designated by the Alquist-Priolo Special Studies Zone Act of 1972 (formerly known as a Special Studies Zone), an area where the potential for fault rupture is considered probable (Riverside County, 2008). Based on the information available and engineering judgment, earthquake-induced ground rupture is not considered to be a significant hazard at the Site.

The Project site and off-site linears associated with the Project are not considered to be an area with the potential for permanent ground displacement due to earthquake-induced landslides because surface topography at and near the site is relatively flat (Riverside County, 2008). Based on the information available and engineering judgment, slope instability is not considered to be a significant hazard at the Site.

Due to generally flat terrain, the Project site is not prone to significant mass wasting (gravity-driven erosion and non-fluvial sediment transport) at present. The Riverside County General Plan, Safety Element (Riverside County, 2008), indicates the Site is in an area with moderate potential for wind erosion, and the off-site linears are in areas with moderate to high potential for wind erosion. Soil characteristics at the Project site allow for the potential for wind and water erosion, and significant sediment transport currently occurs across the valley axial drainage that crosses the majority of the proposed plant site. Soil erosion from wind and water during construction activities is further evaluated in Section 5.6, Soils. The implementation of Best Management Practices (BMPs), which are outlined in the DESCP (Appendix A), is expected to reduce water and wind erosion of soils during construction and post-construction to less than significant levels.

Liquefaction is a soil condition in which seismically induced ground motion causes an increase in soil water pressure in saturated, loose, uniformly-graded sands, resulting in loss of soil shear strength. The Riverside County General Plan Safety Element (Riverside County, 2008) indicates the majority of Chuckwalla Valley, including the soils beneath the Site and associated Project off-site linears, is mapped as having deep groundwater but underlain by soils with an otherwise moderate susceptibility to liquefaction. Based on the information available and engineering judgment, the potential for liquefaction hazard at the Site is considered to be low. The potential for liquefaction will be further evaluated as part of the Final Geotechnical Investigation for the Project.

Based on the general geology of the Chuckwalla Valley, the Riverside County General Plan, Safety Element designates basin fill sediments in the valley as being susceptible to subsidence (Riverside County, 2008). However, subsidence has not been reported in the valley. As discussed in Section 5.4, groundwater demand in the valley was at a maximum in the 1980s and 1990s, when agricultural pumping was estimated to exceed 48,000 acre-feet per year. Current agricultural groundwater demand is estimated to be less than 2,000 acre-feet per year, and with implementation of the Project the cumulative water demand in the basin is anticipated to remain well below the historical maximum. As such, it is not likely water levels in the Bouse Formation aquifer will drop below their historical low levels. In addition, the clays encountered during drilling of borings for the test well program at the site were hard and consolidated. Based on this information and engineering judgment, the potential for significant subsidence associated with the pumping of groundwater for the Project is considered low.

The near surface soils at the Project site are composed primarily of alluvial soils which appear to have been deposited in relatively thin sheet flood and fluvial deposits, which have a low potential for hydrocompaction. Based on the available data and engineering judgment, the site soils do not have a significant potential for hydrocompaction or collapse. The potential for hydrocompaction and soil collapse will be further evaluated as part of the Final Geotechnical Investigation for the Project.

The surficial soils at the site generally consist of predominantly granular soils that do not contain much clay and are not subject to significant expansion hazards. The potential for expansive soils will be further evaluated as part of the Final Geotechnical Investigation for the Project.

4.1.1.2 Atmospheric Hazards

Much of Riverside County is rated as a potential wildland fire area by the State of California Department of Forestry and Fire Prevention, and the County of Riverside General Plan, Safety Element (Riverside County, 2008), as a significant portion of the County is undeveloped and consists of rugged topography with highly flammable indigenous vegetation. However, according to the Wildfire Susceptibility Map, the Project is located in the areas of No and Low Susceptibility.

Portions of Riverside County are mapped as 100 Year and 500 Year Flood Hazard Zones by the County of Riverside General Plan, Safety Element (Riverside County, 2008). However, according to the 100 and 500-Year Flood Hazard Zones Map, the Project is not located in a 100 or 500-Year Flood Hazard Zone.

