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July 27, 2020

Caroline Thomas Jacobs
Director, Wildfire Safety Division
California Public Utilities Commission
505 Van Ness Avenue
San Francisco, CA 94102

SUBJECT: Executive Summary Overview of Southern California Edison's Remedial Compliance Plans for Class A Conditions

Dear Ms. Thomas Jacobs,

Southern California Edison (SCE) is submitting four Remedial Compliance Plans (RCPs) for Class A Conditions pursuant to Wildfire Safety Division (WSD) Resolutions WSD-002 and WSD-004 (Resolutions) that were ratified by the California Public Utilities Commission (CPUC or Commission) on June 11, 2020. SCE hereby provides an Executive Summary Overview of these four RCPs.

OVERVIEW

In its Resolutions, the WSD identified four Class A deficiencies and required SCE to submit four RCPs by July 27, 2020 to resolve the identified deficiencies. On July 17, 2020, the WSD issued a Guidance Statement detailing, among other things, the process that the WSD will implement to evaluate RCPs. The Guidance Statement provides that:

[T]the WSD will evaluate the sufficiency of an electrical corporation's RCP filing in accordance with the following factors:

- Completeness – The RCP is complete and comprehensively responds to the condition;
- Effectiveness – The plans and remedies outlined in the RCP will reasonably resolve the deficiency; and
- Feasibility – The plans and remedies outlined in the RCP are reasonably feasible considering the electrical corporation's resources and the scope and timeline identified.

Each of SCE's four RCPs are comprehensive and meet or exceed the above factors. In many instances, SCE provides a response that resolves a specific part of the condition without requiring any further action. In instances where additional information or steps are required, SCE provides explanations and timelines for when the additional information will be provided, or the actions will be taken. SCE's RCPs are complete, the information provided and/or the actions listed have and will reasonably resolve(d) the deficiency, and the plans are feasible. Overviews of the four RCPs are below.

GUIDANCE-3 LACK OF RISK MODELING TO INFORM DECISION-MAKING, 2020 WILDFIRE MITIGATION PLAN REMEDIAL COMPLIANCE PLAN

Guidance-3 provides that, “Electrical corporations do not provide sufficient detail in their 2020 WMPs to demonstrate how they are leveraging risk models to target the highest risk portions of the grid.” In its response, SCE provides a comprehensive overview of how it prioritizes and focuses on its wildfire initiatives associated with the categories emphasized in this condition and whose primary purpose is the mitigation of wildfire risk or the impact of PSPS. SCE provides a description of its risk-informed decision-making approach followed by initiative level details that focus on the current and future approaches in decision making. These details specifically focus on determining (1) the risk to be mitigated or problem to be addressed, (2) the selected initiative or program, (3) the prioritization or targeting method, and (4) future improvement plans. for each of the wildfire initiatives associated with asset management, vegetation management, grid hardening and Public Safety Power Shutoffs (PSPS). SCE explains the significant improvements it has made in its risk modeling capability and its use of risk analysis to inform decisions such as, selecting appropriate mitigation measures and prioritizing or targeting deployment. SCE also sets risk-related improvement plans for modeling and decision making over the 2020-2022 WMP period.

SCE-2 DETERMINING CAUSE OF NEAR MISSES, 2020 WILDFIRE MITIGATION PLAN REMEDIAL COMPLIANCE PLAN

SCE-2 identified an apparent issue with SCE’s ability to identify and decrease near miss incidents. In its response, SCE explains that its categorization of near misses into the category “Other” was based on adherence to the WSD’s table fields and instructions and 2019 data provided in early February being preliminary, <u>not</u> because SCE did not know the cause for a majority of those faults. SCE had categorized the vast majority of the causes of faults counted as “Other” and provides updated Tables 11a and 11b that reflect this understanding. For example, in the 2020 WMP, SCE included underground and substation equipment caused faults into “Other” because these fault causes are generally not considered a key driver of ignition risk and they did not align to WSD’s categories in its Tables 11a and 11b templates. The updated tables show that the number share of “near miss incidents” in 2019 on the distribution system resulting from “No Cause Found (Momentary & Sustained)” is 12%, much lower than the 74% noted as the primary driver for this deficiency. SCE also describes its improved capability to identify the causes of faults both through additional training and utilization of tools. These improvements have reduced the number of near misses assigned to “other” and “no cause found” over the last several years going from 19-20% in 2015-2017 to 13% in 2018 and 12% in 2019. SCE then provides information to explain our processes, procedures, protocols and tools we utilize in making outage cause determinations including our three-step verification process, identifying the qualifications and training of personnel assigned to determine outage causes, and describing the actions we are taking to continue to drive down the number of near misses and outages attributed to "other" causes.

SCE-12 INSUFFICIENT JUSTIFICATION OF INCREASED VEGETATION CLEARANCES, 2020 WILDFIRE MITIGATION PLAN REMEDIAL COMPLIANCE PLAN

SCE-12 requires SCE to submit an RCP to compare the probability of vegetation-caused ignitions in areas with and without enhanced post-trim clearances. In its response, SCE explains its plan to quantify the extent to which post-trim clearance distances reduce the probability of vegetation-caused ignitions and outages. This plan includes definitions, data sources to be used, analysis methodology, and a timeline.

SCE, PG&E and SDG&E have also agreed on an approach to quantify the impact of enhanced clearances and has presented this consensus methodology as part of their RCP for this item. The consensus approach puts forward effectiveness metrics (Tree Cause Circuit Outages and Vegetation-caused ignitions) with the understanding that WSD should evaluate these effectiveness metrics using long-term trends and/or by normalizing the data for exogenous factors outside of the utilities control. The IOUs' plan includes definitions, key assumptions, data sources to be used, analysis methodology, and a timeline.

SCE-13 LACK OF AMBITION IN IMPROVING VEGETATION INSPECTION AND MANAGEMENT CAPABILITY, 2020 WILDFIRE MITIGATION PLAN REMEDIAL COMPLIANCE PLAN

SCE-13 points out that SCE's survey responses to the maturity model indicate that it did not plan on advancing its current capabilities in vegetation management and inspections. In its response, SCE explains how it currently uses risk analysis to inform some of our vegetation management decisions and our plans to improve utilization of risk modeling for future vegetation management work. We also explain how we plan to further integrate and leverage new technology to enhance our current vegetation inspection and management efforts. These technological improvements require integration of data platforms to enable artificial intelligence and machine learning. SCE is in the early stages of designing and implementing these technological improvements for vegetation management work and thus provides a detailed understanding of its plans, the benefits we expect to gain with these improvements, and high-level implementation timelines.

SCE looks forward to the WSD's review of our four RCPs and would welcome a meeting to walk through our responses if the WSD would find that useful. If you have any questions, or require additional information, please contact me at carla.peterman@sce.com.

Sincerely,

//s//
Carla Peterman
Senior Vice President, Regulatory Affairs
Southern California Edison

cc: R-18-10-007

SCE 2020 Wildfire Mitigation Plan
Remedial Compliance Plan
Class A Conditions
July 27, 2020

GUIDANCE-3 LACK OF RISK MODELING TO INFORM DECISION-MAKING, 2020 WILDFIRE MITIGATION PLAN REMEDIAL COMPLIANCE PLAN

GUIDANCE-3
LACK OF RISK MODELING TO INFORM DECISION-MAKING
2020 WILDFIRE MITIGATION PLAN
REMEDIAL COMPLIANCE PLAN

Name: Lack of risk modeling to inform decision-making
Category: Risk Management
Class: A

Deficiency:

Electrical corporations do not provide sufficient detail in their 2020 WMPs to demonstrate how they are leveraging risk models to target the highest risk portions of the grid. While most utilities indicate current progress and work on developing models to estimate risk across their service territories, there is a lack of focus on how these models can be used in practice to prioritize initiatives to address specific ignition drivers and geographies. Specifically, utilities fail to outline in detail how they determine where to prioritize to improve asset management or determine portions of circuits that would benefit the most from hardening and vegetation management.

By continuing to improve wildfire risk modeling and basing its wildfire mitigations on its wildfire risk modeling outputs, electrical corporations can potentially achieve a greater level of risk reduction with the same resources.

Condition:

Each electrical corporation shall submit in its RCP the following:

i. how it intends to apply risk modeling and risk assessment techniques to each initiative in its WMP, with an emphasis on much more targeted use of asset management, vegetation management, grid hardening and PSPS based on wildfire risk modeling outputs;
ii. identify all wildfire risk analyses it currently performs (including probability and consequence modeling) to determine which mitigation is targeted to circuits and assets where initiatives will provide the greatest benefit to wildfire risk reduction;
iii. a timeline to leverage its risk modeling outputs to prioritize and target initiatives and set PSPS thresholds, including at least asset management, grid operations, vegetation management, and system hardening initiatives;
iv. how it intends to incorporate future improvements in risk modeling into initiative prioritization and targeting processes; and
v. how it intends to adapt its approach based on learnings going forward.

Response:

I. INTRODUCTION

Tables 21-30 in SCE's 2020 Wildfire Mitigation Plan (WMP) included 136 initiatives as requested by the Wildfire Safety Division (WSD). Among these are initiatives that the WSD's guidelines required SCE to describe that do not directly mitigate wildfire risk or the impact of a Public Safety Power Shutoff (PSPS) event. Given the timing of the Remedial Compliance Plan (RCP) and this RCP's focus on risk modeling and risk-informed decision-making, SCE has prioritized and focused on the 41 initiatives associated with the categories the WSD emphasized in this condition (i.e. asset management, vegetation management, grid hardening, and PSPS). The primary purpose of these 41 initiatives is mitigating wildfire risk or the impact of PSPS directly.[1] These initiatives also constitute the majority of SCE's wildfire mitigation scope and cost. SCE will address the other initiatives in its response to Guidance-1, along with additional details on alternative analysis in its response to Guidance-2, the details leveraging risk modeling outputs to prioritize and target initiatives and to reduce PSPS impacts and set PSPS thresholds in its response to Guidance-4, and how lessons learned are incorporated in its response to SCE-1.

Below, SCE provides a high-level description of its risk-informed decision-making approach followed by initiative-level details on the current and future approaches in decision-making. These details specifically focus on determining (1) the risk to be mitigated or problem to be addressed, (2) the selected initiative or program, and (3) the prioritization or targeting method for each of the 41 initiatives associated with asset management, vegetation management, grid hardening and PSPS. Additional details about each of these initiatives (e.g. risk reduction, alternatives analysis, effectiveness measures, etc.) will be provided in responses to other Guidance and SCE-specific conditions.

II. SCE RISK MODELS

Risk-Informed Decision-Making Approach

SCE uses several risk models to inform its decision making. These include the RAMP risk model used at the enterprise level to quantify risks and select mitigation options to address the risk; the Wildfire Risk Model (WRM) used to determine probability and consequence of ignition at the asset level for specific locations, and to inform the prioritization of mitigation deployment such as covered conductor; and weather and fuel models to inform PSPS decisions. The section below summarizes the current capability and use of these model and planned enhancements to these models.

[1] For example, situational awareness initiatives help providing inputs or models for risk models, but their scope or prioritization are not driven by risk models and alternative technology initiatives assess effectiveness of *potential* solutions to mitigate wildfire-related risks and do not reduce wildfire-risks directly.

A. RAMP Risk Model

Current Capability: This risk model is used at the enterprise level to quantify key risks, perform driver analysis and determine program level risk reduction and RSEs. The model is aligned with the Multi-Attribute Value Function (MAVF) method which currently models consequence dimensions in the areas of safety, reliability and financial to estimate baseline risk and post-mitigation risk reduction, and ultimately to calculate annual RSEs at the program level.

SCE used historical CPUC reportable ignitions in HFRA (consistent with Table 11 and 18 of the WMP) to perform risk driver analysis and estimate probability of the occurrence of the risk event. For consequence of risk analysis, SCE classified four distinct outcomes given a wildfire ignition, 1) Red Flag Day, > 5,000 acres, 2) Non-Red Flag Day, > 5,000 acres, 3) Red Flag Day, < 5,000 acres and 4) Non-Red Flag Day, < 5,000 acres. For each of these outcomes, SCE collected historical data (both SCE and industry data) to model the consequences (safety, reliability, and financial) for each of these four outcomes. The consequences of each outcome are converted into a unitless risk score and summed to determine a baseline wildfire risk score. Because the drivers of ignition risk have different frequencies, and the risk exposure (e.g. miles of overhead circuit miles) are distinct, as well as a different mitigations options for each voltage class, risk scoring was performed separately for distribution[2] and transmission[3]/subtransmission systems.[4]

In combination with the deployment scope and exposure (e.g. number of circuit miles in HFRA), SCE calculated the risk reduction by subtracting this mitigated risk score from the baseline risk score. This risk reduction is multiplied by the useful life of the mitigation to arrive at the total risk reduction given the annual deployment scope. The RSE is then calculated by dividing the estimated risk reduction by cost forecasts. RSEs calculated for several major initiatives that mitigate ignition risks were provided in SCE's 2020-2022 WMP and were used to determine or validate mitigation initiative selection.

Future Improvements in Enterprise Risk Modeling:

As with all models, SCE continues to refine its enterprise risk modeling capabilities with every annual iteration. For example, SCE is working with the subject matter experts to assess improvements in RSE calculations and providing risk analysis guidance for new activities as appropriate. In addition, SCE is also studying viable approaches to including PSPS impacts into risk analysis.

On July 16, 2020, the Commission adopted an OIR to further develop a Risk Based Decision-Making Framework to build upon the existing S-MAP proceeding. Amongst the topics being contemplated by the Commission are a) Developing Comparable Risk Scores Across Utilities, b) Risk Tolerance Standards, c) "Simple Optimization" and d) Need for Coordination between S-MAP, RAMP and related proceedings such as R.18-10-007 (Wildfire Mitigation Plan proceedings). The WSD and WSAB have touched upon these topics over the last few months

[2] SCE considers Distribution to be voltages less than or equal to 33 kV
[3] SCE considers Transmission to be voltages greater than 115 kV
[4] SCE considers Subtransmission to be 55 kV, 66 kV, and 115 kV

through WSD's Strategic Roadmap and WSAB's Recommendations on the 2021 WMP Guidelines. SCE looks forward to working with the Commission and stakeholders in further developing a risk framework that builds upon what is already in place and also to integrate it with existing regulatory proceedings.

B. Asset and Location- Level Wildfire Risk Model (WRM)

After a mitigation alternative has been selected (for example covered conductor deployment or hazard tree management program), SCE uses asset or circuit-segment specific models to target and prioritize deployment of the wildfire mitigation initiative (such as which conductor to replace or tree to mitigate). There are two primary model types included in WRM, one for evaluating the probability of ignition for a given asset and another for assessing the consequence of ignition at a given location. As described in SCE's 2020 WMP in Section 4.3 these are advanced models which use machine learning algorithms. If both the probability and consequence of ignition are available for a given asset-location combination, the risk score is calculated as a product of these two values. The available risk scores are used as an input along with operational considerations such as bundling work by geographical proximity to make final determinations of which locations to target and prioritize for execution in the field.

Probability of Ignition (POI)

Individual POI models are developed for each asset type as the drivers of failure vary by asset type. Each asset-specific model uses historical outage data, available asset condition data (age, voltage, etc.) and other asset attributes (historical wind, # of customers, etc.) to determine the probability of the asset creating a spark. Currently all sparks are assumed to be capable of creating an ignition.

Development and maintenance of these models are resource intensive and complex. Significant data synthesis, cleaning, manipulation and quality checks are necessary prior to analysis and building models to estimate probabilities of failures. Once the models are built, they need to be continuously tested and updated using new outage data for observed failures or "near misses," and new inspection, remediation or replacement data for latest available asset condition.

In 2019, SCE developed POI models for distribution overhead conductors, distribution switches, distribution capacitors, and distribution transformers. In the first half of 2020, SCE has further developed POI models for transmission wires and towers, and included some additional assets connected to generation facilities (legacy facilities).

In the event of a spark at any particular location in SCE's HFRA, consequence of ignition scores are calculated using a fire consequence module based on the REAX Engineering methodology.

Fire Propagation Module

The fire propagation module of the WRM replaces the broader "outcome" scenarios presented in SCE's GSRP, RAMP and 2019 WMP filings by forecasting specific fire volume and flame length, fire progression, area, and direction, and potential structures impacted by a fire based on the sample fire scars.

In early 2019, SCE engaged REAX Engineering, a recognized expert in areas ranging from fire investigation and building code to wildfire computer modeling, to develop improved wildfire consequence information using the firm's wildfire simulation tools.[5] Fire propagation characteristics are estimated using a twenty-year fire weather climatology model. Based on ignition simulations in SCE's HFRA where overhead facilities are located, fire volume – the spatial integration of fire area and flame length – were estimated to develop sample fire scars. This process was repeated across SCE's service territory for hundreds of thousands of combinations of ignition location and duration. Outputs of these simulations were used to quantify the consequence as the product of fire volume and the number of impacted structures within the weighted average overlay of simulated fire scars localized to 300-meter by 300-meter REAX grid squares.

Fire Consequence Module

For the fire consequence module, SCE enhanced the REAX consequence output to consider not only the number of structures impacted, but also impacts to safety, such as serious injuries and fatalities, acres of property burned, as well as suppression and restoration costs. REAX uses the weighted average of the fire propagation simulations spreading from each of the points to estimate the number of structures and population that could be impacted for each simulated fire. Using U.S. Census housing density data, the six-hour fire simulation estimates the structure density for each pixel within the perimeter of the simulation. The granularity of this model enables SCE to estimate the scope of the potentially impacted structures based on the specific burn area simulated.

The model outputs are generated as raster files with a resolution of 30 meters. These raster files depict fire area, volume, and number of structures impacted surrounding the modeled ignition point. In order to simplify the analysis, these risk boundaries are smoothed using a kernel density interpolation technique to create 300-meter by 300-meter average REAX grid squares.

When POI models were available, SCE used the probability and consequence of ignition to estimate overall risk scores to target and prioritize deployment of wildfire mitigation initiatives. If POI models were not ready, SCE relied on the location-specific consequence scores as a proxy for the overall risk scores.

Future improvements in WRM Risk Modeling:

SCE continues to refine the POI models by incorporating additional information such as inspection results, remediations, deployment of grid hardening such as covered conductor, and adjacent vegetation. SCE is developing POI models for additional assets including sub transmission and substation assets and including additional risk drivers, more details on these developments will be provided in response to SCE-5 and SCE-11 in SCE's first quarterly report to be submitted in September 2020.

In 2020, SCE is adopting a GIS-enabled software platform known as Technosylva to enhance SCE's ability to model wildfire risk. Fire propagation and consequence score calculations that

[5] Please see SCE's 2021 GRC workpaper SCE-01, Vol. 02, REAX Fire Risk from Overhead Electrical Facilities, June 2019

currently use the REAX Engineering methodology, will be replaced with the Technosylva application commencing in 2020.

One of the tools provided by Technosylva is the Wildfire Risk Reduction Model (WRRM) which integrates wildfire ignition probability developed for the WRM with Technosylva fire spread estimates to calculate the risk score. WRRM improves upon REAX in several ways: this tool will integrate with SCE's weather forecast model, using a customized version of the Weather Research and Forecasting model calibrated to two-kilometer by two-kilometer wind and weather conditions. SCE intends to re-run this simulation on an annual, or semi-annual basis based on updated and calibrated information from previous fire weather seasons. The WRRM will also rely on updated and more granular vegetation, structure, and population data than currently used in REAX to estimate potential consequences. The ability to run multiple scenarios in a myriad of weather and wind conditions along with improved population, structure, weather, and vegetation datasets will improve SCE's ability to target mitigations to high risk areas.

In addition to developing risk scores for known current weather conditions, SCE plans to enhance the WRRM to develop future-facing "what if" climate scenarios based on future projected climate conditions. SCE intends to work with the California Energy Commission (CEC) and stakeholders in other proceedings, such as the Commission's Climate Change Adaptation Order Instituting Ratemaking (R.18-04-019), to better understand climate models that may need to be developed through an iterative working process. These longer-term future-facing models are anticipated to be used to inform SCE's wildfire mitigation strategies and programs. SCE is also working to further develop additional risk flags in the WRRM to identify quantitative and qualitative considerations to improve the risk model including, for example, developing improved assessments of population egress and fire suppression capabilities in local areas. The WRRM will integrate with two other Technosylva tools that SCE is employing, FireSim and FireCast that are further discussed in Section 5.3.2 of the WMP. WRRM will share weather and vegetation data with FireCast and FireSim to ensure consistency between real-time operational planning and system-wide mitigation deployment.

The first data set including the Technosylva consequence scores is expected in August 2020 and the system will be fully functioning by mid-2021.

SCE has initiated deployment of a comprehensive asset management framework as defined by the Institute of Asset Management which includes the full spectrum of lifecycle delivery including grid hardening, vegetation management, technology evaluations, etc. The development of these system and asset class strategies are built on a foundation of asset data, asset risk assessments, and root cause analysis that feed predictive analytics including SCE's wildfire risk models (WRM and WRRM). SCE has formed a dedicated advanced analytics group of data scientists to help ensure sustainability and continuous improvement of WRM and WRRM. As more POI models are developed, SCE will transition to initiative prioritizations that currently rely on REAX consequence risk scores alone to using the overall risk score that incorporates asset-specific ignition probability and the location-specific consequence score. As the asset-specific risk at a given location is reduced due to implemented mitigations, the updated risk score can be used to modify and adjust the scope and frequency of future mitigation activities. For example, deployment of covered conductor can reduce the need for expanded trims in certain locations.

