

# TRANSMISSION LINE SAFETY AND NUISANCE

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## SUMMARY OF CONCLUSIONS

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The applicant, Orange Grove Energy (OGE) LLC, proposes to transmit the power from the proposed Orange Grove Project (OGP) to the San Diego Gas and Electric (SDG&E) transmission grid through an underground, 0.3-mile, single-circuit, 69-kV line via SDG&E's Pala Substation. The project and transmission line are located within a SDG&E 202-acre property. The proposed line's route would lie entirely within SDG&E's property with no nearby residents meaning that there would not be residential field exposure of the health concern of recent years. Since the project and related line would be owned and operated by the applicant within SDG&E's service territory, the proposed line design, construction, and maintenance plan would be according to standard SDG&E practices, which conform to applicable laws, ordinances, regulations and standards (LORS). With the one proposed condition of certification, any line-related safety and nuisance impacts would be at levels reflecting the present California Public Utilities Commission (CPUC) policy on field management, and less than significant.

## INTRODUCTION

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The purpose of this analysis is to assess the design and operational plan for the proposed Orange Grove Project's transmission line to determine whether its related field and non-field impacts would constitute a significant environmental hazard in the area around the proposed route. All related health and safety LORS are currently aimed at minimizing such hazards. Staff's analysis focuses on the following issues taking into account both the physical presence of the line and the physical interactions of its electric and magnetic fields:

- aviation safety;
- interference with radio-frequency communication;
- audible noise;
- fire hazards;
- hazardous shocks;
- nuisance shocks; and
- electric and magnetic field (EMF) exposure.

The following federal, state, and local laws and policies apply to the control of the field and non-field impacts of electric power lines. Staff's analysis examines compliance with these requirements as related to the type of underground line proposed.

## LAWS, ORDINANCES, REGULATIONS AND STANDARDS

### Transmission Line Safety and Nuisance (TLSN) Table 1 Laws, Ordinances, Regulations and Standards (LORS)

Applicable LORS	Description
<b>Aviation Safety</b>	
<b>Federal</b>	
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 Federal Aviation Administration (FAA) "Notice of Proposed Construction or Alteration" in cases of potential obstruction hazards.
FAA Advisory Circular No. 70/7460-1G, "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 70/460-1G, "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.
<b>Interference with Radio Frequency Communication</b>	
<b>Federal</b>	
Title 47, CFR, Section 15.2524, Federal Communications Commission (FCC)	Prohibits operation of devices that can interfere with radio-frequency communication.
<b>State</b>	
California Public Utilities Commission (CPUC) General Order 52 (GO-52 )	Governs the construction and operation of power and communications lines to prevent or mitigate interference.
<b>Audible Noise</b>	
<b>Local</b>	
San Diego County Code of Regulatory Ordinances	Specifies the County's Noise Standards for the differing land uses.
<b>Hazardous and Nuisance Shocks</b>	
<b>State</b>	
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.
National Electrical Safety Code	Specifies grounding procedures to limit nuisance shocks. Also specifies minimum conductor ground clearances.

<b>Applicable LORS</b>	<b>Description</b>
<b>Industry Standards</b>	
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 right-of-way and substations.
<b>Electric and Magnetic Fields</b>	
<b>State</b>	
GO-128, CPUC. "Rules for Construction of Underground Electric Supply and Communication Systems".	Specifies requirements for safety for all persons engaged in construction, maintenance, operation or use of underground systems and to the general public.
CPUC Decision 93-11-013	Specifies CPUC requirements for reducing power frequency electric and magnetic fields.
<b>Industry Standards</b>	
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.
<b>Fire Hazards</b>	
<b>State</b>	
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.

## **SETTING**

As noted in the **Project Description** section of this assessment, the site for the proposed Orange Grove Project is an 8.5-acre SDG&E land parcel in an unincorporated area of San Diego County, California, approximately 5 miles east of the town of Fallbrook and 2 miles west of the community of Pala. The area within a 3-mile radius of the project site consists of agricultural land and open space with scattered rural single-family housing (OGP 2008, pp 6.12-7, 6.12-8 and 6.16-2). Routing the line within SDG&E's property boundaries means that there would be no potential for the residential field exposures at the root of the health concern of recent years. The project site was chosen in part for its closeness to SDG&E's Pala Substation through which the facility would be connected to the SDG&E electric power grid (OGE 2008, pp. 2-2, 2-3, and 3-1 through 3-3).

## **PROJECT DESCRIPTION**

The proposed OGP line consists of the segments listed below:

- The 0.3-mile 69-kV, single-circuit, underground line extending from the project's switchyard to the SDG&E Pala Substation to the south;

- The project's on-site 69-kV switchyard from which the conductors would extend to the connection points at the Pala Substation; and
- Project-related SDG&E modifications within the Pala Substation.

