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BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to Implement Electric Utility Wildfire Mitigation Plans Pursuant to Senate Bill 901 (2018).	R.18-10-007

SOUTHERN CALIFORNIA EDISON COMPANY'S (U 338-E) 2019 WILDFIRE MITIGATION PLAN

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Dated: **February 6, 2019**

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Southern California Edison Company (SCE) hereby submits its 2019 Wildfire Mitigation Plan (WMP). The WMP consists of the following:

Chapter 1: Objectives of the Plan
Chapter 2: Description of the Preventive Strategies and Programs to Minimize the Risk of Electrical Distribution and Transmission Infrastructure-Causing Wildfires (Including Consideration of the Dynamic Climate Change Risk)
Chapter 3: Risk Analysis and Risk Drivers
Chapter 4: Wildfire Prevention Strategies and Programs
Chapter 5: Emergency Preparedness and Response
Chapter 6: Performance Metrics and Monitoring
Chapter 7: Any Other Information that the CPUC May Require (Cost Information)
Appendix A: List of Acronyms
Appendix B: Categorization of Strategies and Programs
Appendix C: List of SCE Design, Engineering and Construction Standards
Appendix D: List of Fast Growing Trees
Appendix E: List of SCE Field Workers, Support Personnel and Contract Crews
Appendix F: Comparison of WMP to 2018 Fire Prevention Plan

Respectfully submitted,

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Southern California Edison

2019 Wildfire Mitigation Plan

February 6, 2019

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1 OBJECTIVES OF THE PLAN

1.1 INTRODUCTION

California's wildfire risk has increased in recent years due to climate change, drought, and other factors such as increased development in the wildland-urban interface and significant build-up of fuel, including on federal and state forest lands. The full magnitude of the increased threat and the significance of its consequences did not become apparent until 2017, when California experienced five of the most destructive fires in its history. The 2017 and subsequent fires in 2018 fires — eight of the 20 most destructive wildfires in California history occurred in 2017 and 2018, destroying more than 31,000 structures (double the number consumed by the other twelve)[1] — emphasize that California's wildfire risk has increased to the point where the safety of our communities requires additional measures designed to address the higher level of wildfire risk. To this end, California Senate Bill 901 (SB 901), enacted in 2018, adopted new provisions of Public Utilities Code (PUC) Section 8386 requiring all California electric utilities to prepare, submit and implement annual wildfire mitigation plans that describe the utilities' plans to construct, operate and maintain their electrical lines and equipment in a manner that will help minimize the risk of catastrophic wildfires associated with those electrical lines and equipment.

This ***Southern California Edison 2019 Wildfire Mitigation Plan*** describes strategies, programs and activities that are in place, being implemented or are under development by Southern California Edison (SCE or Company) to proactively address and mitigate the threat of electrical infrastructure-associated ignitions that could lead to wildfires, further harden the electric system against wildfires and enhance wildfire suppression efforts, meeting the requirements of PUC Section 8386 in accordance with the California Public Utilities Commission (CPUC or Commission) rulemaking to implement it.[2] The 2019 Wildfire Mitigation Plan (WMP) applies to all of SCE's internal organizations and contractors with responsibility for the design, engineering, construction, operation, inspection, and maintenance of SCE's electrical infrastructure.

The mitigation strategies and programs described in this WMP are specifically intended to address unique features of SCE's service territory such as topology, weather, infrastructure, potential wildfire risks, and grid configuration. As such, there will and should be some differences with the other large investor-owned utilities' (IOUs) plans due to differences in their respective service areas and grid configurations.

In addition to the descriptions of strategies and programs, in subsequent chapters, SCE includes 2019 goals and metrics to enable the Commission to evaluate SCE's compliance with the WMP. Substantial compliance with the objective metrics set forth in the WMP (when approved by the Commission) will demonstrate that SCE prudently operated its system, and met the Commission's "prudent manager" standard regarding wildfire risk mitigation. Additionally, when feasible and appropriate, SCE will attempt to complete fire mitigation work and activities in excess of the goals set forth in subsequent chapters, which, if performed, would be an acceleration of future years' fire mitigation activities. This WMP also details additional potential work that SCE may undertake in 2019. Certain risks outside of SCE's reasonable control, such as skilled labor resource constraints, supply chain disruptions, permitting and construction delays, and other unexpected events, could negatively impact SCE's ability to meet all of

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1 *See* http://www.fire.ca.gov/communications/downloads/fact_sheets/Top20_Destruction.pdf.

2 *See* Appendix A for a list of all acronyms used in this Wildfire Mitigation Plan.

the approved metrics, and should be considered by the Commission when completing its subsequent compliance evaluation.

In response to Administrative Law Judge Thomas' January 17, 2019 Ruling (Ruling), SCE has included cost estimates for each activity in Chapter 4 of this WMP in order for the Commission to weigh the potential cost implications of measures proposed in the plans. SCE has included preliminary cost estimates for the scope of work underlying the 2019 compliance goals, and for the scope of work underlying potential acceleration of future years' activities, where applicable. It is important to keep in mind, however, that both SB 901 and the Order Instituting Rulemaking (R.)18-10-007 make clear that this proceeding, and the WMP itself, are not cost recovery exercises. Instead, pursuant to the statute, SCE will track the costs for programs and activities detailed throughout this WMP, and in the future seek recovery for any incremental costs in the appropriate procedural forum. For cost recovery purposes, demonstrating substantial compliance with the Commission-approved WMP requirements should facilitate the Commission's subsequent reasonableness review of the costs recorded to SCE's SB 901 or other appropriate memorandum account.

In addition, the Commission has long recognized that utilities need appropriate flexibility to use management discretion to assess and respond to emergent risks and as they arise. Because wildfire risk is affected by climate change effects and local conditions, and because many of the programs and activities described in this WMP are in the early stages of development and deployment, such flexibility will be especially important. If such circumstances arise, SCE will make changes, as appropriate, to its wildfire risk mitigation efforts consistent with the Commission's expectation that utilities will exercise operational discretion and flexibility to maintain safe, reliable, and resilient service for their customers, and will inform the Commission should such changes in 2019 significantly deviate from this WMP. In the event that it is necessary and appropriate to make mid-year changes, or in the event that exogenous factors necessitate a deviation from the specific goals set forth herein, SCE will seek timely approval from the Commission for such changes or deviations.[3]

Finally, many (but not all) of the programs and activities described herein will be funded through either SCE's Grid Safety and Resiliency Program (GSRP) Application (A.18-09-002) or Commission-approved General Rate Case (GRC) rates. The Commission has not yet issued a Proposed Decision in SCE's pending 2018 GRC (A.16-09-001), which was filed on September 1, 2016. Notably, SCE's 2018 GRC, and the specific programmatic funding requests set forth therein, was based on needs and risks that in some cases are very different than the needs and risks California faces today. The 2018 GRC was litigated on the record in that proceeding, which reflected realities as they existed then. Given the unprecedented risks that wildfires now pose to the public and the electric system, SCE must retain the utility discretion to effectively counter those emergent threats as necessary once a decision in the GRC is approved.

1.2 PLAN OBJECTIVES

The primary objective of this WMP is to set forth an actionable, measurable, and adaptive plan for 2019 to reduce the risk of potential wildfire-causing ignitions associated with SCE's electrical infrastructure in High Fire Risk Areas (HFRA).[4] Additional 2019 objectives include protecting public safety, implementing

[3] SCE will make such notifications to the Commission through a letter to the Director of the Safety and Enforcement Division (SED), or as otherwise directed by the Commission.

[4] As further described in Chapter 3, SCE had previously identified locations in its service area as high fire risk prior to the release of the most recent CPUC High Fire Threat District maps with Tier 2 and Tier 3 designation

measures that further harden SCE's electric system against wildfires and improve system resiliency, enhancing wildfire suppression efforts by improving fire agencies' ability to detect and respond to emerging fires in coordination with utility emergency management personnel, reducing the impact of wildfires and wildfire mitigation efforts on the public, and effectively communicating with customers, community groups, and other stakeholders about how to prepare for, prevent, and mitigate wildfires in SCE's HFRA (including, when appropriate, through preemptive de-energization events).

This WMP is focused on 2019 activities and include overviews of existing programs, practices and standards; enhancements recently enacted and being implemented; and new and developing efforts to further reduce potential electrical infrastructure-associated ignitions in HFRA. Several strategies and programs in this WMP are multi-year efforts designed to target the highest risk drivers for potential wildfire-causing ignitions. In Chapter 3, SCE provides a description of its methodologies for identifying and prioritizing action on wildfire risk factors, with the recognition that there are potential tradeoffs between risk mitigation measures. SCE anticipates that as it gains new and additional information about factors affecting the nature of wildfire risk, it will assess its performance against each annual WMP. Each subsequent year's WMP will be adjusted and improved to continually focus on activities mitigating the highest wildfire risks. Accordingly, consistent with the requirements in PUC Section 8386 and the Ruling, this WMP sets forth SCE's 2019 compliance plan to minimize wildfire risk. Over time and cumulatively, the success of the individual programs and activities in this WMP are expected to result in an overall reduction of controllable fire ignition events associated with SCE's electrical infrastructure.

1.2.1 BEFORE UPCOMING WILDFIRE SEASON

In Chapter 4, SCE identifies activities for strategies and programs that it will complete in 2019 in HFRA. This chapter includes a description of those activities addressing the highest wildfire-risk issues. SCE plans on completing those activities before the traditional beginning of the annual fire season,[5] and Chapter 4 includes the corresponding goals for these wildfire risk mitigation activities.

1.2.2 BEFORE THE NEXT WILDFIRE MITIGATION PLAN FILING[6]

Chapter 4 of this WMP describes the programs and activities SCE intends to complete by year-end 2019. SCE's objective with regard to this timeframe is to complete all of the described activities and meet or exceed its 2019 goals in such areas as (but not limited to) operational practices, inspections, system hardening, vegetation management, situational awareness, Public Safety Power Shut-Off (PSPS), alternative technologies, and post-incident recovery, restoration, and remediation strategies and programs. These goals are further described in subsequent chapters.[7]

1.2.3 WITHIN THE NEXT FIVE YEARS

In some cases because of resource constraints or because they are necessarily longer-term efforts, some of the programs and activities set forth herein are scheduled to take place over longer time frames (up

(*see* Decision (D.)17-12-024). Accordingly, SCE's definition of HFRA for purposes of this WMP includes areas beyond the CPUC Tier 2 and Tier 3 designations including, for example, previously designated HFRA.

5 The traditional beginning of the wildfire season in Southern California is early summer, but increasingly California has experienced wildfires year-round.

6 SCE interprets this category to mean the programs and activities in Chapter 4 that will be completed by year-end 2019. Given that the schedule for next year's WMP filing has not been set, SCE generally understands this category to represent those strategies and programs that will be completed in 2019.

7 Goals are described in Chapters 3 through 6.

to five years and beyond). For example, SCE's Wildfire Covered Conductor Program (WCCP) is a long-term program for which full deployment will go beyond five years, due in part to supply chain and skilled labor installation resource availability. As described in Section 4.3, SCE is attempting to accelerate and expand this program to install more covered conductor in HFRA, this year and within the next five years, beyond the amount contemplated in SCE's GSRP. These longer-term programs are described in Chapter 4, and the discussion therein further delineates between shorter- and longer-term objectives within those programs.

2 DESCRIPTION OF THE PREVENTIVE STRATEGIES AND PROGRAMS TO MINIMIZE THE RISK OF ELECTRICAL DISTRIBUTION AND TRANSMISSION INFRASTRUCTURE-CAUSING WILDFIRES (INCLUDING CONSIDERATION OF THE DYNAMIC CLIMATE CHANGE RISK)

2.1 INTRODUCTION

Fire mitigation has been an integral part of SCE's operational practices for years, and SCE has several existing policies, programs, and procedures in place that directly or indirectly manage or reduce this risk. Over time, SCE has adopted additional fire mitigation programs to adjust to changes in fire-related conditions as well as technological advances and improved operational practices. SCE continues to evaluate and implement new technologies and operating practices to further mitigate the potential for ignitions and to better respond to high wildfire risk conditions.

In early 2018, in response to the significantly increased wildfire risk, SCE created a program management office (PMO) consolidating SCE's fire mitigation efforts and focused on protecting public safety and system resiliency. SCE charged the PMO with the following overarching objectives: (1) executing near-term actions to further mitigate increased wildfire risk; (2) developing enhancements to its operational plans for long-term strategies related to wildfire prevention, public safety, and related grid resiliency; and (3) integrating SCE's wildfire mitigation strategies with existing programs. The PMO analyzed historical SCE fire ignition data, reviewed current fire mitigation strategies, and researched potential enhancements focused on fire prevention (avoiding ignitions), aiding suppression activities by others (speeding up confirmation and assessment of fires), and system resiliency (withstanding fires). The PMO also researched external existing and emerging utility fire mitigation strategies related to risk management and asset management for applicability to SCE's wildfire mitigation efforts.

The PMO's efforts led to SCE's GSRP, which is a portfolio of new programs and mitigation measures primarily focused on preventing wildfire ignitions associated with electrical distribution infrastructure in HFRA. GSRP's focus areas are: (1) further grid hardening; (2) enhanced situational awareness; and (3) enhanced operational practices. SCE filed its GSRP Application with the Commission in September 2018 seeking approval of, and cost recovery for, incremental costs to implement the program over the 2018 to 2020 period. Given the increased wildfire risk, SCE began implementing GSRP in 2018 and will continue to implement GSRP activities in 2019 while program and cost recovery approval is pending.[8] This WMP includes, but is not limited to, the programs and mitigation measures described in the GSRP Application and supporting testimony. Most of the programs and mitigation measures in the GSRP will be implemented over multiple years (i.e., not completed in 2019), such as the full deployment of covered conductor in HFRA.

Since filing its GSRP Application, SCE has continued to review and refine the strategies and programs described in that filing. This WMP includes efforts to assess acceleration of some GSRP elements and development of programs that go beyond the scope of GSRP. For example, as set forth in GSRP, SCE plans to deploy at least 96 circuit miles of covered conductor in HFRA in 2019. Notwithstanding execution risks such as skilled-labor resource constraints, supply chain disruptions, and unanticipated events, SCE will attempt to install additional covered conductor in HFRA in 2019. This WMP also includes

[8] *See* D.19-01-019 (establishing the Grid Safety and Resiliency Program Memorandum Account effective September 10, 2018).

potential new mitigation activities, such as targeted undergrounding in HFRA that SCE will further evaluate in 2019, as further discussed in Chapter 4.

The strategies, programs, and activities included in this WMP, with associated goals and metrics to demonstrate compliance with their implementation, are an effective approach to reduce fire-related risk for SCE's customers in the near term (based on current information) and allow for refinement and improvement over time. As new information is obtained and experience is gained with implementing these mitigation programs, SCE will continue to assess, evaluate, and enhance its wildfire risk mitigation strategies, programs, and activities and implement new programs, methods, and technologies if determined to be effective risk-mitigation solutions.

2.2 RISK OF CLIMATE CHANGE EFFECTS

For over a century, SCE has designed its electrical system with the primary goal of providing safe, reliable, and affordable power. This design includes many decades of engineering experience and the adoption of new technologies over time. SCE's design practices continue to advance with the addition of newer safety- and reliability-related technologies. As part of this advancement, it is important to understand and adapt to the "new normal" and the challenges climate change brings. The greater intensity and year-round frequency of fire danger is driving the need for further evolution, hardening, and strengthening of the grid—particularly in HFRA in SCE's service territory. As one of the nation's largest electric utilities, SCE's service territory is approximately 50,000 square miles located in central, coastal, and Southern California. SCE's electrical system encompasses approximately 52,000 circuit miles of transmission and distribution overhead power lines, with more than 19,000 of those circuit miles traversing HFRA.[9] As detailed in this WMP, SCE is developing and implementing ways to further prevent, mitigate, and withstand the wildfire threat associated with its service territory and HFRA.

Experts had predicted that decades from now climate change would increase the risk of these uncharacteristically large and severe wildfires, including a potential increase in the total area burned.[10] These projected impacts are happening now, and regrettably much faster than some earlier climate forecasts. Shortly after the Mendocino Complex Fire in July of 2018, then-Governor Brown explained that "[t]he more serious predictions of warming and fires to occur later in the century, 2040 or 2050, they're now occurring in real time."[11] California's recently-released Fourth Climate Change Assessment—while acknowledging that projecting future wildfires is complicated—nonetheless notes the potential for greater fire risk in the future and particularly "mass fires" burning large areas simultaneously.[12] Moreover, the California Department of Forestry and Fire Protection (CAL FIRE) has

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9 Approximately 13,000 circuit miles of distribution lines and 6,000 circuit miles of transmission lines. Unless otherwise noted, references to "distribution level circuit miles" refer to distribution primary voltages only.

10 Tania Schoennagel et al., Adapt to More Wildfire in Western North American Forests as Climate Changes, (May, 2017), *available at* http://www.pnas.org/content/pnas/114/18/4582.full.pdf.

11 Jaclyn Cosgrove et al., California fires rage, and Gov. Jerry Brown offers grim view of fiery future, L.A. Times (Aug. 2018), *available at* http://www.latimes.com/local/lanow/la-me-ln-california-fires-20180801-story.html.

12 Bedsworth, Louise, Dan Cayan, Guido Franco, Leah Fisher, Sonya Ziaja (2018). Statewide Summary Report. California's Fourth Climate Change Assessment. Publication number: SUMCCCA4-2018-013, *available at* http://www.climateassessment.ca.gov/state/docs/20180827-StatewideSummary.pdf.

concluded that "[c]limate change has rendered the term 'fire season' obsolete, as wildfires now burn on a year-round basis across the State."[13]

This recent increase in the size of, and destruction caused by, fires in the wildland-urban interface, increased population density and development in the wildland-urban interface, and the extremity of weather conditions, marks a significant change in the state's firefighting and fire prevention posture, and an increased need for comprehensive, year-round mitigation and preparedness efforts. The state's recent wildfires are proving that historical mitigation and preparedness efforts are not sufficient to adequately address the current hazards and risks associated with wildfires in California—it is therefore essential for all stakeholders to change the way we approach wildfire mitigation efforts. SCE agrees with Governor Newsom's statement that there should be "no greater emphasis, energy, and sense of urgency than on the issue of public safety."[14]

Wildfires in the Southern California region in SCE's service territory, and the damage they cause, are influenced by many factors including a dry and warm climate, Santa Ana winds, severe droughts, and extensive development in wildland-urban interface. The Southern California region and the rest of SCE's service territory is expected to continue to warm through this century. Climate studies also predict more severe droughts in California in future years.[15] And although there is uncertainty in future predicted changes to Santa Ana wind events, in late 2017, Southern California was subjected to "unprecedented" strong winds that had the potential to carry palm fronds and other debris from long distances into utility lines.[16] The projected increased climate warming, future prolonged periods of drought, and more potentially frequent extreme Santa Ana winds will continue to exacerbate wildfire risk conditions in Southern California. Given these projected conditions, SCE will continue to adapt its strategies and programs to mitigate wildfire risks. SCE's efforts to mitigate wildfire risks will also continue to be informed by dynamic climate change risks as well as other factors that will be described in subsequent, annual WMP filings with the Commission.

2.2.1 PRELIMINARY FIRE SEASON OUTLOOK

Although it is too early to know with precision or certainty, SCE currently expects this year's annual fire season in Southern California to begin around mid-May, and to have a somewhat-above-normal number of fire events based on: precipitation to date (above normal) and associated vegetation growth; forecast precipitation (normal); forecast Santa Ana and associated wind events (normal); and other climate and weather factors.

Weather conditions during the March through May timeframe will have impacts on the start, and to some extent, the severity of this year's fire season. This preliminary forecast is a shortened summary of SCE's Preliminary Fire Season Outlook, prepared by an SCE Fire Scientist, and finalized on January 25,

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13 *See* CAL FIRE 2018 Strategic Fire Plan, p. 10.

14 USA Today (January 9, 2019), *available at* https://www.usatoday.com/story/news/2019/01/08/california-wildfires-gavin-newsom-pledges-105-funding/2521015002/.

15 *See, e.g.*, California's 4th Climate Change Assessment, Los Angeles Region Report, *available at* http://www.climateassessment.ca.gov/regions/docs/20180928-LosAngeles.pdf.

16 In December 2017, the state for the first time experienced "purple" (i.e., extreme) winds capable of reaching 80 mph. *See* Associated Press, California wind hits unprecedented high—and so does fire danger L.A. Times (December 7, 2017), *available at* http://www.latimes.com/local/lanow/la-me-lnpurple-wind-map-20171207-story.html.