SCE has also considered methods to optimize across multiple mitigations at a specific location (structure level). However, executing wildfire mitigation work in that manner is not practical for certain mitigations as many are complimentary (e.g., vegetation management is required regardless of system hardening for compliance, and installation of covered conductor includes replacement of other equipment such as poles, insulators, cross-arms, and fuses). Furthermore, given that SCE is still in the initial stages of comprehensive wildfire mitigation and significant scope of work is required across HFRA to reduce wildfire risks associated with electric infrastructure, it is not clear if the benefits of such granularity outweigh the costs of planning and executing wildfire mitigation in this manner. Thus, as SCE continues to develop its risk modeling optimization capabilities, it may be more constructive to optimize deployment of mitigations at different levels of granularity. For example, for a tree removal crew to remove the “riskiest” hazard tree in one region and then travel to another region to remove the next “riskiest” tree sharply reduces the pace of risk buy-down for SCE and also increases the cost from the tree removal contractor due to the time elapsed between tree removals. However, determining the risk of each hazard tree in SCE’s inventory, then prioritizing larger areas (i.e. region/district) with the highest hazard tree risk on average, and using that prioritization to remove all identified hazard trees area by area may be more beneficial from a pace of risk-reduction and execution efficiency perspective. In addition, as mentioned earlier, reevaluating need and prioritization criteria once another mitigation has been implemented will be evaluated over time (e.g. need for expanded trims once covered conductor has been installed). This type of sequential evaluation of mitigation deployment inherently provides optimization across multiple mitigations while still helping ensure the most effective mitigations are being deployed in parallel to reduce the greatest amount of risk in the shortest amount of time.

C. Other Risk-Informed Approaches

Besides the quantitative risk models described above, SCE uses other risk-informed approaches to determine what initiatives to undertake and to prioritize work. Examples include the tree risk calculator, risk categorization of various inspection programs, and Fire Potential Index (FPI) used to inform PSPS decisions. SCE provides details about these programs and how they are utilized in the sections below as well.

Currently, the use of these risk models to inform decision making varies across initiatives depending on the applicability, availability and maturity of the quantitative risk models. For each of the 39 initiatives for asset management, vegetation management, system hardening and PSPS, SCE has described the approach used for any of the three decisions mentioned earlier. SCE included 2 additional initiatives outside of SCE-specified WMP activities – 1) Vegetation management to achieve clearances around electric lines and equipment (Table 25, Initiative 20 / Section 5.3.5) and, 2) PSPS Operational Protocol (Table 26, Initiative 5 / Section 5.3.6), for a total of 41 initiatives detailed below, given the key roles these two initiatives play in mitigating wildfire risks associated with electrical infrastructure. If risk models were used, SCE has specified how they were utilized along with the planned future enhancements. When risk analysis was not utilized, SCE provides the alternative decision-making approaches that were used instead.

III. SCE INITIATIVE-LEVEL DETAILS

SCE has organized this response by placing each initiative into the category of interest described in the requested conditions based on how the initiative was classified in the WMP. The asset management section contains initiatives related to SCE's inspection programs (IN-X), the vegetation section contains vegetation management initiatives (VM-X), the grid hardening section contains system hardening initiatives (SH-X), and the PSPS section contains PSPS related initiatives (PSPS-X). The table below provides a summary of the initiatives in this response and their related risk-informed decision making.

#	Activity ID	Initiative / Activity	Risk to be Mitigated	Risk Spend Efficiency (RSE) Calculated	Risk Informed Prioritization	Current Risk Models Used (2020)	Future Risk-Informed Decision Making Enhancements (2021-2022)*
1	IN-1.1	High Fire Risk Informed Inspections of Distribution Electric Lines and Equipment	Ignition risk: contact from object & equipment failure	Yes	Yes	RAMP Model, REAX/WRM, Risk Categorization for Inspections	Technosylva/WRRM
2	IN-1.2	High Fire Risk Informed Inspections of Transmission Electric Lines and Equipment	Ignition risk: contact from object & equipment failure	Yes	Yes	RAMP Model, REAX, Risk Categorization for Inspections	Technosylva/WRRM
3	IN-2	Quality Oversight / Quality Control	Ignition risk: contact from object & equipment failure	No	Yes	REAX, Risk Categorization for Quality Control	Technosylva/WRRM
4	IN-3	Infrared Inspection of energized overhead Distribution facilities and equipment	Ignition risk: equipment failure	Yes	No	RAMP Model	Technosylva/WRRM
5	IN-4	Infrared Inspection, Corona Scanning, and High Definition imagery of energized overhead Transmission facilities and equipment	Ignition risk: equipment failure	Yes	Yes	RAMP Model, REAX	Technosylva/WRRM
6	IN-5	Inspections of Generation Assets in HFRA	Ignition risk: contact from object & equipment failure	Yes	Yes	RAMP Model, REAX	Technosylva/WRRM
7	IN-6.1 & 6.2	Aerial Inspections – Distribution & Aerial Inspections – Transmission	Ignition risk: contact from object & equipment failure	Yes	Yes	RAMP Model, REAX/WRM	Technosylva/WRRM
8	IN-7	Substation Failure Modes and Effects Analysis (FMEA)	Assessment of potential sources of ignition	No	No	N/A	Technosylva/WRRM
9	VM-1	Hazard Tree Management Program	Ignition risk: contact from object	Yes	Yes	RAMP Model, REAX, Tree Risk Calculator	Technosylva/WRRM
10	VM-2	Expanded Pole Brushing	Ignition risk: equipment failure	Yes	Yes	RAMP Model, REAX/WRM	Technosylva/WRRM
11	VM-3	Expanded Clearances for Legacy Facilities	Ignition risk: contact from object	No	No	N/A	Technosylva/WRRM
12	VM-4	Drought Relief Initiative (DRI) Inspections and Mitigations	Ignition risk: contact from object	Yes	No	RAMP Model	Technosylva/WRRM
13	VM-5	Vegetation Management Quality Control	Ignition risk: contact from object	No	Yes	REAX	Technosylva/WRRM
14	Table 25 / Section 5.3.5	Vegetation management to achieve clearances around electric lines and equipment	Ignition risk: contact from object	No	Yes	REAX	Technosylva/WRRM
15	SH-1	Covered Conductor	Ignition risk: contact from object & equipment failure	Yes	Yes	RAMP Model, REAX/WRM	Technosylva/WRRM
16	SH-2	Undergrounding Overhead Conductor	Ignition risk: contact from object & equipment failure	Yes	Yes	RAMP Model, REAX/WRM	Technosylva/WRRM
17	SH-3	WCCP Fire Resistant Poles	Ignition risk: equipment failure; Wildfire consequence risk	Yes	Yes	RAMP Model, REAX/WRM	Technosylva/WRRM
18	SH-4	Branch Line Protection Strategy	Ignition risk: equipment failure; Wildfire consequence risk	Yes	Yes	RAMP Model, REAX/WRM	Scope to be completed in 2020
19	SH-5	Installation of System Automation Equipment – RAR/RCS	Wildfire consequence risk; Impact of PSPS on customers	Yes	No	RAMP Model	Scope to be completed in 2020
20	SH-6	Circuit Breaker Relay Hardware for Fast Curve	Wildfire consequence risk	Yes	No	RAMP Model	Scope to be completed by 2022
21	SH-7	PSPS-Driven Grid Hardening Work	Ignition risk: contact from object & equipment failure; Impact of PSPS on customers	Yes	Yes	RAMP Model	Technosylva/WRRM
22	SH-8	Transmission Open Phase Detection	Ignition risk: equipment failure	No	No	REAX/WRM	Technosylva/WRRM
23	SH-9	Transmission Overhead Standards (TOH) Review	Ignition risk: equipment failure	No	No	N/A	N/A
24	SH-10	Tree Attachment Remediation	Ignition risk: contact from object & equipment failure	Yes	Yes	RAMP Model, REAX	Technosylva/WRRM
25	SH-11	Legacy Facilities	Ignition risk: contact from object & equipment failure	No	Yes	REAX	Technosylva/WRRM
26	SH-12.1, SH-12.2, SH-12.3	Remediations – Distribution, Remediations – Transmission, and Remediations – Generation	Ignition risk: contact from object & equipment failure	Yes	Yes	RAMP Model, REAX/WRM	Technosylva/WRRM
27	N/A	PSPS Operational Protocol	Ignition risk: contact from object & equipment failure; Wildfire consequence risk	Yes	Yes	FPI, REAX/WRM	Technosylva/WRRM
28	PSPS-1.1, 1.2, 1.3	De-Energization Notifications	Insufficient awareness of PSPS & Impact of PSPS on customers	Yes	No	RAMP Model	N/A
29	PSPS-1.4	De-Energization Notifications (EONS)	Insufficient awareness of PSPS & Impact of PSPS on customers	Yes	No	RAMP Model	N/A
30	PSPS-2	Community Resource Centers (CRCs)	Adverse impact of PSPS (access to resources & facilities)	Yes	No	RAMP Model	N/A
31	PSPS-3	Customer Resiliency Equipment Incentives	Adverse impact of PSPS (maintaining energy resiliency)	Yes	No	RAMP Model	N/A
32	PSPS-4	Critical Care Backup Battery (CCBB) Program	Adverse impact of PSPS (maintaining energy resiliency)	No	No	N/A	N/A
33	PSPS-5	MICOP Partnership	Insufficient awareness of PSPS & Impact of PSPS on customers	Yes	No	RAMP Model	N/A
34	PSPS-6	Independent Living Centers Partnership	Adverse impact of PSPS (access to resources & facilities)	No	No	N/A	N/A
35	PSPS-7	Community Outreach	Adverse impact of PSPS (access to resources & facilities)	Yes	No	RAMP Model	N/A
36	PSPS-8	Microgrid Assessment	Adverse impact of PSPS (maintaining energy resiliency)	No	Yes	Alternative risk-informed approach (see narrative)	Refined risk-informed selection criteria

*Notes for Future Risk-Informed Decisions Making Enhancements:

- Some of the risk modeling improvements are exploratory and described in more detail in the narrative
- SCE is also studying viable approaches to including PSPS impacts into risk analysis
- Current risk models do not preclude future use

Asset Management

A. IN-1.1: High Fire Risk Informed Inspections of Distribution Electric Lines and Equipment

i. Risk to be mitigated or problem to be addressed: Deterioration of overhead structures and assets increases the probability of failures and faults and the associated risk of ignition associated with electrical infrastructure. SCE's Distribution Enhanced Overhead Inspection (EOI) program in 2019 demonstrated that the requirements, scope and frequency of compliance-driven grid patrols and overhead detailed inspections were insufficient in detecting a large number of potential hazards, that if not remediated would increase the risk of wildfire ignition in HFRA.

ii. Initiative selection: SCE is continuing a more comprehensive inspection program for its distribution overhead facilities in HFRA to detect equipment issues and mitigate ignition risks that cannot be detected during compliance driven inspection programs alone. The frequency of these inspections will also be higher than the compliance requirements of every five years to identify equipment or structure degradation that occurred since 2019 inspections due to natural wear and tear or emergent events. Though it was necessary to inspect all circuits in 2019 to set a baseline, frequency and scope of inspections in 2020 and beyond has been adjusted based on risk analysis as described below.

Inspections by themselves do not reduce risk, but are necessary to identify equipment conditions that require remediations which reduce risks. The RSE calculations for Distribution High Fire Risk Informed Inspections in HFRA and corresponding distribution remediations (SH-12.1) were combined using the risk reduction from remediation and the total cost of inspections and remediations.[6] The relatively high RSE value supported the continued need for this program to proactively identify equipment failures and potentially hazardous conditions before an ignition could occur.

iii. Prioritization or targeting approach: As risk levels vary across HFRA, a targeted quantitative approach is being deployed to balance resource allocation, costs with risk. Currently, SCE utilizes the WRM to calculate a probability and consequence risk score for every structure or pole in the HFRA. SCE developed a matrix based on three levels (high, medium and low) of probability of ignition and three levels of consequence of ignition using REAX (high, medium and low) at each structure or pole location. All structures or poles with high or medium consequence scores or high probability of ignition scores will be inspected in 2020.

[6] Note that generation inspections (IN-5) and generation remediations (SH-12.3) were also included in this RSE calculation as the small population of generation facilities in scope for these initiatives are similar to the distribution overhead facilities.

iv. Future improvement plans: In 2021, Technosylva will replace the REAX consequence model which will be updated on a regular basis with the most recent available consequence information. In addition, every year, the latest inspection results and remediation progress will be used to update the asset condition inputs to the probability of ignition model. These model updates can adjust the rankings. As more inspection data is compiled and analyzed and issues remediated, the risk profiles change, which will be reflected in future adjustment of the frequency of inspections using the risk-ranked level methodology described above. More details on SCE's Inspection Redesign (IRD) project will be provided in response to SCE-11 in SCE's first quarterly report to be submitted in September 2020.

B. IN-1.2: High Fire Risk Informed Inspections of Transmission Electric Lines and Equipment

i. Risk to be mitigated or problem to be addressed: The deterioration of transmission (and subtransmission) structures and equipment can lead to faults and ignitions that can have similar impacts as the risks associated with distribution structures discussed in IN-1.1 above.

ii. Initiative selection: The scope of this initiative is similar to that of the Distribution High Fire Risk Informed Inspection program (IN-1.1). RSE calculation for this initiative was combined with the corresponding remediation (SH-12.2) as inspections by themselves do not reduce risk, but are necessary to identify equipment conditions that require remediations which reduce risks. This program scored a lower RSE than Distribution inspections and remediation because the historical number of Equipment and Facility Failures (EFF) that resulted in an ignition in SCE's service areas is very low (approximately 0.2 of 3.6 annual HFRA ignitions based on a five-year average), which translated to a calculated low risk reduction. However, California has witnessed the catastrophic results of ignitions related to Transmission assets in recent years, and SCE determined it was imperative to move beyond compliance-driven minimum requirements to enhanced and more frequent inspections of transmission facilities to appropriately mitigate ignition risks in SCE's HFRA.

iii. Prioritization or targeting approach: The Transmission High Fire Risk Informed Inspection program utilizes the same approach as the Distribution High Fire Risk Informed Inspection program (IN-1.1) for prioritizing work based on consequence risk score with one exception. At the time of scoping Transmission (and Subtransmission) inspections, the WRM probability of ignition models were not completed for Transmission and Subtransmission assets. Therefore, consequence risk (REAX) was aggregated at a circuit level and voltage class was used as a proxy for probability of ignition. Each circuit was categorized as high, medium or low risk. In 2020, SCE is inspecting all high and medium risk Transmission circuits.

iv. Future improvement plans: In 2020, SCE completed Transmission POI, and Subtransmission POI development is underway. These scores will be used in conjunction with REAX consequence scores as in IN-1.1 to prioritize 2021 inspections. In 2021, Technosylva will replace the REAX consequence model. As more inspection data is compiled and analyzed and risk profiles change, SCE will adjust the frequency of inspections of the three risk-ranked level described above. More details on SCE's Inspection Redesign project will be provided in response to SCE-11 in SCE's first quarterly report to be filed in September 2020.

C. IN-2: Quality Oversight / Quality Control

i. Risk to be mitigated or problem to be addressed: Since 2019, the work scope and complexity of incremental inspections of overhead lines, structures and equipment in HFRA increased significantly. The number of inspectors has increased, and many are new to SCE's service area and operational practices. All the inspectors are trained but are performing detailed inspections using the enhanced checklists for the first time in 2020. These factors can increase the potential for errors and work not being performed per SCE's inspection and construction standards that go beyond minimum regulatory requirements.

ii. Initiative selection: SCE deemed it important to institute a formal risk-based quality control initiative that relied on statistical sampling to identify work errors and target corrective actions including improving training and tools. The inspection quality control program ensures that inspections conform to the requirements of SCE's overhead inspection related programs by evaluating the results of the inspection after the fact. Since this initiative does not directly mitigate ignition risk, but rather enables effectiveness of inspection programs, SCE did not calculate an RSE for this initiative.

iii. Prioritization or targeting approach: Inspection quality control follows a two-step prioritization. First each transmission and distribution inspection program is categorized as very high risk, high risk, medium risk, and low risk based on each program's maturity, process complexity, organizational complexity, and downstream impacts. Utilizing the risk categorization of the program, along with REAX consequence scores, a confidence level and margin of error is used to determine the overall sample size for the scope of quality control inspections. When developing sample sizes, structures in HFRA were risk ranked using REAX consequence scores grouped by the 99th percentile and above, the 90th-98th percentile, and the 90th percentile and below. By using a higher confidence level in the higher risk categories, the quality control program samples more from the high-risk locations to achieve the overall desired confidence level and margin of error in those areas. This two-step process accounts for the program and location consequence risk attributes.

iv. Future improvement plans: At the time that this program was developing the method for setting sampling rates for 2020, the WRM was not available for inspection targeting of all programs (i.e., Transmission). Hence only the consequence of ignition values were used for ranking the asset locations. For 2021, the inspection quality programs are expected to use WRM (probability and consequence of ignition at each location). Once the Technosylva WRRM model is implemented, the quality programs can rely on these further improved risk scores for sampling. The program risk will also be reevaluated each year as the programs mature. Since the quality control inspections follow completed asset inspections, the level of quality control inspections is expected to decline over time as mitigations are completed and asset risk scores decline, thereby leading to fewer inspections, assuming the conformance rate (number of infractions found) remains stable.

D. IN-3: Infrared Inspection of energized overhead Distribution facilities and equipment

i. Risk to be mitigated or problem to be addressed: Downed wires pose significant public safety risks. Splice and connector failures can cause downed wire incidents, but these are often difficult, if not impossible, to detect through visual inspections using the human eye.

ii. Initiative selection: SCE determined through benchmarking that another California utility had implemented a successful program that uses infrared technology to detect thermal differences and identify hot splices and connectors as leading indicators of asset failure. SCE piloted infrared inspection of energized distribution lines and equipment in 2017 and 2018 to help reduce the risk of contact with energized downed wires. Given the increasing risk of potential wildfires associated with downed wire incidents and the relatively low cost of infrared inspections on distribution circuits, SCE decided to continue inspecting all distribution facilities in HFRA over two years cycles.

The RSE for this initiative is relatively low, again because of the low number historical ignition events associated with of conductor and connector failures. However, because of the low cost and potentially valuable data being gathered, in conjunction with other inspection programs, SCE is continuing this program in 2020.

iii. Prioritization or targeting approach: Since all the HFRA overhead facilities will be inspected every two years, prioritization or targeting was not deemed necessary or practical.

iv. Future improvement plans: SCE plans to analyze the data collected through these infrared inspections at the end of 2020 and correlate results to asset risk scores. The results of this analysis can help improve the POI models by both increasing the volume of input data and potentially identifying new features (independent variables) to increase the accuracy which could inform the future frequency of these inspections. In addition, if the analysis indicates the underlying causes to be related to construction or workmanship, targeted training enhancements can be undertaken.

E. IN-4: Infrared Inspection, Corona Scanning, and High Definition imagery of energized overhead Transmission facilities and equipment

i. Risk to be mitigated or problem to be addressed: In recent years, SCE experienced a number of splice failures. Deteriorated connection points on electrical equipment such as conductors, insulators, splices or connectors can cause localized hot spots that over time can lead to failures if left unmitigated. These conditions are often not visible to the human eye during visual inspections.

ii. Initiative selection: In 2019, SCE started a program to perform infrared and corona inspections of its overhead Transmission system to detect thermal abnormalities that are leading indicators of faults. Unlike ground-based infrared inspections for Distribution facilities, given the long distances between Transmission structures and often rugged terrain, helicopters were used. SCE leveraged REAX's consequence scores to select and to perform these inspections on 20% of its HFRA circuits or approximately 1,000 circuit miles in 2020 within SCE's highest consequence risk areas.

The RSE for this initiative is low based on the historical number of ignitions related to Transmission and Subtransmission equipment failures avoided is low, that translated to low calculated risk reduction in the model. However, as mentioned in IN-1.2 above, since California has witnessed the catastrophic results of ignitions related to Transmission assets in recent years, this program was deemed prudent to reduce potential sources of faults and ignition on SCE's Transmission lines in HFRA.

iii. Prioritization or targeting approach: SCE risk ranked all Transmission and Subtransmission circuits by REAX consequence scores, and the highest risk circuits are in scope. As high ambient temperature can make it difficult to detect temperature differentials, inspections are performed during cooler period of the day and the year. When a hot spot is found, the severity of the hot spot is evaluated by engineering and either marked to be monitored or to be remediated per standard compliance calendar for remediations.

iv. Future improvement plans: POI models for Transmission assets have been completed and those for Subtransmission assets are underway. In 2021, SCE plans to use these and the WRRM model following the implementation of Technosylva models.

