Southern California Edison
WODUP A.13-10-020

DATA REQUEST SET A.13-10-020 WODUP ED-SCE-01

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Question G-04:

Geology and Soils

G-4 PEA Section 4.6.1.6, subsection Seismic Ground Shaking presents peak ground acceleration (PGA) data for the project alignment segments and substations, however the text and tables present the PGA data as 10 percent probability of exceedence in 50 years (corresponding to a return interval of 475 years for a maximum considered earthquake) for the project alignment segments and 2 percent probability of exceedence in 50 years (which corresponds to a return interval of 2,475 years and for a maximum considered earthquake) for the substations. The 10% in 50 and the 2% in 50 probabilities vary considerably for the same site and cannot be used together (mixed) in the same comparison of groundshaking severity. Please be consistent in the data type used and provide an update to the text and table. Additionally it should be noted that the current California Building Code uses the 2% probability of exceedence in 50 years for design calculations.

Response to Question G-04:

The attached Word document contains SCE's recommended revisions to PEA section 4.6.1.6, subsection Seismic Ground Shaking.

Seismic Ground Shaking

Seismic ground shaking is the response of the ground surface to the passing of earthquake wave fronts radiating from the focus of the earthquake. The period of shaking corresponds with the passage of the seismic wave through the site. Earthquake events from one of the regional active or potentially active faults within or near the Project Study Area could result in strong ground shaking that could affect the Project Study Area. The level of ground shaking at a given location depends on many factors, including the size and type of earthquake, distance from the earthquake, and subsurface geologic conditions. Disregarding local variations in ground conditions, the intensity of shaking at different locations within a given area can generally be expected to decrease with distance away from an earthquake source. The size and type of construction also affects how particular structures perform during ground shaking.

In order to evaluate the level of ground shaking that might be anticipated along the Proposed Project segments due to the extent of the area, probabilistic peak horizontal ground acceleration (PGA) contour data available from the United States Geological Survey (USGS) were reviewed. ~~These available data are for a return interval with a 10 percent probability of exceedance in 50 years. The USGS web-based ground motion calculator was used to estimate the site-specific PGA (adjusted for site class) for the substation and junction locations. In accordance with California Building Code guidelines, these site-specific PGA data are for a return interval having a 2 percent probability of exceedance in 50 years. These data indicate that the Project Study Area is located in an area where PGA ranging from 0.4 g to 0.84 g (40 to 84 percent of the acceleration due to gravity) would be anticipated during an earthquake. Higher ground acceleration levels are attributable to potentially higher levels of earthquake ground shaking.~~ A summary of potential ground shaking levels for the Proposed Project segments is presented in Table 4.6-3, Probabilistic PGA Anticipated along the Proposed Project.

Table 4.6-3: Probabilistic PGA Anticipated along Segments of the Proposed Project

Segment /Location	Probabilistic Peak Horizontal Ground Acceleration (g)[1]
Segment 1	0.6 to 0.8 g
San Bernardino Substation	0.60 g
Segment 2	0.4 to 0.8 g
Vista Substation	0.69 g
San Bernardino Junction	0.76 g
Segment 3	0.4 to 0.8 g
El Casco Substation	0.60g
Segment 4	0.4 to 0.6 g
Segment 5	0.4 to 0.8 g
Segment 6	0.4 to 0.8 g
Devers Substation	0.84 g

1 Segment data with a 10 percent probability of exceedance in 50 years from the United States Geological Survey (USGS) Seismic Hazard Maps for the United States (USGS, 2008)~~ Substation/Junction data with a 2 percent probability of exceedance in 50 years from USGS Ground Motion Parameter Calculator (USGS, 2013)~~.
g = acceleration due to gravity

PGA = peak horizontal ground acceleration

The substation locations will be designed based on the latest edition of the Institute of Electrical and Electronics Engineers (IEEE) 693 “Recommended Practices for Seismic Design of Substations” IEEE 693 was developed by the Substations Committee of the IEEE Power Engineering Society, and approved by the American National Standards Institute (ANSI) and the IEEE-SA Standards Board. This document provides seismic design recommendations for substations and equipment consisting of seismic criteria, qualification methods and levels, structural capacities, performance requirements for equipment operation, installation methods, and documentation. This recommended practice emphasizes the qualification of electrical equipment. IEEE 693 is intended to establish standard methods of providing and validating the seismic withstand capability of electrical substation equipment. IEEE 693 provides detailed test and analysis methods for each type of major equipment or component found in electrical substations. This recommended practice is intended to assist the substation user or operator in providing substation equipment that will have a high probability of withstanding seismic events to predefined ground acceleration levels. It establishes standard methods of verifying seismic withstand capability, which gives the substation designer the ability to select equipment from various manufacturers, knowing that the seismic withstand rating of each manufacturer's equipment is an equivalent measure. This recommended practice should be used in all areas that may experience earthquakes.

Tower design in the SCE transmission system follows general industry practices which neglect seismic forces. The codes that are applied to transmission line design in California (G.O. 95) and the United States National Electric Safety Code (NESC) only require the application of wind and ice loads to transmission lines and do not require the application of seismic loads. Seismic forces seldom control transmission tower design. Instead, design is typically controlled by high wind, ice/wind combinations, and unbalanced longitudinal loads. Therefore, transmission structures need not be designed for ground-induced vibrations caused by earthquake motion because, historically, transmission structures have performed well under earthquake events, and transmission structure loadings caused by wind/ice combinations and broken wire forces exceed earthquake loads.

Decades of experience with lines of all sizes has shown that very infrequent line damages have resulted from soil liquefaction or when earth failures affect the structural capacity of the foundation. As a conclusion, the structural capacity provided by meeting the loading cases and strength requirements provides sufficient capability to resist earthquake ground motions.

Reference (to be added to the reference section)

1- Guidelines for Electrical Transmission Line Structural Loading, Third Edition (ASCE-2009)
2- NESC - Section 25. Loadings for Grades Band C Copyright © 2006 IEEE (2006)