The proposed line would be located underground along a paved private Pala Del Norte Road within the SDG&E property. The provided right-of-way would be 20 feet wide. The line would be located within an underground conduit with concrete casing and within a depth in keeping with standard SDG&E and industry practices that ensure safety, efficiency reliability, and maintainability.

## **ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION**

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### **METHODS AND THRESHOLDS FOR DETERMINING SIGNIFICANCE**

The potential magnitude of the line impacts of concern in this staff analysis depends on compliance with the listed design-related LORS and industry standards that apply to the proposed and other underground lines. These LORS have been established to maintain impacts below levels of potential significance. Thus, if staff determines that the project would comply with applicable LORS, we would conclude that any transmission line-related safety and nuisance impacts would be less than significant. The nature of these individual impacts is discussed below together with the potential for compliance with the LORS that apply.

### **DIRECT IMPACTS AND MITIGATION**

#### **Aviation Safety**

Any potential hazard to area aircraft would relate to the potential for collision in the navigable airspace. Since the proposed line would be located underground around the proposed route, it would pose no collision hazard to area aircraft, meaning that the listed aviation-related LORS would not apply.

#### **Interference with Radio-Frequency Communication**

Transmission line-related radio-frequency interference is one of the indirect effects of line operation and is produced by the physical interactions of line electric fields. Since such effects are produced by electric fields which, unlike the companion magnetic fields, are unable to penetrate the soils and other materials, such electric field-related interference are not associated with underground lines such as proposed for the Orange Grove Project.

#### **Audible Noise**

As with radio-frequency noise, audible noise from transmission lines usually results from the action of the electric field at the surface of line conductor and could be perceived as a characteristic crackling, frying, or hissing sound or hum, especially in wet weather.

As with radio-frequency noise, the potential lack of electric field effects from the proposed and other underground lines means that audible noise would not be produced during operations.

## **Fire Hazards**

The fire hazards addressed through the related LORS in **TLSN Table 1** are those that could be caused by sparks from conductors of overhead lines, or that could result from direct contact between the line and nearby trees and other combustible objects. Since the proposed Orange Grove Project line would be located underground, there would be a minimal potential for fires from line contact with combustible materials.

## **Hazardous Shocks**

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 physiological harm or death and remain a driving force in the design and operation of transmission and other high-voltage lines.

No design-specific federal regulations have been established to prevent hazardous shocks from overhead or underground power lines. Safety is assured within the industry from compliance with the requirements specifying the minimum national safe operating clearances applicable in areas where the line might be accessible to the public.

The applicant's stated intention to implement the GO-128-related measures against direct contact with the energized line (OGE 2008a, pp.3-1 through 3-4) would serve to minimize the risk of hazardous shocks. Staff's recommended Condition of Certification **TLSN-1** would be adequate to ensure implementation of the necessary mitigation measures.

## **Nuisance Shocks**

Nuisance shocks are caused by current flow at levels generally incapable of causing significant physiological harm. They result mostly from direct contact with metal objects electrically charged by fields from the energized line. Such electric charges are induced in different ways by the line's electric and magnetic fields. Since the proposed line would be located underground according to GO-128 requirements, there would be a minimal potential for nuisance shocks from induced currents.

## **Electric and Magnetic Field Exposure**

The possibility of deleterious health effects from EMF exposure has increased public concern in recent years about living near high-voltage lines. Both electric and magnetic fields occur together whenever electricity flows and exposure to them together is generally referred to as EMF exposure. The CPUC, other regulatory agencies, and staff have evaluated the available evidence and concluded that such fields do not pose a significant health hazard to exposed humans. There are no health-based federal regulations or industry codes specifying environmental limits on the strengths of fields from power lines. Most regulatory agencies believe, as staff does, that health-based limits are inappropriate at this time. They also believe that the present knowledge of the issue does not justify any retrofit of existing lines.

Staff considers it important, as does the CPUC, to note that while such a hazard has not been established from the available evidence, the same evidence does not serve as proof of a definite lack of a hazard. Staff, therefore, considers it appropriate in light of

present uncertainty, to recommend feasible reduction of such fields without affecting safety, efficiency, reliability and maintainability.

While there is considerable uncertainty about EMF health effects, the following facts have been established from the available information and have been used to establish existing policies:

- Any exposure-related health risk to the exposed individual will likely be small.
- The most biologically significant types of exposures have not been established.
- Most health concerns are about the magnetic field.
- There are measures that can be employed for field reduction, but they can affect line safety, reliability, efficiency, and maintainability, depending on the type and extent of such measures.

## **State**

In California, the CPUC (which regulates the installation and operation of many high-voltage lines owned and operated by investor-owned utilities) has determined that only no-cost or low-cost measures are presently justified in any effort to reduce power line fields beyond levels existing before the present health concern arose. The CPUC has further determined that such reduction should be made only in connection with new or modified lines. It requires each utility within its jurisdiction to establish EMF-reducing measures and incorporate such measures into the designs for all new or upgraded power lines and related facilities within their respective service areas. The CPUC further established specific limits on the resources to be used in each case for field reduction. Such limitations were intended by the CPUC to apply to the cost of any redesign to reduce field strength or relocation to reduce exposure. Publicly owned utilities, which are not within the jurisdiction of the CPUC, voluntarily comply with these CPUC requirements. This CPUC policy resulted from assessments made to implement CPUC Decision 93-11-013.