F. IN-5: Inspections of Generation Assets in HFRA

i. Risk to be mitigated or problem to be addressed: Deterioration of electrical lines and equipment to operate and control generation facilities pose the same fault and ignition risks described in the Distribution High Fire Risk Informed Inspection program (IN-1.1). The potential risk of wildfire propagation in the event of an ignition associated with SCE's generation facilities, which are often located in or near heavily forested areas is ever-present, and such consequences could adversely impact the availability of critical power generation infrastructure and equipment.

ii. Initiative selection: SCE has undertaken a short-term effort to inspect all electrical lines, equipment, and wiring associated with generation infrastructure, including secondary and control lines feeding ancillary generation assets. This would not only help identify any equipment or structure degradation that needed remediation to prevent faults, but also help develop a baseline for the need for future inspections of these facilities. Given there are a limited number of assets in scope for this initiative, SCE included the costs of this program in the same RSE calculation for Distribution High Fire Risk Informed Inspections (IN-1.1) and Remediations (SH-12.1).

iii. Prioritization or targeting approach: In 2019, all of these assets were inspected, and maintenance notifications were created where needed. In 2020, a two-year cycle was adopted and 50% of the assets are being inspected with higher priority being given to facilities in Tier 3 HFRA. WRM models were not available for these assets and location in 2020 for a more detailed risk-informed prioritization.

iv. Future improvements in risk modeling: SCE will analyze the results of the inspections to determine the need, scope and frequency of inspections beyond 2021. Depending on the continued long-term need, SCE will explore including these facilities in SCE's WRRM model and using the WRRM risk scores to prioritize inspections in the future.

G. IN-6.1: Aerial Inspections – Distribution & IN-6.2: Aerial Inspections – Transmission

i. Risk to be mitigated or problem to be addressed: Some equipment condition or deterioration is not visible during detailed inspections from a ground-based perspective. Some examples include woodpecker damage to the top of crossarms, deteriorated electrical connections on top of transformers, or missing/deteriorated insulator pins.[7] These asset deteriorations can cause faults and potentially ignitions if not remediated.

ii. Initiative selection: SCE decided to complement the ground-based inspections in HFRA (IN-1.1 and 1.2) with aerial inspections using helicopters and drones to provide a 360-degree view of the assets. This initiative also helps with collecting valuable data regarding asset conditions that can be analyzed, stored, evaluated and used for risk modeling and asset management activities. Distribution aerial inspections has a moderate RSE comparable to that of IN-1.1, but still favorable based on the number of potentially avoided ignitions identified from an aerial perspective. The calculated RSE for Transmission aerial inspections is low. As discussed in IN-1.2 above, limited historical data in SCE's HFRA related to Transmission and Subtransmission ignitions yield a lower RSE, but given recent catastrophic wildfires, associated with transmission equipment and the tragic consequences observed, SCE deemed it prudent to maximize the inspection coverage of Transmission related assets.

iii. Prioritization or targeting approach: Aerial inspections are currently performed at the same locations as SCE's ground inspections and the same risk-informed prioritization approach described for IN-1.1 and IN 1.2 are used for Distribution and Transmission assets respectively. Currently, for Distribution, SCE utilizes the WRM to calculate a risk score for every structure in the HFRA. SCE developed a matrix based on three levels (high, medium and low) of probability of ignition at each pole location and three levels of consequence of ignition using REAX (high, medium and low) at each pole location as well. All poles with high or medium consequence scores or high probability of ignition scores will be inspected in 2020. At the time of scoping Transmission (and Subtransmission) inspections, the WRM POI models were not completed for Transmission and Subtransmission assets. Therefore, consequence risk (REAX) was aggregated at a circuit level and voltage class was used as a proxy for probability of ignition. Each circuit was categorized as high, medium or low risk. Circuits that scored as high and medium risk will be inspected in 2020.

iv. Future improvement plans: In 2020 Transmission POI has been completed, and Subtransmission POI development is underway. These scores will be used in conjunction with REAX consequence scores to prioritize 2021 inspections. In 2021, Technosylva will replace the REAX consequence model. In addition, every year, the latest inspection results and remediation progress will be used update the asset condition inputs to the probability of ignition model which will change the rankings. Less frequent inspections are expected as mitigations are completed. SCE will revisit the frequency of aerial inspection in 2021 and consider further aligning inspection frequencies with ground inspections.

[7] For example, in March 2019, a crossarm failed resulting in a downed powerline which appears to have caused a small fire. Upon further inspection, it was determined that the bottom of the crossarm as viewed from the ground in a recent ground-based inspection was in good condition, but the top of the crossarm showed significant deterioration.

H. IN-7: Substation Failure Modes and Effects Analysis (FMEA)

i. Risk to be mitigated or problem to be addressed: Through 2019, SCE's wildfire mitigation strategies and programs were more focused on SCE's distribution system largely because of historical ignition sources being predominately from its distribution system. Historically, SCE has experienced few instances of substation fires spreading beyond the premises. Given the increasing risk of catastrophic wildfires, SCE is assessing all potential sources of ignition associated with electrical equipment including substation facilities for completeness of review of ignition probability drivers.

ii. Initiative Selection: In 2020, prior to incurring any costs associated with wildfire mitigation activities at substations, SCE has undertaken a study to assess the risks of substation equipment failure, whether failure could lead to an ignition, and determine if current inspection and maintenance standards are adequate to identify equipment failures proactively. The results of this study will be recommendations for substation equipment inspection and maintenance based on qualitative analysis of probability and consequence of failure and associated ignition. SCE did not calculate an RSE for this initiative as it cannot reduce wildfire risk as a standalone item but can inform wildfire risks analysis when used for field inspections and maintenance activities.

iii. Prioritization or targeting approach: This study is being performed for the equipment deemed significant by subject matters experts for SCE substation locations. Therefore, prioritization was not necessary.

iv. Future improvement plans: Depending on the outcome of the Substation FMEA, future incorporation of this data could be considered for input in SCE's WRM/WRRM to drive substation inspection and maintenance prioritization.

Vegetation Management

A. VM-1: Hazard Tree Management Program

i. Risk to be mitigated or problem to be addressed: Analysis of tree caused circuit interruption (TCCI) data revealed that a significant number of faults were caused by trees "falling in" or branches / fronds "blowing in" to SCE lines and equipment. These trees were typically outside of the compliance clearance zone. Some visually healthy trees that were far enough from SCE lines and equipment to meet clearance requirements, still pose a threat of falling during high wind conditions and striking SCE facilities depending on condition of the tree and other site-specific factors. Branches or fronds getting dislodged from trees near electrical facilities also have a higher probability of blowing into the lines and equipment and causing faults that can potentially initiate an ignition.

ii. Initiative selection: SCE's annual vegetation management program primarily addresses the risks associated with "grow-ins" by trimming trees to maintain required or recommended clearances, and risks of "fall-ins" by removing dead dying and diseased trees. These efforts were deemed insufficient to adequately address the risk described above. Therefore, SCE initiated the hazard tree management program (HTMP) which entails detailed inspection and evaluation of trees that are risky despite trimming and pruning and implementing the appropriate mitigation up to removal of these trees. Note that the detailed assessment goes beyond the patrols and visual inspections performed as part of the Drought Relief Initiative (DRI), see section VM-4 below for more details on the DRI.

The RSE for this initiative is relatively high and similar to that of Covered Conductor. This is because of the estimated reduction of Contact From Object (CFO) Vegetation ignitions and the lifetime value of the program by removing hazardous tree species.

iii. Prioritization or targeting approach: SCE determines the trees to mitigate based on a two-step process, first selecting higher risk locations and then selecting higher risk trees within these locations. When developing 2020 scope, SCE's WRM probability of ignition was not available for vegetation. Therefore, SCE prioritized locations based on HFRA tier, Tree Caused Circuit Outages (TCCI), and density of vegetation surrounding SCE's facilities, combined with REAX consequence scores. "Utility strike zone" were established in these locations, which can vary but extend up to 200 feet on either side of SCE's electrical facilities depending on the height of the trees nearby. Within these locations, arborists perform detailed assessments and classify trees hazards based on tree characteristics (deteriorated trunk, roots or limbs, dead palm fronds, etc.) and site characteristics (soil condition, previous fire damage, high wind areas, etc.). Each tree is assigned a risk score ranging from 0 to 100 using a tree risk calculator. Arborists can apply professional judgment in adjusting these risk scores as well. Trees that score 50 or more are typically mitigated as they are considered more vulnerable to falling or have branches or leaves that are more vulnerable to dislodging and striking nearby electrical facilities. In addition to tree risk scores, operational factors such as ability to obtain tree owner, local and environmental permits and resource availability, and efficient work allocation by location are also considered while prioritizing implementation.

iv. Future improvement plans: For developing 2021 scope for this initiative, SCE has incorporated vegetation contact or vegetation caused outage data into WRM to calculate the probability of ignition due to a vegetation contact at the asset level. As mentioned previously, SCE is also transitioning from REAX consequence models to Technosylva's consequence model. In addition, SCE is exploring tree growth predictive models to improve its risk informed decisions. However, this effort is data and model intensive and needs to adequately address long-term environmental conditions that play a significant role in vegetation growth, and therefore not expected to be available in the near term.

It should be noted, though continued covered conductor installation is expected to reduce the risk of faults and ignitions from vegetation grow-in contact, and will also reduce the need for aggressive mitigation of trees that contribute to blow-ins, it will not fully mitigate the risk due to a tree fall-ins, and tree removals have to continue based on tree characteristics.

B. VM-2: Expanded Pole Brushing

i. Risk to be mitigated or problem to be addressed: Fast growing vegetation at the base of poles and structures can provide the fuel needed to convert a spark from equipment failure into a fire and also supports the fire propagation, especially during dry and windy conditions. This risk is recognized by Cal. Pub. Res. Code § 4292 which requires utilities in certain areas to "maintain around and adjacent to any pole or tower which supports a switch, fuse, transformer, lightning arrester, line junction, or dead end or corner pole, a firebreak which consists of a clearing of not less than 10 feet in each direction from the outer circumference of such pole or tower." Moreover, poles with adjacent brush are more likely to be affected during a wildfire, impeding power restoration and reconstruction efforts. SCE has historically brushed approximately 75,000 distribution poles annually, but given the increasing wildfire risks, SCE considers all poles in HFRA to be at risk.

ii. Initiative selection: The expanded pole brushing program removes fast-growing vegetation at the base of distribution poles to reduce the chance of ignition and/or fire spread due to a spark or contact with failed equipment. SCE's goal in 2020 and beyond is to perform pole brushing on every distribution pole in HFRA each year as it is a relatively inexpensive option to mitigate the above-mentioned risks. The RSE for this initiative is very high reflecting the effectiveness of this program in reducing the propagation of a fire for a relatively low cost of implementation validating SCE's decision to continue this work scope.

iii. Prioritization or targeting approach: If resources are available to perform pole brushing on HFRA poles, prioritization is unnecessary as all HFRA distribution poles will be brushed annually. Performing using SCE's geographical grid approach is more efficient than prioritizing by risk each year which may require moving crews to non-adjacent locations. If sufficient resources are not available, SCE will prioritize the poles subject to PRC 4292 first and perform additional work based on aggregated consequence areas and crew deployment efficiency. Any distribution pole not brushed in a given year will be prioritized the next year.

iv. Future improvement plans: In the future, data gathered through other initiatives such as the fire science enhancements, FPI Phase 2, and the implementation of

Technosylva' s FireCast and FireSim applications may provide insights to vegetation growth rates and weather conditions, in addition to consequence and POI, which would allow for a more targeted approach to executing this program.

C. VM-3: Expanded Clearances for Legacy Facilities

i. Risk to be mitigated or problem to be addressed: As mentioned in IN-5, SCE's generation facilities are often located in or near heavily forested areas. Analysis of historical events identified increased risk of faults from vegetation contact with electrical facilities and increased risk of fires spreading through vegetation in close proximity to SCE's generation facilities in the event of any ignition (i.e., even if caused by avian/wildlife contact, contact with foreign objects, etc.). Cal. Pub. Res. Code § 4291 provides recommended distances for maintaining adequate clearance around facilities.

ii. Initiative selection: It was determined that creating a larger vegetation-free buffer around generation facilities is prudent. The program entails maintaining 10-30 feet of clearance from bare ground and up to 100 feet of clearance from high voltage electrical facilities, where appropriate, in heavily forested areas. This solution was selected based on a simplified cost-benefit analysis to determine the most effective approach to reduce risk. Although other methods of mitigation could be used such as avian and/or wildlife fault guards/protection devices on entire substations, such measures would have been prohibitively costly (whole station upgrades) and infeasible at some locations due to the non-standard equipment sizing. In addition, those measures would not mitigate fall-in or drop-in risk posed by vegetation in a strike zone of impacting such facilities. SCE did not calculate an RSE for this initiative as relevant historical ignition information was not readily available.

iii. Prioritization or targeting approach: Currently the WRM does not include risk models for generation assets. Therefore, an alternative risk-informed approach that considers the HFRA tier level, voltage levels and existing vegetation buffer was utilized to risk rank the locations. Tier 3 locations, facilities with higher voltage levels and areas with less existing vegetation buffer were considered higher risk. In 2020, all generation facilities in scope were assessed and the first third of highest risk locations (based on a combination of the HFRA tier the facilities are located and the size of the existing clearance buffer) are being targeted for treatment to establish appropriate vegetation clearance buffers. The remaining second and third sets of locations will be targeted over years 2 and 3 respectively during this 3-year plan.

iv. Future improvement plans: By 2021, SCE plans to include the generation facilities and locations in the WRM/WRRM models. As these enhancements to probability and consequence of ignition scores become available, SCE will assess replacing the current prioritization method with risk ranking using the WRM/WRRM risk scores. Once all identified locations have the appropriate expanded clearances (buffer zones) established and post-treatment quality control and monitoring have been completed, this program will be complete. Maintenance of the expanded buffer will then move into annual routine vegetation maintenance.

D. VM-4: Drought Relief Initiative (DRI) Inspections and Mitigations

i. Risk to be mitigated or problem to be addressed: Dead, dying and diseased trees have higher probability of failing, and if within striking distance of SCE lines and equipment, can cause fault conditions, sparks and ignition.

ii. Initiative selection: The appropriate mitigation is to remove these dead, dying or diseased trees. Moreover, both General Order 95 and Public Resources Code 4923 require that SCE mitigate the hazards posed by dead trees or those that are identified as significantly compromised upon brief visual inspection. SCE patrols the HFRA areas several times a year to identify and remove compromised trees. SCE patrols the HFRA two to four times a year because insect infestation can move that fast, and all trees within strike distance of SCE overhead facilities that are dead or expected to die within a year are removed. The RSE for this initiative is relatively high and comparable with Covered Conductor. This is because of the estimated reduction of vegetation contact ignition drivers from dead, dying and diseased trees.

iii. Prioritization or targeting approach: Similar to the expanded pole brushing program, the DRI and mitigations cover SCE's full HFRA territory each year. Moreover, SCE is required to mitigate the hazards posed by dead trees or those that are identified as significantly compromised upon brief visual inspection. Therefore, using a risk-informed prioritization is unnecessary. However, in the event of high tree mortality combined with limited tree removal capacity, the WRM could be used for removal prioritization, but this has not been a factor so far.

iv. Future improvement plans: Changes to decision making approach or risk analysis is not being considered for DRI inspections and remediations at this time. If there are resource constraints, the enhanced WRM model with Technosylva consequence model will be used.

E. VM-5: Vegetation Management Quality Control

i. Risk to be mitigated or problem to be addressed: SCE relies on contract crews to perform vegetation management. In recent years, the work scope, the number of crews and complexity of execution has increased substantially. This increases the potential for errors and work not being performed per regulatory requirements and SCE's line clearance standards.

ii. Initiative selection: Given the compliance requirements and the risk of vegetation related faults that can potentially cause ignitions, SCE deemed it important to institute a formal quality control (QC) initiative, where arborists certified by the International Society of Arboriculture (ISA) inspect vegetation around a risk-informed sampling of HFRA circuit miles to verify regulatory clearance requirements have been adhered to at a minimum. QC inspectors also validate if SCE's line clearance standards have been achieved. The results of QC inspections are analyzed and feedback is provided to contractors for performance improvement. Since this initiative does not directly mitigate ignition risk, but rather enables effectiveness of vegetation management programs, SCE did not calculate an RSE for this initiative.

iii. Prioritization or targeting approach: The WRM was not available for vegetation at the time 2020 scope was identified. The program uses the REAX consequence scores to segment the total population into risk tranches. 100% of the line miles with the top 20% of REAX consequence of ignition scores (highest risk) are inspected. For the remaining areas, line miles are sampled to achieve a 99% confidence level and 1.7% margin of error. For the line miles selected, all trees along overhead lines are inspected.

iv. Future improvement plans: For 2021, SCE is exploring transitioning from REAX consequence model to the Technosylva to provide more accurate risk prioritization. In addition, the asset and location-specific probability of ignition models have been updated to include the vegetation-caused faults. SCE will explore transitioning to using the risk scores that includes probability and consequence of ignition to determine the quality control samples.

F. Vegetation management to achieve clearances around electric lines and equipment (WMP Table 25, Initiative 20 / Section 5.3.5 / Outside of SCE-specified WMP activities)

i. Risk to be mitigated or problem to be addressed: Vegetation encroachment into electrical lines and equipment and "grow-ins" can result in faults and ignitions. Historical data analysis indicated that nearly 20% of faults associated with contact with foreign objects were from vegetation contact with electrical facilities. In addition, there are compliance requirements associated with vegetation management in HFRA.

ii. Initiative selection: SCE's line clearance standards require maintaining a minimum of four feet clearance in HFRA, but targets GO 95 R35 Appendix E recommended clearances where feasible. All trees in scope are inspected annually and trimmed as necessary. Expanded clearances, which are aligned with CPUC recommendations, are expected to further reduce the risk of faults and associated ignitions. The increased clearance can also reduce the need for repeat visits to certain locations to maintain minimum requirements. SCE did not calculate an

RSE for this initiative. The inherent risk if no mitigation was in place cannot be estimated as SCE has had line clearance programs to meet the minimum required clearances in the past. Moreover, the line clearance scope in HFRA is driven by Commission requirement and recommendations to mitigate wildfire risks and not informed by RSE estimates.

iii. Prioritization or targeting approach: Since all trees are inspected annually, risk-informed prioritization is not currently used as it would be less efficient in deploying crews than the current grid-based approach for distribution lines and circuit-based approach for transmission lines. However, trees within SCE's inventory are evaluated using professional judgment considering factors such as species (e.g., fast-growing trees), site conditions (e.g., moist soil) and weather (e.g., rainfall) to determine if additional inspections and trims are necessary within the year to maintain the appropriate line clearance. Supplemental or mid-cycle patrols are prioritized based on locations where the vegetation growth cycle, conditions, and/or REAX score drive the need for additional assurance, more details are provided in the RCP response to deficiency SCE-12, condition ii.

iv. Future improvement plans: Given the importance of vegetation management in mitigating wildfire risks and the financial and labor resources required to implement vegetation management programs, SCE is exploring several enhancements in quantitative and risk analysis to inform decisions on prioritization, scope and frequency and location of vegetation management and inspection/patrol activities. SCE is exploring if risk scoring can be used to prioritize annual inspections and trimming without adversely impacting operational efficiencies. SCE is also exploring potential modifications to trim distances and inspection/patrol frequency based on tree and location characteristics, both in terms of probability and consequence of ignition. While SCE will consider changes to trimming frequency, any reduction will likely require changes to regulatory requirements. Also, SCE is often unable to achieve the CPUC recommended clearances due to opposition from customer, cities, and other agencies. In the future, risk scores can be used to overcome such opposition and persuade these stakeholders in allowing timely trimming for appropriate clearances. If further analysis demonstrates that the changes are beneficial, SCE is targeting to implement the enhancements with regard to scheduling and frequency of inspection/patrols by 2022. _Please see response to condition SCE-13 iv for additional information on future improvements involving new technology.