4.1.2 On-Site Fire Protection Systems

Please refer to Section 3.4.11 of the Facility description for further discussion on fire protection systems.

4.1.3 Local Fire Protection Services

Please refer to Section 5.8.1.6, Public Services and Facilities, for further discussion on local fire protection services.

4.1.4 Personnel Safety Programs

Please refer to Section 5.14, Worker Safety, for further discussion regarding personnel safety programs.

4.2 Transmission Line Safety and Nuisance

The nearest airport to the Project and related facilities is Blythe airport, approximately 15 miles east of the Project site and approximately 10 miles east of the proposed gen-tie line. Federal Aviation Administration (FAA) standards for determination of navigable airspace obstruction are outlined in Title 14 Section 77 of the Code of Federal Regulations (CFR). Criteria defining obstruction include in part: (1) A height of 500 feet above ground level at the site of the object; (2) A height that is 200 feet above ground level or above the established airport elevation, whichever is higher, within 3 nautical miles of the established reference point of an airport; (3) A height within a terminal obstacle clearance area; (4) A height within an en route obstacle clearance area; and (5) The surface of a takeoff and landing area of an airport or any imaginary surface. Given that all Project structures leading from the plant switchyard to the interconnection point would be less than 200 feet in height and are not less than 20,000 feet from an airport, no proposed structure will be identified as an object affecting navigable airspace according to Title 14 Section 77 of the CFR.

4.2.1 Audible Noise and Radio and Television Interference

4.2.1.1 Audible Noise

Audible noise usually results from the action of the electric field at the surface of the line conductor and could be perceived as a characteristic crackling, frying, hissing sound, or hum, especially in wet weather. Since the noise level depends on the strength of the line electric field, the potential for perception can be assessed from estimates of the field strengths expected during operation. Such noise is usually generated during rainfall, but mainly from overhead lines of 345-kV or higher. Significant noise levels are not generally expected from lines of less than 345-kV, such as the proposed gen-tie line. Research by the Electric Power Research Institute in 1982 has validated this by showing the fair-weather audible noise from modern transmission lines to be generally indistinguishable from background noise at the edge of a right-of-way (ROW) of 100 feet or more.

4.2.1.2 Radio and Television Interference

Transmission line-related radio-frequency interference is one of the indirect effects of transmission line operation and is produced by the physical interactions of line electric fields. Such interference is due to the radio noise produced by the action of the electric fields on the surface of the energized conductor. The process involved is known as corona discharge and can occur within gaps between the conductor and insulators or metal fittings. Since the level of interference depends on factors such as line voltage, distance from the line to the receiving device, orientation of the antenna, signal level, line configuration, and weather conditions, maximum interference levels are not specified as design criteria for modern transmission lines. The level of any such interference usually depends on the magnitude of the electric fields involved and the distance from the line. However, the potential for

such impacts is minimized by reducing the line electric fields and locating the line away from inhabited areas.

There are no residences in the vicinity of the Project and gen-tie route. Due to the remoteness of the Project gen-tie line and proposed plant switchyard from inhabited areas, no adverse effects to local communication networks are anticipated. The Project gen-tie line and switching station would be built and maintained in compliance with standard practices that minimize surface irregularities and discontinuities, thus reducing the potential for gaps between the conductor and insulators or metal fittings. Moreover, the potential for such corona-related interference is usually of concern for lines of 345 kV and above; the Project gen-tie line is less than 345 kV.

4.2.2 Electromagnetic Fields

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 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 through the conductors, measured in terms of amperes. 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, and 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 electromagnetic fields (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 evidence, some states, California in particular, have chosen not to specify maximum acceptable levels of EMF. Instead, California mandates 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.

4.2.2.1 EMF Assumption

It is important that any discussion of EMF include the assumptions used to calculate the field values and to remember that EMF in the vicinity of power lines varies based on a variety of factors including line design, the presence of other lines in the ROW, line loading, and distance from the line. The electric field depends upon the line voltage and the specified voltage of 230 kV in this document is consistent with the industry use of 230 kV to describe the nominal standard voltage for the proposed class of system. The magnetic field is proportional to the line loading (amperes), which varies based on the interconnected power system loading. The power output of the generating facility varies to meet increases or decreases in demand for electric power or as the solar insulation varies. The line loading values were based on the nominal load carried by each line section.