2019. While CAL FIRE typically issues a similar report for the entire state, as a result of the shutdown of the federal government in early 2019, this report was not kept current for a period of time.[17]

2.3 OVERVIEW OF PREVENTIVE STRATEGIES AND PROGRAMS

SCE's suite of mitigation strategies, programs and performance management in this WMP addresses:

- Risk analyses of wildfire frequencies and consequences (Chapter 3)
- Operational practices, inspection programs, system hardening programs, vegetation management programs, situational awareness tools and strategies, and de-energization protocols to minimize wildfire ignitions, aid suppression activities by others, and/or improve system resiliency (Chapter 4)
- Alternative technology assessments to continually improve SCE's equipment and practices (Chapter 4)
- Post-incident recovery, restoration, and remediation activities to safely and effectively restore service and minimize damage after a wildfire occurs (Chapter 4)
- Emergency preparedness and response plans to effectively prepare for and communicate with first responders, customers, community groups, and other stakeholders before, during and after a wildfire (Chapter 5)
- Programs to support customers that have been impacted by a disaster (Chapter 5)
- Performance metrics to evaluate compliance with this WMP (Chapter 6)
- Comparison of the past Fire Prevention Plans (FPP) to this WMP and how previous metrics informed this WMP (Chapter 6)
- Description for how SCE will monitor and audit this WMP and identify and correct deficiencies (Chapter 6)
- Cost information for SCE's programs and strategies included in Chapter 4 (Chapter 7)[18]

Several of SCE's strategies and programs in use now are not limited to any particular timeframe, and are instead situational, and based on certain real-world events, such as Red Flag Warnings (RFW) and other high fire-risk conditions. For example, SCE's PSPS protocols are only triggered when conditions pose a significant threat to the public. These conditions are predominantly weather- and vegetative fuel-related and not associated with particular time periods (e.g., in 2019, or within 5 years). Similarly, SCE's emergency preparedness and response plans, its post-incident recovery, restoration, and remediation activities, and its programs to support customers impacted by a wildfire are event-driven and are not timeframe-dependent. SCE's operational practices are also not time-dependent, and certain practices are triggered by RFW and other high fire risk conditions. Additionally, these practices are updated as SCE gains new information and adopts improved practices. Furthermore, all administrative-related

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[17] The Fire Season Outlook (https://gacc.nifc.gov/oscc/predictive/outlooks/myfiles/assessment.pdf) is a rolling four-month prediction of above/below normal fire activity that comes from the United States Forest Service (USFS) (Predictive Services). Due to the shutdown of the federal government, this report was not updated until February 1, 2019. The report's current forecast is consistent with the analysis conducted by SCE's Fire Scientist.

[18] Several of the programs and strategies included in this WMP are large efforts that will require administrative and other support such as organizational change management. SCE anticipates the need for additional support resources and any such incremental costs would be tracked in the appropriate memorandum account. Except where noted in this WMP, these potential incremental costs are not reflected in Chapter 7, but will be tracked in the SB 901 OIR Memorandum Account, and reviewed in SCE's 2021 GRC, as appropriate.

programs such as risk analyses, performance metrics, and monitoring of this WMP will be performed at regular or annual intervals.

In general, this WMP describes certain programs that SCE will attempt to complete on an accelerated basis in order to mitigate wildfire risks as quickly as possible. However many of the programs are multi-year and programmatic in nature, i.e., there is a startup period with limited initial implementation followed by full implementation that expands as processes and methods mature. For these multi-year programs that are further described in subsequent chapters, SCE has set 2019 goals.

2.3.1 BEFORE UPCOMING WILDFIRE SEASON

As described in Chapter 4, SCE has identified activities and goals it plans to achieve in 2019 in HFRA. Several of SCE's strategies and programs include prioritized deployments that focus on assets associated with the highest risk first. SCE's approach also allows for rapid deployment of some strategies across HFRA with relatively minimal expense. For example, SCE prioritized the use of current-limiting fuses (CLF) in HFRA and began applying a more sensitive fast curve trip setting for remote-controlled automatic reclosers (RAR) and circuit breaker relays to allow for more rapid clearing of faults during Red Flag Warnings and other high fire risk conditions. While the overall system hardening activities will continue throughout 2019 and beyond, SCE will attempt to accelerate completion of these specific activities. In Section 4.2, SCE describes its inspection programs, which are currently predominantly driven by time-based compliance requirements, and how it is focusing completion of certain inspections for HFRA. For example, as part of its Annual Grid Patrol (AGP) program SCE will visually inspect approximately 380,000 poles and associated equipment in HFRA by August 31 of each year. SCE has also recently initiated a new inspection effort referred to as enhanced overhead inspections (EOI). This effort began in late 2018, and continued into 2019. Under it, SCE will complete enhanced overhead inspections on all transmission and distribution circuits within HFRA, including the approximately 450,000 transmission and distribution pieces of equipment on those circuits within HFRA. SCE is attempting to accelerate these enhanced inspections to complete them by the height of the upcoming wildfire season. One goal of the EOI effort is to shift from a schedule-driven, compliance-based approach to a risk-based approach to address the evolving wildfire threat.

2.3.2 BEFORE THE NEXT WILDFIRE MITIGATION PLAN FILING

SCE interprets this category of strategies and programs to mean the strategies and programs in Chapter 4 that will be completed by year-end 2019.[19] In Chapter 4, SCE describes numerous activities that have 2019 completion goals. These strategies and programs include operational practices, inspections, system hardening, vegetation management, situational awareness, PSPS protocols, alternative technologies, and post-incident recovery, restoration and remediation.

2.3.3 WITHIN THE NEXT FIVE YEARS

Many of SCE's strategies and programs in Chapter 4 are multi-year efforts and are anticipated to continue beyond 2019. Several of SCE's inspection programs have time-period compliance requirements to inspect SCE's electrical infrastructure within the next five years. Other programs such as covered conductor, RAR, fusing mitigation, weather stations, and high definition (HD) cameras are multi-year efforts.

[19] Given that the schedule for next year's WMP filing has not been set, SCE generally understands this category to represent those strategies and programs that will be completed in 2019.

2.4 CHAPTER ORGANIZATION AND STRUCTURE

SCE has organized this WMP based on the SB 901 Wildfire Mitigation Plan Template included in the Ruling, with minor exceptions. The Ruling requires several levels of categorization for each of SCE's strategies and programs. Due to time limitations, these categorizations are included, in tabular format, in Appendix B. SCE has also organized its subsequent chapters as follows:

- Overview of the Program: This section includes a high-level overview of existing strategies and programs, GSRP activities and new and/or enhanced activities developed since the GSRP filing;
- Existing Programs: This section provides a description of existing programs that have wildfire risk mitigation benefits;
- Additional actions taken in HFRA: This section focuses on SCE's targeted wildfire risk programs and activities that are directed toward HFRA. This section also includes explanations of the work SCE will be conducting in HFRA in 2019; and
- Activities and 2019 Goals: This section includes, in tabular format, the list of additional activities to be performed in HFRA and associated 2019 goals, as well as a description of the evidence SCE will use to demonstrate compliance with and achievement of those goals.

The chapters also include a few key categories including activities, goals, metrics, and indicators defined as follows:

- **Activities**: "Activities" are specific actions conducted in HFRA that are execution-focused (e.g., covered conductor installation) and directed at reducing wildfire risk. Activities are measurable and auditable, and each will have a "goal" (as defined below).
- **2019 Goals**: "Goals" are assigned to each activity and provide the measurable target SCE aims to achieve in 2019 (e.g., circuit miles of covered conductor installed). While SCE will endeavor to meet or exceed the goals, to the extent that resource constraints, material delays, weather delays, and/or other necessary tradeoffs do not allow SCE to achieve the specific values that this WMP targets, SCE will demonstrate in the required after-the-fact compliance report why its performance constituted substantial compliance with the WMP.[20]
- **Metrics**: "Metrics" are intended to capture WMP performance at a higher level than activities. These may track progress of a broader set of activities (e.g., miles hardened including but not limited to covered conductor) or quality of execution.[21]
- **Indicators**: The three "indicators," further discussed in Chapter 6, evaluate information over time, and reflect the long-term outcomes that the activities (cumulatively and over time) are intended to influence. Although "indicators" will identify long-term trends, they are not related to compliance performance evaluation in 2019, because the drivers of the indicators include certain uncontrollable factors. For example, ignitions-per-year is a key indicator that will be tracked. However, this indicator can be subject to variation over time related to exogenous events such as severe drought and extreme wind. The uncontrollable variation in certain indicators makes it difficult to target accurate, achievable, and numerical goals over a short time period.[22] Indicators require assessment over time to identify trends before proposing performance goals in future WMP submissions.

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[20] SCE recognizes that certain work covered by this WMP is subject to mandatory, prescriptive regulatory requirements.

[21] Both "metrics" and "goals" will be used to demonstrate SCE's substantial compliance with this WMP.

[22] Indicators reviewed over a short period of time could lead to either false-negative results (e.g., an increase in ignitions in 2019 could be driven by an unusually high number of extreme weather events) or false-positive results (e.g., a significant reduction in ignitions in 2019 could be driven by an unusually small number of extreme weather events).

3 RISK ANALYSIS AND RISK DRIVERS

3.1 METHODOLOGY FOR IDENTIFYING AND EVALUATING ENTERPRISE-WIDE SAFETY RISK AND WILDFIRE-RELATED RISK

SCE follows a comprehensive risk management evaluation protocol to assess and mitigate enterprise-wide safety risks. The CPUC has recently adopted two new risk-mitigation procedures: the Safety Model Assessment Proceedings (S-MAP) and the Risk Assessment Mitigation Phase (RAMP). The purpose of the S-MAP is to: (1) allow parties to understand the models the utilities propose to use to prioritize programs/projects intended to mitigate risks; and (2) allow the CPUC to establish standards and requirements for those models. In each utility's RAMP, the utility will "describe[e] how it plans to assess its risks, and to mitigate and minimize such risks."[23] Each utility's RAMP filing should be consistent with the direction provided in the S-MAP. The RAMP submission, "as clarified or modified in the RAMP proceeding, will then be incorporated into the large energy utility's GRC filing."[24]

Pursuant to the RAMP process, SCE deployed a new multi-attribute probabilistic risk evaluation model to evaluate safety risks (including safety-related risks and the associated probability and consequences of potential events). As part of this process, SCE utilizes a risk-informed decision-making process to identify, evaluate, mitigate, and monitor enterprise risks, including risks associated with wildfires.[25] This process enables the company to explicitly include risk considerations in SCE's decision-making for work identification, prioritization, and funding and resource allocation. Senior leaders employ the framework to review the risk analyses and mitigation plans in place to manage enterprise risks. Though risk management has always been an essential part of the management toolkit for strategic, business, and operational planning, over the last few years, risk-informed planning has become a much more explicit and essential component of decision-making.

SCE annually identifies and evaluates the key risks that the enterprise and its customers face, with a focus on safety risks, such as wildfire risk, utilizing a multi-step process from both a top-down and bottoms-up approach, as described below:

- **Top-down review of enterprise-level risks:** This effort is aimed at assessing the breadth of activities ongoing at SCE, in the state, and in the utility industry to identify key risks. It includes a review of industry trends and research, public policy efforts, legislative activities, key CPUC and other regulatory proceedings, major SCE initiatives, and critical business functions. The team also compiles feedback on current and emerging enterprise-level risks through company-wide surveys and direct discussions with SCE leadership.
- **Bottom-up review of SCE Enterprise Risk Register:** SCE maintains an enterprise risk register that captures and assesses risks from across the enterprise, based on interviews and feedback from working groups throughout the organization.
- **Consolidation and aggregation:** SCE aggregates the risks identified through the above processes to evaluate which risks have potential major safety consequences, including consolidation of duplicate and similar risks.
- **Review and refinement with senior leadership:** Through leadership review and assessment, further refinements are made as appropriate.

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[23] *See* D.14-12-025, p. 3.

[24] *See* D.14-12-025, p. 3.

[25] A detailed discussion of the application of SCE's Risk Informed Decision Making Process to Wildfire Risk is included in SCE's GSRP filing.

3.1.1 METHODOLOGY CONSISTENCY WITH OTHER UTILITIES

Over the past several years, there have been significant steps taken by California utilities and the Commission to align on the foundational frameworks and methods used to identify and evaluate enterprise risks. This began in earnest in 2013, when the Commission issued an Order Instituting Rulemaking to Develop a Risk-Based Decision-Making Framework to Evaluate Safety and Reliability Improvements and Revise the Rate Case Plan for Energy Utilities (R.13-011-006). This rulemaking established two primary processes for achieving consistency across utilities: (1) S-MAP, which is focused on developing a uniform methodology and framework for risk identification and evaluation across utilities; and, (2) RAMP, in which utilities implement the methodologies and framework adopted in S-MAP.

Through these processes, SCE and other California utilities (Pacific Gas and Electric Company (PG&E), Southern California Gas Company (SoCalGas), and San Diego Gas & Electric Company (SDG&E)), have implemented generally consistent methods for risk identification and evaluation. For example, utilities have risk management frameworks that are consistent with the Cycla Corporation 10-step risk assessment framework.[26]

Most recently in the S-MAP process, the Commission issued a Decision Adopting Safety Model Assessment Proceeding (S-MAP) Settlement Agreement with Modifications.[27] In this Decision, the Commission adopted certain guidelines for California utilities to more uniformly and quantitatively assess risk within the RAMP and GRC proceedings. This Decision adopted, with a few modifications, the Settlement Agreement that SCE had worked at great length with other California utilities to develop, in collaborative partnership with external stakeholders.[28] The intent of this Decision was to help drive consistency in the approach and methods used to evaluate risk among utilities.

While this Decision applies on a prospective basis to future utility RAMP reports (i.e., those starting in 2019), California utilities, including SCE, have already incorporated many of the tenets of this Decision into their respective risk assessment processes. For example, one of the requirements includes the use of a Multi-Attribute Value Framework (MAVF) and probabilistic methods in the evaluation of risk. PG&E in their 2017 RAMP report, and SCE in its 2018 RAMP report, implemented many of the MAVF principles, and deployed probabilistic methods in the evaluation of enterprise safety risks; this included the assessment of wildfire-related risk. In 2019, SoCalGas and SDG&E will submit their RAMP reports using the MAVF principles.

While each utility will necessarily tailor specific aspects of these risk assessment frameworks to best align with their internal planning and decision-making processes, utilities have taken significant steps to align with and implement the overall risk analysis frameworks envisioned by the Commission.

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[26] In D.16-08-018, p.2, the Commission adopted the Cycla Corporation 10-Step Evaluation Method as a common yardstick for evaluating how mature, robust, and thorough utility risk assessment and mitigation models and risk management frameworks are. See each utility's latest RAMP report for discussion on alignment to this framework.

[27] D.18-12-014.

[28] Settling Parties include PG&E, SCE, SoCalGas, SDG&E, (collectively, the Joint Utilities or JU); The Utility Reform Network (TURN), and Energy Producers and Users Coalition and Indicated Shippers (EPUC/IS) (collectively, the Joint Intervenors or JI); and the Office of the Ratepayer Advocates. SB 854 (Stats. 2018, ch. 51) amended Pub. Util. Code § 309.5(a) so that the former Office of Ratepayer Advocates is now named the Public Advocate's Office of the Public Utilities Commission.

3.2 IDENTIFICATION, DESCRIPTION AND PRIORITIZATION OF WILDFIRE RISKS AND DRIVERS FOR THOSE RISKS

This section summarizes SCE's approach for wildfire-specific issues as evaluated in its 2018 RAMP report. SCE filed its RAMP report with the Commission in November 2018. Since filing its RAMP report, SCE has continued to enhance and update its wildfire risk analyses. A description of these updates subsequent to the submission of its RAMP report is described at the end of this section.

In preparing its RAMP report, SCE further refined its understanding of the fundamental elements that enable fires to ignite, the statistical trends associated with fires across California, particularly those associated with electrical power lines, the historically reported ignitions associated with SCE's grid infrastructure, and the geographic locations within SCE's service area that represent the greatest wildfire risk. SCE began by analyzing ignitions that occurred in its service territory from 2015 through 2017 that were of significant size and were reportable to the Commission.[29] The first step was to determine the parts of its system that are at the highest risk of ignition, followed by a detailed analysis of drivers and outcomes for wildfire ignitions in those areas.

3.2.1 RISK TRANCHING AND PRIORITIZATION

SCE analyzed the frequency and consequence of ignitions by categorizing its system based on two factors: system voltage level (e.g., distribution voltage or transmission voltage) and HFRA designation. As detailed below, because the vast majority of electrical infrastructure-related ignitions associated with SCE's system have been located on the distribution voltage-level system during the analyzed period, that system has been categorized in a higher-risk tranche for purposes of this WMP. HFRA are areas in SCE's service territory where there is an elevated hazard for the ignition and rapid spread of fires associated with electrical equipment due to strong winds, abundant dry vegetation, and other environmental conditions. HFRA represents approximately 35 percent of SCE's service territory. As defined by SCE and as shown below, this includes those locations with Tier 2 or Tier 3 designations identified in the most recent CPUC High Fire Threat District (HFTD) maps,[30] a self-imposed buffer of 200 feet around the CPUC-designated Tier 2 and Tier 3 areas, and those locations within the SCE service territory previously identified as high fire risk prior to the release of the most recent CPUC maps. Collectively, HFRA are those areas with the highest potential frequency and consequences of wildfire ignition events, which includes a consideration of topographical and climatological risk factors. In the interests of public safety, SCE chose to include certain non-Tier 2 and Tier 3 areas in its definition of HFRA, because those areas were previously identified as high fire risk by SCE. SCE is currently in the process of performing a detailed evaluation of these areas to determine which of these areas should remain designated as high fire risk. Further details of this HFRA evaluation are discussed within Section 3.4. As discussed herein, going forward SCE will continue to use local conditions and other factors to evaluate its service territory for wildfire risk and will recommend additions or removal of HFRA areas in future plans.

Over the 2015-2017 time period, SCE experienced 302 reportable ignition events associated with electrical infrastructure within its service territory. 92 percent of these ignitions occurred at distribution

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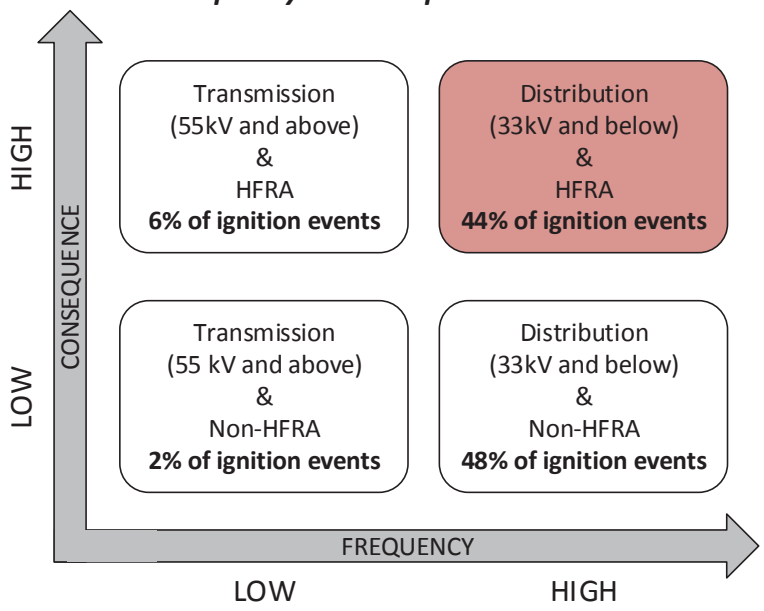
[29] Pursuant to D.14-02-015, reportable fire events are any events where utility facilities are associated with the following conditions: (a) a self-propagating fire of material other than electrical and/or communication facilities, (b) the resulting fire traveled greater than one linear meter from the ignition point, and (c) the utility has knowledge that the fire occurred.

[30] http://www.cpuc.ca.gov/firethreatmaps/

level voltages (33 kilovolt (kV) and below), while eight percent occurred at subtransmission and transmission level voltages (55 kV and above). When analyzed based on presence in HFRA, 50 percent of these ignitions occurred in HFRA, and 50 percent occurred outside of HFRA.

Based on both frequency and consequence considerations, four tranches of SCE assets for wildfire risk analysis are illustrated in figure 3-1 below. SCE identified distribution equipment within SCE's HFRA as the specific tranche of assets that poses the most significant wildfire risk. SCE considers the tranche of HFRA distribution assets, representing approximately 44 percent of all ignition events associated with SCE during the studied period, to have the highest frequency and the highest potential consequence of ignitions of the four tranches. Therefore, SCE's risk analyses performed to date have prioritized evaluation and mitigation of wildfire risk within this tranche.