Grid Hardening

A. SH-1: Covered Conductor

i. Risk to be mitigated or problem to be addressed: Analysis of historical ignition and fault data in SCE's service area showed overhead conductor failure to be a significant factor of these incidents. Driver analysis indicated that contact-from-object (such as vegetation, metallic balloons or debris), and wire-to-wire faults contacts in SCE's HFRA were associated with approximately 60% of suspected wildfire initiating events. Fault conditions can weaken and sometimes cause conductor failures, resulting in energized wire down events, which in turn could result in electrical arcing in the air or on the ground leading to ignitions. Small conductors that are more prone to failure due to fatigue from cumulative mechanical stresses and/or damage from electrical faults can also lead to downed wire incidents and potential ignitions or other public safety risks.

ii. Initiative selection: Based on benchmarking and industry research, SCE identified insulated or covered conductor as a viable alternative to significantly reduce overhead conductor faults associated with contact with foreign objects or adjacent conductors, thereby significantly reducing the risk of ignitions. Replacing conductors would also address the risks from small conductors. SCE evaluated the effectiveness of covered conductor deployment in its HFRA based on historical analysis of ignitions and both SME opinion and industry benchmarking analysis. SCE utilized its enterprise-level RAMP risk model to evaluate the scale of deployment of covered conductor, and validated this initiative as the most practical option to reduce ignitions in SCE's HFRA considering expected risk reduction, cost, time to deploy, resource availability, and ease of long-term maintenance and repair. SCE evaluated alternatives such as reconductoring with heavier gage wire that would be less prone to faults and undergrounding that would eliminate certain fault conditions. The RSE for this initiative is relatively high because covered conductor is effective at mitigating several types ignition drivers such as contact from object and wire to wire contact, as well as reducing equipment failures associated with smaller conductors and potentially older distribution system hardware. Even when excluding the operational considerations, such as time and feasibility to deploy, the alternative mitigations such as reconductoring with bare wire and undergrounding had RSEs three to four times lower than the RSE for deploying covered conductor.

iii. Prioritization or targeting approach: Beginning in 2019, SCE used the risk scores from the WRM to prioritize the circuit segments for replacing bare conductor with covered conductor. The underlying POI and consequence score models have undergone several refinements and SCE continues to incorporate these enhanced risk scores into its deployment strategy to the extent practicable.

iv. Future improvement plans: With the expected implementation of Technosylva in 2020, SCE will update the REAX based consequence scores and all covered conductor scope developed after that time will use these updated risk scores from Technosylva's WRRM. As described in SH-7, SCE is also considering past PSPS events to explore expanding various forms of mitigations including potentially further refining covered conductor scope in locations that experienced the most impact from de-energizations in 2018 & 2019. Since PSPS is significantly influenced by expected and observed weather conditions at a particular time in addition to wildfire risk, the next circuit segments to be impacted by PSPS do not always coincide with the next circuit segments that have the highest wildfire risk scores based on probability and consequence of ignition.

B. SH-2: Undergrounding Overhead Conductor

i. Risk to be mitigated or problem to be addressed: Please see the description of risk in SH-1 Covered Conductor.

ii. Initiative selection: Undergrounding can be a very effective mitigation for faults associated with overhead conductors, but it is not always cost-effective, easy to deploy or easy to maintain and repair. However, given significant interest among external stakeholders to consider undergrounding, SCE undertook an effort to selectively target circuit segments that would most benefit from undergrounding. The RSE for the undergrounding conversion of targeted circuit segments is relatively low because the costs associated with the design, permitting and deployment of underground cabling is high. There could be PSPS customer impact mitigation benefits that are currently not accounted for in SCE's wildfire RSE calculations.

iii. Prioritization or targeting approach: In 2019, SCE evaluated circuit segments on the basis of multiple criteria including wildfire risk scoring from WRM, PSPS impacts, terrain, grid topography, construction complexity associated with undergrounding, and cost to evaluate if targeted undergrounding for circuits that have experienced multiple PSPS events could reduce the number of customers affected. SCE also reviewed egress in areas where poles and overhead facilities may make it challenging to evacuate should a fire occur. In addition, SCE considered areas where customers may require electric service to provide essential public health and safety services. In 2020, SCE will continue to refine its evaluation methodology and work with local communities to pursue undergrounding in HFRA. SCE intends to complete the six miles of undergrounding scope in 2021 and eleven miles in 2022.

iv. Future improvement plans: Once Technosylva and WRRM are available, SCE will incorporate the updated risk scores into the evaluation and selection criteria for undergrounding. SCE is also exploring approaches to adding PSPS impacts into its quantitative risk analysis.

C. SH-3: WCCP Fire Resistant Poles

i. Risk to be mitigated or problem to be addressed: Wood poles are susceptible to ignitions caused by equipment on the pole failing or from damage from fire on the ground. As evidenced in 2019, SCE recorded 28 pole base ignitions and 10 pole top ignitions in HFRA with varying root causes (e.g., third party, contact from foreign object, equipment failure). Furthermore, burned poles can cause other equipment on the pole to fail making service restoration after a fire more difficult.

ii. Initiative selection: The scope of this initiative is to replace or harden wood poles in HFRA with FR poles (subject to material availability) when identified for replacement in the Wildfire Covered Conductor Program (WCCP) or identified from another pole program performing work in SCE's HFRA. FR composite poles mitigate ignition from risk drivers such as capacitor banks, cross arms and transformers. In addition, pole hardening with FR materials also provides additional benefits of saving equipment from fire damage and facilitating restoration after a wildfire which are not included in the RSE calculation.

iii. Prioritization or targeting approach: Installing FR composite poles or FR wrapped wood poles follow the prioritization of the initiative through which poles are replaced in HFRA. Given the constrained material availability of FR composite poles and FR wrapping, SCE selects the locations for FR composite pole installation within these programs based on the respective program's risk prioritization (e.g. WCCP) and SCE's Distribution Design Standards. For wood poles identified for replacement, FR composite poles are installed for higher risk poles in HFRA supporting equipment (e.g. transformer, capacitor, automatic recloser, or switches) that could arc during faults or poles in woodpecker-prone areas. The remainder of the wood poles identified for replacement in HFRA are replaced with FR wrapped wood poles.

iv. Future improvement plans: SCE is exploring expanding the deployment of FR poles as a standalone program (instead of being performed as part of another program that need pole replacements) by assessing the ignition risk reduction potential of FR poles for faults caused by equipment on the pole. SCE plans to use WRRM for this evaluation. In addition, if material constraints continue, SCE plans to use WRRM to prioritize areas where FR poles should be installed when done as part of a different program. However, the risk of pole failure leading to fire is low compared to other equipment failure based on WRM results. Therefore, risk-informed prioritization or targeting in this initiative will be deferred until the higher priority models are completed.

D. SH-4: Branch Line Protection Strategy

i. Risk to be mitigated or problem to be addressed: High fault energy can disperse incandescent particles that can contribute to ignition and increased probability of equipment failure such as downed wire associated with fault events. Additionally, some existing fuses do not meet Cal Fire "Exempt" classifications.

ii. Initiative selection: SCE's 2020 efforts focus on replacing existing conventional fuses to bring them up to Cal Fire "Exempt" standard and also target particular designs such as liquid fuses which are obsolete and unsupported by suppliers. "Non-Exempt" fuse designs can also produce expulsion products that can lead to ignitions. Existing fuses are typically replaced by current limiting fuses (CLFs) or branch line automatic reclosers, although larger branch circuits may use other Cal Fire "Exempt" fuse designs. The replacement devices generally clear faults faster reducing the fault energy minimizing arcing and sparks during fault events and minimizing impact from a fault to electrical equipment along the circuit. SCE performed risk analysis for this initiative and the RSE is moderately high validating its efficacy.

iii. Prioritization or targeting approach: In the past few years, SCE installed fuses at branch lines where fusing did not exist. In 2020 SCE is initiating fuse replacement efforts, first targeting expulsion fusing in conventional cutouts and liquid fuses as these are considered higher risk. SCE will then replace, where appropriate, the remaining Cal Fire "Exempt" fusing focusing on reduced energy with current limiting fusing. For all circuits that have conventional fuses, the aggregate circuit-level risk score from the WRM was calculated to prioritize installation of CLFs. Although the WRM could have been used at the pole level rather than the circuit level for prioritization, it is operationally more efficient to batch fuse replacements.

iv. Future improvement plans: Most of the scope in this initiative will be completed in 2020, and therefore further refinement in risk-informed targeting is not required.

E. SH-5: Installation of System Automation Equipment – RAR/RCS

i. Risk to be mitigated or problem to be addressed: Distribution circuits span many miles and cross through multiple risk consequence zones, contain assets at various levels of resiliency, and are subject to varying weather conditions based on specific asset locations. During PSPS events, portions of circuits or circuit segments that do not pose ignition risks also have to be de-energized along with portions that present ignition risks as there is no available means of isolating these segments from each other. Even if switches existed to isolate only the risky circuit segments, having to do these manually requires time and resources, both of which are constrained during rapidly evolving PSPS events. Isolating the larger circuit portions or entire circuits result in longer patrols and extended outages when working to restore electric service following a PSPS event.

ii. Initiative selection: Installing more automated fault detection and sectionalizing equipment is a time-tested approach that SCE and other utilities have successfully implemented. SCE is installing additional Remoted Automated Reclosers (RARs) on circuits across its HFRA. In some instances, SCE is installing Remote Controlled Switches (RCSs) instead of RARs as they are deemed to be more cost-effective solution in those locations. The RSE was relatively low as the impact of this initiative is less on mitigating ignition risk and mostly for mitigating the impact of PSPS. PSPS impacts are not currently modeled in SCE's RSE calculations. In addition to minimizing these effects of PSPS events, RARs also minimize outage impacts to customers by isolating or restoring power quickly to circuit segments not impacted by the concerning weather conditions. RARs also reduce ignition risks allowing reduced fault energy and increased fault sensitivity by way of the operational settings which includes the capability of toggling to fast curve operating settings during concerning weather conditions.

iii. Prioritization or targeting approach: Since all circuits are in scope within the year, no prioritization is necessary.

iv. Future improvement plans: No improvements or modifications are planned as this initiative is expected to be complete by the end of 2020.

F. SH-6: Circuit Breaker Relay Hardware for Fast Curve

i. Risk to be mitigated or problem to be addressed: During the time that a circuit breaker (CB) takes to detect and respond to a fault on the line, heating, arcing and sparking can occur leading to ignitions.

ii. Initiative selection: Fault durations can be reduced with Fast Curve operating settings at the substation CB relay by enabling quicker fault detection and fault clearing. Fast Curve settings reduce fault energy by increasing the speed with which a relay reacts to most fault currents, and can reduce heating, arcing, and sparking for many faults compared to conventional settings. To allow SCE the capability to toggle between normal and Fast Curve operating setting during high fire threat conditions requires CB relays to be newer microprocessor-type relays. In 2019, SCE updated the settings for CBs in HFRA that had microprocessor relays. In 2020-2022, SCE work scope is to upgrade the non-compatible CBs in HFRA and also install the Fast Curve settings. The RSE for this initiative is moderately high even without including other benefits of installing new CBs with microprocessor relays.

iii. Prioritization or targeting approach: Since all the non-compatible CBs in HFRA are in scope by 2022, no risk-informed prioritization was utilized. The projects were generally prioritized based on feasibility, with more simple projects happening in earlier years and more complex projects in later years, as these can take over a year to engineer alone. Construction efficiency was also considered in the prioritization of this work.

iv. Future improvement plans: Since the initiative will be completed by 2022, no modifications or improvements in risk modeling is contemplated.

G. SH-7: PSPS-Driven Grid Hardening Work

i. Risk to be mitigated or problem to be addressed: PSPS de-energizations are disruptive and can have significant impact on customers. Reducing the frequency, scope and duration of PSPS events in of utmost importance to SCE. Since PSPS is significantly influenced by expected and observed weather conditions at a particular time, circuit segments at high risk of PSPS do not necessarily coincide with circuit segments that have high risk score based on probability and consequence of ignition estimated based on average conditions at that location. Therefore, current initiatives for reducing ignition risks do not necessarily target areas that experienced PSPS.

ii. Initiative selection: SCE is targeting grid hardening and circuit modifications in locations that have experienced multiple PSPS events in 2019. SCE's plans include replacing targeted segments of bare conductor with covered conductor, undergrounding circuit segments, and/or adding switching devices to facilitate circuit reconfigurations/load transfers. These circuit modifications will minimize the impact of PSPS on customers located in 1) non-HFRA that are connected to circuits that traverse HFRA and 2) certain underground areas within HFRA that are fed from overhead circuitry within HFRA. Risk analysis was not performed for this initiative as the objective was not to reduce ignition probability and consequence, but rather to reduce the impact of PSPS. There are ignition risk reduction benefits from these projects as well, but they are smaller scale and the specific scope of the projects was unknown at the time of the WMP submittal.

iii. Prioritization or targeting approach: SCE first targeted circuits that experienced PSPS de-energization in 2019, prioritizing those that were most impacted. Of the identified scope that could help reduce PSPS frequency and scope, SCE further prioritized switching projects (installing sectionalization equipment or transferring load to other circuits) as these are quicker to implement prior to 2020 fire season. Sections identified for covered conductor installation or undergrounding were ranked against other projects being scoped as part of SH-1 and SH-2 using WRM and qualitative input for PSPS benefits to determine prioritization for deployment.

iv. Future improvement plans: Currently, SCE's enterprise-level and asset-level risk models estimate ignition risk and do not include quantitative estimates of how initiatives mitigate PSPS impacts. SCE is exploring how best to incorporate completed grid hardening work to help further inform future PSPS thresholds and hopes to have an approach available by 2021.

H. SH-8: Transmission Open Phase Detection

i. Risk to be mitigated or problem to be addressed: Through 2019, SCE's mitigation programs to reduce the probability of downed wire were focused on its distribution system which is significantly larger than SCE's transmission system in terms of circuit miles and had historically experienced more downed wire incidents. However, there have been 12 transmission and subtransmission downed wire incidents from 2015-2019 across SCE's service territory. While the frequency of incidents remains low, the consequence of energized downed wire incidents on the Transmission system can be significant as previously discussed.

ii. Initiative selection: In 2019, SCE evaluated the use of a protection scheme to detect an open phase (broken conductor) condition on its Transmission system. Through simulations testing, SCE optimized the detection scheme for an open phase condition, allowing de-energization of the line before it could contact a grounded object resulting in a fault event. In 2020, SCE is deploying transmission open phase detection on six transmission and subtransmission lines. SCE did not perform a risk analysis or calculate an RSE for this initiative as it is a pilot and the objective of the initiative is not to mitigate wildfire risk, but rather to evaluate a technology that can help mitigate wildfire risks if deployed.

iii. Prioritization or targeting approach: At the time of scope selection, the WRM did not have models for transmission assets. Transmission lines in HFRA were therefore selected based on system characteristics including whether they had single conductor per phase (instead of bundled conductor) and the type of relays. This list was further narrowed down by considering where Open Phase Detection logic could be deployed. Finally, engineering judgement was used based on existing relay schemes to identify six of those locations for the 2020 pilot.

iv. Future improvement plans: SCE now has transmission lines modeled in WRM. Once the pilot is completed, if larger scale deployment is planned, SCE will use WRM/WRRM risk scoring for future deployment of open phase detection where appropriate.

I. SH-9: Transmission Overhead Standards (TOH) Review

i. Risk to be mitigated or problem to be addressed: Through 2019, SCE's wildfire mitigation strategies and programs had a greater emphasis on SCE's distribution system largely because of historical ignition sources being predominately from its distribution system. However, transmission systems faults can also cause ignitions that could have potentially hazardous consequences. As California has witnessed the catastrophic consequences of transmission equipment failures, SCE determined it to be prudent to ensure it has updated system design and construction standards that incorporate the lessons learned from the recent events from its industry peers and to ensure the updated design and construction practices will appropriately mitigate transmission ignition risks.

ii. Initiative selection: During 2020, SCE will continue its detailed review of its transmission and subtransmission design and construction standards, identify improvements necessary and develop modifications needed to help further reduce the likelihood of electric system-related ignitions, especially during extreme wind events. SCE did not perform risk analysis or calculate an RSE for this initiative as it cannot reduce wildfire risk as a standalone item but can only help mitigate wildfire risks when used during design and field construction.

iii. Prioritization or targeting approach: As this study is not location specific, WRM is not applicable from a scope selection perspective. All transmission design and construction standards are in scope and no prioritization is necessary.

iv. Future improvement plans: As the WRM quantifies the contribution of specific asset types and drivers (Including some physical characteristics of assets) to probabilities of ignitions, future emphasis for standards review can be placed on standards that relate to the highest risk assets and drivers.

J. SH-10: Tree Attachment Remediation

i. Risk to be mitigated or problem to be addressed: Older construction methods used in SCE's forested service area utilized the practice of using existing trees to support overhead conductors instead of installing utility poles. These are called "tree attachments." The integrity of the trees cannot be verified as it is through SCE's pole loading program or intrusive inspection techniques as this could decrease the structural integrity of the tree. In addition, tree attachments increase the probability of faults and damages from vegetation contact and "fall-ins." Tree attachments are an obsolete construction technique that do not meet SCE's current design standards.

ii. Initiative selection: To reduce the probability and faults and consequence of a spark close to vegetation, SCE will relocate such tree attachments to a pole. This will typically be done in conjunction with covered conductor deployment for operational efficiency. Note that if there is aerial cable that is in good condition, SCE will relocate the aerial cable to a pole instead of installing covered conductor. Therefore, SCE included the risk reduction from, and cost of removing tree attachments (with the exception of aerial cable), with the total risk reduction and cost of the covered conductor program.

iii. Prioritization or targeting approach: The WRM was not used to identify 2020 tree attachment scope. Rather, an alternate risk informed method prioritizes tree attachment relocations by circuit based on REAX scores, conductor type (primary voltages were considered higher risk compared to secondary), potential to damage structures (the greater the number of structures, the higher the priority) and tree mortality (the more severe the condition, the higher the priority). Prioritization is conducted not based on health of individual trees the conductors are attached to, but rather health of area based on topographical map. Tree mortality data mapped by the US Department of Agriculture (USDA) Forest Services is used to inform tree mortality. The USDA data provided severity of tree mortality based on number of dead trees per acre.[8]

iv. Future improvement plans: For 2021, SCE is exploring transitioning from REAX consequence model to the Technosylva to provide more accurate risk prioritization.

K. SH-11: Legacy Facilities

i. Risk to be mitigated or problem to be addressed: Through 2019, SCE's wildfire mitigation strategies and programs were more focused on SCE's distribution system largely because of historical ignition sources being predominately from its distribution system. However, given the increasing risk of wildfires, SCE is assessing all potential source of ignitions associated with electrical equipment including generation facilities for completeness of review of potential drivers. Legacy facilities primarily refers to high and low voltage equipment supporting hydroelectric operations. Findings from the 2019 enhanced inspections of generation assets uncovered potential risks that needed further assessment to help ensure adequate wildfire risk mitigation.

ii. Initiative selection: In 2020, SCE is pursuing detailed assessments of legacy facility assets to determine asset health and potential of faults and ignition risks due to equipment failure and contact from foreign objects. This includes assessing existing protections in place such as grounding grids and lightning arrestor systems to ensure their adequacy and identify necessary modifications. SCE did not calculate an RSE for this initiative as it is an assessment of the efficacy of current standards. There is insufficient data prior to completion of this initiative to estimate potential risk reduction if changes are implemented in the future as a result of this assessment.

iii. Prioritization or targeting approach: The WRM did not have POI models for the legacy assets in scope for this assessment. As an alternative, SCE used the REAX consequence score of the closest available overhead structure along with the legacy asset's age, last major overhaul date, and operating voltage to prioritize. Other factors (e.g., unique asset characteristics, HFRA Tier, years since last assessment) were included in prioritization efforts depending on the specific workstream or activity.

[8] After entire circuits are selected, only the removal of tree attachments from the circuits are scoped. For location where there are only primary, the aerial cable attached to tree are re-used if in good condition or replaced if showing signs of degradation and move onto a newly installed pole. If there is adequate spacing, covered conductor on open cross-arm will be installed instead. For circuits with both primary and secondary, the secondary will also be remediated. For secondary, with equipment, current SCE standard for addressing obsolete equipment will be followed. For secondary wire that used old insulation, it will be updated to the current SCE standards of triplexed conductors. The tree will either be removed to facilitate construction or left to be assessed by Vegetation Management.

iv. Future improvement plans: Legacy assets will be incorporated into future versions of the WRM, but the models are not as mature due to limited data availability compared to those of transmission and distribution assets, so risk scores will continue to be enhanced for 2021 scoping. The costs and wildfire risk reduction benefits of these measures will be analyzed as part of this assessment to determine inclusion of these mitigations in future construction and maintenance.

L. SH-12.1: Remediations – Distribution, SH-12.2: Remediations – Transmission, and SH-12.3: Remediations – Generation

i. Risk to be mitigated or problem to be addressed: As described in IN-1.1, IN-1.2, and IN-5, deterioration of overhead structures and assets increases the probability of failures and faults which could lead to ignitions associated with electrical infrastructure.

ii. Initiative selection: Once asset deterioration or other corrective actions are identified during inspections, timely remediations of these conditions are imperative to reduce the probability of faults and potential ignitions and thus achieve the ignition driver reduction benefits. As discussed in IN-1.1, IN-1.2, and IN-5, since remediations follow inspections, combined RSEs were calculated by estimating the risk reduction from the corresponding remediations by the particular initiative (e.g. Distribution Inspections IN-1.1 and Distribution Remediations SH-12.1) and incorporating in the costs of both the inspection programs and the subsequent remediations. For the same reasons highlighted in IN-1.1, the costs of both inspection and remediation must be combined as inspection itself does not remediate the risk. The moderately high RSE value for Distribution inspections and remediations supported the continued need for this program to proactively identify equipment failures and potentially hazardous conditions before an ignition could occur. The inspection and remediation costs for IN-5 Generation Inspections, and SH-12.3 Generation Remediations are included in this initiative based on similarity of inspection scope.