The arrangement of the transmission lines in the ROW is another important consideration for the field calculation. The gen-tie interconnection will use a new ROW for the majority of the distance; therefore, no other lines are considered in this study. Immediately prior to interconnecting to the Colorado River Substation, the line will share a two-circuit transmission pole with the Blythe Energy Project Transmission Line (BEPTL). For more information on the two-circuit transmission pole, the Bythe Energy Project Request for Staff Approved Project Modifications (99-AFC-8C) can be referenced. The phase arrangement of each line has been entered into the model used for the field calculation and phase splitting has been used to reduce EMF at ground level. The phase arrangement is indicated in the conceptual pole configuration in Figure 4.2-1.

4.2.2.2 EMF Calculations

The PLS-CADD (Power Line Systems Software) program calculates the electric fields expressed in kV/m and the magnetic fields expressed in mG. The various inputs for the calculations include voltage, maximum load in amperes, current angle (phasing), conductor diameter and spacing, along with relative location of conductors and shield wires. The elevation used for the conductors is the lowest point of the conductors which corresponds to the midpoint between two tangent structures where the conductor sag is the greatest. Table 4.2-1 shows the input values used for modeling and Figure 4.2-1 shows the pole design used for phase configuration and circuit height for the single circuit pole. The double circuit pole configuration can be referenced in the Blythe Energy Project Request for Staff Approved Project Modifications (99-AFC-8C) document. The EMF calculation inputs are as follows:

- All calculations are based on the Electric Power Research Institute (EPRI) Red Book methods (2nd Edition, 1982 - infinite straight wire with flat earth approximation).
- These approximations are only valid for low frequency (50-60Hz) AC transmission lines.
- Bundles are modeled with an equivalent conductor as per EPRI Red Book 8.3.1.
- The effects of earth return currents (earth resistivity) are ignored when calculating the magnetic field.
- Wire position is determined by the currently displayed weather case.
- Wire height used is the height of the wire where the target point is projected upon it.
- All calculations assume the ground is flat with the same elevation as that of centerline.
- The single-circuit EMF study was performed at pole 43 as shown in the Blythe Energy Project Request for Staff Approved Project Modifications (99-AFC-8C) document
- The double-circuit EMF study was performed at pole 99 as shown in Blythe Energy Project Request for Staff Approved Project Modifications (99-AFC-8C) document.

Table 4.2-1. EMF Study Conductor Information

Line	Equivalent Conductor OD (inches)	No. of Conductors per phase	Load Amperes
Genesis Gen-Tie Line	18	2	777
Blythe Energy Project Transmission Line	20.8	3	2294

Figures 4.2-2 and 4.2-3 summarize the results of the PLS-CADD EMF Simulation of the interconnecting gen-tie line for the single circuit line. Figures 4.2-4 and 4.2-5 summarize the results of the PLS-CADD EMF Simulation of the interconnecting gen-tie line and the Blythe Energy Project Line for the double circuit line. The numerical results at the edges of the ROW are included in Table 4.2-2 and Table 4.2-3.

Table 4.2-2. EMF Study Edge-of-ROW Calculation Results (Single Circuit)

Station (ft)	Offset (ft)	B Real (mG)	B Imag. (mG)	B Phase Angle (deg)	B rms Res (mG)	E Real (kV/m)	E Imag. (kV/m)	E Phase Angle (deg)	E Axis Angle (deg)	E rms Res (kV/m)
31844	-50.00	16.500	22.082	53.2	27.566	0.367	0.792	65.1	264.4	0.873
31844	50.00	21.872	22.833	46.2	31.619	0.306	0.685	65.9	96.6	0.747

Table 4.2-3. EMF Study Edge-of-ROW Calculation Results (Double Circuit)

Station (ft)	Offset (ft)	B Real (mG)	B Imag. (mG)	B Phase Angle (deg)	B rms Res (mG)	E Real (kV/m)	E Imag. (kV/m)	E Phase Angle (deg)	E Axis Angle (deg)	E rms Res (kV/m)
75003	-50.00	97.430	69.756	35.6	119.826	0.446	0.371	39.7	253.1	0.580
75003	50.00	119.814	89.407	36.7	149.496	0.493	0.418	40.3	286.5	0.647