Figure 3-1
Four Tranches of SCE Assets for Risk Analysis
Based on Frequency & Consequence Considerations



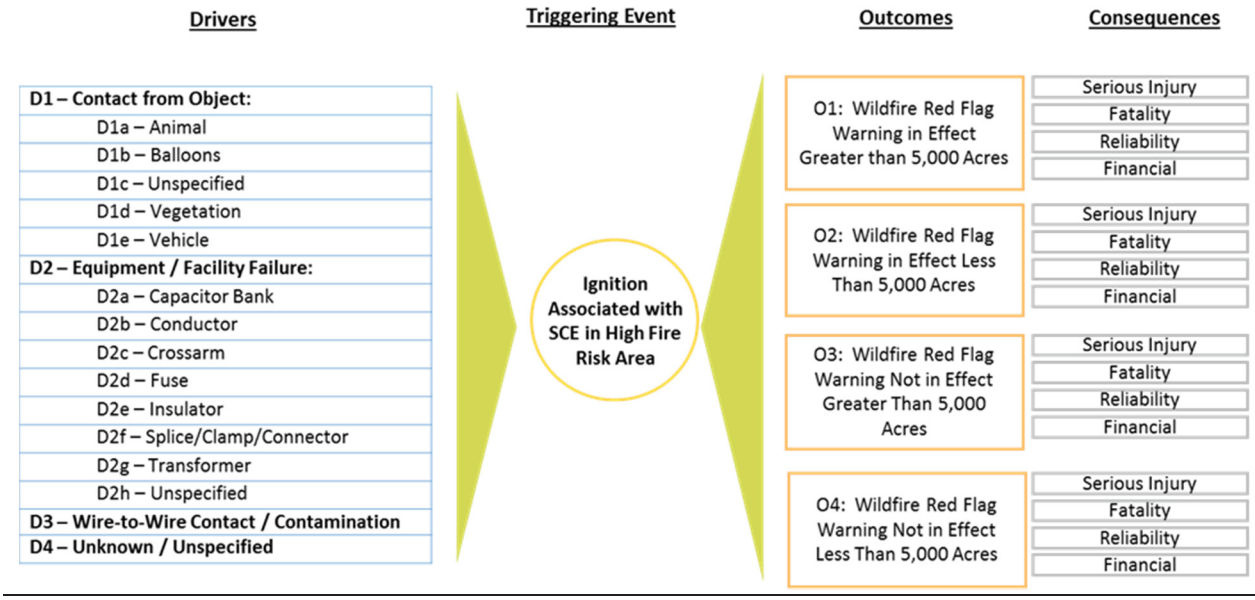
3.2.1.1 Risk Bowtie

For the tranche of risk associated with SCE's distribution equipment in HFRA, SCE developed and performed a risk bowtie analysis that includes risk drivers, triggering events, outcomes, and consequences.[31] SCE defined wildfire risk as "ignition associated with SCE's Distribution equipment in HFRA," specifically focused upon ignition associated with overhead distribution equipment. The risk bowtie, as presented within SCE's 2018 RAMP report, is shown below in Figure 3-2:

[31] Please refer to Investigation (I.)18-11-006 - SCE 2018 RAMP Report, Chapter 2 for a description of the bowtie methodology used by SCE, and Chapter 10 for a description of the Wildfire risk bowtie.

Figure 3-2

Risk Bowtie for ignition associated with SCE's distribution equipment in HFRA



3.2.1.2 Risk Drivers

SCE's risk driver analysis identified and studied four major categories of drivers:

1. D1 - Contact from object, which includes external factors that cause SCE's equipment to fail, or to function as an ignition source to foreign material;
2. D2 - Equipment/facility failure, which includes events caused by failure of SCE equipment, independent of events listed in D1;
3. D3 - Wire-to-wire contact/contamination; and,
4. D4 - Unknown/unspecified.

Data for the drivers resulting in ignitions associated with SCE's distribution infrastructure in HFRA are shown in Table 3-1.

Table 3-1
Breakdown of Contact from Object and Equipment/Facility Failure-Related Fires
(Distribution Voltage Infrastructure in HFRA from 2015-2017)

Suspected Initiating Event	Count	Percentage
D1 - Contact From Object	70	53%
D2 - Equipment/Facility Failure	40	30%
D3 - Wire-to-Wire Contact/Contamination	6	5%
D4 - Unknown/Unspecified	16	12%
Total	**132**	**100%**

D1 - Contact From Object	Count	Percentage
D1a - Animal	15	11%
D1b - Balloons	14	11%
D1c - Other	10	8%
D1d - Vegetation	22	17%
D1e - Vehicle	9	7%
Total	**70**	**53%**

D2 - Equipment/Facility Failure	Count	Percentage
D2a - Capacitor Bank	2	2%
D2b - Conductor	12	9%
D2c - Crossarm	1	1%
D2d - Fuse	1	1%
D2e - Insulator	5	4%
D2f - Splice/Clamp/Connector	8	6%
D2g - Transformer	3	2%
D2h - Unspecified	8	6%
Total	**40**	**30%**

D3 - Wire-to-Wire Contact/Contamination	Count	Percentage
Wire-to-Wire Contact/Contamination	6	5%
Total	**6**	**5%**

D4 - Unknown/Unspectified	Count	Percentage
Unknown/Unspecified	16	12%
Total	**16**	**12%**

In order to map drivers to (1) Design and Construction, (2) Inspection and Maintenance, (3) Operational Practices, and (4) Situational/Conditional Awareness, and (5) Response and Recovery, SCE first mapped its mitigations to these categories. SCE then mapped its drivers against mitigations, as shown in Table 3-2 below. Within SCE's RAMP report, mitigations were not mapped to Driver D3 (wire-to-wire contact) because of the small number of ignitions occurring due to this driver during the 3-year period analyzed. Mitigations were not mapped to Driver D4 due to limited data available regarding this type of ignition.

Table 3-2
Mapping of RAMP Drivers to Mitigations and Categories

Applicable RAMP Control/Mitigation	Drivers	(1) Design and Construction	(2) Inspection and Maintenance	(3) Operational Practices	(4) Situational/ Conditional Awareness	(5) Response and Recovery
C1 - Overhead Conductor Program (Bare + Covered)	D1, D2	Yes				
C2 - FR3 Overhead Distribution Transformers	D2	Yes				
M1 - Wildfire Covered Conductor Program	D1, D2	Yes				
M2 - RAR & Fast Curve Settings	N/A*	Yes		Yes		
M3 - PSPS Protocols and Support Functions	N/A*			Yes	Yes	
M4 - Infrared Inspection Program	D2		Yes			
M5 - Expanded Vegetation Management	D1		Yes	Yes		
M7 - Enhanced Situational Awareness	N/A*				Yes	Yes
M8 - Fusing Mitigation	D2	Yes				
M9 - Fire Resistant Poles	N/A*	Yes				Yes

* For purpose of risk modelling in SCE's 2018 RAMP report, these mitigations were modeled to affect outcomes only. As such, these particular mitigations were not directly mapped to drivers.

3.2.1.3 Risk Outcomes and Consequences

SCE identified four potential outcomes for ignitions associated with SCE in HFRA. These four outcomes are differentiated based on RFW conditions and wildfire size (see Figure 3-2):

1. O1 – Wildfire/RFW in Effect/Greater than 5,000 acres (0.8% of outcomes)
2. O2 – Wildfire/RFW in Effect/Less than 5,000 acres (31.0% of outcomes)
3. O3 – Wildfire/RFW Not in Effect/Greater than 5,000 acres (0.2% of outcomes)
4. O4 – Wildfire/RFW Not in Effect/Less than 5,000 acres (68.1% of outcomes)

For each of these outcomes, SCE estimated the potential public safety (serious injuries, fatalities), reliability, and financial impacts. The safety consequences were analyzed using historical data from both California Department of Forestry and Fire Protection (CAL FIRE) and the National Fire Protection Association (NFPA). Reliability consequences were analyzed utilizing data from SCE's Outage Database and Reliability Metrics (ODRM) system. Financial consequences were analyzed using a combination of national insurance databases, national firefighting cost data, restoration cost studies, and CAL FIRE data.

3.2.1.4 Wildfire Risks and Drivers Identified After RAMP Report

Since filing its RAMP report in November 2018, SCE has continued to refine its analyses and processes, and evaluate additional data as it becomes available.

Transmission Ignition Data

As shown in Figure 3-1, 6 percent of ignitions in SCE's HFRA (19 ignition events over three years) were associated with SCE's transmission system during years 2015-2017. The following table shows the breakdown of these 19 ignition events:

Table 3-3
Breakdown of Contact from Object and Equipment/Facility Failure-Related Fires
(Transmission Voltage Infrastructure in HFRA from 2015-2017)

Suspected Initiating Event	Count	Percentage
Contact From Object	14	74%
Equipment/Facility Failure	1	5%
Other, Unknown, Contamination	4	21%
Total	**19**	**100%**

Contact From Object	Count	Percentage
Animal	6	32%
Balloons	3	16%
Other	2	11%
Vegetation	1	5%
Vehicle	2	11%
Total	**14**	**74%**

Equipment/Facility Failure	Count	Percentage
Other	1	5%
Total	**1**	**5%**

Other, Unknown, Contamination	Count	Percentage
Other	1	5%
Unknown	2	11%
Contamination	1	5%
Total	**4**	**21%**

The limited quantity of ignitions associated with transmission infrastructure has limited the analysis performed based on historical ignitions. Section 3.2.1.5 below describes the future planned analysis that includes transmission infrastructure.

3.2.1.5 Expansion of Analysis beyond Historical Ignition Data (Activity RA-1)

In developing the RAMP report, the analysis was based on historical ignition events in HFRA. SCE is currently in the process of analyzing 2018 fire ignition data. In addition to incorporating CPUC-reportable 2018 historical ignition data (preliminary data indicates there were 46 reported ignitions across SCE's HFRA) into its analysis to identify trends and changes among ignition drivers, SCE will incorporate additional engineering and operational subject matter expertise into its risk analysis performed in 2019, and data collected through inspections of equipment in HFRA, including distribution, transmission, and substation infrastructure. Additionally, in its 2019 risk analysis (to inform the 2020 WMP), SCE will include an analysis of equipment that were not associated with reportable historical ignitions in HFRA, but that could potentially lead to an ignition, such as lightning arresters, poles, protective relays, switches, etc. SCE is also currently developing a fire consequence model at a circuit segment level, which will further inform the prioritization for various mitigations based on wildfire risk exposure. The

Company will perform an analysis for various mitigations, including, when appropriate, potential undergrounding of lines.

3.3 DESCRIPTION OF HOW THE WILDFIRE MITIGATION PLAN ACCOUNTS FOR THE WILDFIRE RISKS IDENTIFIED IN THE RAMP

SCE's WMP includes activities to mitigate the wildfire risks identified above. The impact of a mitigation is estimated in terms of its ability to reduce driver frequency, to reduce the probability of an outcome occurring, and/or to reduce the severity of consequences when an outcome occurs. This section identifies how the strategies and programs described in Chapter 4 are aligned with the controls and mitigations discussed and analyzed in the wildfire chapter of SCE's RAMP report,[32] and how each mitigation affects the drivers, outcomes, and/or consequences associated with wildfire risks.

The following table summarizes the elements of the WMP that were assessed in RAMP, and the corresponding drivers, outcomes, and consequences impacted by elements of the plan as analyzed and modelled in RAMP. As the table shows, the WMP is a comprehensive portfolio of activities that collectively addresses both the left-hand side of the bowtie (i.e., drivers) and the right-hand side of the bowtie (i.e., outcomes and consequences).

Table 3-4
Alignment of WMP strategies and programs to RAMP control/mitigation

WMP Topic	Applicable RAMP Control/Mitigation	Drivers	Outcomes	Consequences
Operational Practices	M2 - RAR & Fast Curve Settings	-	O1, O2	All
Plans for Inspections of Electrical Infrastructure	M4 - Infrared Inpsection Program	D2	-	-
System Hardening to Achieve Highest Level of Safety, Reliabilty and Resiliency	C1 - Overhead Conductor Program (Bare + Covered)	D1, D2	-	-
	C2 - FR3 Overhead Distribution Transformers	D2	-	-
	M1 - Wildfire Covered Conudctor Program	D1, D2	-	-
	M2 - RAR & Fast Curve Settings	-	O1, O2	All
	M8 - Fusing Mitigation	D2	-	-
	M9 - Fire Resistant Poles	-	All	All
Vegetation Management Plan	CM1 - Vegetation Management	discussed but not modeled in RAMP		
	M5 - Expanded Vegetation Management	D1	-	-
Protocols on Situational Awareness	M7 - Enhanced Situational Awareness	-	All	All
Protocols on Public Safety Power Shut-Off	M3 - PSPS Protocols and Support Functions	-	O1	All

NOTE: There are additional elements in each of these WMP categories that were not directly addressed in RAMP; for a description of these additional elements, see Chapter 4.

In Table 3-4, the "WMP Topic" column refers to the section of Chapter 4 where each of these mitigations are discussed in greater detail. The "Applicable RAMP Control/Mitigation" column refers to the name of the RAMP activity, along with an abbreviated notation of whether the activity was classified as a compliance activity, control, or mitigation.[33] The "Drivers, Outcomes, and Consequences" columns indicate the potential positive impact of the applicable control or mitigation to the corresponding element of the bowtie diagram.[34]

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[32] Please refer to I.18-11-006 - SCE 2018 RAMP Report, Chapter 10, pages 10-22 - 10-42 for a detailed description of controls and mitigations analyzed in RAMP.

[33] CM = Compliance. This is an activity required by law or regulation. Compliance activities were not risk analyzed in the RAMP report. C = Control. This is an activity performed prior to 2018 to address the risk, and which may continue through the RAMP period. M = Mitigation. This is an activity commencing in 2018 or later to affect this risk. Both Controls and Mitigations were modeled in SCE's RAMP report.

[34] Please refer to I.18-11-006 - SCE 2018 RAMP Report, Chapter 10 for a description of the Driver, Outcome and Consequence mapping for each analyzed mitigation.

3.3.1 WMP ELEMENTS IDENTIFIED IN RAMP

Below is a description of the specific WMP elements and their expected impact on risk bowtie components as analyzed in RAMP.

3.3.1.1 Operational Practices

3.3.1.1.1 RAMP Mitigation M2 – Remote-Controlled Automatic Reclosers and Fast Curve Settings

RAR are protective devices for mainline conductor that can automatically interrupt faults. The RAR are programmed with special fast curve settings that can be remotely toggled to provide faster or more selective "fault clearing" to further reduce fire ignition risks and reduce service interruptions for SCE customers. Fast curve settings modify the relay fault detection curve, providing faster fault detection and interruption. These fast curve settings reduce the fault clearing time, reducing heat and arcing therefore reducing the possibility of ignition. This mitigation is primarily designed to be implemented during Red Flag Warnings or other high fire risk conditions.

3.3.1.2 Plans for Inspections of Electrical Infrastructure

3.3.1.2.1 RAMP Mitigation M4 – Infrared Inspection Program

SCE is deploying a biennial Infrared (IR) Inspection Program for overhead distribution lines within HFRA. The IR program identifies "hot spots" on distribution system equipment that indicate potential equipment failures. Inspection findings will be prioritized in accordance with SCE's Distribution Inspection and Maintenance Program (DIMP) manual and given appropriate system remediation timeframes.

3.3.1.3 System Hardening to Achieve Highest Level of Safety, Reliability and Resiliency

3.3.1.3.1 RAMP Control C1 – Overhead Conductor Program

SCE's Overhead Conductor Program (OCP) addresses public safety risks associated with wire-down events. This program includes both reconductoring and installation of branch line fuses (BLF). Reconductoring and branch line fusing are intended to target and remedy overhead conductor susceptible to failure due to overcurrent.

3.3.1.3.2 RAMP Control C2 – FR3 Overhead Distribution Transformers

Under this program, SCE will replace existing overhead distribution transformers (which are primarily filled with mineral oil) with overhead distribution transformers filled with ester fluid (such as Envirotemp FR3 Fluid).[35] Ester fluid is a derivative of renewable vegetable oil and has a higher flash point rating than mineral oil. This decreases the likelihood that the fluid and/or fluid vapors will ignite and remain ignited during a catastrophic event.

3.3.1.3.3 RAMP Mitigation M1 – Wildfire Covered Conductor Program

Installing covered conductor on SCE's system is an enhanced mitigation technique for reducing wildfire ignition risks, as compared to bare conductor. The covered conductor SCE is proposing to deploy as part of this mitigation utilizes a robust three-layer design. The design can prevent arcing caused by contact with a tree limb or other vegetation, another conductor, or a metallic balloon. In addition, the covering

[35] As part of routine maintenance and inspections in HFRA, SCE assesses the condition of existing transformers and will replace failing units with ester fluid-filled transformers.

on the conductor (the "insulation") helps reduce the frequency of contact-related circuit interruptions that can lead to wire-down events.

3.3.1.3.4 RAMP Mitigation M2 – Remote-Controlled Automatic Reclosers and Fast Curve Settings

This mitigation is expected to reduce the frequency of only those drivers that lead to RFW condition outcomes (O1 and O2). However, given constraints associated with the RAMP model structure, SCE represented this mitigation as not impacting any drivers (i.e., they are not "causal" factors for fires). Instead, for RAMP modeling purposes, SCE represented this mitigation as impacting all consequences associated with O1 and O2 (i.e., they are "preventive" factors for fires).[36]

3.3.1.3.5 RAMP Mitigation M8 – Fusing Mitigation

SCE plans to install or replace fuses at branch line locations in the HFRA. First, SCE will install new CLF at branch line locations. Second, SCE will replace existing fuses with CLF on circuits that traverse HFRA. This program is intended to reduce the risk of fire ignitions associated with SCE's distribution lines and equipment by reducing fault energy.

3.3.1.3.6 RAMP Mitigation M9– Fire-Resistant Poles

If pole replacements are required at locations where SCE is installing covered conductor in HFRA, SCE will use fire-resistant poles instead of traditional wood poles.[37] These poles will be composite material poles or other types of fire-resistant poles.[38]Use of the poles is intended to improve distribution system resiliency, increasing the chances that SCE equipment, including conductor, will remain intact should a wildfire occur.

3.3.1.4 Vegetation Management Plan

3.3.1.4.1 RAMP Compliance Control CM1 – Vegetation Management

SCE's existing Vegetation Management program reduces wildfire risk and meets current laws and regulations. The benefits of this activity were included in SCE's assessment of baseline wildfire risk, but SCE did not evaluate the specific risk reduction resulting from this compliance activity as it is prescriptively required. In other words, the impact of this activity on drivers, outcomes, and consequences was not explicitly modeled.

3.3.1.4.2 RAMP Mitigation M5 – Expanded Vegetation Management

SCE's expanded vegetation management effort will assess the structural condition of trees in HFRA that are not dead or dying, but could fall into or otherwise impact electrical facilities. These trees may be as far as 200 feet away from SCE's electrical facilities. Trees determined to pose a potential risk to electrical facilities due to their structural or site condition will be removed or otherwise addressed, where feasible.

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[36] SCE notes that reducing wildfire risk by implementing more sensitive protective settings and the blocking of reclosing will increase reliability consequences associated with faults that do not ignite wildfires. Because non-wildfire-related faults were not included within the scope of RAMP, the negative reliability impact of M2 was not reflected in the RAMP risk analysis.

[37] *See* section 4.3.3.4 for additional detail. Covered conductor is heavier than bare conductor and in some cases may require stronger replacement poles.

[38] Includes wood poles with a protective wrap specifically designed to withstand wildfires or steel poles.

3.3.1.5 Protocols on Situational Awareness

3.3.1.5.1 RAMP Mitigation M7 – Enhanced Situational Awareness

This mitigation will enhance SCE's wildfire situational awareness by deploying micro weather stations and HD cameras across its HFRA, developing a high-resolution weather model, enhanced meteorology capability and a high-performing computing platform for fire potential index modeling.

3.3.1.6 Protocols on Public Safety Power Shut-Off

3.3.1.6.1 RAMP Mitigation M3 – Public Safety Power Shutoff Protocol and Support Functions

SCE has recently instituted a formalized PSPS where it may de-energize selected circuits in HFRA to reduce the chances of fire ignitions during extreme and potentially dangerous fire conditions. This practice is aimed at keeping the public, SCE customers, and electrical workers safe.

3.4 EVALUATION OF NON-CPUC HFRA

3.4.1 SCE HFRA BACKGROUND

In December 2017, the CPUC adopted new fire-safety regulations, which included a requirement for the IOUs to integrate into their operations a new HFTD map, which indicates areas in California that are affected by Tree Mortality High Hazard Zones (HHZ, or Tier 1) or represent an elevated (Tier 2) or extreme (Tier 3) wildfire risk due to utility infrastructure-associated ignitions. These tiers drive certain maintenance, inspection, and vegetation management criteria/inspection intervals of overhead assets in high fire-threat areas as described in later sections. Prior to the creation of the CPUC HFTD Map, SCE utilized multiple sources to specify which areas in SCE's service area historically represented a high fire risk. Currently, SCE maintains HFRA maps that are a combination of historical map boundaries (based on past fire management and response experiences), CAL FIRE's Fire Hazard Severity Zone (FHSZ) maps, and most recently the CPUC HFTD map. SCE considers all three categories (i.e., Tier 2, Tier 3, and non-CPUC historical high fire risk areas) to be "HFRA."

SCE HFRA designation has implications on the way SCE designs, constructs, operates, inspects, and maintains its grid. In addition, there have been significant changes across SCE's service territory with respect to development/urbanization, system design/configuration, vegetation health, and climate change over the past few decades.[39] Going forward, SCE will assess if the areas currently designated as HFRA that are beyond the CPUC HFTD continue to pose significant wildfire risk sufficient to remain designated as HFRA. SCE's HFRA designations will be updated as a result of the assessment in 2019. Additionally, SCE will continue to assess areas in its service territory that are not currently within a HFRA and will add new areas that pose high fire risk due to changing conditions.

As shown in table 3-5 below, SCE designates approximately 35 percent of SCE's service area to be high fire risk.