The RSE for Transmission remediations is lower than that for Distribution remediations. This is a because the historical number of equipment failures that result in an ignition related to Transmission facilities is very low. However, as discussed in IN-1.2, since California has witnessed the catastrophic consequences of Transmission equipment failures, SCE determined it to be prudent to thoroughly inspect Transmission assets in the HFRA and perform the remediations in a timely manner.

iii. Prioritization or targeting approach: Please see IN-1.1 and IN-1.2 how risk analysis informs scope and frequency of inspections. Inspection results are prioritized based on expected risks and in accordance with SCE's Inspection and Maintenance program standards, GO 165 guidelines.

- Priority 1 (P1) issues require action as soon as the issue is discovered, either by fully remediating the condition, or by temporarily repairing the equipment or structure to allow for follow-up corrective action. Examples of P1 issues include vegetation touching lines, broken crossarms or insulators, burned connectors, wires laying on crossarms, or exposed wiring. Priority 1 issues are typically made safe within 24 hours and remediated within 72 hours.
- Priority 2 (P2) issues are lower risk and therefore may be resolved within 24 months based on the existing safety or reliability condition and location. If the P2 issue is located within HFRA and poses a potential fire risk, remediation work is scheduled to be completed within 12 months. In an extreme fire threat area of Tier 3, the maximum remediation time is within 6 months. Examples of P2 issues include vegetation near lines, deteriorated crossarms or splices, or insufficient pole depth.
- Priority 3 (P3) issues do not require near-term remediation as they do not pose material safety, reliability, or fire risks, and will either be repaired or re-evaluated at or before the next detailed inspection. P3 issues require remediation within 60 months pursuant to D.18-05-042. Examples of P3 issues include missing items such as reflector strips, ground moldings, guy wire guards, or high voltage signs.

iv. Future improvement plans: Please see IN-1.1, IN-1.2, and IN-5 for information on how risk modeling is used for setting inspection cycles. In 2020, SCE plans to remediate 100% of notifications with ignition risk in accordance with CPUC requirements, non-inclusive of notifications which meet the criteria of a valid exception. Additionally, SCE is evaluating assets for inclusion in its risk modeling efforts to determine a risk-informed approach for this work by the end of 2022.

PSPS

A. PSPS Operational Protocol

i. Risk to be mitigated or problem to be addressed: Though grid hardening and other activities being actively pursued, SCE is in the initial stages of completing the work needed for wildfire mitigation. During high-risk fire weather conditions that pose unacceptable levels of wildfire risk to the public based on wind, temperature, humidity levels, ground fuel capacity and grid attributes, SCE initiates PSPS as a proactive measure to mitigate catastrophic wildfire risk.

ii. Initiative Selection: If conditions indicate fire danger is elevated — for example, if there are strong winds, low humidity, dry vegetation, there is a fire threat to public safety or electric structures — SCE may temporarily de-energize areas with a high risk of wildfires. SCE recognizes and appreciates the impact of PSPS events on its customers, and it does not take lightly any decision to proactively de-energize portions of the grid. Though PSPS events are expected to lessen as SCE deploys more of its WMP activities, PSPS will need to remain available as a tool to mitigate wildfire risk during increased fire danger conditions because real-time weather conditions do not always align with historical trends. SCE's capability to isolate circuit segments, and its reliance on real-time weather data and field conditions to inform de-energization decisions will help SCE reduce the number of customers impacted by PSPS in its service area in the upcoming wildfire seasons, although a longer or more intense fire season could potentially increase PSPS frequency, scale, and duration. SCE has developed circuit-specific plans to reduce the frequency, scope and impact of PSPS on its customers and communities. SCE calculated an RSE for PSPS using the cost for all PSPS-related activities, and the resulting RSE score was high due to PSPS's effectiveness in reducing ignitions and the relatively low cost of PSPS operations. SCE does not use RSE as a justification for specific PSPS de-energizations.[9]

iii. Prioritization or targeting approach: SCE's WRM currently calculates the probability of a spark using average wind conditions at the circuit segment or asset level. PSPS ensures SCE is prepared to account for real time abnormal weather conditions which occasionally may include extreme wind events.

PSPS activation (process of activation includes standing up the incident management team, notifying public safety partners and customers, and performing pre-event patrols and live field observations) and de-energization are complex decisions based on several quantitative and qualitative that cannot be reduced to a mathematical formula. While SCE considers two primary factors in initiating a PSPS activation, its decision to shut off power is dynamic and made by considering many factors.

The first factor used to drive PSPS decisions is the Fire Potential Index (FPI), which estimates the likelihood of a spark turning into a major wildfire. FPI is calculated using forecasted wind speed, dewpoint depression, and various fuel moisture variables which are generated from SCE's customized version of the Weather Research and Forecasting (WRF) model. FPI scores range from 1 to 17, and any score above 12 is considered high risk. SCE reviews fire potential related products from the National Weather Service (NWS) and the Geographic Area Coordination Center (GACC) to confirm the wildfire threat related to PSPS.

The second factor used to drive PSPS decisions is wind speed. SCE considers the National Weather Service Wind Advisory levels (defined as 31 mph sustained wind speed and 46 mph gust wind speed) and the 99th percentile of historical wind speeds in the area to set activation thresholds. If the wind speed forecasts exceed

[9] Refer to WMP resolution that asks us not to use RSE for PSPS going forward.

these activation thresholds in a location with elevated FPI, SCE initiates PSPS activation and notifications.[10]

iv. Future improvement plans: SCE is working on several enhancements to the risk modeling associated with PSPS. First, the REAX consequence scores will be replaced with the more granular and updated Technosylva consequence scores. Second, SCE is exploring improvements to the circuit health model by incorporating the design capacity of poles (windspeed the pole can withstand based on its physical design and load), circuit-specific vegetation management and grid hardening information, and probability of ignition scores that will help refine windspeed thresholds for PSPS activation and de-energization, potentially reducing both false positives and false negatives for customer notifications and de-energizations. SCE expects this new method to be in place in 2021 following testing and piloting in 2020. Third, as more data on ignitions is compiled, SCE is calibrating the FPI index to improve its predictive capability. Lastly, SCE is developing an approach to incorporate PSPS impacts into its risk modeling which will enable identifying targeted grid hardening and other activities to mitigate PSPS frequency and scope.

Notwithstanding the significant undertakings in SCE's WMP to help ensure public and employee safety, extreme weather events can pose high ignition and public safety risks, necessitating PSPS. SCE has a suite of customer care initiatives which mitigate the impact during a PSPS event and target increased customer communication on wildfire preparedness and education.

B. PSPS-1.1 thru 1.3: De-Energization Notifications

i. Risk to be mitigated or problem to be addressed: In order to reduce customer and community impact, public entities including public safety agencies, local governments, CAL OES and the CPUC need to be aware of and prepare for PSPS de-energization events to adequately enact their emergency preparedness protocols and procedures. Sufficient advance notification to these public entities reduces the risk of customers and the public not receiving the necessary support during PSPS de-energization events.

ii. Initiative selection: SCE established processes and technology to help ensure that key stakeholders (public safety agencies, local governments, Cal OES, CPUC) receive appropriate and timely notifications of potential PSPS events based on a schedule set forth in various resolutions and decisions.[11] SCE uses the Emergency Outage Notification System (EONS) which was already in place for emergency notifications and was proven effective to perform the required mass-notification

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[10] Please see https://www.sce.com/wildfire/fire-weather for additional information regarding SCE's PSPS de-energization criteria.

[11] Resolution ESRB-8 (Resolution Extending De-energization Reasonableness, Mitigation and Reporting Requirements in Decision 12-04-024 to All Electric Investor Owned Utilities; June 2018), D. 19-05-042 (Decision Adopting De-energization Guidelines; May 2019) and D. 20-05-051 (Phase 2 of PSPS OIR Final Decision; June 2020).

functionality. Stakeholder communication initiatives do not reduce the probability or consequence of ignitions, but rather supports agency and customer needs during PSPS, and therefore risk models were not used to select the scope of work, calculate RSE or target deployment.

iii. Prioritization or targeting approach: The prioritization or targeting of stakeholders is based on circuits with windspeeds breaching the activation threshold and the timing protocols established in various PSPS resolutions and decisions.[12]

iv. Future improvement plans: The selection and implementation of these initiatives are not based on risk modeling, but SCE remains committed to collaborating with regulators, public safety partners and other stakeholders to improve, adjust or streamline notifications to various agencies before, during and after a de-energization events.

C. PSPS-1.4: De-Energization Notifications (EONS)

i. Risk to be mitigated or problem to be addressed: PSPS notifications have to be timely, accessible to the public in an impacted location even if their residences and businesses are not located there (such as visitors, workers, persons monitoring family members' wellbeing, and the public at large), and they need to be available in preferred languages to help ensure customers have the information necessary to prepare adequately for a PSPS event.

ii. Initiative selection: SCE has put in place the systems and processes necessary for timely notifications to customers during PSPS events. In 2019, SCE identified the need to have information accessible to the public regardless of their residence or business location and leveraged the EONS Zip Code-level alerting solution enabling customers and others in SCE's service area the ability to enroll to receive PSPS notifications based on their preferred zip code(s). In July 2020, SCE enhanced its Zip Code-level alerting to include in-language notifications to align with SCE's existing notification capabilities for SCE customers. De-energization notifications do not reduce the probability or consequence of ignitions, but rather supports public needs during PSPS, and therefore risk models were not used to select the scope of work, calculate RSE or target deployment.

iii. Prioritization or targeting approach: This service is available to all customers and non-customers in SCE's service area and no scope prioritization was necessary. Selected deployment schedule was designed to have functionality in place in July 2020 ahead of when major PSPS events may potentially take place this year (historically August through December).

iv. Future improvement plans: The selection and implementation of this initiative are not based on risk modeling, but SCE remains committed to collaborating with

[12] Ibid

regulators, public safety partners, community based organization and other stakeholders to improve, adjust or streamline notifications provided to customers and the public in SCE's service area before, during and after a de-energization events.

D. PSPS-2: Community Resource Centers (CRCs)

i. Risk to be mitigated or problem to be addressed: PSPS de-energization events can be disruptive and stressful, and customers need access to information updates along with access to resources and amenities such as charging mobile devices, flashlights, access to restrooms, ice, water and snacks to mitigate the impact.

ii. Initiative selection: Based on stakeholder feedback on the need for temporary relief and additional information during PSPS de-energization events, SCE sets up CRCs where SCE representatives provide information and amenities in an effort to reduce the impact of de-energization events on customers. The representatives help customers sign up for PSPS alerts, update their contact information, and answer program or customer account questions. To continue to serve customers during the COVID19 pandemic, SCE has made certain modifications to the operation of CRCs to enforce social distancing. For example, instead of allowing customers to help themselves to snacks and fact sheets, SCE has made available pre-packaged resiliency kits which includes fact sheets, bottled water, snacks, a pre-charged phone charger, mask, gloves, and sanitizers. SCE is also prepared to set up drive-throughs as space permits to further enforce social distancing. The establishment of CRCs does not reduce the probability or consequence of ignitions, but rather supports customer needs during PSPS, and therefore risk models were not used to select the scope of work, calculate RSE or target deployment.

iii. Prioritization or targeting approach: The location and timing of CRC locations are selected based on an assessment of circuits most likely to be impacted by a PSPS event and in consultation with local governments in the impacted area. Additionally, Phase 2 of PSPS OIR Decision (D. 20-05-051) imposes certain requirements on CRCs such as location criteria, hours of operation, and services. CRCs will be activated from 8AM-10PM the day of the event unless event ends before 10PM or the government facility at which the CRC is located provides guidance otherwise. If a CRC cannot be established in a particular community, SCE may utilize Community Crew Vehicles (CCVs) to support impacted communities, although CCVs should be seen as supplemental to CRCs, not as replacements. See PSPS-7 below for more information on CCVs.

iv. Future improvement plans: The selection and implementation of this initiative are not based on risk modeling, but SCE remains committed to collaborating with regulators, local governments, and various community stakeholders to improve, adjust or streamline CRC deployments during de-energization events. SCE also continues to explore ways to better serve customers as it has in adjusting its CRC operations during the COVID 19 pandemic.

E. PSPS-3: Customer Resiliency Equipment Incentives

i. Risk to be mitigated or problem to be addressed: Having access to backup power and resiliency solutions during extended PSPS de-energization events can help reduce the impact of PSPS de-energization events. If a community location has solar and storage facilities, it could act as a community resiliency center if it could be islanded during emergencies. Having islanding capability and control will allow the customers to redirect electricity as needed and provide the appropriate resiliency based on their needs during a de-energization event. Implementing this capability needs upfront investments and some customers willing to provide a resiliency option may not have the financial ability to make the investment.

ii. Initiative selection: In 2020, SCE has a pilot project to collaborate with one customer in a location that has been historically impacted by PSPS events, and assess the potential benefits of a customer resiliency equipment incentive program that provides financial support to customers willing to increase resiliency within HFRA. Customers have to meet specific criteria to be eligible for this program. These criteria include large commercial facilities that can act as a shelter for the community, already have or are planning to have on-site solar and storage installed and are willing to island and redirect the energy in the storage battery to a designated building on site for use during PSPS events or other emergencies. These facilities are required to be open to the public during PSPS events or other emergencies. The majority of customers that have these features at their sites are larger entities such as schools, local government facilities, and large retailers. The islanding allows the use of the designated building as a powered CRC in HFRA. This initiative does not reduce the probability or consequence of ignitions, but rather supports customer needs during PSPS events, and therefore risk models were not used to select the scope of work, calculate RSE or target deployment.

iii. Prioritization or targeting approach: SCE considered two potential types of customers would could be considered for the pilot initiative: 1) customers that have already installed solar and storage capabilities (retrofit design) and 2) customers that have solar and are in the process of adding storage capabilities (upfront design). The purpose of the pilot is to learn about the complexity of the islanding design, costs, and customer participation. Currently SCE has selected one customer for the pilot program in 2020. If this pilot is successful, SCE has plans for wider-scale deployment of this program, prioritizing schools located in Tier 2 or 3 HFRA which are already designated Red Cross shelters.

iv. Future improvement plans: The selection and implementation of this initiative are not based on risk modeling. SCE plans to learn from its pilot in 2020 to determine what modifications may be needed in 2021 and beyond and how best to target locations.

F. PSPS-4: Critical Care Backup Battery (CCBB)[13] Program

i. Risk to be mitigated or problem to be addressed: SCE has critical care customers who rely on medical equipment for their health and safety. These customers need to be prepared to ensure medical equipment will be operational during a PSPS de-energization event.

ii. Initiative selection: The decision to undertake this initiative was driven by the needs of SCE's income qualified critical care Medical Baseline customers residing on HFRA circuits, and was designed to fully fund the cost of a battery-powered portable backup solution to operate critical medical equipment during de-energization events. SB 167 authorizes electrical corporations to deploy backup electrical resources or provide financial assistance for backup electrical resources to those customers receiving medical baseline allowances and who meet specified requirements. The CCBB Program helps provide an energy resiliency solution for vulnerable customers through assistance with battery backup generation. This initiative does not reduce the probability nor consequence of ignitions, but rather supports customer needs during PSPS, and therefore risk models were not used to select the scope of work, calculate RSE or target deployment.

iii. Prioritization or targeting approach: SCE prioritized approximately 140 customers who experienced multiple PSPS events in 2019 for the CCBB program, and delivery of the battery-powered portable backup devices for these customers is underway. Additionally, outreach letters were sent to more than 2,000 potentially eligible customers residing in HFRA based on their economic needs and critical care designation. SCE will conduct follow-ups via phone outreach to confirm these customers meet eligibility criteria and will coordinate delivery and set up of the battery solution. SCE anticipates providing approximately 2,000 customers with the backup device by the end of 2020. If for any unforeseen reason SCE is unable to provide the targeted number of batteries (e.g. customer request or battery inventory) in 2020, the program may continue into 2021.

iv. Future improvement plans: The selection and implementation of this initiative are not based on risk modeling, but SCE will continue to explore effective and cost-effective means of reducing PSPS impacts for high risk customers.

G. PSPS-5: MICOP Partnership

i. Risk to be mitigated or problem to be addressed: Not having access to critical wildfire related and PSPS information can impact residents' ability to adequately

[13] Formally called the Income Qualified Critical Care (IQCC) Customer Battery Backup Incentive

prepare for de-energization events. As SCE implemented measures to address the needs of vulnerable populations during PSPS, discussion and analysis expanded to the needs of all individuals with AFN, including those with limited English proficiency. In the case of Mixteco, Zapoteco and Purepecha, communication is primarily through a spoken indigenous language, and this customer segment can be isolated from important public safety and preparedness information made available through traditional channels. This was reaffirmed in the June 2019 edition of the CPUC monthly newsletter where Commissioner Guzman Aceves discussed Mixteco and the utilities' role in ensuring that critical information reaches all populations.

ii. Initiative selection: SCE has a longstanding partnership with Mixteco/Indígena Community Organizing Project (MICOP), a nonprofit organization dedicated to supporting, organizing and empowering the indigenous migrant communities in California's Central Coast. In 2019, SCE enhanced the MICOP partnership to enable the dissemination of emergency preparedness and PSPS information to residents in Ventura County who are from these indigenous communities. This initiative does not reduce the probability or consequence of ignitions, but rather supports specific customer segments during PSPS, and therefore risk models were not used to select the scope of work, calculate RSE or target deployment.

iii. Prioritization or targeting approach: Mixteco, Zapoteco and Purepecha are largely spoken languages in certain parts of SCE's service territory. Following MICOP's guidance, the communication channels utilized to reach out to these communities include their local radio station out of Oxnard, in-person events such as monthly community meetings and school events and one-on-one outreach. Outreach transitioned from in-person to phone calls during the COVID-19 pandemic.

iv. Future improvement plans: SCE did not apply a risk analysis for selection or implementation of this initiative but is committed to reducing the impact of PSPS events and meeting the unique needs of these communities.

H. PSPS-6: Independent Living Centers Partnership

i. Risk to be mitigated or problem to be addressed: As described in PSPS-5, not having access to critical wildfire related and PSPS information can impact residents' ability to adequately prepare for de-energization events. Clients of independent living centers (ILCs) have unique needs that can require resources and services specific to the individual.

ii. Initiative selection: As previously noted, SCE has existing partnerships with nonprofit organizations throughout the SCE service area that serve its vulnerable populations. SCE established partnerships with the Southern California members of the California Foundation for Independent Living Centers (CFILC) as part of the broader effort for AFN outreach. The ILCs are dedicated to increasing independence, access and equal opportunity for people with disabilities. These partnerships have incorporated and leveraged the subject matter expertise of AFN advocates and members of the AFN community to ensure education and outreach as it relates to emergency preparedness and SCE's medical baseline program. This initiative does not reduce the probability or consequence of ignitions, but rather supports needs of specific customer segments during PSPS, and therefore risk models were not used to select the scope of work, calculate RSE or target deployment.

iii. Prioritization or targeting approach: All ILCs within the SCE service area, operating under the CFILC umbrella, are included in this initiative. Outreach and education are being performed by the ILCs through the most appropriate and accessible methods to meet client needs, using specifically developed materials in alternative formats, as necessary. Methods include trainings, small-group workshops, outreach events, social media messaging, emails, mailers, as well as one-on-one communication. Trainings and workshops were transitioned to virtual platforms during the COVID-19 pandemic.

iv. Future improvement plans: The selection and implementation of this initiative are not based on risk modeling, but SCE will continue to explore effective and cost-effective means of reducing PSPS impacts for vulnerable customers.

I. PSPS-7: Community Outreach

i. Risk to be mitigated or problem to be addressed: PSPS de-energization events can be disruptive and stressful, and customers need access to information updates along with access to resources and amenities such as charging mobile devices, flashlights, access to restrooms, ice, bulk water and snacks to mitigate the impact. SCE is unable to set up CRCs at all locations due to community, regulatory and operational constraints.

ii. Initiative selection: There are two activities in this initiative – equipping and deploying Community Crew Vehicles (CCVs) and targeted information exchange. This initiative does not reduce the probability or consequence of ignitions, but rather supports customer needs during PSPS, and therefore risk models were not used to select the scope of work, calculate RSE or target deployment.

CCVs are a mobile option to reach impacted communities that do not have a CRC location in their community or as a supplement to CRCs, as needed to support impacted communities. SCE has designed and outfitted eight cargo transit vans as CCVs with the required equipment and technology to enable SCE staff to transport water, snacks, portable charging devices, lights, and other amenities to communities potentially impacted by a PSPS de-energization event.

SCE is also employing a variety of targeted communication channels to ensure that customers are notified in a timely manner. For example, Nextdoor, a neighborhood online forum to exchange helpful information has more than 2.5 million verified subscribers in SCE's service area. This forum can be customized to target recipients based on the unique needs of the community. SCE made its first Nextdoor post in December 2019 and is refining its customer notification strategy in 2020 and through this WMP period.

iii. Prioritization or targeting approach: CCVs deployments are targeted in remote areas heavily impacted by de-energization events, that do not have easy access to a CRC. SCE works with local governments to determine the location for CCV deployment. SCE's plans include communication through social media to spread awareness of the availability of the CCVs in the community. SCE will target communications regarding CCV deployments to key stakeholder groups including critical care customers, government agencies (e.g. CAL OES), media, and municipalities. SCE's communication team will identify the most effective communication channel to use with these groups.

iv. Future improvement plans: The selection and implementation of this initiative are not based on risk modeling, but SCE will continue to explore effective and cost-effective means of reducing PSPS impacts for customers in remote locations and to improve information exchange with impacted customers.

