Scope – Covered Conductor
Support for Section (IV)(B)(1)(e)

Objective Summary

This work paper describes the forecasting methodology used to determine the proposed scope estimate of 592 miles of replacement of existing bare overhead conductor with covered conductor as part of the Covered Conductor described within Section (IV)(B)(1)(e).

Introduction

SCE conducted two analyses to determine the forecasted covered conductor scope for the nine overhead primary circuits recommended for assessment in 2018-2020, shown below in Table 1.[1] These analyses focused on two categories that require conductor replacement with covered conductor: 1) vintage small conductor at risk of damage during fault conditions based upon a Short Circuit Duty (SCD) assessment; and 2) conductor with elevated risk of faults from vegetation-related contact.

Table 1
2018-2020 Circuit Prioritization

Overhead Primary		
Circuit (Rank Order)		Rank
~~THACHER~~	THACHER	1
~~GALAHAD~~	METTLER	2
~~CHAWA~~	CUDDEBACK	3
~~JORDAN~~	JORDAN	4
~~METTLER~~	HUGHES LAKE	5
~~CUDDEBACK~~	CHAWA	6
~~PATRICIA~~[2]	GALAHAD	7
~~DAVENPORT~~[2]	TITAN	8
~~CORSAIR~~[2]	TENNECO	9

Category 1: Vintage Small Conductor at Risk of Damage During Abnormal Fault Conditions Based on Short Circuit Duty Review:

The first category of scope identification for purposes of conductor replacement is conductor that could be at risk of damage during fault conditions. SCE used a methodology consistent with the approach used for the Overhead Conductor Program (OCP). This methodology centers on the

[1] SCE's circuit prioritization analysis is explained in the accompanying "Circuit Prioritization Workpaper".
[2] The circuit prioritization that defines the top ranked circuits is informed by geographic information system (GIS) data that has been updated due to an ongoing asset review. Additionally, SCE improved its methodology for querying system data. These updates changed circuit rankings: the Hughes Lake, Titan, and Tenneco replaced Patricia, Davenport, and Corsair circuits in the top nine circuits as shown above. Patricia is now ranked fourteenth, Davenport is now tenth, and Corsair is now fifteenth.

ability of conductor to withstand forecasted short circuit duty in the case of a fault. Generally, "vintage" conductor tends to be older and smaller in size due to historical industry standards and system demands. Smaller conductor usually has a lower current rating compared to larger conductor and is more likely to need replacement under OCP methodology.

In aggregate, the forecasted scope includes these smaller, vintage conductors that would be most susceptible to damage during fault conditions due to their lower SCD ratings. SCE arrived at the forecasted estimate for this category using two methodologies: A) Scope identified with detailed engineering for circuits that have started the scoping process; and B) Scope identified with desktop forecasting for circuits that will soon start the scoping process:

A. **Conductor identified using detailed engineering for circuits that have started the scoping process:** Given the critical nature of the Grid Safety and Resiliency Program, SCE began addressing the highest ranking circuits to reduce wildfire risk in March 2018, commencing work on ~~six~~ five[3] of the nine circuits listed above. The first step in this process is detailed engineering using OCP scoping methodology and recommending the use of covered conductor for all identified conductor replacement. The purpose of detailed engineering is to allow the Field Engineering organization to assess the need for conductor replacement while reviewing asset specific information. Detailed engineering defined initial scope by reviewing circuit-specific information like conductor material, conductor size, distance from substation, estimated impedance, circuit breaker settings, circuit configuration, splice type and count, and additional protection settings. Based on these factors, SCE identified the conductor to be replaced.

B. **Conductor identified using desktop forecasting for circuits that have not yet started the scoping process:** For the remaining circuits, SCE performed a desktop forecasting exercise to identify conductor that did not have sufficient SCD rating. SCE first examined the short circuit characteristics at nodes on the entire length of each circuit. In parallel, an analysis was performed to estimate each conductor segment's SCD rating utilizing multiple characteristics associated with each conductor segment, namely: conductor material, conductor size, distance from substation, estimated impedance, and circuit breaker settings and placement on the circuit. SCE then performed a comparison analysis: if a conductor segment's expected SCD exceeded its SCD rating during abnormal fault conditions for that particular point in the system (as indicated by the nodal analysis), it was selected for replacement. This desktop forecasting exercise was aligned with OCP scoping methodology, and SCE expects to perform detailed engineering on these circuits before beginning construction. Detailed engineering results may slightly differ from initial estimates. These differences are driven by the availability of information during detailed engineering not available for initial forecasting like splice count, which is not tracked in SAP.

[3] SCE previously started scoping six of the top nine circuits, including the Davenport circuit. SCE is continuing work on Davenport to help ensure full deployment of the targeted covered conductor scope identified for the 2018-2020 timeframe (see Table 2) and thus maximize its wildfire mitigation efforts.