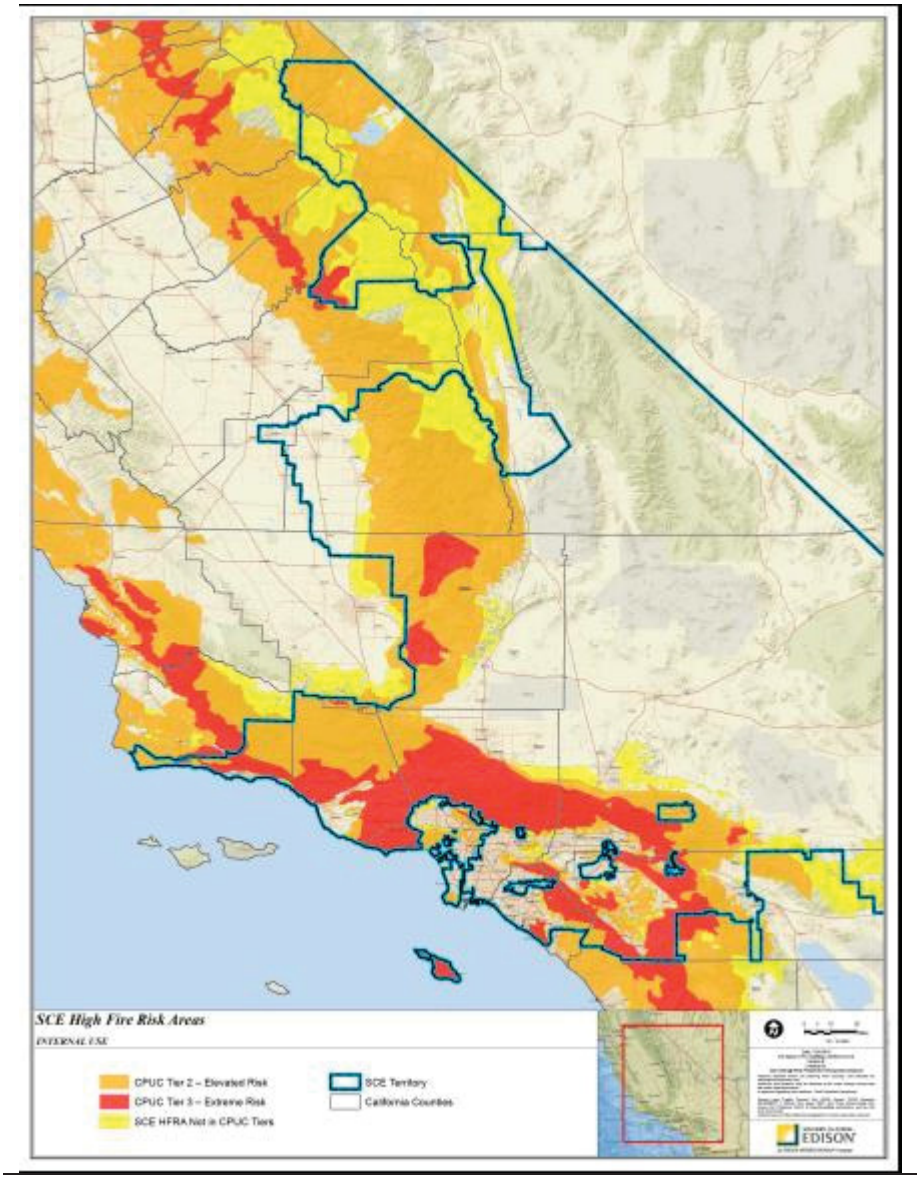
[39] SCE's HFRA designation takes into account the effects and realities of climate change at large, but does not rely on a particular "meteorological or climatological study."

Table 3-5
HFRA in SCE's Service Territory

	Area (Sq. Miles)	Percent of Service Area
CPUC Tier 3 – Extreme Risk	4,708	9 percent
CPUC Tier 2 – Elevated Risk	9,573	18 percent
SCE HFRA Not in CPUC Tiers	4,212	8 percent
TOTAL	**18,493**	**35 percent**

Figure 3-3 below shows the geographical representation of SCE's HFRA, as well as CPUC HFTD.

Figure 3-3
SCE'S HFRA



3.4.2 ACTIONS WITHIN HFRA

3.4.2.1 Changing Definitions of SCE's High Fire Risk Areas (Activity EVAL-1)

Beginning in September 2018, a team consisting of SCE employees with subject matter expertise in fire management/response, fire behavior/fuels, meteorology, maintenance/inspection, grid operations, vegetation management, and geospatial analysis embarked on a project to evaluate these non-CPUC HFRA (divided geospatially into over approximately 1,000 space areas or "polygons"). The evaluation of these areas considered several criteria, including, but not limited to, the presence of overhead assets, density of development/urbanization, vegetation density/type/health, typical wind speed, and circuit design/operation. The objective of this team is to determine whether to retain or exclude the areas under evaluation as "SCE HFRA." SCE will document the reasoning used to determine the final disposition of each of the polygons during the 2019 HFRA evaluation.

If an area is no longer included within SCE's non-CPUC HFRA, that area may be excluded from adhering to protocols associated with maintenance and inspection, grid operating restriction, and reassessment of protection devices in HFRA. Existing protective devices are likely to remain in place as they also provide a valuable reliability benefit. If a non-CPUC HFRA is removed from SCE's HFRA, SCE will reach out to the customers in the affected area and inform them of the changes. Additional details on operational and customer impacts is discussed in subsequent sections.

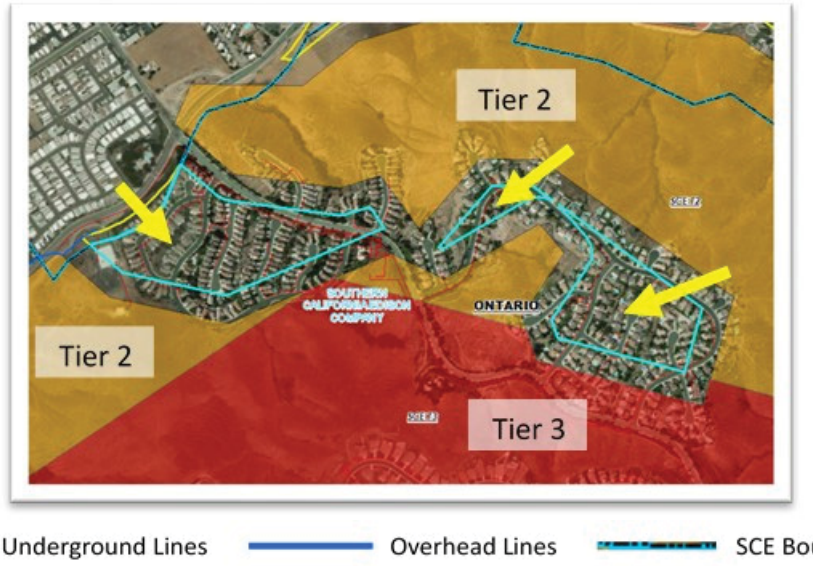
3.4.2.1.1 Non-CPUC HFRA Recommended for Exclusion from SCE HFRA

Examples of the kinds of polygons that will be removed from SCE's definition of HFRA going forward include but are not limited to non-CPUC HFRA that now have non-combustible landscapes, have become urbanized since they were originally included as HFRA, or have subsequently been undergrounded.

3.4.2.1.2 Example of non-CPUC HFRA polygon to be excluded

Figure 3-4 below is an example of a non-CPUC HFRA polygon that is surrounded by CPUC Tier 2 and Tier 3; however it is fully urbanized, and the circuitry is completely underground. There is a low probability of a wildfire associated with utility electrical equipment in an urbanized area where circuitry is undergrounded.

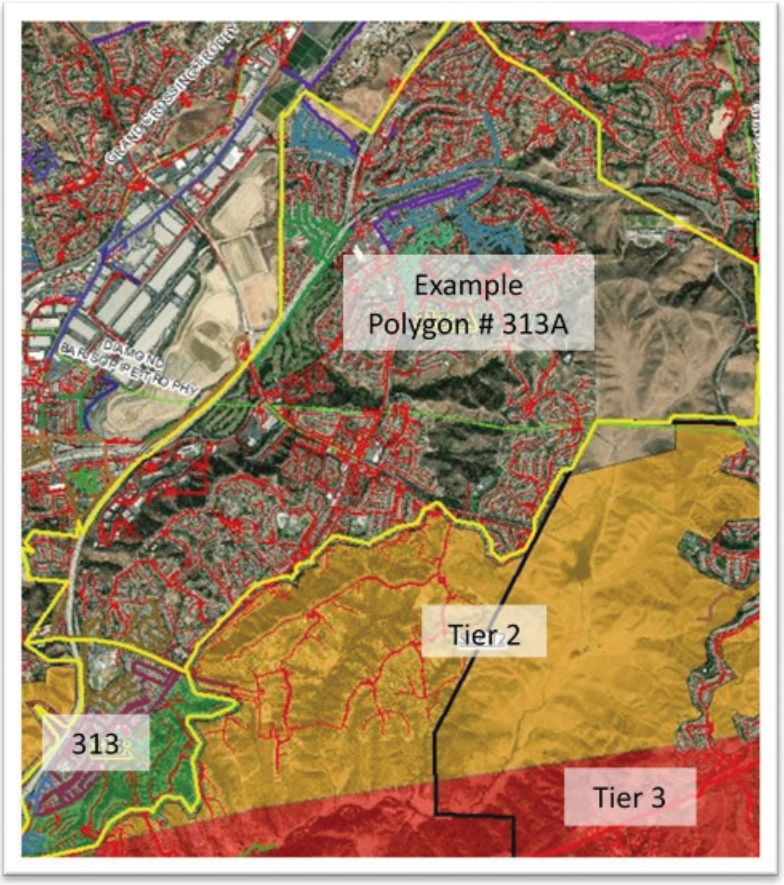
Figure 3-4
Example of a Non-CPUC HFRA Polygon Recommended for Exclusion



3.4.2.1.3 Non-CPUC HFRA Recommended for Retention

Figure 3-5 below illustrates an example of a non-CPUC HFRA that would remain in SCE HFRA. The non-CPUC HFRA has been sub-divided into two areas – one recommended to remain as non-CPUC HFRA and one to be removed. This area has a mix of both overhead and underground circuitry, but it has different adjacencies and proximities to CPUC Tier 2 and Tier 3. Underground circuitry is in red, and the other colored lines (purple and blue) are overhead lines. The primary polygon (#313A) is recommended to be removed as it is highly developed, the areas bordering CPUC Tier 2 are all underground, and there is low vegetation density. However, the subdivided polygon #313 has overhead circuitry that traverses in and out of the CPUC HFTD. Other considerations include a previous fire in this region and homes that border Tier 2, highlighted in green, are in a hilly area with high vegetation density and have prominent, prevailing winds. This creates a higher probability for a fire to propagate into the adjacent hills. Therefore, this area is recommended to be retained as non-CPUC HFRA.

Figure 3-5
Example of a Non-CPUC HFRA Polygon Recommended for Retention



3.4.2.2 Maintenance and Inspection Impacts

Electrical infrastructure assets are to be inspected, maintained, and repaired in accordance with General Orders (GO) 95, 128, and 165. Non-CPUC HFRA that are considered SCE HFRA will be treated as a Tier 2 (elevated) fire-threat.

3.4.2.3 Grid Operating Restriction Impacts

SCE restricts certain operations and switching procedures in HFRA during RFW and elevated fire weather threats. These operating restrictions are defined in SCE's System Operating Bulletin (SOB) 322 that outlines the operational protocols for overhead distribution and subtransmission equipment within HFRA. These guidelines include RFW restrictions, switching protocols, enabling of protective devices such as RAR and patrolling requirements in HFRA.[40] Additional detail on these restrictions and protocols can be found in Section 4.1.

3.4.2.4 Reassessment of Protection Devices in HFRA

SCE deploys certain protective devices, such as RAR and Circuit Breaker (CB) relays, on overhead systems in HFRA in accordance with SCE's SOB 322 and the operational restrictions contained therein. These protective devices are programmed to enable RAR/CB recloser blocking and fast curve settings during

[40] SCE is in the process of revising Standard Operating Bulletin (SOB) 322 to enable blocking of reclosers and execute PSPS during non-RFW weather events.

RFWs.[41] When a HFRA boundary is changed or otherwise moved, a reassessment of the protective devices in the affected areas will be conducted and an appropriate action plan developed. Whether these changes are due to periodic CPUC fire-threat map revisions and/or an internal HFRA assessment as noted above, these reassessments may trigger design/programming changes, device installation/relocation/removal, and system/database revisions.

3.4.2.5 Customer Impacts

As part of its communication strategy supporting awareness and education of SCE's wildfire prevention and mitigation strategies, SCE has sent various communications and conducted community "Town Hall" meetings with customers located within and adjacent to HFRA.

If communities or areas are newly considered as HFRA due to fire-threat map changes or other evolving wildfire risks, outreach efforts, as further described in Section 4.5.4, will be conducted to help keep customers notified and aware of the impacts.

3.5 ACTIVITIES AND 2019 GOALS

Activity	Description	2019 Goal	Compliance Evidence
RA-1	Expansion of risk analysis	Conduct risk analysis which includes, but is not limited to, 2018 fire ignition data, additional distribution and transmission information, and consequence modeling to evaluate wildfire risk at a circuit segment level	• Completed risk analysis • Updated list of prioritized wildfire drivers and risk mitigation efforts
EVAL-1	Evaluation of HFRA boundaries	Complete evaluation of non-CPUC HFRA for retention or exclusion	• A final disposition determination for each polygon • Documentation identifying the criteria used to determine each polygon's final disposition

[41] See Section 4.1 for further explanation.

4 WILDFIRE PREVENTION STRATEGY AND PROGRAMS

This section describes the strategies and programs SCE has implemented, is in process of implementing, and will implement to mitigate the threat of electrical infrastructure-related wildfires and their consequences within its service territory. The strategies and programs also include activities to increase grid resiliency, enhance wildfire suppression, reduce the impact of wildfires and wildfire mitigation efforts on the public, and improve outreach and education with customers, community groups, and other stakeholders about how to prepare for, prevent, and mitigate wildfires in SCE's HFRA. SCE's strategies and programs are described in the following sections.

4.1 OPERATIONAL PRACTICES

Grid Operations is responsible for monitoring and operating SCE's electric system. During significant events, Grid Operations personnel act as SCE's accountable representatives in matters concerning the real-time operation of the system and coordinate activities with external agencies such as fire agencies and emergency response personnel. Grid Operations is also responsible for applying SOBs, which encompass operating protocols, remedial actions, communication and notification protocols, ratings and limits of lines and equipment, and system protection schemes. Qualified employees (e.g., Troublemen, Senior Patrolmen, Foremen, or Field Supervisors) may contact Grid Operations at any time to request a line or line segment be temporarily de-energized or place sectionalizing equipment into "non-automatic" settings to promote public and employee/contractor safety and system reliability. To reduce power line ignitions during extreme weather conditions, overhead subtransmission and distribution lines and line sections are subject to operating restrictions described in SCE's SOB 322 and summarized below.

4.1.1 OPERATIONAL CONSIDERATIONS

4.1.1.1 Red Flag Warning Program

The Red Flag Fire Prevention Program, internally referenced at SCE as the RFW Program, is a statewide wildfire awareness and prevention program in which SCE is a participant along with other key stakeholders such as CAL FIRE, California Office of Emergency Services (Cal OES), U.S. Forest Service (USFS), National Weather Service, and various city and county fire agencies. The program utilizes available CAL FIRE forces, cooperating fire agencies, utilities, citizens' groups, and news media to inform the general public of the potential for major wildland fires and the need to be aware of and exercise fire safe practices to lessen the damage and loss to California watershed, resources, life, and property.

The "Red" in the RFW Program refers to the Santa Ana Wildfire Threat Index (SAWTI)[42] which is produced by the USFS, the National Interagency Coordination Center's Predictive Services and other collaborators to categorize Santa Ana conditions in Southern California according to fire potential. The threat index uses a predictive model that incorporates moisture levels of dead and live vegetation and weather models, including wind speeds and atmospheric moisture, to produce a six-day forecast for potentially large fires. There are five threat categories, purple being the most extreme. The purple category was utilized for the first time in 2017, highlighting the evolving wildfire threat. SCE will activate RFW measures during a Red Flag warning or more severe event, such as a Purple Flag warning. For ease of reference in this WMP, "Red Flag warning" means Red Flag or greater conditions.

[42] SAWTI website: https://fsapps.nwcg.gov/psp/sawti/

SCE's FPP,[43] in compliance with D.14-05-020, is currently applied during RFW conditions (regardless of measured wind speed). It requires specific actions to be taken regardless of the affected area being HFRA or wind speeds not exceeding design criteria for the affected overhead lines. It does not require or depend on real-time wind speed measurements or monitoring. The FPP has historically been updated annually by SCE's Business Resiliency team and/or when changes are made to SOB 322 (which is further described below).

In counties under a RFW, SCE vehicles operating in or near HFRA display temporary "Red Flag Fire Patrol" vehicle signs. Fire agencies pre-deploy personnel and equipment in high fire hazard areas to spot and extinguish fires in their incipient stage. Non-fire agency personnel serve as lookouts, able to spot fires in the incipient stage and quickly notify fire agencies to respond. The presence of these "Red Flag Fire Patrol" placarded vehicles may also serve as a deterrent to arsonists.

When SCE's operating organizations receive notice that a RFW has been issued in their respective operating areas, they adhere to the following:

- "Red Flag Fire Patrol" signs are displayed on vehicles
- Work in HFRA (both emergency and non-emergency) is only performed when the following requirements are met, with limited exceptions:[44]
    - Activities are under the direct observation of the crew foreman or site lead;
    - When the crew can maintain adequate communications (using 900 MHz, cellular, satellite phone, etc.) with other SCE personnel and SCE's Distribution Operations Centers;
    - The crew has fire suppression equipment accessible in the immediate area of the work being performed that would facilitate an immediate response to an ignition (shovels, water backpack, ABC fire extinguisher); and
    - Local weather conditions, terrain, and surrounding vegetation would permit the crew to extinguish a fire resulting from the work being performed.
- The opening of remote-controlled air break pole switches (e.g., Remote Transmission Switches, Remote Controlled Switches), are (when possible) performed under visual observation to detect abnormalities.
- Crews remain on alert for fires or possible fires while working in or passing through fire hazard areas and fires are accurately reported to the appropriate switching or control center as soon as possible.

Further, where hot work (e.g., arc welding/cad welding, burning, grinding, brazing, thawing pipes, etc.) is performed, each work site develops a site-specific Hot Work Plan. The Hot Work Plan identifies hazards and control measures associated with hot work activities.

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[43] 2018 Southern California Edison Fire Prevention Plan: http://www.cpuc.ca.gov/uploadedfiles/cpuc_public_website/content/safety/electric_safety_and_reliability/filings/2018%20sce%20go%20166.pdf

[44] Limited exceptions include when work performed in an area devoid of flammable materials (e.g., parking lot, commercial area, agricultural lands, bare ground, work indoors, etc.) and where sparks or flame are not expected to be emitted.

4.1.1.1.1 Operation of Distribution Voltage Lines in HFRA

SOB 322 is used to standardize the operation of distribution voltage lines traversing HFRA. This operating bulletin imposes operating restrictions on designated overhead distribution lines to reduce the risk of wildfires when the National Weather Service issues a RFW and/or SCE determines there is an elevated fire weather threat that warrants additional protective measures.

Specifically, SOB 322 requires all circuit breakers and reclosers protecting the portions of circuits traversing through HFRA be set to not automatically re-energize following initial activation until the RFW expires and/or elevated fire weather conditions sufficiently abate. In the event protective relays on these circuit breakers operate to interrupt the flow of electricity, the line is not re-energized until the line is patrolled and deemed safe.

SOB 322 also specifies which SCE personnel are responsible for triggering and releasing these restrictions—this proactive approach minimizes any potential delays in responding to events and helps SCE staff to be fully aware of the responsibilities associated with their roles.

Blocking the reclosing feature of these relays can be set remotely on nearly all overhead reclosing devices throughout SCE's service territory. This automated functionality is an important feature that allows system operators located in centralized control facilities to quickly change the reclosing settings (automatic versus blocked) without the need to send crews to actual field locations.[45]

SCE conducts annual reviews of SOB 322 to proactively reevaluate its distribution circuits in HFRA to verify that the automatic switches can be blocked from reclosing in the event of a RFW or other elevated fire weather threats. SCE also reviews the few non-automated distribution circuits in HFRA to confirm that the recloser is non-automatic and operating properly.

4.1.1.1.2 Operation of Subtransmission Voltage Lines in HFRA

In addition to the operation of distribution lines, SCE also utilizes SOB 322 to standardize the operation of subtransmission voltage lines traversing HFRA. This imposes operating restrictions on designated overhead subtransmission lines to reduce the risk of wildfires when a RFW is issued or other elevated fire weather threats are identified. Specifically, SOB 322 requires all circuit breakers feeding subtransmission lines traversing HFRA be made non-automatic until the RFW expires or other elevated fire weather conditions sufficiently abate. With very few exceptions, the operation of subtransmission lines is similar to that of SCE's distribution lines, noted above.