J. PSPS-8: Microgrid Assessment

i. Risk to be mitigated or problem to be addressed: Having backup power and resiliency solutions during extended PSPS de-energization events can help reduce the impact of de-energization events.

ii. Initiative selection: As distributed energy resources (DERs) become more common, especially clean DERs, microgrids that can island from the grid during de-energization events may provide opportunities to increase community resilience. Legislators, regulators, industry stakeholders and communities are increasingly interested in the potential of this technology and SCE continues to assess the viability of microgrids in mitigating PSPS impacts.

SCE is in the process of determining where microgrids can be deployed on a pilot basis and how they compare with other mitigation options. Developing and installing microgrid solutions is complex and requires consideration of multiple factors including detailed understanding of local system configurations, air quality requirements, policy objectives, and regulatory requirements. The microgrid(s) would not reduce the probability or consequence of ignitions, but rather reduce the impacts of PSPS. Therefore, risk models were not used to select the scope of work or calculate RSE.

iii. Prioritization or targeting approach: Though SCE did not use the WRM model to select locations for potential microgrid pilot deployment, SCE used an alternate risk-informed approach that is currently being refined. Initial assessment criteria included whether the circuit experienced more than two PSPS de-energization events in 2018-19, locations that could safely remain energized during a PSPS event, locations that did not have other previously identified mitigations, number of low income customers, number of Essential Use customers (i.e., customers who provide essential public health, safety, and security services), complexity of work required to interconnect the microgrid (e.g. new switching equipment required), total customer count, and load that the microgrid would need to serve. These criteria were weighted, and a sensitivity analysis was performed using different weights to identify viable circuit segments that consistently scored high as areas that would benefit most from a microgrid.

iv. Future improvement plans: SCE requested vendor proposals for six locations for 2020 deployment but chose not to select any of these proposals as they were cost prohibitive and utilized natural gas reciprocating engines. SCE is continuing to refine its risk-informed selection criteria and exploring options to identify technically viable and cost-effective opportunities. New criteria being considered are factors that make a circuit more susceptible to PSPS in the future and/or prohibitively expensive to address through more traditional solutions such as topography, remoteness, and historical wind speeds.

IV. SUMMARY

SCE has made significant improvements in its risk modeling capability, and using the results of risk analysis in informing decisions such as quantifying key risks, selecting appropriate mitigation measures and prioritizing or targeting deployment. SCE continues to further develop its capabilities in making risk informed decisions based on actual data to appropriately mitigate wildfire risks within constrained resource availability.

SCE's 2020-2022 WMP development and 2020 WMP deployment was informed and validated by various enterprise level, asset-level and program-specific risk models and analysis as described in the sections above. In 2020, SCE has focused on (1) developing more POI models and including more assets into the WRM, (2) further improving the existing probability of ignition (POI) models, (3) transitioning from REAX to Technosylva and WRRM, and (4) assessing further integration of WRM outputs for decision-making for system hardening, inspections, vegetation management and PSPS. Through the second half of 2020 and early 2021, SCE will also develop its approach, to be used in its 2022 RAMP filing, for incorporating PSPS impacts into its RSE calculations in accordance with the SMAP Settlement Agreement. In addition, SCE will further advance the determination of PSPS thresholds by leveraging quantitative risk analytics beyond what it has already done in late 2019 and the first half of 2020. In 2020, SCE also expects to work with stakeholders in advancing best practices and receiving additional guidance from the Commission as part of the new OIR on developing a Risk Based Decision-Making Framework.

In 2021, when a reliable risk model is available to further incorporate PSPS impacts and inform PSPS thresholds, SCE will (1) enhance use of PSPS reduction criteria to target wildfire mitigation scope (along with the primary driver of reducing ignition probability and consequence), and (2) incorporate information about completed system hardening measures in PSPS decision-making. Additionally, SCE plans to explore quantitative modeling opportunities to refine its vegetation management practices (based on vegetation, site, regional, and adjacent asset attributes) to further advance risk reduction and operational efficiencies. Similarly, SCE also plans to use the findings from the 2020 High Fire Risk Informed Inspections of Electric Lines and Equipment to further refine ongoing ground and aerial inspection frequencies and scope for Distribution, Transmission and Subtransmission, and Generation facilities. In 2021, SCE also expects to have some data regarding the effectiveness of various mitigation programs deployed in 2018, 2019 and 2020 which can help refine SCE's risk models, scope of work, and how best to prioritize deployment. Lastly, in 2021, SCE expects to be partnering with the Commission (including WSD) and the other utilities to incorporate the outcomes of the above mentioned OIR.

Beyond 2021, SCE will continue regular risk model upgrades by actively pursuing and evaluating new field data, tools, and benchmarking. Further details about SCE's longer-term plan on wildfire mitigation capability maturity will be provided in SCE's response to Guidance-12.

SCE-2 DETERMINING CAUSE OF NEAR MISSES, 2020 WILDFIRE MITIGATION PLAN REMEDIAL COMPLIANCE PLAN

SCE-2
DETERMINING CAUSE OF NEAR MISSES
2020 WILDFIRE MITIGATION PLAN
REMEDIAL COMPLIANCE PLAN

Name: Determining cause of near misses
Category: Asset Management and Inspections
Class: A

Deficiency:

Since 2015, SCE's reported near miss incidents have steadily increased every year. As SCE's near miss incidents have increased, so has the number of near miss incidents attributed to "Other" (not specified) sources. This increase is so pronounced that in 2019, 74% of SCE's near miss incidents were categorized as resulting from "Other" (i.e., unspecified sources), in accordance with Appendix B, Figure. 2.2a. It appears that with steadily increasing rates of near miss incidents, SCE has had difficulty in determining the causes of such incidents to allow for better understanding of the potential ignition risks on its grid, thus the marked increase in near miss incidents attributed to "Other" causes. This calls into question the protocols and depth of SCE's outage cause investigations as well as the training and abilities of its personnel responsible for making such determinations.

Condition:

SCE shall submit a Remedial Correction Plan (RCP) to provide a detailed description of:

i. the processes, procedures, protocols and tools utilized in making outage cause determinations,

ii. the percent of these "other" ignitions that are known to SCE, and for each known ignition driver, a breakdown of each of the drivers contained in "other" ignitions,

iii. the qualifications and training of personnel assigned to determine outage causes,

iv. its Quality Assurance/Quality Control program for verification of outage cause data; and

v. the actions it is taking to drive down the number of near misses and outages attributed to "other" causes, including a timeline for such actions.

Response:

INTRODUCTION

As communicated in SCE's May 27, 2020 comments on WSD's Draft Resolutions, SCE's categorization of near misses into the category "Other" should not be used to draw the conclusion that SCE did not know the cause of those faults. Instead, Tables 11a and 11b attempted to capture key drivers of ignition. Therefore, SCE placed certain types of faults in the "Other" category that are generally not considered a key driver of ignition risk, such as underground or substation equipment failure. SCE's "Other" category also included faults that did not fit into one of the table categories, such as faults caused by lightning or dig-ins. While a subset of SCE's "Other" category was "No Cause Found," a significant number of these were momentary faults where the circuit was only momentarily de-energized. SCE regrets the incorrect impression created by the data provided in Tables 11a and 11b.

Furthermore, as noted in SCE's 2020-2022 WMP, SCE's 2019 data provided on February 7, 2020 was preliminary and data validation on causes had not been completed.[1] As part of this RCP, SCE is providing an update to Tables 11a and 11b that further clarifies the cause of the faults in the last five years and describes SCE's improved capability to identify the causes of faults both through additional training and utilization of tools. The result of these updates is that the share of "near miss incidents" in 2019 on the distribution system resulting from "No Cause Found (Momentary & Sustained)" is 12%, much lower than the 74% noted as the primary driver for this deficiency[2].

SCE further notes that each grid operator has evolved its respective practice of tracking outage data based on the unique needs of its internal business processes. As such, a direct comparison of the data presented in the WMP tables should not be performed without an in-depth understanding of the various cause codes and the logic and criteria applied by the team that made this determination over the years. For example, SCE knows there are inherent differences in how each utility reports outage data, such as the inclusion or exclusion of outages that are in the "undetermined" category. Going forward, SCE is committed to supporting a more transparent, uniform and consistent application of these reporting practices that are inherently complex and with many nuances.

i. the processes, procedures, protocols and tools utilized in making outage cause determinations

To accurately capture and determine outage causes, SCE relies on our front-line technical experts in the field (senior patrolmen, troublemen and substation operators) to make the initial determination based upon evidence in the field and/or at a substation. When an unplanned outage occurs, SCE's switching centers and system operators receive the appropriate outage notifications (i.e. alarms, meter indications, etc.) and field staff are dispatched into the field. The field staff are responsible for determining what occurred, the outage cause, making the area near the outage safe for the public and crew, documenting material needed to restore power, trying to minimize the number of customers affected by the outage, and restoring power if possible. The following are examples of tools that field staff may use to assist in their determinations:

- Ammeter to amp-check a circuit at strategic points to help them find a blown tap.
- Fault indicators to help determine the cause of an outage by comparing or checking the amperage through the circuit.

[1] See SCE's *2020-2022 Wildfire Mitigation Plan*, Section 3.2 "Recent Drivers of Ignition Probability, Last 5 Years", p. 36.
[2] In this deficiency, WSD appears to reference near miss data provided for SCE's distribution system.

- Meter Alarming of Down Energized Conductor alarm and associated actions that proactively monitors and detects a subset of wire downs as well as other valuable troubleshooting data that helps field staff respond quickly and find outage causes.
- Smart meter exception data to help diagnose issues by observing when smart meter exceptions occur along with the approximate location of the issue.

During this process, the field staff are in communication (via radio or phone) with a Distribution Operations Center (DOC) dispatcher and/or a System Operator. Most of the time, outages are documented by both dispatchers and system operators due to the different nature of their roles (i.e. dispatchers focus on customer and field-facing perspectives and system operators look at the system-wide perspective and will direct field staff on next steps i.e. to restore power). DOC dispatchers document the outage information in SCE's Outage Management system (OMS), which contains pre-populated outage cause codes. System operators manually enter outage information into an interruption log sheet (ILS) based on the information provided by the field staff. Should an outage occur inside a substation, substation operators will also contact system operators and outage information is entered into ILS.

As part of the validation process the OMS and ILS information is then transcribed into SCE's Outage Database & Reliability Metrics System (ODRM). ODRM has built-in nested logic for cause selection to facilitate accurate recording. The staff of SCE's Reliability Operation Center (ROC), which consist of experienced engineers and technical experts, subsequently validates ODRM entries involving distribution load including the Customer Minutes of Interruption and verifies and validates that the outage data was entered correctly into ODRM based on reported data in OMS and ILS. Information for transmission line and substation outages that do not involve distribution load are validated by a System Operator or System Operator Supervisor.

Additionally, in 2019, SCE launched a new program to conduct deeper investigations into ignitions caused by our infrastructure to better understand the causes of fires, whereas in earlier years SCE relied on desktop review of information from the field, now there is additional analysis of the incident which may include additional site visits, analysis of fault data, and analysis of failed equipment in the lab. SCE is currently working to develop a similar investigation process for wire downs.

ii. the percent of these "other" ignitions that are known to SCE, and for each known ignition driver, a breakdown of each of the drivers contained in "other" ignitions,

The attached spreadsheet, titled Tables 11 & 18 Revised.xlsx, contains revised tables 11 and 18. To ensure proper and detailed categorization, SCE revised and recalibrated the mapping of data contained in ODRM to fires. The revised data differs from the original submission for the following reasons:

1. Finalized 2019 data
2. Breakout of "Other" category
3. Breakout of other equipment failures

4. Finalized 2019 data
5. Classifying all underground failures as underground
6. Classifying all substation failures as substation
7. Removal of non-faults (i.e. routine maintenance outages)

Please note that data changed in all years from what was previously provided as part of 2020-2022 WMP submittal, not just in 2019. Also, as noted above, the data previously submitted was preliminary. The data has since been finalized and this has resulted in a substantial shift in 2019 numbers as causes were identified for many outages previously identified as "Other." Below is a detailed explanation of the other changes made to tables 11 and 18 between the original WMP submission and this filing.

The most noticeable difference between the original WMP submission and the revised tables 11 and 18 is that SCE broke out the "Other" category into more detail, which include in part; Lighting, Underground, Testing/Crew, Substation, and 3rd Party/Vandalism. Originally, SCE grouped "Underground" and "Substation" faults into the generic "Other" categorization, as they are not significant drivers of wildfire historically, nor did they align with WSD's template for tables 11 and 18. The "Underground" sub-category constituted over half of the "Other" category. Additionally, between 2015 and 2017, approximately 20%, or 2,200 faults on average, recorded in ODRM were either No Cause Found (momentary and sustained) and other, whereas in 2019 less than 13%, or approximately 1,900 faults, fell into those categories. Furthermore, the majority of these faults are momentary. SCE included momentary outages that occurred on its system where "No Cause Found" was entered into SCE's outage management system, which indicates that a protection device operated and reclosed, and the fault had cleared without leaving any evidence of what may have caused the fault.

In presenting the outage information in the revised tables 11 and 18, SCE refined the "Other Equipment Type" failure category by further categorizing faults associated with Towers, Poles, and Guy failures to provide more specificity to the revised tables. Please note prior to 2019, if SCE could not determine the equipment that failed from the documentation from the field, the "Other-Equipment" category was selected, resulting in high fault to fire percentages. As noted in condition i above, in 2019, SCE launched a new program to conduct deeper investigations into ignitions caused by infrastructure to better understand the causes of fires (including additional site visits, analysis of fault data and analysis of failed equipment in the lab). As a result, while not part of the deficiency, SCE notes that the number of fires listed as "Other" has significantly decreased between 2015 and 2019 given SCE's new process of investigating all fires that occur. Due to this improved ability to classify faults over time, different categories showed increases in number of faults while the "Other" category decreased.[3]

In the original tables 11 and 18, SCE classified contacts from foreign objects on underground equipment and substation in the "Contact From Object" category. In the revised tables, SCE has classified these events as "Other-Underground" and "Other-

[3] Please note that though there was an increase in the number of outages, the recorded reliability metrics excluding Major Event Days were not higher than historical trends, as described in SCE's 2019 Reliability Report to the CPUC filed on July 14, 2020.

Substation" as SCE believes that the WSD wants to understand potential wildfire ignitions, which is usually associated with overhead facilities. Historically, contact from object on underground and substation assets are not large wildfire ignition drivers, so SCE classified these as underground events to ensure a more appropriate comparison of Faults to Fires.

To help ensure proper mapping of the Faults to Fire cause categories, SCE went through over 500 outage causes individually. This effort did result in slight shifts to the numbers from the original submission.

SCE's original submission also included some outages that were not faults, but rather crew-initiated interruptions. SCE has removed these events, such as proactively deenergizing a line to make repairs, from the fault information.

Lastly, as SCE updated these tables, we noticed there was an increase in number of faults associated with equipment failure in 2018 and 2019 compared to previous years.[4] A significant portion of this increase was driven by crew-initiated interruptions to remediate Enhanced Overhead Inspection notifications. The outages were classified in ODRM as equipment failures. SCE will conduct refresher training by the end of 2020 on appropriate outage cause reporting going forward such that crew-initiated outages are classified separately.[5]

iii. the qualifications and training of personnel assigned to determine outage causes

SCE personnel assigned to determine the initial outage causes, including field staff, substation operators, Distribution Operations Center (DOC) dispatchers and system operators, receive extensive training in outage cause identification. The qualifications and training of field staff, DOC dispatchers and system operators are described below.

Field staff, including troublemen and senior patrolmen are SCE's first responders who are dispatched to the field when an unplanned outage occurs. If an outage occurs within a substation, substation operators will make a cause determination. DOC dispatchers and system operators collect outage information from field staff and substation operators and enter information into the relevant system (OMS for dispatchers and ILS for system operators). Dispatchers and system operators are required to provide sufficient information in the systems so that an outage can be validated for accuracy and provide a historical record of the event.

Troublemen typically undergo a six-month mentorship program when they first take on their role. During this time, trainees undergo three weeks of standardized New-To-Role training classes ("Basic", "Intermediate" and "Advanced" classes) interspersed with one to two months of in-the-field training under supervision. Each standardized class consists of several training modules that include pre-class self-study, review questions, scenarios, and hands-on and written assessments. Classes include, among many modules, around a

[5] Please note the timeline for these changes may be impacted by COVID-19-related work restrictions.

dozen courses that specifically address outage cause identification.[6] Students must pass each class to advance to the next level of classes, and release to full duty is also based on their immediate supervisor's assessment. Troublemen also receive a three-day refresher training course every two years which covers the most up to date and critical issues including new tools, equipment, revisions to System Operating Bulletin's (SOB) and policies and procedures. Refresher training also includes around six modules that focus on outage cause identification. SOBs are also utilized for instruction or to communicate/address changes between the training and refresher cycles.

Senior patrolmen are recruited from an eligible pool of linemen and typically have spent significant time supporting a senior patrolman as their "lineman on patrol." Senior patrolmen trainees complete four web-based training modules, two of which cover responding to and identifying causes of outages. Trainees are subsequently assigned to a ride along with an existing senior patrolman where they work to effectively complete 20 on-the-job tasks, including performing a detailed inspection of a transmission circuit and responding to various outage calls.

Substation operator trainees undergo approximately six months of core curriculum training at SCE's Alhambra Training School (comprising of six sessions) followed by three to six months of on-the-job training and a shift evaluation prior to going on shift. Existing Substation Operators can receive up to 16 hours of refresher training every two years.

DOC Dispatchers are required to have knowledge of all of SCE's DOC Center policies and procedures, including those corresponding to SCE's outage management system and customer service system, circuit map data, distribution equipment and system call out process and telephone systems. DOC dispatchers are required to accurately enter data in a high paced environment, process calls in a timely manner, monitor radio, telephone and other electronic communications to provide accurate, concise and relevant information, understand and utilize proper notification procedures according to protocol, and monitor circuit interruption and area outages.

New DOC dispatchers undergo a four to six-week training module followed by on the job training and an on-shift evaluation before formally being released to shift. During the training module, dispatchers are trained to validate reported outages, including verifying that the information provided by field staff and recorded in the ILS, including location, customer count, start time and load restoration times, and cause is accurate. Dispatchers are trained to ask field staff what the cause of the outage is, to follow up if no cause is provided and to use of the "Other See Notes" code for unknown causes as the last option. DOC supervisors occasionally provide refresher training to dispatchers on an as-needed basis. SCE is currently working to develop a formal training program for dispatchers, which would include regular refresher training.

[6] Modules focusing on identifying outage causes include: Basic, Intermediate and Advanced Customer Service Voltage Problems, Basic Primary Troubleshooting, Basic Fault Indicators, Intermediate and Advanced Emergency Primary Troubleshooting, Intermediate Environmental, Basic SOB 322 (patrolling, fault finding/identifying the problem), Basic Remote Control Switches, etc.

System operators are required to have knowledge of the function and operation of substation electrical and mechanical equipment, overall electrical system operations and circuits under switching center jurisdiction, including line capacities and protection settings. System operators are required to direct switching center shift activities, read and interpret instrument and automated monitoring readings, act quickly, effectively, and reasonably under normal and emergency conditions, and maintain records, prepare reports, store and retrieve data and information using manual and automated systems and methods.

A new System operator receives approximately four months of core curriculum training at SCE's Alhambra Training School followed by a three-month "break-in" period and an on-shift evaluation prior to going on-shift. System operators receive formal training on how to create an ILS, including entering start and end times, location, cause, and a step-by-step description on how they isolated and restored load. Existing System Operators can receive up to 16 hours of refresher training every two years.

iv. its Quality Assurance/Quality Control program for verification of outage cause data

Outage cause determination goes through a three-step verification process during or immediately following the outage and after the outage, during data checks.

The first step occurs in real time. In recent years, SCE has placed an increasing emphasis on improving training programs and tools to reduce the categorization of outages as "Other" or "No Cause Found". DOC dispatchers and system operators have also been instructed to follow up and collect sufficient information from field staff in order to more accurately assign and describe causes in OMS and ILS. See SCE's response to Condition v. below for specific actions taken in to reduce the number of outages attributed to "Other" causes.

Next, the OMS and ILS information is then transcribed into ODRM and staff at SCE's Reliability Operations Center, consisting of experienced engineers and technical experts, verify that the transcribed information matches with what occurred in the field (i.e. location, start and load-restoration times, customer counts) and that the right cause code was selected. As described in Condition i above, ODRM has built-in nested logic for cause selection to facilitate accurate recording. If an outage cause does not make sense, it will be flagged for further review and correction by staff.