At the completion of the SCD analysis, each of the segments qualifying for replacement were mapped to determine if they were located within high fire risk areas (HFRA) as defined in SCE's supporting testimony. Only segments within the HFRA were considered for the program.

Category 2: Conductor with Elevated Risks of Faults from Vegetation-Related Contact From Object (CFO)

SCE reviewed fault history from 2015 - 2017 and vegetation data to identify specific segments within HFRA that are most susceptible to contact-related faults.[4] SCE only considered the vegetation-related fault-history within the HFRA. Each circuit was assigned a vegetation fault count that represented the circuit's history of vegetation-related faults. The list of circuits was updated by removing circuits that would be most effectively mitigated by the expanded vegetation management effort proposed in this filing. This identification was performed by SCE's Vegetation Management organization. Circuits that had a relatively higher frequency of vegetation-related faults, defined as two or more vegetation-related faults over the 2015 - 2017 period, were identified to have all overhead conductor within the HFRA replaced with covered conductor.

In aggregate, these circuits have been identified to have elevated risks of vegetation-related contact from object (CFO) faults.

Results

The forecasting and scoping effort identified 596 circuit miles to be replaced in the 2018-2020 period. SCE is requesting funding for 592 circuit miles because, prior to submission of this filing, SCE was able to replace four of the 596 circuit miles identified. Identified miles by circuit and category are listed in Table 2 below. Final scope completed for 2018 - 2020 may differ from the scope identified in Table 2 due to a number of factors such as permitting challenges, storms and inclement weather, geographic resource availability, and variation between system data and actual field conditions. SCE is preparing for potential variances by scoping additional high ranked circuits beyond the top nine circuits, including the Davenport circuit which is now ranked tenth on the list of critical circuits.

In some instances, portions of circuits meet the criteria for both CFO-related scope and SCD-related scope. To avoid double counting, the quantities computed for CFO-related scope exclude overlapping areas that meet the SCD-related criteria.

[4]. This is the same dataset used for the Mitigation Effectiveness Comparison workpaper.

Table 2
2018-2020 Covered Conductor Scope

~~Recommended Replacement of Overhead Conductor (Circuit Miles)~~			
~~Circuit Name (Rank Order)~~	~~SCD~~	~~CFO~~	~~Total (SCD + CFO)~~
~~THACHER~~	~~0.0~~	~~75.0~~	~~75.0~~
~~GALAHAD*~~	~~0.0~~	~~51.6~~	~~51.6~~
~~CHAWA*~~	~~44.1~~	~~0.0~~	~~44.1~~
~~JORDAN*~~	~~0.4~~	~~158.8~~	~~159.2~~
~~METTLER*~~	~~47.2~~	~~0.0~~	~~47.2~~
~~CUDDEBACK*~~	~~0.2~~	~~83.5~~	~~83.8~~
~~PATRICIA~~	~~8.4~~	~~26.4~~	~~34.8~~
~~DAVENPORT*~~	~~43.9~~	~~0.0~~	~~43.9~~
~~CORSAIR~~	~~56.7~~	~~0.0~~	~~56.7~~
~~Total~~	~~201.0~~	~~395.3~~	~~596.3~~

Recommended Replacement of Overhead Conductor (Circuit Miles)			
Circuit Name (Rank Order)	**SCD**	**CFO**	**Total (SCD + CFO)**
THACHER	31.5	52.1	83.6
METTLER*	46.6	0.0	46.6
CUDDEBACK*	23.9	65.5	89.4
JORDAN*	41.6	122.4	164.0
HUGHES LAKE	0.0	89.6	89.6
CHAWA*	54.2	0.0	54.2
GALAHAD*[5]	4.7	32.7	37.4
TITAN[6]	0.0	0.0	0.0
TENNECO[7]	31.5	0.0	31.5
Total	234.0	362.3	596.3

* Circuits used detailed engineering results for SCD category

[5]As of November 25, 2018, SCE identified approximately 20 circuit miles of the Galahad circuit that were damaged by the Woolsey Fire and are being rebuilt using covered conductor. The rebuild will likely continue into January 2019 and may result in additional circuit miles being rebuilt on this circuit. Because this rebuild effort is being performed under storm conditions, associated costs may be recorded and subject to recovery under the Catastrophic Event Memorandum Account (CEMA) mechanism. SCE plans to reconductor the remaining circuit miles under the GSRP and record associated costs to the requested GSRP memorandum account and/or balancing account.
[6]The desktop analysis determined no scope was needed for the Titan circuit, but the circuit will undergo a detailed assessment by the Field Engineering organization to determine if a portion of the circuits reconductor under as SCD scope using OCP scoping criteria. As mentioned above, more information is available during the detailed engineering process and could lead to some scope identified.

[7] SCE estimates that approximately 100 circuit miles of the Tenneco circuit will be reconductored, with approximately 41 circuit miles being completed by year end 2020. The remaining 59 circuit miles will likely be completed after 2020.