4.1.1.1.3 Patrolling Requirements in HFRA

During a RFW or other elevated fire weather threat, if a distribution or subtransmission line or line section in the HFRA experiences a fault and the line relays, it is not re-energized until patrolled. A patrol, while operating restrictions are in effect, includes a visual check of all overhead main line and branch line conductors and equipment. A line section may be isolated and re-energized after a patrol with no cause found. Subsequent line sections may then be patrolled, isolated and re-energized until the faulted line section is found or the entire line and equipment has been patrolled. Fast curve settings, described further below, are temporarily disabled on all upstream interrupting devices for each section that is re-energized during the restoration to avoid undesirable circuit interruptions during the restoration

[45] A small population of reclosers/circuit breakers are set to be blocked year-round or can only be manually tested by control room personnel after a patrol of the line has been conducted.

process. When a line or line section relays with a fault located, the remaining upstream and downstream line sections are patrolled prior to re-energizing.

Once the patrol has been completed, whether the problem was found and isolated or there was no cause found, the line or line section recloser remains non-automatic until the RFW expires or other elevated fire weather conditions sufficiently abate.

This additional patrolling may cause longer outages for customers but is required for safety reasons prior to re-energization.

4.1.1.1.4 Distribution Blocking for RAR and Circuit Breakers

RAR are protective devices applied to mainline conductors that can automatically interrupt faults. SCE has existing RAR, and plans to install additional RAR, which will permit SCE to remotely block reclosing in SCE's HFRA during a RFW or other elevated fire weather threat. The RAR will provide faster and more selective "fault clearing" to further reduce fire ignition risks and lessen service interruptions for SCE customers. If RAR protection is unavailable, SCE blocks reclosing at the substation CB. A thorough patrol of the circuit is required prior to isolating the fault condition and restoring power.

4.1.1.1.5 Fast Curve Settings for RAR and Circuit Breakers

Fast curve settings modify the relay fault detection curve, providing faster fault detection and interruption. SCE has developed and started deploying fast curve settings on distribution voltage RAR and CB on circuits that traverse HFRA. These fast curve settings reduce the fault clearing time, which reduces heat and arcing, and as a result, the likelihood of ignition. Like the blocking of reclosers, fast curve settings can be remotely activated or de-activated by SCE system operators through SCE's monitoring and control radio network. Lastly, if a fault interrupts a circuit when fast curve settings are enabled, SCE will only re-energize these lines after a patrol of the line has been performed and it is safe to do so.

4.1.1.1.6 Air Operations

SCE utilizes its Aircraft Operations department (Air Operations), which operates a fleet of helicopters and unmanned aerial vehicles (UAV (i.e., drones)), to assist in patrolling distribution and transmission lines. Air Operations also provides as-needed, aerial surveillance (e.g., line/equipment inspections, burn scar analyses, debris flow analyses, etc.) following fire and weather-related storms. As conditions allow, Air Operations also assists in the transport of personnel and material to remote locations.

4.1.1.1.7 Annual SOB 322 Review (Activity OP-1)

In 2019, SCE will review and update SOB 322 to reflect lessons learned from past elevated fire weather threats, including those where a RFW was not issued. Additionally, SCE will integrate, where applicable, new and improved data from its situational awareness resources to bolster risk-informed decision making and improve operational effectiveness during elevated fire weather threats.

4.1.2 WILDFIRE INFRASTRUCTURE PROTECTION TEAMS

SCE has permanent Fire Management Officers and specialized experts with fire service and electrical backgrounds that monitor, respond to and provide information on fires affecting, or determined to have the potential to affect, SCE infrastructure. During an active fire event, the team provides a weekly update report to the CPUC. These personnel represent SCE during fire incidents, often embedding in the fire management structure and serving as a liaison to it. They help coordinate SCE's response to fires by

providing information to manage the bulk electric system, repair damage, restore the electric system, and safely gain access to begin restoration work. These personnel maintain close working relationships with fire and emergency management agencies throughout the service territory and serve as consultants and subject matter experts on fire risk management. They provide actionable and timely information to responsible personnel throughout SCE. They also enhance first responder safety by developing and delivering Electrical Safety for First Responders Awareness Training.

SCE's staff includes a team of meteorologists who are members of the American Meteorological Society and who are specifically educated in Atmospheric Sciences. SCE's meteorologists support pre-incidents by monitoring evolving weather, fuel and other conditions that might lead to fire event events and other hazardous conditions. In addition, these meteorologists coordinate the installation of weather stations; work with vendors to deploy high resolution weather models; develop new tools and products to support SCE's Situational Awareness Center; explore new models to predict fire potential; and support incidents and pre-incidents by providing meteorological expertise (including on a twenty-four hour, seven-day-a-week schedule at SCE's Situational Awareness Center during activated incident management conditions). SCE also employs Geographic and Information System (GIS) specialists that provide support for various mapping activities, such as working with SCE's meteorologists to aggregate data to inform decision making.

4.1.2.1 GIS Data Availability

Real-time information is vital to the success of mitigation activities and incident management and provides a necessary common operating picture of how impacts to SCE infrastructure during an incident may affect local communities. SCE is currently engaged in an effort that regularly provides GIS data, such as general SCE infrastructure locational information, outage maps and related vegetation databases to local governments in SCE's service territory, CAL FIRE, Cal OES, and the CPUC prior to any active incident.[46] SCE will continue to work with local and state government to further improve GIS data sharing practices.

During an active incident, SCE designates a point of contact for all external agencies and establishes open lines of communication with affected local communities as well as the California State Warning Center (CSWC) and the CPUC's SED. Regular, ongoing situational updates on the status of the incident including maps of circuits affected and impacts to local communities due to de-energization are continually shared and actively updated for the duration of the incident.

4.1.2.2 Additional Staffing (Activity OP-2)

In 2018, SCE hired one meteorologist, one fire management officer, and one fire scientist. SCE plans to hire one additional meteorologist in 2019. Increasing fire risk has placed a significant strain on SCE's fire management officers, who also support system planning efforts related to grid resiliency. The additional fire management officer will help SCE continue to timely respond to fire incidents and coordinate with first responders. The new fire scientist will help build and mature complex fire models designed to predict wildfire ignition and propagation by considering multiple variables such as weather, fuel, and asset conditions. As further described in Section 4.5, these models will inform SCE's Incident Management Team (IMT) of severe fire conditions which may require deployment of PSPS in HFRA. The additional meteorologist will support the tasks described above. Moving forward, SCE will continue to

[46] GIS data that SCE provides includes general locations of SCE infrastructure and is not considered critical energy infrastructure information (CEII) under federal law.

evaluate the need for additional fire management experts to support the Wildfire Infrastructure Protection Team.

4.1.3 ACTIVITIES AND 2019 GOALS

Activity	Description	2019 Goal	Compliance Evidence
OP-1	Annual SOB 322 Review	Review and update SOB 322 to reflect lessons learned from past elevated fire weather threats and integrate, where applicable, new and improved data from its situational awareness resources	Updated SOB 322
OP-2	Wildfire Infrastructure Protection Team Additional Staffing	Hire one additional meteorologist	Human Resources record of date hired

4.2 PLANS FOR INSPECTIONS OF ELECTRICAL INFRASTRUCTURE

4.2.1 PROGRAM OVERVIEW

SCE's distribution, subtransmission, transmission, and substation facilities are inspected or patrolled annually through its DIMP, Transmission Inspection and Maintenance Program (TIMP), Substation Inspection and Maintenance Program (SIMP), and the Quality Oversight/Quality Control groups to facilitate compliance with state and federal requirements. SCE's inspection and maintenance programs are designed to proactively identify and remediate potential equipment/facility failure. These inspection and maintenance programs help reduce potential ignition events and improve reliability and grid resiliency by replacing failed or failing equipment. Because certain inspection programs are linked with routine maintenance programs, this section provides descriptions and activities for both.

4.2.2 EXISTING INSPECTION AND MAINTENANCE PROGRAMS

4.2.2.1 Distribution Inspection and Maintenance Program

DIMP helps SCE maintain public and worker safety and regulatory compliance by completing scheduled detailed inspections and AGP in conformance with GO 165, and performing distribution infrastructure maintenance, as described in SCE standards and in accordance with GO 95, GO 128, and prudent utility practice. The purpose of DIMP is to 1) provide procedures, instructions, and guidance to the field inspectors who perform detailed inspections and patrols of distribution equipment and 2) outline criteria to prioritize inspection findings and schedules to complete repairs and replacements of distribution infrastructure based on the condition of each asset and its potential for impact on safety and reliability, considering various factors.

The maintenance aspect of DIMP focuses on the repair or replacement of distribution infrastructure identified through SCE's inspection programs, equipment, and structures that fail in service, and engineering analyses, for the safety of the public, contractors, and SCE personnel.

DIMP uses a three-priority rating system designed to identify and prioritize action items to resolve safety and reliability issues. A Priority 1 issue typically requires 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. An example would be a broken cross arm on a pole.

Priority 2 issues are considered to be lower risk and therefore may be resolved that day or within 24 months based on the existing safety or reliability condition and location. However, if the Priority 2 issue is located within HFRA and poses a potential fire risk, remediation work will be completed within 12 months. In an extreme fire threat area or Tier 3, the maximum remediation time is within 6 months.

Priority 3 issues currently 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. Beginning June 30, 2019, new Priority 3 issues will require remediation within 60 months pursuant to D.18-05-042.

Below is a Risk Assessment Matrix to illustrate the relationship between reliability and safety. The Risk Assessment Matrix provides inspectors guidelines to assign a reasonable timeframe for the correction or re-inspection of any distribution facility condition.

Figure 4-6
Risk Assessment Matrix

Reliability (Failure Risk)	No/Slight Impact	Minor Impact	Moderate Impact	High Impact
Component Failure could lead to System Failure	Priority 2 Action Required 13-24 Months	Priority 2 Action Required 4-12 Months	Priority 2 Action Required 0-3 Months	Priority 1 Action Required Immediately
Component Has Failed No significant risk to system	Priority 3/No Action Required Only 95/128 Infractions Recorded	Priority 2 Action Required 13-24 Months	Priority 2 Action Required 4-12 Months	Priority 2 Action Required 0-3 Months
Potential Component Failure	Priority 3/No Action Required Only 95/128 Infractions Recorded	Priority 3/No Action Required Only 95/128 Infractions Recorded	Priority 2 Action Required 13-24 Months	Priority 2 Action Required 4-12 Months
	Safety **(People/Property/Environment)**			

The major programs within DIMP are further described below.

4.2.2.1.1 Overhead Detail Inspection Program

The purpose of the Overhead Detail Inspection (ODI) program is to perform a close in-depth inspection of SCE's overhead electrical distribution facilities, such as poles, capacitors, switches, transformers, conductors, guy wires and risers, with the intent to identify and document visually apparent conditions. ODI inspectors also verify the accuracy of asset information and facility inventory mapping references for appropriate corrective actions. ODI adheres to GO 165 inspection frequency of 5 years for detailed inspections.

Inspectors identify and perform certain maintenance tasks during the course of the detailed inspections. ODI inspectors make minor repairs at the "public" level while at the site, to the extent possible, rather than having other SCE personnel return later to make the repairs. The public level is typically an area that is readily accessible to the general public, approximately 8 feet up from the ground level for a utility pole. Examples of typical minor repairs are installing new visibility strips, replacing damaged ground molding at the public level, installing guy guards, installing pole tags, and removing unauthorized attachments. For conditions that cannot be repaired during the inspection, the ODI inspectors document and prioritize items for follow-up corrective action in accordance with the priority classifications described above. These routine maintenance repairs and replacements resulting from ODI are considered preventative maintenance and have secondary wildfire risk mitigation benefits. The inspector will also identify, document and report any safety or reliability conditions created by communication company activities on inspected poles that result in General Order (GO) 95 and/or GO 128 infractions, and GO 95 and/or GO 128 infractions created on or near distribution facilities by non-utility third parties that are not subject to CPUC jurisdiction, such as unauthorized attachments.

4.2.2.1.2 Annual Grid Patrol

The purpose of the AGP is to visually inspect SCE's overhead and above-ground underground electrical distribution facilities every year to identify and document obvious safety and reliability conditions that require corrective action.[47] AGP adheres to or exceeds the inspection frequencies required within GO 165. The grid patrol inspector performs a simple visual inspection of publicly-accessible electrical distribution facilities within the assigned inspection area. Annual patrols are performed primarily from ground vehicles but can also be performed by foot or by aircraft. When conducting annual patrols, the inspectors also assess visible portions of distribution underground systems such as pad-mounted transformers, vault lids, and vent pipes. Like ODI, these inspectors document and prioritize items for follow-up corrective action in accordance with the priority classifications described above. These routine maintenance repairs and replacements resulting from AGP are considered preventative maintenance and have secondary wildfire risk mitigation benefits.

4.2.2.1.3 Underground Detail Inspection Program

The purpose of the Underground Detail Inspection (UDI) program is to perform an in-depth inspection of SCE's underground distribution facilities and pad-mounted equipment including structures, switches, transformers, visible cables, and associated components. UDI inspectors identify and document safety hazards and visually apparent conditions, and verify the accuracy of asset information and facility inventory mapping references for appropriate corrective actions. UDI adheres to GO 165 inspection frequencies of three years for subsurface facilities and five years for pad-mounted facilities. Inspectors identify and perform certain maintenance tasks and minor repairs during these detailed inspections. Typical minor repairs can include such things as installing new signage, structure tags, securing vault lids and removing debris. Like the ODI program, for conditions that cannot be repaired during the inspection, the UDI inspectors document and prioritize items for follow-up corrective action in accordance with the priority classifications described above. The crews are typically comprised of a lineman and a groundman who have received specialized training to work in underground vaults and near energized high voltage equipment. These routine maintenance repairs and replacements resulting from UDI are considered preventative maintenance and have secondary wildfire risk mitigation benefits.

[47] In many cases, the ODI can satisfy the AGP requirement for compliance purposes.

4.2.2.2 Transmission Inspection and Maintenance Program

SCE's TIMP helps maintain public and worker safety and regulatory compliance by completing scheduled inspections of subtransmission and transmission assets, in conformity with GO 165, and performing transmission maintenance, in accordance with GO 95, GO 128, SCE standards, and prudent utility practice. The purpose of TIMP is to 1) provide procedures, instructions, and guidance to field inspectors who perform detailed inspections and patrols and 2) specify guidelines to prioritize and complete repairs and replacements of transmission infrastructure based on the condition of each asset and its potential for impact on safety and reliability, considering various factors. Any abnormal conditions, such as a broken cross arm or damaged tower footings identified through TIMP are repaired immediately if categorized as a Priority 1 condition. Priority 2 conditions are corrected within 12 months in Tier 2 HFRA, within 6 months in Tier 3 HFRA, and within 36 months in non-HFRA.

SCE conducts annual routine patrols of overhead lines, communication circuits, above-ground equipment, and overhead components of underground circuits, such as riser poles, terminations, and lightning arrestors. Rights-of-way inspections are incorporated into transmission circuit patrols and are not considered a separate inspection program. Detailed inspections of overhead lines, communication circuits, underground lines and vaults are conducted every three years. Patrols and detailed inspections are performed and completed by Senior Patrolmen or qualified Linemen.

Additional inspections are performed on overhead lines that run through densely populated urban areas, more rugged rural areas, or geographic locations facing severe weather or environmental conditions (e.g., high winds, coastal areas exposed to salt, etc.). Inspections are also performed after unplanned events, such as severe weather, fires, and equipment malfunctions. Inspectors document any discrepancies, which are evaluated against construction and compliance standards to determine the item's priority level and sets the timeframe for corrective action.

SCE's underground subtransmission and transmission lines, along with the structures housing the lines, require routine inspections to detect and remedy any degradation. SCE performs these activities on a predetermined schedule to comply with the requirements of GO 128. At a minimum, all overhead components including riser poles, terminations and lightning arrestors are inspected annually under GO 95. Annual inspections also include the examination of transmission components within each substation. Inspections of the underground components, which include vaults, cable, splices, and shield arrestors, are inspected at a minimum once every three years. Emergent line inspections to assess component or structural damage are performed after unplanned events, such as severe weather, lightning, fires, equipment malfunction, and other incidents that may have caused circuit interruption or damage.

Transmission maintenance is driven by inspection results or Infrastructure Replacement Program activities. Sometimes, field observations lead to projects to address emergent issues in a particular grid or equipment or structure type. In other instances, projects are identified through SCE's Transmission Infrastructure Replacement program, which identifies maintenance work for items such as conductor and switch replacements using grid and/or engineering analyses. SCE initiated its Transmission Infrastructure Replacement program in 2013 to address safety and/or reliability risk resulting from issues with aging transmission infrastructure that were identified but had not led to equipment failure. The criteria for projects identified in this program includes the replacement of obsolete or deteriorated assets.

4.2.2.3 Substation Inspection and Maintenance

SIMP helps SCE maintain public and worker safety and regulatory compliance by completing scheduled inspections, in conformance with GO 174, and by performing maintenance and testing of equipment, as described in SCE standards and in accordance with prudent utility practice. SIMP also facilitates SCE's testing of its protection systems to meet regulatory requirements and commitments, such as North American Electric Reliability Corporation (NERC) reliability standards.[48] This protection system testing consists of routine inspection and maintenance in conjunction with repairs and replacement of equipment, such as distribution relays, as necessary. Distribution relays less than 66 kV in HFRA have 6-year test intervals, while those that are outside of HFRA are inspected every 12 years.

4.2.2.4 Pole Inspections

SCE's pole inspection programs are included in this section. The repair and replacement of poles resulting from these inspections are described in Section 4.3.

4.2.2.4.1 Intrusive Pole Inspection Program

The purpose of the Intrusive Pole Inspection (IPI) program is to evaluate SCE's wood poles using visual and internal examination of the poles to identify and document damage or decay requiring remediation. GO 165 requires intrusive inspections for all poles at least 15-years old, or older, to be completed using a 10-year cycle. Intrusive inspections involve drilling into the pole's interior to identify and measure the extent of internal decay, if any. Inspectors will apply a preservative to poles that pass the inspections to reduce the likelihood of future decay when conditions warrant.[49] Inspectors may also perform a visual inspection on poles that are in the inspection grid but that are younger than 15 years old to look for signs of obvious external damage. The inspector analyzes the integrity of the pole and classifies it for repair or replacement, as necessary. Approximately 10,000 poles are identified for repair or replacement each year through this program across SCE's service territory. IPI is an integral part of the Deteriorated Pole Program established in 1997; the Deteriorated Pole Program is further discussed in Section 4.3.

4.2.2.4.2 Pole Loading Program

The Pole Loading Program (PLP) is an inspection and remediation program to identify poles that do not meet safety factor requirements of GO 95 and SCE's internal design and construction standards territory for repair or replacement. PLP's goal is to assess the structural loading capabilities of the approximately 1.4 million poles in SCE's service territory to meet current design standards by 2021, and to continue addressing pole overloading issues by 2025. This program is designed to verify that the structural integrity of existing poles is sufficient to withstand anticipated wind loads acting on poles including wind loading in high wind areas within SCE's service territory. PLP prioritizes assessment of poles in HFRA. Although the CPUC requires a design wind pressure of 6 pounds per square foot (with 0.5 inches of radial ice) or 8 pounds per square foot (no ice), SCE adopted higher wind loading design standards of 12, 18, and 24 pounds per square foot in addition to the standards for 6 and 8 pounds. This is based on meteorological studies in areas with higher wind velocities. The wind-loading criteria that SCE applies is based on specific line locations and potential wind speeds at those locations. SCE will continue to assess pole conditions and replace poles, where applicable, based on the higher wind loading criteria outlined above. All poles that require replacement are prioritized based on their safety factor and on whether

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[48] For example, NERC Reliability Standard PRC-005-6 – protection system, automatic reclosing, and sudden pressure relaying maintenance.

[49] Preservatives are applied in conformance with the regulations of the California Department of Pesticide Regulation. In 2016 and 2017, 99.76% of passing poles had preservatives applied.

the pole is in HFRA. SCE typically replaces wood poles with new wood poles that meet or exceed SCE's current standards, and in some circumstances, SCE utilizes light weight steel poles for its subtransmission overhead system or composite poles for its distribution overhead system. PLP has secondary wildfire risk mitigation benefits.

4.2.2.5 Quality Oversight / Quality Control

SCE's Quality Oversight / Quality Control group performs independent evaluation of activities that impact the safe, reliable, and affordable delivery of electricity and partners with organizations throughout Transmission and Distribution (T&D) to correct quality gaps. The Quality Oversight / Quality Control group assesses compliance with GO 95, 128, 165, and 174 in addition to various SCE maintenance, inspection, and construction standards.

Current Quality Oversight / Quality Control programs include inspection of distribution overhead and underground construction by SCE and contract crews. The group also assesses performance quality of compliance-driven inspection programs such as ODI, UDI, and IPI; performs quality assessments of vendor-performed pole loading calculations for PLP; and assesses performance quality of vendor-performed steel stub pole repairs.