While the State of California does not set a statutory limit for electric and magnetic field levels, the California Public Utilities Commission (CPUC), which regulates electric transmission lines, mandates EMF reduction as a practicable design criterion for new and upgraded electrical facilities. As a result of this mandate, the regulated electric utilities have developed their own design guidelines to reduce EMF at each new facility. The California Energy Commission (CEC), which regulates transmission lines to the first point of connection, requires generators to follow the existing guidelines that are in use by local electric utilities or transmission-system owners.

In keeping with the goal of EMF reduction, the interconnections of the proposed gen-tie line will be designed and constructed using the principles outlined in the directives of the CPUC by developing design procedures compliant with Decision 93-11-013 and General Orders 95, 128, and 131-D.

4.2.3 Induced Voltage and Current

Hazardous shocks are those that could result from direct or indirect contact between an individual and the energized line, whether overhead or underground. Such shocks are capable of serious harm or death and remain a driving force in the design and operation of transmission and other high-voltage lines.

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 and could be characterized as a nuisance shock. Proper

design standards will be implemented to prevent hazardous and nuisance shocks by ensuring metallic objects on or near the ROW are grounded and 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), as dictated by the National Electrical Safety Code (NESC).

The Project's transmission interconnection will be constructed in conformance with CPUC GO-95 and Title 8 Code of California Regulations (CCR) 2700 requirements. These regulations require sufficient grounding to ensure hazardous shocks do not occur. A shield wire will be installed as a feature of the Project. Additionally, shocks are effectively minimized through grounding procedures specified in the NESC and the joint guidelines of the American National Standards Institute (ANSI) and the Institute of Electrical and Electronics Engineers (IEEE). Therefore, hazardous shocks are unlikely as a result of Project construction, operation, or maintenance.

4.2.4 Fire Prevention

The 230 kV transmission interconnection lines will be designed, constructed, and maintained in accordance with the CPUC's GO-95, which establishes clearances from other man-made and natural structures as well as tree-trimming requirements to reduce/avoid fire hazards. The Project will maintain the on-site portions of the transmission line route and immediate area in accordance with existing regulations and accepted industry practices that will include identification and abatement of any fire hazards.

4.3 Reliability and Availability

4.3.1 Plant Reliability and Availability

Plant reliability and availability are further discussed in Section 3.0, Facility Description and Location and Section 3.11, Design Criteria.

4.3.2 Equipment Redundancy

Equipment redundancy is further discussed in Section 3.0, Facility Description and Location and Section 3.11, Design Criteria.

4.3.3 Fuel Availability

Fuel availability is further discussed in Section 3.4.6 within Section 3.0.

4.3.4 Water Availability

Water availability is further discussed in Section 3.0, Facility Description and Location and Section 5.4, Water Resources.

4.4 Applicable Laws, Ordinances, Regulations and Standards (LORS)

4.4.1 Transmission Line Safety and Nuisance

4.4.1.1 Federal Authorities and Administering Agencies

- Federal Aviation Administration (FAA)
- Federal Communications Commission (FCC)

4.4.1.2 State Authorities and Administering Agencies

- California Public Utilities Commission (CPUC)

4.4.1.3 Local Authorities and Administering Agencies

- Riverside County

4.4.1.4 Industry Codes and Standards

- Institute of Electrical and Electronics Engineers (IEEE)
- American National Standards Institute (ANSI)
- National Fire Protection Association (NFPA)
- Electric Power Research Institute (EPRI)

4.4.1.5 Compliance with Transmission Line Safety and Nuisance LORS

This section provides a list of applicable LORS that apply to the transmission system. The Project will comply with the applicable LORS during construction and operation.

The potential magnitude of the line impacts of concern in this analysis depends on compliance with the listed design-related LORS and industry standards. These LORS have been established to maintain impacts below levels of potential significance. Thus, if it is determined the Project would comply with applicable LORS, it is reasonable to conclude that any transmission line-related safety and nuisance impacts would be less than significant.

Design and Construction

Table 4.4-1 lists the applicable LORS for the design and construction of the proposed transmission system improvements.