Additionally, outage information is reviewed on a monthly basis, typically in the first week or two following the end of the month, whereby a random sample of outages in the prior month is selected for validation. This process seeks to verify that information in SCE's ODRM matches with the description of what occurred in the field and the information is correctly entered into the ILS and OMS. Supervisors work with analysts to review and correct any anomalies that are found.

v. **the actions it is taking to drive down the number of near misses and outages attributed to "other" causes, including a timeline for such actions.**

In recent years, SCE has focused on improving the classification of outage causes on both its transmission and distribution systems. On the transmission side, in 2017, SCE conducted a study of outage cause data and determined that if the cause of an outage was not explicitly apparent, field staff were more likely to default to a “no cause found” determination. In 2018, training programs were developed to re-train field staff to be more vigilant in identifying causes. New Situational Awareness tools (e.g. lightning tool to track strikes in the area) were also deployed to help inform personnel making the classifications. Increased oversight was placed on the “No Cause Found” incidents with weekly reliability calls to review and close out open incidents. SCE also addressed technology gaps to provide field staff and/or system operators easier access to populate and revise the ILS or the data in ODRM. Finally, SCE analyzed 15 years of past outages and developed an algorithm, to assign the most likely cause for some outages classified as “No Cause Found” based on factors common in a particular location and/or similar pattern in a series of outages. For example, in a location prone to lightning strikes in June, if there are multiple consecutive outages only one of which was clearly identified as caused by lightning, the others can be reasonably classified as lightning-caused as well.

On the distribution side, in 2017, SCE conducted an outage validation project which similarly found a high number of outages being classified as “no cause found”. As a result, in early 2018 SCE launched new training programs and processes to improve outage cause categorization and reduce the amount of outages classified as “no cause found”. Dispatchers were instructed to coordinate with field staff to collect additional information and conduct more research to validate the outage cause if initially described as unknown or other. For example, if field staff patrolling an area initially found no apparent cause for a branch line fuse failure, prior to 2018 this would have been classified as “no cause found”. After the new training and outage cause categorization improvement, for the same situation, staff would be asked to further review load on circuits to determine whether any upgrades or replacements were required. If the fusing was determined to be too small, a new fuse size would be installed, and the outage cause would be reclassified as “Fuse failure”.

Furthermore, SCE is currently developing new ODRM training that will consist of two sessions covering how to create and validate an ODRM Log Entry and Substation Log Refresher Training. This will be rolled out to all SCE System Operators in the fourth quarter of 2020 and will then become part of the core curriculum for new system operators going forward.

As a result the number of Distribution and Transmission near misses assigned to “Other” and “No Cause Found” has decreased, going from 19-20% in 2015-2017 to 13% in 2018 and 12% in 2019.

Attachment A

Table 11-a: Key recent drivers of ignition probability, last 5 years - Distribution																				
Incident type by ignition probability driver		Near misses tracked (y/n)?	Number of incidents per year						Average percentage probability of ignition per incident						Number of ignitions per year from this driver					
			2015	2016	2017	2018	2019	Average	2015	2016	2017	2018	2019	Average	2015	2016	2017	2018	2019	Average
Contact From Object	**Contact From Object**	**Y**	**2,429**	**2,655**	**2,792**	**2,830**	**2,632**	**2,667.6**	**1.98%**	**1.54%**	**1.83%**	**2.47%**	**2.36%**	**2.04%**	**48**	**41**	**51**	**70**	**62**	**54.4**
	Animal contact	**Y**	655	598	622	648	686	**641.8**	1.37%	1.34%	0.96%	1.85%	2.62%	1.65%	9	8	6	12	18	10.6
	Balloon contact	**Y**	758	785	911	975	776	**841.0**	1.58%	1.27%	1.98%	3.08%	1.93%	2.02%	12	10	18	30	15	17
	Unspecified CFO	**Y**	109	114	103	135	123	**116.8**	2.75%	4.39%	4.85%	0.00%	4.88%	3.25%	3	5	5	0	6	3.8
	Vegetation	**Y**	395	557	609	416	527	**500.8**	3.29%	2.15%	2.63%	3.61%	2.47%	2.76%	13	12	16	15	13	13.8
	Vehicle contact	**Y**	508	586	528	647	517	**557.2**	2.17%	1.02%	1.14%	2.01%	1.93%	1.65%	11	6	6	13	10	9.2
	ICE/SNOW	**Y**	4	15	19	9	3	**10.0**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
Equipment/Facility Failure	**Equipment/Facility Failure**	**Y**	**3,826**	**3,923**	**4,336**	**5,742**	**7,913**	**5,148.0**	**0.55%**	**1.02%**	**0.67%**	**0.45%**	**0.42%**	**0.58%**	**21**	**40**	**29**	**26**	**33**	**29.8**
	Capacitor bank failure	Y	319	309	427	378	458	378.2	0.00%	0.32%	0.23%	0.00%	0.22%	0.16%	0	1	1	0	1	0.6
	Conductor failure—all	Y	463	594	654	713	1,116	708.0	0.43%	3.20%	2.29%	0.70%	0.99%	1.47%	2	19	15	5	11	10.4
	Conductor failure— wires down	Y	265	333	319	263	234	282.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Crossarm	Y	127	143	138	354	834	319.2	0.79%	1.40%	0.72%	0.28%	0.12%	0.38%	1	2	1	1	1	1.2
	Fuse failure—all	Y	232	195	245	508	1,245	485.0	0.43%	0.51%	0.41%	0.00%	0.16%	0.21%	1	1	1	0	2	1
	Fuse failure—conven-tional blown fuse	N	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Insulator	Y	42	77	79	123	121	88.4	2.38%	2.60%	2.53%	0.81%	1.65%	1.81%	1	2	2	1	2	1.6
	Lightning arrestor failure	Y	105	127	99	105	216	130.4	1.90%	0.00%	2.02%	0.00%	0.46%	0.77%	2	0	2	0	1	1
	Other Equipment Types	Y	5	4	7	18	160	38.8	120.00%	200.00%	14.29%	38.89%	0.63%	11.86%	6	8	1	7	1	4.6
	Splice/Clamp/Connector	Y	386	490	406	501	500	456.6	1.04%	0.82%	0.74%	0.20%	1.40%	0.83%	4	4	3	1	7	3.8
	Switch failure	Y	51	46	45	67	78	57.4	0.00%	0.00%	0.00%	1.49%	2.56%	1.05%	0	0	0	1	2	0.6
	Transformer failure	Y	1,889	1,649	1,978	2,594	2,489	2,119.8	0.16%	0.12%	0.10%	0.39%	0.12%	0.19%	3	2	2	10	3	4
	Pothead	Y	91	141	109	155	128	124.8	0.00%	0.00%	0.00%	0.00%	0.78%	0.16%	0	0	0	0	1	0.2
	Pole	Y	98	126	130	207	541	220.4	1.02%	0.79%	0.77%	0.00%	0.18%	0.36%	1	1	1	0	1	0.8
	Guy	Y	17	20	18	17	20	18.4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
	Regulator	Y	1	2	1	2	4	2.0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
	Tower	Y	0	0	0	0	2	0.4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
	Pole Top Sub	Y	0	0	0	0	1	0.2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
Other	**Other**	**Y**	**5,136**	**4,853**	**5,111**	**5,309**	**5,507**	**5,183.2**	**0.55%**	**0.12%**	**0.25%**	**0.13%**	**0.20%**	**0.25%**	**28**	**6**	**13**	**7**	**11**	**13**
	3rd Party/VANDALISM	Y	78	80	78	102	103	88.2	3.85%	1.25%	0.00%	0.98%	5.83%	2.49%	3	1	0	1	6	2.2
	Lightning	Y	757	264	167	225	323	347.2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
	No Cause Found-Momentary	Y	1,403	1,360	1,555	1,074	1,149	1,308.2												
	No Cause Found-Sustained	Y	739	781	853	667	735	755.0	1.16%	0.23%	0.54%	0.34%	0.10%	0.49%	25	5	13	6	2	10.2
	OTHER	Y	4	14	12	10	29	13.8												
	Source Lost	Y	5	2	26	49	98	36.0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
	Substation	Y	10	18	30	61	109	45.6	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
	Testing/Crew	Y	149	117	99	94	67	105.2	0.00%	0.00%	0.00%	0.00%	4.48%	0.57%	0	0	0	0	3	0.6
	Underground Equipment	Y	1,949	2,166	2,234	2,944	2,846	2,427.8	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
	Dig In	Y	42	51	57	83	48	56.2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
Wire-to-wire contact / Contamination		**Y**	**46**	**78**	**64**	**41**	**13**	**48.4**	**4.35%**	**1.28%**	**4.69%**	**7.32%**	**76.92%**	**7.85%**	**2**	**1**	**3**	**3**	**10**	**3.8**

Table 11-B: Key recent drivers of ignition probability, last 5 years - Transmission																				
Incident type by ignition probability driver		Near misses tracked (y/n)?	Number of incidents per year						Average percentage probability of ignition per incident						Number of ignitions per year from this driver					
			2015	2016	2017	2018	2019	Average	2015	2016	2017	2018	2019	Average	2015	2016	2017	2018	2019	Average
Contact From Object	Contact From Object	Y	27	29	37	52	25	34.0	22.22%	20.69%	13.51%	0.00%	16.00%	12.35%	6	6	5	0	4	4.2
	Animal contact	Y	16	12	15	27	10	16.0	18.75%	16.67%	20.00%	0.00%	20.00%	12.50%	3	2	3	0	2	2
	Balloon contact	Y	2	3	8	12	4	5.8	50.00%	33.33%	25.00%	0.00%	25.00%	17.24%	1	1	2	0	1	1
	Unspecified CFO	Y	1	3	0	0	1	1.0	100.00%	33.33%	0.00%	0.00%	0.00%	40.00%	1	1	0	0	0	0.4
	Vegetation	Y	3	3	5	4	5	4.0	0.00%	33.33%	0.00%	0.00%	20.00%	10.00%	0	1	0	0	1	0.4
	Vehicle contact	Y	5	6	9	9	5	6.8	20.00%	16.67%	0.00%	0.00%	0.00%	5.88%	1	1	0	0	0	0.4
	ICE/SNOW	Y	0	2	0	0	0	0.4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
Equipment/Facility Failure	Equipment/Facility Failure	Y	13	19	57	54	29	34.4	0.00%	0.00%	3.51%	3.70%	10.34%	4.07%	0	0	2	2	3	1.4
	Conductor failure—all	Y	4	6	35	20	9	14.8	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
	Conductor failure— wires down	Y	1	1	17	6	1	5.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Crossarm	Y	3	0	1	3	1	1.6	0.00%	0.00%	100.00%	0.00%	0.00%	12.50%	0	0	1	0	0	0.2
	Fuse failure—all	Y	0	0	0	1	0	0.2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
	Fuse failure—conven-tional blown fuse	N	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Insulator	Y	1	2	3	2	2	2.0	0.00%	0.00%	0.00%	0.00%	50.00%	10.00%	0	0	0	0	1	0.2
	Lightning arrestor failure	Y	1	2	1	3	0	1.4	0.00%	0.00%	0.00%	0.00%	0.00%	14.29%	0	0	0	0	1	0.2
	Other Equipment Types	Y	0	2	2	1	4	1.8	0.00%	0.00%	50.00%	100.00%	0.00%	22.22%	0	0	1	1	0	0.4
	Splice/Clamp/Connector	Y	1	1	3	1	2	1.6	0.00%	0.00%	0.00%	100.00%	50.00%	25.00%	0	0	0	1	1	0.4
	Switch failure	Y	1	0	0	2	1	0.8	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
	Transformer failure	Y	0	1	0	5	0	1.2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
	Pothead	Y	0	3	0	11	3	3.4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
	Pole	Y	0	2	8	4	6	4.0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
	Guy	Y	1	0	3	1	1	1.2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
	Regulator	Y	1	0	0	0	0	0.2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
	Tower	Y	0	0	1	0	0	0.2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
Other	Other	Y	301	323	318	319	215	295.2	0.66%	0.62%	0.31%	0.31%	0.00%	0.41%	2	2	1	1	0	1.2
	3rd Party/VANDALISM	Y	1	1	0	5	0	1.4	100.00%	0.00%	0.00%	0.00%	0.00%	14.29%	1	0	0	0	0	0.2
	Lightning	Y	13	1	3	17	3	7.4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
	No Cause Found-Momentary	Y	72	75	81	37	25	58.0												
	No Cause Found-Sustained	Y	24	16	18	22	25	21.0	1.0%	2.1%	1.0%	1.7%	0.0%	1.2%	1	2	1	1	0	1
	OTHER	Y	0	5	1	0	0	1.2												
	Source Lost	Y	7	2	10	37	10	13.2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
	Substation	Y	170	214	196	181	142	180.6	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
	Testing/Crew	Y	8	6	4	4	5	5.4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
	Underground Equipment	Y	5	3	5	14	5	6.4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
	Dig In	Y	1	0	0	2	0	0.6	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0	0	0	0	0	0
Wire-to-wire contact / Contamination		Y	3	6	4	3	2	3.6	0.00%	0.00%	25.00%	0.00%	50.00%	11.11%	0	0	1	0	1	0.4

Table 18a: Key drivers of ignition probability (Distribution)									
Ignition probability drivers		Number of incidents per year (according to 5-year historical average)	Average likelihood of ignition per incident	(Distribution) Ignitions from this driver (according to 5-year historical average)					
				Total	In non-HFTD	In HFTD Zone 1	In HFTD Tier 2	In HFTD Tier 3	SOB322
Contact From Object	**Contact From Object**	2,667.6	2.04%	54.4	34.8	0	6.4	12.6	0.6
	Animal contact	641.8	1.65%	10.6	6.2	0	1.8	2.6	0
	Balloon contact	841.0	2.02%	17	12.4	0	1.2	3.4	0
	Unspecified CFO	116.8	3.25%	3.8	2	0	0.4	1.2	0.2
	Vegetation	500.8	2.76%	13.8	8.8	0	1.8	3	0.2
	Vehicle contact	557.2	1.65%	9.2	5.4	0	1.2	2.4	0.2
	ICE/SNOW	10.0	0.00%	0	0	0	0	0	0
Equipment/Facility Failure	**Equipment/Facility Failure**	5,148.0	0.58%	29.8	19.8	0	2.6	7.2	0.2
	Capacitor bank failure	378.2	0.16%	0.6	0.4	0	0	0.2	0
	Conductor failure—all	708.0	1.47%	10.4	7.2	0	1.2	2	0
	Conductor failure— wires down	282.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Crossarm	319.2	0.38%	1.2	1	0	0	0.2	0
	Fuse failure—all	485.0	0.21%	1	0.8	0	0	0.2	0
	Fuse failure—conven-tional blown fuse	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Insulator	88.4	1.81%	1.6	0.4	0	0.6	0.6	0
	Lightning arrestor failure	130.4	0.77%	1	1	0	0	0	0
	Other Equipment Types	38.8	11.86%	4.6	3.2	0	0	1.4	0
	Splice/Clamp/Connector	456.6	0.83%	3.8	1.6	0	0.6	1.4	0.2
	Switch failure	57.4	1.05%	0.6	0.6	0	0	0	0
	Transformer failure	2,119.8	0.19%	4	2.8	0	0.2	1	0
	Pothead	124.8	0.16%	0.2	0.2	0	0	0	0
	Pole	220.4	0.36%	0.8	0.6	0	0	0.2	0
	Guy	18.4	0.00%	0	0	0	0	0	0
	Regulator	2.0	0.00%	0	0	0	0	0	0
	Tower	0.4	0.00%	0	0	0	0	0	0
	Pole Top Sub	0.2	0.00%	0	0	0	0	0	0
Other	**Other**	5,183.2	0.25%	13	8.2	0	1.4	3	0.4
	3rd Party/VANDALISM	88.2	2.49%	2.2	1.8	0	0.2	0.2	0
	Lightning	347.2	0.00%	0	0	0	0	0	0
	No Cause Found-Momentary	1,308.2	0.49%	10.2	6.4	0	0.8	2.6	0.4
	No Cause Found-Sustained	755.0							
	OTHER	13.8							
	Source Lost	36.0	0.00%	0	0	0	0	0	0
	Substation	45.6	0.00%	0	0	0	0	0	0
	Testing/Crew	105.2	0.57%	0.6	0	0	0.4	0.2	0
	Underground Equipment	2,427.8	0.00%	0	0	0	0	0	0
	Dig In	56.2	0.00%	0	0	0	0	0	0
Wire-to-wire contact / Contamination		48.4	7.85%	3.8	2.6	0	0.6	0.6	0

Table 18b: Key drivers of ignition probability (Transmission)										
Ignition probability drivers		**Number of incidents**	**Average likelihood of ignition**	**(Transmission) Ignitions from this driver**						
				Total	**In non-HFTD**	**In HFTD Zone 1**	**In HFTD Tier 2**	**In HFTD Tier 3**	**SOB322**
Contact From Object	**Contact From Object**	34	12.35%	4.2	1.4	0	1	1.8	0
	Animal contact	16	12.50%	2	0.6	0	0.4	1	0
	Balloon contact	5.8	17.24%	1	0.4	0	0.4	0.2	0
	Unspecified CFO	1	40.00%	0.4	0.2	0	0.2	0	0
	Vegetation	4	10.00%	0.4	0.2	0	0	0.2	0
	Vehicle contact	6.8	5.88%	0.4	0	0	0	0.4	0
	ICE/SNOW	0.4	0.00%	0	0	0	0	0	0
Equipment/Facility Failure	**Equipment/Facility Failure**	34.4	4.07%	2.4	1.8	0	0.2	0.2	0.2
	Conductor failure—all	14.8	0.00%	0	0	0	0	0	0
	Conductor failure— wires down	5.2	N/A	0	0	0	0	0	0
	Crossarm	1.6	12.50%	0.2	0.2	0	0	0	0
	Fuse failure—all	0.2	0.00%	0	0	0	0	0	0
	Fuse failure—conven-tional blown fuse	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Insulator	2	10.00%	0.2	0.2	0	0	0	0
	Lightning arrestor failure	1.4	14.29%	0.2	0.2	0	0	0	0
	Other Equipment Types	1.8	22.22%	1.4	0.8	0	0.2	0.2	0.2
	Splice/Clamp/Connector	1.6	25.00%	0.4	0.4	0	0	0	0
	Switch failure	0.8	0.00%	0	0	0	0	0	0
	Transformer failure	1.2	0.00%	0	0	0	0	0	0
	Pothead	3.4	0.00%	0	0	0	0	0	0
	Pole	4	0.00%	0	0	0	0	0	0
	Guy	1.2	0.00%	0	0	0	0	0	0
	Regulator	0.2	0.00%	0	0	0	0	0	0
	Tower	0.2	0.00%	0	0	0	0	0	0
Other	**Other**	295.2	0.41%	0.2	0.2	0	0	0	0
	3rd Party/VANDALISM	1.4	14.29%	0.2	0.2	0	0	0	0
	Lightning	7.4	0.00%	0	0	0	0	0	0
	No Cause Found-Momentary	58	1.25%	0	0	0	0	0	0
	No Cause Found-Sustained	21	0.00%	0	0	0	0	0	0
	OTHER	1.2	0.00%	0	0	0	0	0	0
	Source Lost	13.2	0.00%	0	0	0	0	0	0
	Substation	180.6	0.00%	0	0	0	0	0	0
	Testing/Crew	5.4	0.00%	0	0	0	0	0	0
	Underground Equipment	6.4	0.00%	0	0	0	0	0	0
	Dig In	0.6	0.00%	0	0	0	0	0	0
Wire-to-wire contact / Contamination		3.6	11.11%	0	0	0	0	0	0

SCE-12 INSUFFICIENT JUSTIFICATION OF INCREASED VEGETATION CLEARANCES, 2020 WILDFIRE MITIGATION PLAN REMEDIAL COMPLIANCE PLAN

SCE-12
INSUFFICIENT JUSTIFICATION OF INCREASED VEGETATION CLEARANCES
2020 WILDFIRE MITIGATION PLAN
REMEDIAL COMPLIANCE PLAN

Name: Insufficient justification of increased vegetation clearances
Category: Vegetation Management and Inspections
Class: A

Deficiency:

Throughout its WMP, SCE indicates an intent to obtain greater vegetation clearances than those required or recommended by the WSD. Moreover, based on its survey responses to vegetation-related maturity model capabilities, SCE indicates no planned growth in its vegetation management capabilities. As these vegetation management programs continue to grow in scope, SCE has yet to provide a detailed discussion or evidence of the effectiveness of increased vegetation clearances on decreasing utility near misses (i.e. outages) and ignitions.

Condition:

SCE shall submit an RCP with a plan for the following:

i. Comparing areas with and without enhanced post-trim clearances to measure the extent to which post-trim clearance distances affect probability of vegetation caused ignitions and outages;

ii. Collaborating with PG&E and SDG&E, in accordance with PGE-26 and SDGE-13, to develop a consensus methodology for how to measure post-trim vegetation clearance distance impacts on the probability of vegetation caused ignitions and outages.

Response:

INTRODUCTION

In June 2019, SCE began performing enhanced clearances that are aligned with the guidance in Commission Decision (D.) 17-12-024 and in conformance with General Order (GO) 95 Rule 35, Appendix E, across its Distribution facilities in High Fire Risk Areas (HFRA).[1] The goal of enhanced clearances in HFRA is to reduce the probability of vegetation contacting electric facilities in areas that are at heightened risk for wildfire. One objective is to avoid "grow ins" by allowing a greater buffer for individual tree growth rates that may be faster than typical or anticipated. For distribution voltages, this translates to 8 feet (8') of potential annual growth buffer between the standard at time of pruning (12') and the minimum compliance distance (4').