4.2.3 ADDITIONAL ACTIONS TAKEN IN HFRA

4.2.3.1 Enhanced Overhead Inspections and Remediation (Activity IN-1 and IN-2)

In light of rapidly evolving wildfire risks, SCE continues to review and assess its inspection and maintenance programs to keep pace with the evolution of wildfire threats. Historically, SCE's inspection and maintenance programs have been developed and executed with a focus on regulatory compliance, and multiple inspection programs have been established over time to meet additional compliance obligations.

To address the evolving wildfire risk beyond existing programs, SCE commenced the EOI initiative with two primary goals. The first goal is to conduct inspections of all overhead transmission and distribution structures (approximately 50,000 transmission structures and 380,000 distribution structures) and equipment in HFRA with a focus on potential ignition risk conditions. These inspections started in late 2018, and SCE is attempting to complete them before the start of the height of the 2019 wildfire season. Inspections are being conducted by qualified electrical workers, and remediation identified during these inspections will be categorized using the three-priority rating system as described in Section 4.2.2.1. Remediation activities likely will include, but are not limited to, vegetation pruning/removals and the repair or replacement of overhead structures and equipment, such as conductors, poles, cross arms, insulators, and transformers. As part of the EOI effort, SCE will also assess and deploy additional system hardening measures to reduce ignition risk or increase grid resiliency, as appropriate, based on conditions observed. These measures may include, but are not limited to, wildlife protection (e.g., critter guards), long span mitigations (e.g., installation of line spacers, reconductoring, cross arm replacement), and the application of fire-retardant coatings to poles and in some cases surrounding vegetation.

The second goal of the EOI initiative is focused on SCE's desire to evolve from a compliance-based approach to a risk-based approach that adequately addresses the evolving wildfire threat. Inspection results will be analyzed in light of SCE's existing inspection, maintenance and capital programs, a risk-based inspection and remediation model will be explored, and lessons learned from the EOI initiative will be studied. The results of these analyses will serve as a foundation for a risk-based inspection and maintenance strategy that is likely to impact the objectives, design, and tactics of existing inspection and

maintenance programs moving forward. Furthermore, SCE anticipates that these findings may also influence future design, engineering, construction, and operational standards/procedures to assess wildfire risks throughout the asset lifecycle.

4.2.3.2 Quality Oversight / Quality Control of EOI (Activity IN-3)

SCE's Quality Oversight / Quality Control group will perform independent quality control (QC) inspections on approximately 7,500 transmission and distribution structures in HFRA based on EOI in 2019. These QC inspections will be performed utilizing sampling to ascertain the effectiveness of the EOI inspections. The QC inspections exceed the requirements of GO 165. Any conditions identified as part of the QC process will be remediated. Additionally, in 2019, SCE will further refine and adjust its sampling methodology using a risk-based prioritization for differing wildfire risk levels within HFRA.

4.2.3.3 Distribution Infrared Inspection Program (Activity IN-4)

The Distribution IR Inspection program, which SCE began in 2017, provides for routine, ground-based infrared inspections of overhead distribution facilities in HFRA. SCE conducted IR inspection on overhead distribution energized facilities on all circuits in HFRA in 2017-2018. The infrared inspections are performed using infrared cameras (heat-sensing cameras), which may find deterioration-indicating conditions not visible to the human eye. IR inspections can detect a wide range of anomalies, including, but not limited to, failing switch and fuse contacts, poor connections, loose bushings, overloaded/failing transformers, and other issues that can result in component failure. The findings are evaluated and prioritized per SCE's current DIMP and addressed in the respective remediation timeframes. As described in SCE's GSRP application and supporting testimony, SCE will conduct another cycle of IR inspections of overhead distribution energized facilities on all circuits in HFRA over 2 years, in 2019-2020.

4.2.3.4 Transmission Infrared and Corona Inspection Initiative (Activity IN-5)

In addition to the EOI initiative noted above in Section 4.2.3.1, SCE launched a Transmission IR and Corona inspection effort focused on certain subtransmission and transmission (hereafter collectively referred to as transmission) lines in HFRA. This effort, which started in the first quarter of 2019, seeks to perform an IR and Corona scan of all overhead transmission facilities and equipment located in HFRA.[50] Specialized infrared and ultraviolet (Corona) light cameras are typically mounted to helicopters and the line is flown, with special attention paid to splices, conductor connection/attachment points, and insulators. The IR scan detects temperature differences and heat signatures of components, which may indicate problems (not visible to the naked eye) that could result in component/conductor failure. The Corona scan detects the degree of electric discharge or 'leakage' due to the ionization of air surrounding high voltage electric components, which, if substantial enough, could result in an arc flash or mechanical component failure. In addition, a high-definition camera takes pictures of anomalies found for review. A remediation plan is developed for anomalies and integrated with any needed repair or replacement resulting from the physical EOI of transmission assets. To further mitigate wildfire ignition risks, the results from this initiative will be factored into the continuous improvement of SCE's TIMP and Quality Oversight/Quality Control programs and the design and construction of transmission facilities.

4.2.4 ACTIVITIES AND 2019 GOALS

[50] Industry standard practice is to IR scan transmission lines operating at 40% or higher of rated line capacity. SCE is evaluating the ability to capture IR images at lower rating capacities.

Activity	Description	2019 Goal	Compliance Evidence
IN-1	Distribution Enhanced Overhead Inspections and Remediation in HFRA	1) Complete visual inspection of all distribution circuits in HFRA before 5/31 2) Remediate all conditions that create a fire risk in accordance with CPUC requirements	Enhanced Overhead Inspection and Maintenance records
IN-2	Transmission Enhanced Overhead Inspections and Remediation in HFRA	1) Complete visual inspection of all transmission circuits in HFRA before 5/31 2) Remediate all conditions that create a fire risk in accordance with CPUC requirements	Enhanced Overhead Inspection and Maintenance records
IN-3	Quality Oversight / Quality Control of EOI	1) Perform quality review on approximately 7,500 Transmission and Distribution structures in HFRA based on EOI inspections	Quality Oversight / Quality Control records
IN-4	Infrared Inspection of energized overhead distribution facilities and equipment	1) Inspect 50% of overhead circuit lines in HFRA 2) Remediate conditions as required based on inspection results	Infrared inspection records
IN-5	Infrared Inspection, Corona Scanning, and High Definition imagery of energized overhead transmission facilities and equipment	1) Complete IR, Corona, and HD image scanning of all overhead transmission lines in HFRA that are loaded to 40% of rated capacity or higher 2) Integrate remediation with EOI activities	Infrared inspection records

4.3 SYSTEM HARDENING TO ACHIEVE HIGHEST LEVEL OF SAFETY, RELIABILITY, AND RESILIENCY

4.3.1 PROGRAM OVERVIEW

SCE's system hardening effort is largely an ongoing, multi-year program focused on wildfire prevention (i.e., reducing ignitions) and enhancing system resiliency (i.e., reducing damage to electrical infrastructure from fires). For example, replacing standard "bare" overhead conductor with "covered" conductor in HFRA is expected to significantly reduce ignitions caused by foreign objects such as palm fronds, metallic balloons, debris, etc. Additionally, use of composite/fire retardant poles provides a two-fold benefit. First, such an approach improves system resiliency and reduces damage to electrical facilities by ensuring poles do not burn and result in attached equipment (e.g., conductor, transformers, etc.) falling to the ground. Second, it reduces restoration time as composite poles are more fire-resistant, thereby reducing the amount of poles needing replacement.

To address the increased wildfire risk, SCE is implementing many of the activities described in the GSRP and this WMP, as well as assessing the potential to accelerate certain activities described in its GSRP

application. Even if SCE is successful at accelerating certain activities, programs such as SCE's WCCP in HFRA will be a long-term program.

SCE's grid hardening activities in this chapter primarily targets the distribution system (with some also being applicable to higher-voltage subtransmission and transmission lines) in HFRA due to the higher risk of fire ignition from distribution power lines compared to transmission-level power lines. As noted in Chapter 3, in 2019, SCE will conduct additional risk-based analyses focused on its subtransmission and transmission infrastructure in HFRA to consider additional wildfire mitigation programs and activities.

4.3.2 EXISTING SYSTEM HARDENING PROGRAMS

SCE's existing system hardening strategies have evolved over time and provide wildfire risk mitigation. For example, automated equipment such as circuit breakers, and RAR are standard pieces of equipment throughout SCE's service territory and are used to quickly detect faults, isolate circuits, and restore electric service to customers. RAR have been used at the high-fire boundaries in SCE's service territory for decades, and SCE has had reclosing restrictions on distribution lines traversing HFRA since the 1950s. As described in Section 4.1, RAR and circuit breakers on distribution lines prevent reclosing following a fault, which lessens the potential for ignitions from distribution line faults during RFW events or other high wildfire risk conditions. SCE also has the capability to remotely disable groups of reclosers during RFW events or other high wildfire risk conditions. SCE has previously targeted HFRA to mitigate wildfire risk. For example, sensitive ground schemes have previously been deployed in HFRA; sensitive ground schemes reduce the magnitude of current delivered to ground faults and allow for lower, more sensitive ground protection settings, thus minimizing ignition risk. While three-phase and phase-to-phase fault currents are not reduced, these schemes do provide a reduction in energy for ground faults.

SCE follows several principles when designing its system, including using wider easements and rights-of-way (ROW), and clearing buffers around substations to reduce the possibility of ignition due to debris contacting substation equipment.

Over the years, SCE has implemented many infrastructure replacement and improvement programs. These programs help mitigate wildfire risk and include replacement programs designed to mitigate in-service failures for aging distribution and transmission assets (e.g., wooden poles, overhead conductors, relays, etc.) and replacements for safety purposes. SCE reviews its multi-year plan for these infrastructure programs during the annual operating plan process and, as necessary, reprioritizes and adjusts program accordingly. These infrastructure programs, outlined in detail in SCE's 2018 GRC filing, include, for example, OCP and the Deteriorated Pole Program, and are described below.

As part of SCE's equipment and hardware selection process, SCE uses the CAL FIRE Power Line Fire Prevention Field Guide, which identifies utility equipment that has increased safety margins and a lower likelihood of causing ignitions. The guide was created to collectively document utility best practices for line construction with safer equipment and materials. Beyond the Power Line Fire Prevention Field Guide, SCE may use additional fire resilient materials, where available, and after evaluating the relative tradeoffs of using such materials. The following sections include summaries of SCE's major existing system hardening programs that have wildfire risk mitigation benefits.

4.3.2.1 Design and Construction Standards

SCE has traditionally designed its system to safely deliver reliable and affordable power to customers, and these efforts often provide direct or indirect wildfire mitigation benefits. SCE has detailed standards

for design, engineering, and construction that supplement or exceed minimum regulatory requirements for all of SCE's electrical infrastructure.[51] Additionally, SCE regularly reviews and updates these standards based on new requirements, construction methods, technologies, etc. Design and construction standard changes that SCE has made or is making to further mitigate wildfire risks are described below.

4.3.2.2 Overhead Conductor Program

SCE's OCP is a long-term program that pre-dates this WMP, and which is aimed at reducing the risks associated with downed energized conductors and covers all of SCE's service area. OCP evaluates and reconductors small wire circuits with the greatest public safety risks from a wire down event. OCP prioritizes circuits based on various factors, including circuits that serve many customers and are in densely populated areas where reliability and public safety risks from human contact with a downed wire are greatest, not the wildland-urban interface that is typical of HFRA. Even though OCP's primary focus is not specifically wildfire risk mitigation, it does have important secondary wildfire risk mitigation benefits, such as preventing wire down events that could have led to ignitions.[52]

4.3.2.3 Deteriorated Pole Program

SCE's Deteriorated Pole Program was established pursuant to the distribution pole inspection program in compliance with GO 165, which became effective in 1997. As discussed in Section 4.2, GO 165 requires intrusive inspections for all poles at least 15 years old, or older, to be completed within 10 years of program inception. Thereafter, it requires all poles to be intrusively inspected by the time they are 25 years old and then re-inspected at least once every 20 years. SCE completed its first cycle of intrusive inspections in 2007 and continues intrusive inspections through the IPI program. SCE's Deteriorated Pole Program replaces poles throughout its service territory based on the results of these inspections, as described below.

Besides poles identified because of the formal inspection program, poles identified as deteriorated per other programs may be submitted to the Deteriorated Pole Program for replacement based on their external condition. If these poles meet the criteria for external decay outlined in the program standard, they are prioritized according to the standards described above for replacement in the Deteriorated Pole Program. Like OCP, to the extent this program reduces the risk of deteriorated pole failures in HFRA, it has important secondary wildfire risk mitigation benefits.

4.3.2.4 Capacitor Bank Replacement Program

Capacitor banks are used in SCE's distribution system to regulate the voltage to usable levels by compensating for load inductance and to maintain adequate voltage levels (at least 95% of nominal service voltage levels). Inadequate voltage could damage customers' electrical equipment and appliances. Serious voltage drops resulting from inadequate capacitance could conceivably lead to grid collapse. SCE replaces capacitor banks under two criteria: age-based replacements or inspection driven replacements. Inspection of the capacitor banks is part of SCE's preventive maintenance program. Once every five years, each capacitor bank in SCE's system is inspected for proper operation, corrosion, leaking

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[51] These include, for example, Distribution Overhead Construction Standards, Distribution Design Standards, Transmission Overhead Construction Standards, Transmission Design and Right-of-Way Manual, and many others. For a complete list of all of SCE's design, engineering and construction standards please see Appendix C.

[52] In the context of this WMP, "secondary wildfire risk mitigation benefits" means that the program was not primarily designed in the first place to reduce wildfire risk, but it nonetheless has wildfire risk mitigation benefits.

oil, and loose connections. Capacitor banks requiring replacement or repair are recorded and prioritized for follow-up work. The expected average time to wear out of an overhead capacitor bank is estimated at about 30 years, at which time failure rates begin to increase. To the extent this program reduces risk related to capacitor bank failures located in HFRA, it has important secondary wildfire risk mitigation benefits.

4.3.2.5 Automatic Reclosers Replacement Program

Automatic reclosers (AR) are used in distribution circuits to interrupt power to a portion of the circuit. They act much like a circuit breaker. However, instead of being at the upstream-most end of the circuit, ARs are typically located toward the end of the circuit. AR are typically installed for two reasons - safety and reliability. When a fault occurs downstream of an AR, the AR opens before the circuit breaker in the substation responds to the fault, thus minimizing customer service interruptions. Only the downstream portion of the circuit is interrupted, and all customers upstream of the AR remain energized.

AR are replaced based on age or reactively when they fail. The AR Replacement program is only for the age-based replacement of AR. The estimated time to wear out of an AR is estimated at about 25 years, at which time the failure rate begins to increase. To the extent this program reduces AR failure and/or AR-associated ignitions in HFRA, it has important secondary wildfire risk mitigation benefits.

4.3.2.6 PCB Transformers Replacement Program

For a period of about 20 years, transformer manufacturers distributed transformers and other oil-filled electrical equipment containing insulating oil with polychlorinated biphenyls (PCB) to utilities in the United States. While SCE never specifically ordered transformers containing PCB oil, many transformers were received and installed with oil contaminated with PCB. SCE instituted a proactive PCB transformer replacement program for suspected PCB-contaminated transformers. SCE's proactive PCB Transformer Replacement program, with its accelerated replacement rate, will significantly reduce the balance of all PCB-contaminated transformers by 2025. To the extent this program reduces risk related to transformer equipment failure in HFRA, it has important secondary wildfire risk mitigation benefits.

4.3.2.7 Transmission Line Rating Remediation

SCE has been conducting a Transmission Line Rating study to identify transmission lines with potential clearance issues. As part of this study, SCE completed an initial survey of all of SCE's California Independent System Operator (CAISO)-controlled transmission lines built before 2005. Based on the results of that survey, SCE prioritized the transmission line discrepancies requiring line clearance remediation. A discrepancy is any condition found in the field requiring remediation to meet GO 95 requirements during peak loading conditions. Discrepancies have been prioritized based on criteria such as line sag when operating at or below 130 degrees Fahrenheit, and potential risk to public safety and system reliability based on location of span, terrain, encroachment type, and extent of deviation from standards.

In 2015, SCE developed a plan to remediate all CAISO discrepancies over a ten-year period, from 2016 to 2025. The ten-year plan was developed with input from NERC and the Western Electricity Coordinating Council (WECC).

Besides the CAISO discrepancies, NERC/WECC requested that SCE perform studies on the non-CAISO controlled lines (radial lines). This study was completed in 2015 and requires additional discrepancies to be remediated by 2030, as agreed to by SCE and NERC/WECC. To the extent this program reduces risk

related to transmission line discrepancies in HFRA, it has important secondary wildfire risk mitigation benefits.

4.3.2.8 Road and Rights-of-Way Maintenance

SCE performs both proactive and reactive road and ROW maintenance. This work is required to provide field crews with safe access to SCE facilities. SCE's roads and ROW are also used by fire agencies as fire breaks and for access during other emergencies. Road and ROW maintenance activities include annual grading, repairs of damaged storm drains, repairs of access roads, and annual brush clearing along access roads to allow safe passage of vehicles and equipment. Transmission ROW clearing also includes weed abatement on parcels of property owned by SCE along transmission ROW, as required by city or county fire codes. These practices have important secondary wildfire risk mitigation, response time, and fire suppression benefits.

4.3.2.9 Insulator Washing

Insulator washing is performed by spraying high-pressure water on to subtransmission and transmission insulators to remove contaminants such as salt, dirt, or automobile exhaust. Excessive contamination on an insulator reduces its ability to insulate the energized line from the grounded support structure, which may cause lines to short circuit. Insulator washing is performed through various means. SCE typically uses specially equipped water trucks with a derrick and water nozzle to direct a high-pressure stream of water safely onto the insulators while the line remains in service.

In 2015, SCE moved away from a "calendar-based" wash schedule to a "condition-based" wash program. This updated program requires a visual inspection of a circuit to show contamination or signs of imminent failure, such as arcing or buzzing, before washing is conducted. If no signs of contamination are evident, the circuit will continue to be monitored until it is deemed necessary to perform a wash. Beach areas with high salt levels and high traffic volume require more frequent washing than a desert area with dryer air and less exhaust from traffic. To the extent this program reduces risk related to insulator ignitions in HFRA, it has important secondary wildfire risk mitigation benefits.

4.3.3 SYSTEM HARDENING ACTIONS IN HFRA

SCE's system hardening actions in HFRA are largely based on the GSRP, which contemplates broader, more advanced measures than those described in its 2018 GRC. The GSRP is a comprehensive program, incorporating leading practices and mitigation measures selected based on their effectiveness and with appropriate consideration of resource allocation and alternatives. For example, SCE introduced the use of fire-resistant composite poles and crossarms in HFRA. For system protection, SCE prioritized the use of current limiting fuses in HFRA and began applying a more sensitive fast curve trip setting for RAR and circuit breaker relays to allow for a more rapid clearing of faults during Red Flag Warning and other high fire risk conditions. These and other GSRP measures will help enhance the safety of the electrical system and make it more resilient during wildfires, consistent with state policy. Additionally, SCE is endeavoring to accelerate and expand certain GSRP activities and initiate additional programs beyond GSRP to further harden the grid as described below.

4.3.3.1 Design and Construction Standards

In 2018, SCE updated its Distribution Design Standards (DDS) and Distribution Overhead Construction Standards (DOH) to expand the use of wildfire mitigating measures in HFRA. For example, DOH and DDS were updated to specify the use of covered conductor in re-conductoring projects in HFRA. Covered

conductor has robust, insulating, and protective layers; replacing bare conductor with covered conductor is an effective way to mitigate contact-related faults.

SCE also updated its DDS and DOH to evaluate and consider the use of composite poles and composite crossarms in HFRA applications. The composite poles SCE is installing are coated with a fiber reinforced polymer (FRP) laminate which is fire resistant. Similar fire-resistant material is wrapped around the composite pole to create a shield which helps protect the pole and further increases fire resistance. A shielded composite pole resists ignition and can maintain its strength in fire conditions. Composite crossarms have a longer service life, greater strength and are more fire resistant than wood crossarms. SCE is using fire resistant composite crossarms and poles with shielding for pole replacements, when appropriate, to increase resiliency and reduce potential outage impacts resulting from a fire event.

Additionally, SCE updated its DDS BLF requirements to prioritize CLF in HFRA. CLF are selected for HFRA applications because they can limit peak fault current, provide faster fault clearing for most faults, and reduce fault energy by up to 25 times compared to a conventional fuse. Reducing fault energy lowers the risk of possible ignition when a fault occurs. CLF also help minimize impacts to customer electric service reliability from fast curve operating settings.

In 2018, SCE converted its overhead transformer design requirements when replacing obsolete or failing overhead transformers to utilize ester fluid (such as FR3) instead of mineral oil. Transformers with ester-based insulating fluid have a much higher flash point compared with conventional mineral oil-immersed units and will further reduce the possibility of transformer failures becoming the source of wildfire ignitions.