In keeping with this CPUC policy, staff requires a showing that each proposed overhead or underground line would be designed according to the safety and EMF-reducing design guidelines applicable to the utility service area involved. These field-reducing measures can impact line operation if applied without appropriate regard for environmental and other local factors bearing on safety, reliability, efficiency, and maintainability. Therefore, it is up to each applicant to ensure that such measures are applied in ways that prevent significant impacts on line operation and safety. The extent of such applications would be reflected by ground-level field strengths as measured during operation. When estimated or measured for lines of similar voltage and current-carrying capacity, such field strength values can be used by staff and other regulatory agencies to assess the effectiveness of the applied reduction measures and any related need for mitigation.

Since the proposed line would be located underground, only the ground-penetrating magnetic field component would be encountered above ground. Its above-ground levels can be estimated or measured for a height of one meter above the ground, in units of milligauss (mG). The magnitude in each case would depend on the amount of current on the line, and the degree of cancellation from the presence of the other conductors.

The closer the conductors are placed together, (whether above or below ground), the greater the degree of cancellation and thus the lower the resulting field intensity. Since undergrounding potentially results in the least distance between the individual conductors, the proposed design and construction according to GO-128 requirements would constitute compliance with present CPUC policy of minimizing the intensity of fields from high-voltage lines. Since undergrounding potentially produces the lowest human exposure levels possible for lines of the proposed current-carrying capacity, staff does not consider operational-phase field strength measurements (for possible mitigation purposes) as necessary for this line and recommends Condition of Certification **TLSN-1** to ensure implementation of the necessary GO-128-related measures.

## **CUMULATIVE IMPACTS AND MITIGATION**

Since the proposed project transmission line would be located underground to produce magnetic fields of the lowest intensity possible (without affecting safety, efficiency, reliability, and maintainability) as is current SDG&E practice, any contribution to cumulative area exposures should be at the lowest levels possible given present industry practices and CPUC requirements. Such minimal contribution to any cumulative exposures constitutes compliance with current CPUC requirements on EMF management. No mitigation-driven requirements for field strength measurements would be necessary.

## **COMPLIANCE WITH LORS**

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As previously noted, current CPUC policy on safe EMF management requires that any high-voltage overhead or underground line within a given area be designed to incorporate the field strength-reducing guidelines of the main area utility lines to be interconnected. The utility in this case is SDG&E. Since (a) the proposed underground line would produce magnetic fields of the lowest intensity possible without affecting safety, efficiency, reliability, and maintainability, and (b) the requirement for such field strength minimization is the driving force behind the applicable LORS, staff considers the proposed design and operational plan to be in compliance with the health and safety requirements of concern in this analysis and does not recommend any mitigation-driven field strength measurements during operation.

## **RESPONSE TO AGENCY AND PUBLIC COMMENTS**

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Staff received no public or agency comments on the transmission line nuisance and safety aspects of the proposed Orange Grove Project.

## **CONCLUSIONS**

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Since the proposed transmission line would be an underground line, it would not pose a collision hazard to area aircraft. The potential for nuisance shocks would be minimal from the line's underground location. The absence of related electric fields would prevent production of the audible noise and radio-frequency noise associated with the overhead counterparts.

Since health effects have neither been established nor ruled out for the line's magnetic fields, the public health significance of any related exposures cannot be characterized with certainty. The only conclusion to be reached with certainty is that the proposed undergrounding would ensure magnetic fields of the lowest intensity possible from SDG&E lines of similar voltage and current-carrying capacity. Such similarity in intensity constitutes Compliance with present CPUC policy on field management.

Staff's recommended Condition of Certification (**TLSN-1**) is intended to ensure compliance with the GO-128 requirements that apply.

## **PROPOSED CONDITIONS OF CERTIFICATION**

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**TLSN-1** The project owner shall construct the proposed transmission lines according to the requirements of California Public Utility Commission's GO-128 and SDG&E's EMF-reduction guidelines.

**Verification:** At least thirty days before starting construction of the transmission line or related structures and facilities, the project owner shall submit to the Compliance Project Manager (CPM) a letter signed by a California registered electrical engineer affirming that the lines will be constructed according to the requirements stated in the condition.

## **REFERENCES**

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Electric Power Research Institute (EPRI) 1982. Transmission Line Reference Book: 345 kV and Above.

National Institute of Environmental Health Services 1998. An Assessment of the Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields. A Working Group Report, August 1998.

OGP2008a-OGE/S. Thome (tn46770). Application for Certification of Orange grove Energy, Volumes I-III, dated 6/19/08. Submitted to the California Energy Commission on 6/19/08.