[1] High Fire Risk Areas (HFRA) includes all of the Commission's High Fire Threat District as well as a relatively small amount of area described in SCE's Petition to Modify D.17-12-024.

Another objective is to reduce "blow-ins," by reducing opportunity for nearby trees to shed limbs or branches that can blow into conductors, especially during heavy winds.

SCE expects to complete the first cycle of enhanced clearances across all distribution HFRA locations in its service area by approximately August 2020.

Although enhanced clearances are recommended by the Commission, there are some circumstances that may preclude SCE's ability to achieve those clearances. Primarily, this occurs when customers refuse to grant SCE permission to achieve the expanded clearances. SCE does not have the authority to enforce pruning for distances beyond those required to maintain the minimum clearance distance of 4' and evaluates the risk of each customer refusal based on the expected rate of growth. Additionally, lesser distances are permitted for historic trees and exemptions to the minimum clearance distance, such as Woody Stem Exemption.[2] To date, SCE's quality control data shows that full expanded clearances have been obtained for approximately 60% of the trees scheduled for such work.

It is important to note that the enhanced clearance information is tracked on an individual tree basis, and thus is not necessarily correlated with circuits or other broad geographic locations. Additionally, it does not reflect where an expanded trim may exceed the prior clearance, but does not meet the full standard (e.g., the trim achieved only 11' of clearance rather than 12').

SCE has only just started to acquire data on the impact of its enhanced clearances with the goal of eventually quantifying the impact of the Commission's recommended clearance distances on vegetation-caused faults and ignition events. However, given that the sample size of faults or ignition events are relatively small and there are many uncontrollable variables that can drive faults and ignitions, it will require a multi-year effort to synthesize data and perform trend analysis. SCE's approach and the consensus methodology for SCE, PG&E and SDG&E to measure how effective post-enhanced clearances are in reducing the probability of vegetation-caused ignitions and outages are described below.

i.) SCE APPROACH TO ANALYZING ENHANCED CLEARANCES

DEFINITIONS

SCE defines with and without enhanced post-trim clearances as follows:

Without Enhanced Clearances: Trees in Distribution HFRA that are trimmed to the Regulation Clearance Distance (RCD), which has a minimum clearance of 4' as required by the regulator, plus additional clearance as necessary to hold compliance through an annual cycle.

[2] *See* GO 95, Rule 35, Exception 4: "Mature trees whose trunks and major limbs are located more than six inches, but less than the clearance required by Table 1, Cases 13E and 14E, from primary distribution conductors are exempt from the minimum clearance requirement under this rule."

With Enhanced Clearances: Trees in Distribution HFRA that are trimmed to the Enhanced Clearance Distance of at least 12’ as recommended by GO 95, Rule 35, Appendix E.

Tree-Caused Circuit Interruptions (TCCIs): events during which trees, or portions of trees, have contacted electrical equipment and caused circuit interruptions. TCCIs can result from vegetation that has fallen-in, blown-in, or grown-in.

Vegetation-Caused Ignition Events: events where a determination was made that the ignition was caused by vegetation.

DATA

SCE plans to use the following data for its analysis:

- List of Tree Caused Circuit interruptions (TCCIs) and Vegetation Caused Ignition Events by their latitude and longitude GPS coordinates for areas Without Enhanced Clearances dating back to 2014.
- List of Tree Caused Circuit interruptions (TCCIs) and Vegetation Caused Ignition Events by their latitude and longitude GPS coordinates for areas With Enhanced Clearances dating back to 2019.

SCE may exclude from the comparison any TCCI and ignition events that were caused by “fall-ins” or “blow-ins” that are deemed outside of the typical recommended clearance distances (as applicable).

METHODOLOGY

SCE plans to perform a trend analysis on the reduction in TCCI and Vegetation-Caused Ignition Events over time. Comparisons to historical baseline data will be more reliable if the data can be normalized for exogenous factors such as weather and other environmental attributes. SCE will pursue developing normalization methods.

In addition, SCE plans to perform statistical analysis correlating TCCI and Vegetation-Caused Ignition Events to trees in the vicinity of these incident locations that are With and Without Enhanced Clearances.

SCE will also continue to analyze the specific cause for each TCCI and Vegetation-Caused Ignition Event. SCE plans to compile data on tree, site and asset attributes to gain better insight into the drivers of the TCCI and the Vegetation-Caused Ignition Events and to understand how to develop a more targeted approach to clearance distances and the frequency of vegetation management work for ignition risk reduction.

SCE expects the analysis to improve over time as it draws lessons learned from both SCE’s and the partner IOUs’ approach to quantifying the impact of enhanced clearances. SCE does not anticipate any resource constraints to perform this analysis.

TIMELINE

The first evaluation will be performed using data from December 1, 2019 through June 30, 2020. The results of the initial analysis will be used to quantify the impact of and help refine and adjust SCE's approach as appropriate. Subsequent analyses of the data will be performed every six months thereafter. SCE will share the status of its analysis and results in the 2021 WMP update and annually thereafter. Collecting this data over time will enable a meaningful analysis of the data trends and will make more robust the statistical models developed correlating TCCI and Vegetation-Caused Ignition Events to clearance distances.

As stated above, SCE expects that it will require a minimum of 3 to 5 years of data to determine if there are reliable trends in reduction in TCCIs and Vegetation-Caused Ignition Events to accurately quantify the impact of implementing enhanced vegetation clearances. A summary analysis of results will be included with SCE's annual WMP Update, beginning in 2021.

ii.) JOINT IOU APPROACH TO QUANTIFYING THE IMPACT OF ENHANCED CLEARANCES

Since the ratification of the 2020 WMP Resolutions, SCE, PG&E and SDG&E held several collaborative meetings to determine a consensus methodology for quantifying the impact of enhanced vegetation clearance distance impacts on the probability of vegetation-caused ignitions and outages. The approach is outlined below, but it may be modified as the vegetation programs and analytics mature.

All three IOUs agreed on the following consensus methodology:

DEFINITIONS

- Without Enhanced Clearances: Trees in Distribution HFRA that are trimmed to the Regulation Clearance Distance (RCD), which has a minimum clearance of 4' as required by the regulator, plus additional clearance as necessary to hold compliance through an annual cycle.
- With Enhanced Clearances: Trees in Distribution HFRA that are trimmed to the Enhanced Clearance Distance of at least 12' as recommended by GO95 Rule 35 Appendix E.
- Tree-Caused Circuit Interruptions (TCCIs): events during which trees, or portions of trees, have contacted electrical equipment and caused circuit interruptions. TCCIs can result from vegetation that has fallen-in, blown-in, or grown-in.
- Vegetation-Caused Ignition Events: events where a determination was made that the ignition was caused by vegetation.

DATA

- List of TCCIs and Vegetation-Caused Ignition Events by their latitude and longitude GPS coordinates for areas Without Enhanced Clearances dating back to 2014.

- List of TCCIs and Vegetation-Caused Ignition Events by their latitude and longitude GPS coordinates for areas With Enhanced Clearances dating back to 2019.
  SCE may exclude from the comparison any outage event (i.e., TCCIs) and ignition events that were caused by "fall-ins" or "blow-ins" that are deemed outside of the typical recommended clearance distances (as applicable).

METHODOLOGY

- IOUs will compare the number and drivers of vegetation-caused outages and ignition data for Without Enhanced Clearance work and With Enhanced Clearance work to quantify the impact of enhanced clearances. IOUs are still exploring ways to do the actual comparison and will share lessons learned with each other. However, there is general agreement among the IOUs that it may take multiple years before the analysis can yield meaningful and quantifiable results. The plan is to obtain results that accurately quantify the impact of these measures by analyzing changes in the outage and ignition data.
- The impact of enhanced clearances will be measured by changes in the vegetation-caused outage and ignition events, i.e., the percentage change calculated on an interval basis and/or composite score generated.

ASSUMPTIONS

- SCE plans to use HFRA, while PG&E and SDG&E plan to utilize the HFTD Tier 2 and 3 areas only.
- Additional tree work such as Hazard Tree mitigation can be included to quantify the impact of comprehensive vegetation management programs.
- Going forward, IOUs will collect and analyze this information every 6 months.
- IOUs will focus on clearances on Distribution facilities.
- IOUs will collect and analyze year-round information, as opposed to limiting the analysis to the "fire-season" only
- To refine and improve the analysis, IOUs will share with each other lessons learned on the analysis and continue to collaborate and agree upon changes to the consensus methodology.
- SCE will use existing resources to perform analysis required for this deficiency.

TIMELINE

- In Q3 2020, IOUs will share with each other their initial analysis of the data collected.
- IOUs will then share the status of their analysis and results in the 2021 WMP Update process and annually thereafter. This will allow for sufficient data in the first report out and material updates thereafter.

SCE-13 LACK OF AMBITION IN IMPROVING VEGETATION INSPECTION AND MANAGEMENT CAPABILITY, 2020 WILDFIRE MITIGATION PLAN REMEDIAL COMPLIANCE PLAN

SCE-13
LACK OF AMBITION IN IMPROVING VEGETATION INSPECTION AND MANAGEMENT CAPABILITY
2020 WILDFIRE MITIGATION PLAN
REMEDIAL COMPLIANCE PLAN

Name: Lack of ambition in improving vegetation inspection and management capability
Category: Vegetation Management and Inspections
Class: A

Deficiency:

SCE's survey responses for the maturity model indicate that SCE does not plan on advancing its current capabilities in vegetation management and inspections. Considering that SCE significantly overspent beyond its vegetation management targets in implementing its 2019 WMP, SCE's planning, prioritization and execution of this work raises concern.

Condition:

SCE shall file a Remedial Correction Plan (RCP) to provide a detailed plan for addressing the following:

i. how it uses risk models and their outputs to identify and prioritize vegetation management work in areas that provide the largest reduction in utility ignition risk;

ii. whether and how it targets VM work in areas that are historically prone to vegetation-caused outages and ignitions;

iii. what measures and metrics it uses to track the effectiveness and efficiency of its vegetation management work; and

iv. how it plans to integrate and leverage new technology to enhance its current vegetation inspection and management efforts.

Response:

i. SCE currently utilizes risk analysis to inform some of its vegetation management decisions such as implementing General Order (GO) 95, Rule 35, Appendix E recommended ("enhanced") clearances obtained in High Fire Risk Areas (HFRA). Given that risk modeling was a driver for determining HFRA boundaries, SCE's expanded trims in those locations is based on risk. SCE uses location-specific ignition consequence risk scores to prioritize hazard tree risk assessments and the quality assurance program. Additionally, supplemental patrols are prioritized, based on locations where the vegetation growth cycle, conditions, and/or REAX score drive the need for additional assurance.

Additionally, SCE started in 2020 and will continue to consider consequence risk modeling in its annual line clearing schedule. The timing of vegetation management work is primarily driven by operational efficiency, which is favored due to line clearing inspection frequency and pruning volume. This work is distributed throughout the year based on the need to balance relatively stable volumes of vegetation crews each month, distribution of HFRA and non-HFRA, REAX score, and environmental or weather restrictions such as snow during winter months. However, within the confines of those restrictions, it may be feasible to adjust work for the riskiest locations, so that pruning is performed just in advance of the “traditional” fire season. For example, risk-informed vegetation scheduling may result in trimming a higher risk area in August rather than February, to facilitate the achievement of maximum clearance distance during the months of greatest fire potential. SCE plans to incorporate risk into this process to determine the 2021 schedule for line clearing and evaluate other workstreams for opportunities to integrate risk modeling into scheduling decisions.

Please also refer to SCE’s Remedial Compliance Plan (RCP) for Guidance-3, where SCE elaborates on its risk-informed decision-making approach for each vegetation management initiative as well as plans to further its use of risk modeling to enhance its vegetation management practices. In our Guidance-3 RCP, SCE outlines plans to normalize risk analysis for weather starting in 2021, for example, by incorporating weather data (e.g., presence of Santa Ana winds at time of event) to better inform the analysis of vegetation-caused outages and ignitions.

ii. SCE has implemented several programs in areas that incrementally account for elevated risk factors that contribute to vegetation-caused outages and ignitions. SCE deploys the HFRA Supplemental Patrols on an annual basis to identify and address concerns in areas with high potential for vegetation-caused outages and ignitions, which include Canyon Patrols, Summer Readiness Verification Patrols and Operation Santa Ana. While SCE inspects its entire service territory annually, these patrols represent a re-inspection outside the normal inspection process of areas that may also have had a prior history of vegetation-caused outage and ignition events, in order to verify that the areas are free from vegetation encroachments. HFRA Supplemental Patrols occur in the summer months to prepare for the “traditional” fire season, where months of low rainfall and the advent of Santa Ana wind conditions combine to increase the consequence of an ignition. In 2020, all mitigations resulting from these patrols are scheduled to be completed by October 1st. The following briefly describes each program:

- Canyon Patrols – Certain canyons present elevated risk factors such as high winds, terrain, ingress/egress issues, at-risk electrical facilities, or limited firefighting capabilities and may have also had a history of vegetation-caused outages and ignition events. These locations are chosen in consultation with local fire agencies. SCE performs inspections annually on approximately 75 canyons to verify that circuits are free from vegetation encroachment and visibly hazardous conditions that might cause tree limbs or branches to blow into electrical lines during high winds.
- Summer Readiness Verification Patrols – This is the third year of this patrol and its purpose is to help ensure that vegetation regrowth is within expected parameters and vegetation clearances are sufficient to last until the next regular trim cycle. The specific

scope varies but focuses on HFRA locations. For 2020, this includes circuits that are approximately 6 months to 10 months into the trim cycle and are in the top 50% of REAX ignition consequence risk score.

- Operation Santa Ana – A joint patrol effort with state and local fire authorities to perform patrols of overhead powerlines in HFRA. These patrols focus on electrical facilities and adherence to PRC Sections 4292 and 4293 vegetation-related requirements and sites are selected based on the risk perspective of the fire authorities.

During these patrols, any identified encroachments of the vegetation are subsequently scheduled for mitigation. Mitigation types may include pruning or removal depending on the identified conditions. A schedule is set up to prioritize the mitigation activities resulting from these patrols, according to the severity of the risk posed by the encroachment. SCE is working to integrate these activities into its existing schedules using technology to better manage costs (see discussion of data platform in section iv below). Since the CPUC has determined SCE's HFRA to be at elevated or extreme fire risk, SCE's goal is to achieve the enhanced clearance, to the extent feasible, in these areas for the identified encroachments.

The HFRA Supplementary Patrols are performed annually, using existing resources. Rather than spending to acquire more resources, SCE is working to improve the performance and efficacy of the annual program. As described in SCE's RCP for Guidance-3, SCE is exploring several enhancements in quantitative and risk analysis, including factors such as historical Tree-Caused Circuit Interruptions (TCCIs) and Vegetation-Caused Ignitions Events, to inform decisions on prioritization, scope and frequency and location of vegetation management and inspection/patrol activities. If further analysis demonstrates that the changes are beneficial, SCE is targeting to implement the enhancements with regards to the scheduling and frequency of the inspection/patrols by 2022.

iii. As a measure of the overall effectiveness of vegetation management activities, SCE is looking to drive a reduction in the following outcomes:

- Tree-Caused Circuit Interruptions (TCCIs): events during which trees, or portions of trees, have contacted electrical equipment and caused circuit interruptions. TCCIs can result from vegetation that has fallen-in, blown-in, or grown-in.
- Vegetation-Caused Ignition Events: events where a determination was made that the ignition was caused by vegetation.

Please see additional details provided in SCE's RCP for SCE-12. The eventual goal of vegetation management is to reduce vegetation-caused ignitions or fire spread. These effectiveness metrics can be influenced by exogenous factors such as weather and other environmental attributes and need to be normalized to facilitate relevant trend analysis. These metrics also should be considered together to determine how well the vegetation management programs are working. All other weather and environmental factors being equal, reducing TCCI lowers the probability of ensuing faults and ignitions.

SCE has tracked data from TCCIs and Vegetation-Caused Ignition Events for several years and plans to continue compiling this data to measure the overall effectiveness of its vegetation management work activities. SCE will use data on the TCCIs and Vegetation-Caused Ignition Events to quantify the benefits of its enhanced vegetation management work (i.e., Hazard Tree Mitigation Program (HTMP) and enhanced clearances). However, it may take several years of data analysis and trending to accurately quantify the effects and benefits of the enhanced vegetation management work (please see SCE's RCP for SCE-12 for further information on measuring the effectiveness of SCE's enhanced clearances). SCE expects to provide a summary analysis of results with SCE's annual Wildfire Mitigation Plan (WMP) Update beginning in 2021 and will provide updates on its progress annually in each subsequent WMP Update filing.

iv. SCE is planning to further integrate and leverage the following new technology to enhance its current vegetation inspection and management efforts:

Light Detection and Ranging Technology

Light Detection and Ranging (LiDAR) technology is useful for determining encroachments when factoring in line dynamics, such as conductor sag and sway, during inspections, especially for locations with restricted access. LiDAR was first piloted in 2018 and then implemented in 2019. SCE has primarily used LiDAR to determine potential vegetation encroachments into transmission systems. SCE has found that LiDAR is more readily applicable in certain circumstances, such as when inspecting for vegetation encroachments along lines that are cleared to 30 feet in the transmission system while factoring in line dynamics. In distribution areas, where the inspections are focused on trees and not conductors, and even expanded clearances trim to 12-foot distances, the application of LiDAR must be much more concise in order to obtain the data necessary to meaningfully inform vegetation management operations. Based on benchmarking, however, SCE has learned that other utilities have found LiDAR use beneficial for their distribution systems. SCE is looking into whether these benefits can be realized for our distribution system and plans to initiate a LiDAR pilot by Q4 2021. The expansion of LiDAR as an inspection tool will be a continuous process of re-evaluation as the quality improves, cost goes down, and achievement of expanded clearances improve the quality of the data that can be collected from LiDAR inspections.

LiDAR is not yet fully integrated into SCE's vegetation management inspection practices (see discussion of data platform below).

Integration of Data Platforms to Enable Artificial Intelligence and Machine Learning

SCE's prior work management systems were focused on compliance and routine vegetation management activities and tracked on different data platforms. To better manage the addition of new programs, increased scope of work, increased complexity and SCE's transition towards data-driven resource allocation and decision-making, SCE is enhancing its work management capabilities. These capabilities would include the ability to facilitate greater coordination of activities across programs, increase visibility of the different types of work being executed by the crews and place more focus on data governance and analytics capabilities.

To facilitate data sharing between programs, SCE is exploring a work management platform solution that can consolidate management of all vegetation program work and data (e.g., line clearances, HTMP, Drought Relief Inspections (DRI), pole brushing, etc.) in one system. The platform would include process orchestration,[1] automation, mobile tools and an integrated repository across all vegetation management programs. The platform would integrate disparate vegetation management tools and systems to improve work planning and scheduling, work notifications, and reporting. The platform would also improve data accuracy by: 1) assisting with maintaining updated vegetation management data, further reducing reliance on paper-based and manual processes; 2) eliminating data errors from manual data entry; 3) obtaining real-time information on tasks, such as status checks, crew assignment, and schedules; and 4) reducing manual intervention in overseeing vegetation management work and improving visibility into the individual tasks. Additional benefits may include improved risk-informed allocation of resources, which should reduce time between targeted trim date and actual trim date and reduce the number of visits per site. SCE's goal for the platform would be to facilitate better collaboration with arborists, environmental and utility regulators, and customers to achieve the appropriate trim clearances at the right time. We are currently implementing this platform for DRI. Based on the results of the pilot, the current plan is to extend this to HTMP in 2020 and to routine, non-routine work and Pole Clearing in the 2021 timeframe.

Further, as risk data becomes more available, this platform could use the data to manage, view, and allocate work points from queues as well as prioritize or accelerate work to address emergent challenges. Extensible Artificial Intelligence and Machine Learning could be implemented to accommodate deeper analytics in order to flag areas of interest, support numerous data overlays, and better facilitate operating in a risk-informed manner.

Tree Risk Index - Improved Analytics Using New Technology

SCE is planning to improve its analytical capability to predict the drivers of vegetation encroachment and failure by developing a Tree Risk Index. In addition to aggregating and analyzing the characteristics of individual TCCI events, SCE intends to incorporate remote sensing technology (e.g., satellite imagery) that provides additional intelligence on the behavior of trees in the vicinity of the electrical facilities. Relevant data may include tree health, species, height, and weather patterns such as wind speed and will be used to improve modeling capabilities to determine the Tree Risk Index, which is the probability of ignition from specific types of trees in specific locations. SCE will then use this information to drive operational decisions across all vegetation management programs. SCE will develop the model using one or more pilot locations, validate the initial predictive capability using field data, and determine the initial factors on which to base its Tree Risk Index by Q4 2021.

[1] Process orchestration in this context is the ability to have a system that can intelligently integrate, automate, and optimize transactional processes through a single system across the end-to-end scoped process.