SCE has updated its construction standards to increase line spacer usage and to install wildlife protection, such as covers, tubing, and covered jumper wire. Additional overhead line spacers in HFRA will improve system resiliency from conductor to conductor faults. Wildlife protection shields overhead equipment, such as transformer bushings, fuses, cable terminations and arrestors, from animal-related contact faults, and other contact-related faults associated with vegetation and metallic balloons. These new construction standards will help reduce ignitions associated with SCE's electric infrastructure.

In 2019, SCE intends to refine its DOH requirements for connector selection for HFRA application to prioritize the use of CAL FIRE-exempt connectors such as bolted wedges.

4.3.3.2 Conductor

4.3.3.2.1 Wildfire Covered Conductor Program (Activity SH-1)

WCCP is a new, long-term program that began in 2018 (as part of GSRP) and is aimed at replacing standard bare overhead conductor with covered conductor in HFRA. This program is anticipated to significantly reduce contact-from-object ignition risks. As discussed in Chapter 3, contact from object faults in SCE's HFRA during the analyzed historical period were associated with more than one-half (53 percent) of suspected wildfire-initiating events. SCE's risk analysis demonstrates that application of covered conductor should be an effective approach to reduce ignitions associated with electrical infrastructure in SCE's HFRA. The reduction of faults should also decrease the frequency of wire down events. In combination with other mitigation measures such as advanced protective relays, automatic reclosers with fast curve settings, and CLF, the benefits of covered conductor significantly outweigh the increased cost of covered conductor (compared to bare conductor), and the associated modest increase

in-wind loading. The covered conductor also offers significantly better safety protection for the public in the limited cases of high impedance faults, as tests and studies have demonstrated that incidental contacts with energized conductor that is covered do not result in injuries. Given the significant wildfire mitigation benefits, SCE is targeting the proactive replacement of approximately 5,500 circuit miles of existing bare distribution primary overhead conductor in HFRA by 2025. SCE has prioritized its circuit re-conductoring plan based on a weighting of ignition consequence, ignition frequency, and mitigation effectiveness factors, such as wind loading considerations, number of historical vegetation faults, and number of historical wire down events. In 2018, SCE began deploying covered conductor in HFRA and installed 84 circuit miles as part of GSRP. SCE is targeting completing approximately 600 circuit miles by year-end 2020, focused on portions of nine at-risk circuits in HFRA. SCE selected these circuits based on a combination of their environmental footprint, asset characteristics and potential HFRA impact. Where appropriate, pole replacements and transformer replacements driven by this re-conductoring will be fire-resistant composite poles and ester fluid transformer, respectively. Additionally, in covered conductor systems, SCE will employ other accessories to combat contact-related faults, including dead-end covers, termination covers, fuse covers, arrester covers, wildlife guards, and transformer bushing covers. Bare conductors remaining in high wind areas (which in some, but not all, cases overlap with HFRA), will be retrofitted with insulated overhead wire spacers or have the pole reconfigured to "Ridge Pin" construction to reduce the potential of wires contacting each other. Furthermore, vibration dampers may also be installed to reduce conductor fatigue.

SCE may use aerial bundled cable in limited areas as an alternative to covered conductor. Installation of aerial bundled cable would likely be in areas with narrower spaces, to remediate tree attachments, and areas with dense vegetation that cannot be trimmed. Aerial bundled cable is more complicated to make connections with, making it more suited for long runs with few equipment and tap lines. Additionally, the increased weight of aerial bundled cable will lead to shorter spans and more pole replacements. Both covered conductor and aerial bundled cable have comparable benefits regarding preventing contact from objects, however covered conductors are more economical for most applications.

WCCP is a multi-year program, and in 2019 SCE will install at least 96 miles of covered conductor in HFRA. Given the significant amount of covered conductor targeted under this program and the wildfire risk mitigation benefits it provides, SCE will endeavor to install more circuit miles of covered conductor in HFRA in 2019 and accelerate installation in subsequent years. Additionally, SCE is assessing expanding the WCCP to deploy covered conductor across all Tier 3 HFRA over multiple years, starting in 2019. This assessment along with accelerated installation under GSRP could increase the 2019 total amount of covered conducer installed, in HFRA, to approximately 290 circuit miles.

4.3.3.2.2 Undergrounding Overhead Conductor (Activity SH-2)

Undergrounding overhead distribution lines, which typically have been used to mitigate aesthetic impacts in high-traffic urban areas, is a wildfire risk mitigation option in HFRA. While underground systems can help reduce the risk of wildfires and increase reliability during high winds and storms, they also take longer and cost much more to construct,[53] maintain, and repair – particularly in mountainous regions and those with steep terrain. In some cases, undergrounding may be infeasible due to local geology (e.g., bedrock, granite, etc.). Further, placing lines underground is less efficient than installing covered conductor, since underground lines take longer to construct, are difficult to inspect, may have shorter life expectancy than covered conductors and often have extended duration restoration times when there are outages. SCE will continue to work with local communities to pursue undergrounding in

[53] Underground systems can cost up to 10 times more than overhead systems – roughly $3 million per mile.

HFRA using its existing Tariff Rule 20. Additionally, and as part of its continued efforts to reduce wildfire risk, in 2019, SCE will conduct an evaluation to determine the highest risk portions of its HFRA and assess SCE's circuits around those areas that may be inaccessible should a fire occur and where SCE's circuits are critical to first responders to determine if there are certain sections that should be undergrounded. This evaluation may lead to engineering and design of targeted underground facilities in 2019 with potential construction commencing in late 2019/early 2020.

4.3.3.3 Equipment

Equipment-related efforts that are underway include changes to distribution transformer fluid requirements, improving conductor resiliency with the use of overhead line spacers and wildlife protection covers, and expanding the use of CAL FIRE-exempt equipment. SCE began deploying distribution transformers with ester-based insulating fluids in 2018, with the vast majority of HFRA new installations including ester fluid transformers. As part of WCCP, SCE began deploying wildfire protection such as critter guards to prevent animal contact and incidental contact from vegetation and metallic balloons.

In 2019, SCE intends to expand its conductor resiliency effort with use of line spacers on existing conductors by developing standard installation practices. Line spacers are installed to maintain the separation of overhead conductors. SCE expects the expanded use of line spacers to existing conductors will improve grid resiliency by preventing outages and associated fault impacts from conductor-to-conductor contacts. Additionally, SCE intends to further enhance grid resiliency by developing standard installation practices for vibration dampers. Vibration dampers are hardware attached to conductors (usually near insulators) which helps reduce conductor connection and attachment degradation from vibration.

Additionally, in 2019, SCE is piloting 50 CAL FIRE-exempt surge arresters in field conditions to learn more about their operations and installation before deploying them as a standard in HFRA in the future. SCE is also expanding the use of CAL FIRE-exempt connectors such as the bolted wedge connector. These new and alternative technologies are further discussed in Section 4.7.

4.3.3.4 Fire-Resistant Composite Poles and Composite Crossarms (Activity SH-3)

SCE is planning to install fire-resistant composite poles and composite cross-arms in HFRA. As part of re-conductoring work to install covered conductors in HFRA, SCE will conduct pole loading assessments on existing poles to determine if pole replacement is required. If the pole loading analysis shows that minimum safety factors would not be met when installing covered conductor, SCE will install fire-resistant composite poles with a fire protective shield (or other fire-resistant poles) instead of traditional wood poles. These poles are specifically designed to withstand wildfires and will harden the distribution system and reduce the risk of a wire down event. Extensive fire testing studies have shown that a fire protective shield will protect the pole and further increases fire resistance, enabling the pole to withstand an "extreme" wildfire. SCE began installing composite poles and composite cross arms in 2018. As part of WCCP, SCE will utilize either composite poles (or other fire-resistant poles) for replacements in HFRA. Based on historical pole replacements due to reconductoring and the miles of covered conductor targeted in 2019, SCE expects to replace at least 1,100 wood poles with fire-resistant composite poles (including a fire protective shield) in HFRA. Consistent with SCE's efforts to accelerate and expand its WCCP, in 2019, SCE may replace up to approximately 2,300 additional wood poles (i.e., for a total of approximately 3,400) with composite poles (or other fire-resistant poles should material supply constraints limit the availability of fire-resistant composite poles).

4.3.3.5 Protection and Isolation (Activity SH-4, SH-5, and SH-6)

In 2018, SCE adopted a branch line protection strategy that will install new (and replace some) existing devices to minimize fault energy. These devices will include CLF, CAL FIRE-exempt expulsion fuses, and single-phase reclosers. Additionally, SCE will continue deploying fast curve settings to circuit breakers and remote automatic reclosers in HFRA. These approaches are intended to assist in minimizing wildfire ignition risks by clearing faulted conditions rapidly, thus reducing the fault energy. In 2019, SCE plans to install/replace devices at least 7,500 branch line locations in HFRA. In addition to the fault energy reduction, the placement of CLF is expected to improve electric circuit reliability by segmenting faulted circuits to smaller line sections.

SCE will continue to install RAR for mainline circuit protection and reliability improvements. SCE will update existing RAR control settings to allow fast curve interrupting operating strategies. SCE plans to install RAR in at least 50 new HFRA locations in 2019 and install fast curve settings in at least 150 existing HFRA locations.

SCE will update settings on existing relays where possible and replace relays where necessary to allow fast curve interrupting operating strategies. Completed quantities may vary in 2019 depending on where SCE can install additional RAR most efficiently.

SCE began implementing fast curve trip settings for RAR and circuit breaker relay settings in 2018. In 2019, SCE will develop a plan to continue to install fast curve settings on circuit breaker relays in HFRA.

4.3.4 ACTIVITIES AND 2019 GOALS

Activity	Description	2019 Goal	Compliance Evidence
SH-1	Covered Conductor	Install at least 96 circuit miles of covered conductor in HFRA	1) List of circuits and associated miles of covered conductor installation 2) Record of completed work orders of covered conductor construction
SH-2	Evaluation of Undergrounding in HFRA	Conduct evaluation of undergrounding for HFRA	Assessment of undergrounding in HFRA
SH-3	Composite Poles and Crossarms	Install at least 1,100 composite poles	1) List of circuits and associated number of composite pole installations 2) Record of completed work orders of covered conductor construction
SH-4	Branch Line Protection Strategy	Install at least 7,500 CLF in HFRA locations	Record of completed work (i.e. work orders), including circuit, fuse location and installation date
SH-5	Remote Controlled Automatic Reclosers Installations	Install at least 50 new RAR	Record of completed work (i.e. work orders), including location and installation date
SH-6	Remote Controlled Automatic Reclosers Setting Updates	Update at least 150 existing RAR settings	1) List of RAR/CBs for fast curve settings change 2) Record of completed work of RAR/CB settings (OD43), including circuit, device number, relay change date for fast curves
SH-7	Circuit Breaker Fast Curve	1) Develop engineering plan to upgrade remaining CB relays and update settings 2) Conduct CB upgrades and setting updates according to plan	1) CB Upgrade plan 2) List of CBs for upgrade and fast curve settings 3) Record of relay upgrade (work order) and record of completed relay settings completed (OD43)

4.4 VEGETATION MANAGEMENT PLAN

4.4.1 PROGRAM OVERVIEW

SCE's vegetation management program involves the ongoing activities related to tree inspection, pruning, and removal, and weed abatement in proximity to SCE's distribution and transmission lines. SCE's vegetation management program is designed to comply with vegetation-related regulations,

including but not limited to GO 95 Rule 35, Public Resources Code (PRC) Sections 4291, 4292 and 4293, and NERC Reliability Standard FAC-003.

4.4.2 EXISTING VEGETATION MANAGEMENT PROGRAMS

SCE's distribution and transmission lines are inspected annually for compliance with state and federal vegetation management requirements. During these inspections, vegetation that requires pruning to maintain required clearances from the lines is scheduled for pruning or removal. The pruning takes into consideration a tree's anticipated growth over twelve months. Fast-growing species, or trees in HFRA, may need additional inspections or removal to maintain compliance. SCE engages contractors to inspect, prune, and remove trees, and to abate weeds. See Appendix D for list including fast-growing tree species which require removals.

4.4.2.1 Pole Brushing

SCE maintains poles with non-exempt attachments in HFRA that require 10 feet of radial brush clearance at the base of the pole in accordance with PRC Section 4292. These poles are inspected annually and brush clearing is performed as required to maintain compliance. This work is performed by contractors and is performed separately from other vegetation management activities. In 2019, SCE will continue to inspect and clear brush around the population of poles with non-exempt attachments, as required.

4.4.2.2 Supplemental Vegetation Inspections in HFRA

SCE's vegetation management program includes supplemental vegetation inspections such as Canyon Patrols and At-Risk Circuit Patrols. Canyon Patrols are performed annually on approximately 120 canyons to verify the circuits are free from vegetation encroachment into the minimum vegetation clearance distance. The canyons included for inspection are typically selected based on higher risk factors such as high winds, terrain, ingress/egress issues, type of electrical facilities, or limited fire-fighting capabilities. Additionally, At-Risk Circuit Patrols are performed, at least once per calendar year, on circuits that have a history of multiple vegetation-caused circuit interruptions. In 2019, SCE plans to continue performing Canyon and At-Risk Circuit Patrols.

4.4.2.3 Operation Santa Ana

Operation Santa Ana is a joint patrol effort with state and local fire authorities to facilitate understanding of each agency's roles and responsibilities and to provide cross-training opportunities. Each year, SCE's Vegetation Management staff meets with and accompanies local, county, and/or state fire agency personnel to perform these supplemental patrols of overhead power lines in HFRA. These patrols focus on electrical facilities and adherence to PRC Sections 4292 and 4293 vegetation-related requirements. Any vegetation conditions identified during these patrols that need to be remediated will be completed in accordance with SCE's vegetation management program. Operation Santa Ana is typically performed during a 3-4 month window with Los Angeles and Riverside County areas being completed by September 1, and the Ventura and San Bernardino County areas completed by the end of October. SCE plans to continue Operation Santa Ana in 2019.

4.4.2.4 Vegetation Management Program Re-Design

SCE's current vegetation management program is described in two key program documents: the Transmission Vegetation Management Plan and the Vegetation Management Operations Manual.

SCE's vegetation management program is currently undergoing a comprehensive redesign and restructuring. The staged deployment of the revised vegetation management program is anticipated to

commence in early 2019 and continue into 2020. Enhancements reflected in SCE's revised vegetation management program include, but are not limited to: expanded administrative controls; comprehensive Quality Control and Quality Assurance activities; increased focus on hazard tree removals/mitigation; and increased identification and removal of vegetation overhangs.[54]

CPUC GO 95, Appendix E recommends a minimum clearance of 12 feet for circuits 2.4 kV to 72 kV be established during pruning in areas that are designated as Extreme and Very High Fire Threat Zones as specified in GO 95, Case 14, Table 1.[55] SCE has determined, based on the high fire threat in its service territory, that it will implement the CPUC's recommendations in HFRA, where practical. While it is SCE's objective to achieve a 12-foot clearance, some conditions may limit SCE from achieving those clearances, such as particular tree species, woody stem exemption trees,[56] prior pruning practices, maturity of the trees, customer concerns or refusals, or other factors. These restrictions will be documented in SCE's vegetation management database. Once deployed, it is anticipated that it will take 12 to 18 months to complete the first inspection and pruning cycle reflecting the 12-foot recommended clearance in HFRA. In other cases, there may be a need to prune trees more than 12 feet to manage the growth of the tree or to meet ANSI 300 standards for tree pruning. These decisions are made by certified arborists on a case-by-case basis.

The revised vegetation management program is modifying SCE's approach to vegetation management under and around transmission lines. Directly under conductors, SCE will clear all trees and brush which could potentially grow into the compliance clearance space around the conductors. In addition, the area between the outer-most conductors and the ROW border will be cleared of brush and trees that have the potential to strike electric facilities. Where foot patrols or normal helicopter patrols are insufficient to evaluate the clearance, SCE will use LiDAR technology to identify trees along the ROW border that can potentially contact conductors during high wind events. Additionally, and where achievable, SCE plans to maintain a 30-foot clearance between conductors and vegetation for power lines 115kV and above. The 30-foot clearance is recommended as part of GO 95, Appendix E. SCE's calculation of the 30-foot clearance will incorporate line dynamics (sag and sway).

The Pacific Southwest Region of the Department of Agriculture, USFS has been integral in helping SCE and other electric utilities cope with the increased risks associated with wildfires, drought, and bark beetle epidemic. Currently, SCE and other electric utilities are working with the USFS to negotiate master service agreements to expedite a broad range of vegetation management activities on Forest Service Lands, such as the process for trimming and removal of trees. This master service agreement is expected to be finalized in first quarter 2019.

SCE has also set up funding agreements with state and federal environmental resource agencies including the California Department of Fish and Wildlife, the U.S. Army Corps of Engineers, and the U.S. Fish and Wildlife Service to provide either dedicated staff and/or the ability for personnel to make SCE's

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54 While the revised vegetation management program will be deployed in 2019 through 2020, some aspects of the program such as removal of vegetation overhangs will take multiple years to complete the initial cycle.

55 *See* D.17-12-024.

56 Section (a)(3)(A) of Section 1257 of PRC 4293. (A) Exempt Trees must meet all of the following criteria, as confirmed by a Certified Arborist or a Registered Professional Forester: 1. The tree or limb must be six (6) inches or more from the line at all times. 2. The size of the tree or limb at the conductor level must be at least six (6) inches in diameter. 3. The tree must not have "scaffold branches," below eight and one-half feet from the ground (so the tree cannot be easily climbed).

projects in HFRA a priority. The funding agreements allow for faster processing of environmental permits which are needed to carry out certain vegetation management/fuels reduction activities. This allows SCE to work with the agencies on prioritizing activities that better position the company to obtain timely approvals in HFRA.

4.4.3 ADDITIONAL ACTIVITIES IN HFRA

To further help mitigate wildfires, SCE has and will perform additional vegetation management activities in HFRA that are beyond those ongoing activities required by GO 95 (Rule 35), PRC Sections 4291, 4292 and 4293, and Federal Energy Regulatory Commission (FERC) Reliability Standard FAC-003. These enhanced activities are described below.

4.4.3.1 Hazard Tree Removals (Activity VM-1)

As set forth in SCE's GSRP application, SCE proposes to expand its vegetation management activities to begin assessing the structural condition of trees in HFRA that are not dead or dying but could nevertheless fall into or otherwise impact electrical facilities and potentially lead to ignitions and outages. These trees can be located up to 200 feet on either side of SCE's electrical facilities, an area designated as the Utility Strike Zone, which is significantly beyond the 4-foot clearance requirement in HFRA.

SCE's risk assessment methodology is based upon American National Standards Institute (ANSI) A300 and the International Society of Arboriculture Tree Risk Assessment Qualification Training Manual. As discussed in SCE's 2018 GSRP application, SCE's assessment methodology considers the attributes of the tree, the site conditons, impact to the infrastructure, and the likelihood of failure.

To implement the Hazard Tree Management program (HTMP),[57] arborists certified by the International Society of Arboriculture (ISA) perform these assessments and determine appropriate mitigation. SCE's HTMP assists the arborists by detailing a consistent approach to be applied to all trees assessed in SCE's service territory. In HFRA, SCE defines all trees within the Utility Strike Zone that have the potential to strike the conductors or fall within the Minimum Violation Clearance Distance (MVCD) as "subject trees." After assessment, a subject tree can remain a "subject tree" or be classified as a "hazard tree" or "reliability tree." A hazard tree has conditions within the tree that pose an expected risk to electrical facilities. A reliability tree is considered a healthy tree but is located in an area in which site conditions pose an expected risk. Both hazard and relibility trees are risk-ranked and removed based on expected risk to the infrastructure.

The tree-specific risk assessment will identify if the tree should be mitigated to reduce an expected risk. Trees that are determined to potentially threaten electrical facilities and require mitigation will be included in SCE's tree inventory for tracking purposes. Mitigation may include: heavy topping, removal of limbs, or the removal of the entire tree. Post-inspection of work prescribed by a tree assessment inspector is performed by an independent quality control contractor. Post-tree removal, inspection and quality review includes evaluation and mitigation of any potential risks that may arise from the work, such as erosion and windshear.

Some tree removals may require enhanced efforts to obtain property owner approval and leveraging new laws such as Assembly Bill (AB) 2911. SCE is currently finalizing these additional hazard tree removal

[57] Part of Expanded Vegetation Management Activities described in SCE's GSRP Application.

procedures and anticipates beginning the enhanced efforts in early 2019. Under this program, SCE anticipates that it will perform at least 125,000 tree-specific threat assessments and mitigate, through removal or trimming, at least 7,500 trees in 2019. It is currently estimated that it will take approximately 5 to 8 years to complete the first pass of assessments and mitigation in HFRA.

4.4.3.2 Expanded Pole Brushing (Activity VM-2)

SCE is expanding its pole brushing (i.e., brush clearance around poles) activities to inspect and clear brush to a 10-foot radial clearance on at least 25,000 additional poles within HFRA in 2019.[58] These additional poles are not part of PRC Section 4292 requirements but their surrounding brush is being cleared or maintained to further reduce ignition risk and increase grid resiliency.