Table 4.4-1. TRANSMISSION LINE SAFETY AND NUISANCE (TLSN)
Laws, Ordinances, Regulations and Standards (LORS)

Applicable LORS	Description
Aviation Safety	
Federal	
Title 14, Part 77 of the Code of Federal Regulations (CFR),"Objects Affecting the Navigable Air Space"	Describes the criteria used to determine the need for a FAA "Notice of Proposed Construction or Alteration" in cases of potential obstruction hazards.
FAA Advisory Circular No. 70/7460-1 G, "Proposed Construction and/or Alteration of Objects that May Affect the Navigation Space"	Addresses the need to file the "Notice of Proposed Construction or Alteration" (Form 7640) with the FAA in cases of potential for an obstruction hazard.
FAA Advisory Circular 70/460-1 G, "Obstruction Marking and Lighting"	Describes the FAA standards for marking and lighting objects that may pose a navigation hazard as established using the criteria in Title 14, Part 77 of the CFR.
Interference with Radio Frequency Communication	
Federal	
Title 47, CFR, Section 15.2524, Federal Communications Commission (FCC)	Prohibits operation of devices that can interfere with radio-frequency communication.

Table 4.4-1. TRANSMISSION LINE SAFETY AND NUISANCE (TLSN)
Laws, Ordinances, Regulations and Standards (LORS)

Applicable LORS	Description
State	
California Public Utilities Commission (CPUC) General Order 52 (G0-52)	Governs the construction and operation of power and communications lines to prevent or mitigate interference.
Audible Noise	
Local	
IEEE 1127-1998, IEEE Guide for the Design, Construction, and Operation of Electric Power Substations for Community Acceptance and Environmental Compatibility	Specifies standards for minimizing audible noise emitted from substations and switchyards through recommended design practices.
Riverside County General Plan, Noise Element	References the County's Ordinance Code for noise limits.
Hazardous and Nuisance Shocks	
State	
CPUC GO-95, "Rules for Overhead Electric Line Construction"	Governs clearance requirements to prevent hazardous shocks, grounding techniques to minimize nuisance shocks, and maintenance and inspection requirements.
Title 8, California Code of Regulations (CCR) Section 2700 et seq. "High Voltage Safety Orders"	Specifies requirements and minimum standards for safely installing, operating, working around, and maintaining electrical installations and equipment.
Industry Standards	
National Electrical Safety Code	Specifies grounding procedures to limit nuisance shocks. Also specifies minimum conductor ground clearances.
Institute of Electrical and Electronics Engineers (IEEE) 1119, "IEEE Guide for Fence Safety Clearances in Electric-Supply Stations"	Specifies the guidelines for grounding-related practices within the ROW and substations.
Electric and Magnetic Fields	
State	
GO-131-D, CPUC "Rules for Planning and Construction of Electric Generation Line and Substation Facilities in California"	Specifies application and noticing requirements for new line construction including EMF reduction.
CPUC Decision 93-11-013	Specifies CPUC requirements for reducing power frequency electric and magnetic fields.
Industry Standards	
American National Standards Institute (ANSI/IEEE) 644-1944 Standard Procedures for Measurement of Power Frequency Electric and Magnetic Fields from AC Power Lines	Specifies standard procedures for measuring electric and magnetic fields from an operating electric line.

Table 4.4-1. TRANSMISSION LINE SAFETY AND NUISANCE (TLSN)
Laws, Ordinances, Regulations and Standards (LORS)

Applicable LORS	Description
Fire Hazards	
State	
General Order 95 (GO-95), CPUC, “Rules for Overhead Electric Line Construction”	Specifies tree-trimming criteria to minimize the potential for power line-related fires.
14 CCR Sections 1250-1258, "Fire Prevention Standards for Electric Utilities"	Provides specific exemptions from electric pole and tower firebreak and conductor clearance standards and specifies when and where standards apply.

Electrical Clearances

Typical high-voltage overhead transmission lines are composed of bare conductors connected to supporting structures by means of porcelain or polymer 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 CPUC 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.

4.5 References

Riverside County General Plan (RCIP), Chapter 6 Safety Element, 2008.