4.4.3.3 Expanded Clearance Distances at Time of Maintenance (Activity VM-3)

The CPUC-required minimum clearance in HFRA is 4 feet; however, when achievable, SCE has historically trimmed trees at the time of maintenance to a greater distance. Under its revised vegetation management program, consistent with recommended guidance in D.17-12-024, SCE is expanding, where possible, the clearance distance in HFRA at time of maintenance to at least 12 feet for line voltages between 2.4kV and 69kV. However, conditions beyond SCE's control such as customer refusals may limit SCE from achieving the recommended 12-foot clearance in all instances. Once the new vegetation management program is deployed starting in 2019, it is anticipated that it will take 12 to 18 months to achieve the increased clearance distance at time of maintenance in HFRA.

4.4.3.4 DRI Quarterly Inspections and Tree Removals (Activity VM-4)

Due to climate change effects, drought and bark beetle infestation, California is facing an epidemic of dead and dying trees. As a result of the drought emergency, SCE established the Drought Relief Initiative (DRI) as a separate and distinct program from SCE's ongoing vegetation management activities. All DRI activities occur within HFRA. Activities and expenses for the DRI are tracked separately, as costs are recovered through the Drought Catastrophic Event Memorandum Account (Drought CEMA). Under its DRI, SCE conducts quarterly inspections in Tier 2 and Tier 3 HFRA for tree mortality to identify and remove dead, dying, or diseased trees affected by drought conditions. Identified dead, dying, or diseased trees are removed in accordance with SCE's vegetation management program.

4.4.3.5 LiDAR Inspection Program (Activity VM-5)

SCE utilizes light detection and ranging technology (LiDAR), to inspect select transmission lines, particularly in rugged and hard-to-access areas, in order to meet FAC 003-4, GO 95-Rule 35 and PRC Section 4293 (see below for more detail) to maintain appropriate clearances between SCE's lines and vegetation. LiDAR is a surveying method that measures distance to a target by illuminating the target with pulsed laser light and measuring the reflected pulses with a sensor. Differences in laser return times can then be used to make digital three-dimensional representations of the target. LiDAR is an efficient and effective method to assess vegetation clearances, a key component of SCE's wildfire prevention and mitigation plan. In 2019, SCE plans to conduct LiDAR inspections of approximately 1,000 conductor miles in HFRA to identify potential subject trees for assessment under HTMP or potential vegetation clearance issues.

[58] SCE is exploring the use of fire retardant spray around poles as an alternative to brush clearing.

4.4.4 ACTIVITIES AND 2019 GOALS

Activity	Description	2019 Goal	Compliance Evidence
VM-1	Hazard Tree Mitigation program	1) Perform at least 125,000 tree-specific threat assessments in HFRA 2) Perform at least 7,500 risk-based tree removals or mitigations in HFRA	1) List of tree assessments performed 2) List of risk-based tree removals or mitigations performed following tree assessments 3) Customer refusal forms for trees identified for removal but where the customer refused to allow removal
VM-2	Expanded Pole Brushing	1) Inspect and clear brush to 10 feet radial clearance at the base of the pole (at least 25,000) poles 2) Clear brush as necessary to achieve 10 feet of clearance	1) List of poles inspected 2) List of poles cleared of brush
VM-3	Expanded clearance distances at time of maintenance	Obtain tree-to-line clearance distance of 12 feet, as achievable, in HFRA at time of maintenance for line voltages of 2.4kV to 69kV	Records of tree pruning activities to achieve 12 feet of clearance, or documentation of reason why clearance could not or did not need to be achieved (e.g., customer refusals, woody stem trees, etc.)
VM-4	DRI quarterly inspections and removals	1) Perform all quarterly DRI inspections. 2) Remove identified dead, dying, or diseased trees in accordance with SCE's vegetation management program	1) Inspection records 2) DRI tree removal records
VM-5	LiDAR Inspections of Transmission (220 kV and above)	LiDAR inspect at least 1,000 conductor miles in HFRA (results from LiDAR inspections will be used to inform of subject trees assessed under the Hazard Tree Mitigation program)	1) Invoices 2) Flight logs

4.5 PROTOCOLS ON SITUATIONAL AWARENESS (INCLUDING INFORMATION GAINED FROM SITUATIONAL AWARENESS TOOLS)

4.5.1 PROGRAM OVERVIEW

Situational awareness is an integral part of emergency management, and it is imperative SCE has a granular understanding of what is happening across its service territory prior to and during emergency events. SCE's Watch Office monitors activities on a 24/7 basis, notifies response teams when action is

needed, and updates SCE's management on evolving events. The Watch Office is co-located within the Emergency Operations Center (EOC), which was upgraded in 2016 and serves as the training center for SCE's Incident Management Teams. In the newly-established Situational Awareness Center, SCE maintains meteorologists and GIS (i.e., mapping) specialists on staff, and uses various measures to monitor evolving weather, fuel, and other conditions that might lead to fire events and other hazardous conditions.

SCE is further enhancing its situational awareness capabilities by leveraging more detailed circuit-level information to better understand how weather conditions might impact public safety and utility infrastructure in HFRA. This includes creation of a high-resolution weather model specific to SCE's service territory and strategically installing weather stations to enhance the high-resolution weather model and provide real-time data near circuits in HFRA. This data will be collected and analyzed for potential weather impacts by meteorologists and GIS specialists in the Situational Awareness Center. SCE is also installing HD cameras to help communities in HFRA, fire responders and utility staff maintain visual awareness of potential fire events in real time.

4.5.2 ADDITIONAL ACTIONS TAKEN IN HFRA

4.5.2.1 Weather Stations (Activity SA-1)

The size of SCE's service territory and its diverse topography necessitates granular weather data, which requires a dense network of weather stations to monitor location-specific, real-time conditions in HFRA to enable operational decision making. For example, Southern California's mountains have rapid elevation changes and differing canyon orientations, which need to be taken into account to determine the .number of weather stations necessary for monitoring HFRA across SCE's service territory. While there are numerous public weather stations, SCE utilizes data from trusted and validated sources[59] to determine where to site additional weather stations. A guiding principle in building out the network is to have an adequate number of weather stations installed. Weather stations will ideally be placed on locations with varied elevations (i.e., on ridge or hill tops, and valley or canyon locations). Distribution circuits in HFRA are in scope for siting SCE weather stations. Circuits that have shorter length, uniform topography and similar weather characteristics will require fewer weather stations to be installed. Weather station data will be used for real-time monitoring and historical data analysis. Wind and relative humidity data will allow for granular fire weather monitoring on a circuit by circuit basis. Weather stations will also provide observed wind, relative humidity, and temperature values that will be utilized to optimize the Weather Research and Forecasting (WRF) model configurations. Statistical analyses utilizing historical weather data can be used in post-processing to deliver increasingly accurate wind forecasts.

SCE has already begun to enhance existing weather models by installing 125 weather stations in key HFRA locations in 2018. In 2019, SCE will install at least 315 weather stations in HFRA. These weather stations will enhance the resolution of existing weather models and provide real-time information to assist in making key operational decisions during wildfire risk conditions, including the use of proactive de-energization protocols.

[59] Trusted weather data sources include Remote Automated Weather Stations (RAWS) under the National Interagency Fire Center (NFIC), the National Weather Service and the Federal Aviation Administration.

4.5.2.2 Fire Potential Index and Santa Ana Wildfire Threat Index (Activity SA-2)

The SCE Fire Potential Index (FPI) is an internal tool used to estimate wildfire potential based on actual weather and fuel conditions. Inputs include wind, the dryness of the air near the ground, and how receptive existing fuels are to fire, with specific inputs involving the moisture content of the vegetation. The FPI is used in conjunction with wind thresholds to identify areas that are likely to have significant fire activity which could threaten communities and SCE infrastructure. The FPI is currently the best method for assessing fire potential across SCE's extensive service territory due to it being customizable in addressing specific fire thresholds across different weather climates.

In 2019 SCE will begin Phase II of the FPI project intended to increase capability by adding more granular weather data, expanding the coverage to all of SCE's service territory, and integrating historical weather data. This allows SCE to observe detailed weather and fuel conditions, as well as the potential for fire activity at the circuit level. This level of data will clarify which circuits will be impacted the most during weather events, reducing the number of circuits monitored for possible de-energization, and thereby reducing the number of customers affected. Adding historical weather data allows for better calibration and the ability to put current events into historical context for better decision making.

The FPI has three categories that relate weather and fuel conditions to fire activity; the categories are Normal, Elevated, and Extreme. "Normal" means that fuels are generally unsupportive of fire activity despite the potential for extreme weather events. "Elevated" suggests that fuels are receptive to ignitions, and in the event of any critical weather, fires could spread quickly. "Extreme" implies that fuels are very dry and will support significant fire activity with dangerous rates of spread during critical weather events.

SCE also uses the SAWTI issued by USFS, which measures the severity of Santa Ana winds with respect to the potential for large fires to occur. This index assesses weather and fuel conditions to generate a threat level associated with Santa Ana wind events. The index extends out six days showing four threat levels that range from Marginal to Extreme. The SAWTI covers much of Southern California and SCE's service territory. SCE uses this index to gauge the overall severity of a forecasted or ongoing Santa Ana wind events across affected SCE districts and as additional validation of the Fire Weather Watches and RFW provided by the National Weather Service.

4.5.2.3 Meteorological Resources

SCE staffs its Situational Awareness Center with a team of in-house meteorologists who have a specialized understanding of fire-weather characteristics. All the meteorologists are members of the American Meteorological Society and hold degrees in Atmospheric Sciences. This team of professionals uses the aforementioned forecasting tools and weather stations to develop comprehensive weather forecasts starting 4-7 days in advance of any predicted severe weather event. This information is provided to impacted departments and incident management personnel and is critical in shaping response and mitigation activities for potential wildfire events. SCE continues to produce and refine forecasts as the potential event approaches; these updates and refinements are essential inputs for identifying impacted circuits so that field personnel can be dispatched to at-risk locations to monitor real-time conditions.

4.5.2.4 Deployment and Support of Situational Awareness Cameras (Activity SA-3)

SCE is installing pan-tilt-zoom (PTZ) HD cameras throughout its HFRA to enable fire agencies and SCE fire management personnel to address emerging wildfires more quickly, helping mitigate potential safety

risks to the public and preventing damage to electric infrastructure. The PTZ HD camera views transmit into SCE's Watch Office and are used by SCE's IMT when deciding how to deploy crews and make other operational decisions.

PTZ HD cameras can help in spotting smoke and assessing conditions in real-time.[60] In particular, PTZ HD cameras can save time in verifying and assessing a fire's severity instead of sending fire crews to perform this assessment. Between 2018 and 2020, SCE is targeting installation of up to 160 PTZ HD cameras on approximately 80 towers within HFRA to achieve up to 90 percent visual coverage of SCE's HFRA. In 2019, SCE will install at least 62 cameras on 31 towers in HFRA.

4.5.2.5 High Performance Computer Weather Modeling System (Activity SA-4)

In 2019, SCE will procure and install a High-Performance Computing Cluster (HPCC) that will generate forecasts of weather and fuel conditions at high resolution. Greenness of the vegetation, moisture content of the dead and live fuels, relative humidity, and wind data from the HPCC will be used to comprehensively assess wildfire risk across the area (e.g., HPCC will compute FPI). Having this information will enable SCE to more accurately understand the fuel's receptivity to fire. In addition, this dataset will be used to run fire spread models which will determine potential risks of past, current, and future event scenarios. Furthermore, the HPCC will be used to generate and store weather and fuel conditions over a 30-plus-year period which will provide valuable insight into the nature of wildfire behavior and allow SCE to relate weather and fuel parameters to historical fire occurrences.

4.5.2.6 Develop Asset Reliability & Risk Analytics Capability (Activity SA-5)

This effort seeks to: (1) develop capabilities in predicting an asset's overall wildfire-related risk; and (2) given an asset's risk, prioritize work, repairs, and/or replacement(s) to minimize potential wildfire ignitions. SCE will utilize its existing analytics platform to develop composite risk models that can be used to predict risk as it relates to distribution assets, vegetation health, and extreme weather events that could impact public safety, including wildfire ignitions. These risk models will be used to enhance existing processes, including the following:

- Identifying which assets should be prioritized for replacement or upgrade based on the environment they operate in and their asset characteristics (i.e., number of splices, conductor type; fusing, etc.);
- Analyzing forecasted and historical weather conditions;
- Conducting and prioritizing maintenance;
- Analyzing asset types; and
- Analyzing operational data (such as load, duty cycle, etc.).

Using these analytics to prioritize mitigation efforts on the highest risk assets in HFRA will help target SCE's actions to reduce overall ignition risk. This program also proposes advanced analytic capabilities for streaming grid data (smart meter, supervisory control and acquisition data (SCADA), etc.) to improve advanced fault detection. This capability will allow SCE to use artificial intelligence, machine learning, and predictive modeling on real-time data to identify early warning signs of potential faults, to quickly identify a fault that has occurred, and to more rapidly respond to remediate a public safety risk. SCE intends to complete the implementation of the Asset Reliability and Risk Analytics tools in 2019.

[60] Camera feeds are publically accessible at www.alertwildfire.org

4.5.3 ACTIVITIES AND 2019 GOALS

Activity	Description	2019 Goal	Compliance Evidence
SA-1	Additional Weather Stations	Install at least 315 units in HFRA	1) Installation Guidelines 2) Production order/invoice 3) Weather station location master tracker
SA-2	Fire Potential Index Phase II	Enhance capabilities of FPI by increasing granularity, adding historical climatology data, and expanding to cover all of SCE's service territory	1) Statement of Work 2) Sign in sheets from trainings
SA-3	Additional HD Cameras	Install at least 62 cameras on 31 towers	1) Production order/Invoice 2) HD camera location master tracker
SA-4	High-Performing Computer Weather Modeling System	Procure and install High Performance Computing Cluster weather and fuels modeling system	1) Production Order/invoice 2) Sign in sheets from trainings
SA-5	Develop Asset Reliability & Risk Analytics Capability	Complete implementation of the Asset Reliability and Risk Analytics tools	Demonstration of tool

4.6 PROTOCOLS ON PUBLIC SAFETY POWER SHUT-OFF

4.6.1 STRATEGY TO MINIMIZE PUBLIC SAFETY RISK DURING HIGH WILDFIRE CONDITIONS AND DETAILS OF THE CONSIDERATIONS

SCE employs guidelines to be prepared to proactively de-energize circuits within HFRA if data sources indicate that extreme local weather conditions pose an imminent and significant threat to public safety associated with wildfire risk. The significant variability of weather and environmental conditions across SCE's service territory, coupled with climate change effects, severe drought/bark beetle issues, require flexible de-energization guidelines that can be used under a variety of weather and physical circumstances and electrical system operating conditions. SCE's protocol, officially titled Public Safety Power Shut-Off, consists of a set of de-energization criteria and guidelines with a wide variety of factors that are considered.

SCE utilizes aspects of the National Incident Management System to manage its emergency and resiliency operations. Consistent with this methodology, execution of SCE's PSPS protocol is overseen by a specialized Task Force in the Incident Command Structure under the Operations Section Chief. The Task Force is composed of representatives from key internal departments to manage the necessary public safety notifications to critical care customers, essential service providers, business customers and local governments potentially affected by its use. The Task Force is responsible for monitoring and considering conditions and relevant information before recommending the de-energization of any SCE circuit(s).

4.6.2 TACTICAL AND STRATEGIC DECISION-MAKING PROTOCOL FOR INITIATING A PSPS/DE-ENERGIZATION

SCE is refining the tactical and strategic decision-making protocols needed to consistently consider the factors required to initiate pro-active de-energization internally and through the ongoing PSPS Order Instituting Rulemaking (OIR) process initiated by the CPUC. The complexities of the service territory, including size, topography, wind and weather patterns, and the uncertainty of weather events, make it difficult to predict exact locations where pro-active de-energization would or should be consistently considered.

The decision to preemptively shutoff power requires consideration of many complexities both known and unknown. Therefore, execution of de-energization is ultimately based on the judgment of the IMT and the considerations that follow are intended to provide a framework to assist the IMT in exercising this discretion:

- Potential impacts to customers and communities;
- RFW issued by the National Weather Service for fire weather zones that contain SCE circuits in HFRA;
- SCE meteorologists' assessments of known local conditions, including wind speeds (sustained and gusts), humidity and temperature, fuel moisture, fuel loading and data from SCE weather stations (including real-time data);
- Real-time situational awareness information from personnel positioned in HFRA areas identified as potentially at risk, areas located near circuits identified for inclusion on the circuit monitoring list, and in other areas identified during the incident as at risk of being subject to extreme weather conditions;
- Input from SCE Fire Management experts;[61]
- Input from SCE's Vegetation Management team as appropriate;
- Input from local and state fire authorities with specific concerns regarding the potential consequences of wildfires in select locations;
- Alternative ways to re-route power to affected areas;
- Awareness of mandatory or voluntary evacuation orders in place;
- Expected impact of de-energizing circuits on essential services;
- Other operational considerations to minimize potential wildfire ignitions, including the blocking of reclosers on the identified circuit(s);
- On-going fire activity throughout SCE's service territory and California in general;
- Progress of customer notification processes; and
- Ongoing notifications to local governments and public officials.

The IMT considers the factors above when determining if de-energization of specific locations within HFRA is necessary.

4.6.3 STRATEGY TO PROVIDE FOR SAFE AND EFFECTIVE RE-ENERGIZATION OF ANY AREA THAT WAS DE-ENERGIZED DUE TO PSPS PROTOCOL

When fire risk conditions subside to safe levels and safe conditions are validated by field resources, SCE will begin patrolling impacted circuits to check for any condition that could potentially present a public safety hazard when re-energizing circuits. Once field resources confirm that it is safe to re-energize the

[61] *See* Chapter 5.B.

circuit(s), power will be restored, and local government and customers will be notified of re-energization. The order in which circuits are re-energized will depend on many factors including, but not limited to, customer safety and well-being, consideration of affected essential services, damage to electrical and other infrastructure, and circuit design/topology.

4.6.4 SCE STANDARDS RELATIVE TO CUSTOMER COMMUNICATIONS, INCLUDING CONSIDERATION FOR THE NEED TO NOTIFY PRIORITY ESSENTIAL SERVICES

SCE is committed to providing timely notification to potentially-impacted local governments, public safety agencies, the CPUC, the California State Warning Center, and customers prior to, during, and after a de-energization event, with special consideration of impacts to local governments and public safety agencies, as well as critical care customers, essential service providers, and business customers. SCE's PSPS plan sets the following guidelines for these notifications and SCE seeks to execute them when it is feasible; however, given particular urgent and unforeseen circumstances, these timelines may vary.

- **4-7 days ahead** of forecasted fire conditions in a HFRA, SCE meteorologists will begin predictive modeling to assess potential impacts to infrastructure that may require SCE to implement a PSPS de-energization event. At this stage, the accuracy and granularity of forecasts will not enable SCE to identify potentially impacted customers with a high level of confidence, so no notifications will be made.
- **3 days ahead** of the forecast event, SCE meteorologists will continue to refine predictive models and will place IMT on alert for activation 2 days ahead of the forecast event.
- **2 days ahead** of the forecast event, predictive models begin to improve in accuracy, and SCE activates its IMT. To the extent possible, SCE begins coordinating closely with local government and agencies (e.g., first responders) on a possible PSPS de-energization event. A specialized Task Force will work to identify impacted circuits. SCE will begin its customer notifications process in the following order:
    1. Local government and public safety agencies
    2. Critical care customers
    3. Essential service providers
    4. Business and residential customers
- **1 day ahead** of the forecast event, if fire conditions are imminent, the SCE meteorology team continues to refine its predictive models using more accurate forecasting capabilities to narrow down the affected circuits and customers. At this stage, SCE continues to work closely with local government and agencies on a possible power shutoff and will make additional notifications to impacted customers and local governments.

4.6.4.1 De-Energization Notifications (Activity PSPS-1)

If extreme fire conditions are validated by field resources, SCE weather stations, or other situational awareness means, SCE may decide to de-energize impacted circuit(s) and will make every attempt to notify local government, public safety agencies, and customers when this decision is made. In 2019, if SCE decides to de-energize circuit(s), SCE will continue to make notifications to local government, public safety agencies, the CPUC, the California State Warning Center, and customers, throughout the event when important updates are available. If the forecasted conditions do not materialize, SCE will notify local government and customers that the planned de-energization event has been cancelled.

As discussed in its 2018 GSRP Application, SCE utilizes its Emergency Outage Notification System (EONS) to quickly create and deliver customized outage communications in the customers' digital channel(s) of preference (smartphone, SMS text, email, TTY and social media) regarding de-energization events. In 2019, SCE will enhance EONS notification capabilities to expand in-language notifications based on customer preference including, but not limited to, Spanish, Chinese, and Cantonese.

4.6.5 PROTOCOLS FOR MITIGATING THE PUBLIC SAFETY IMPACTS OF THESE PROTOCOLS, INCLUDING IMPACTS ON FIRST RESPONDERS AND ON HEALTH AND COMMUNICATION INFRASTRUCTURE

SCE continues to host meetings and provide information to county Offices of Emergency Management (OEM), local and tribal governments, public safety agencies and community members (including selected groups through specialized workshops) that may be impacted by circuits that traverse HFRA in SCE's service territory. These meetings enable SCE to provide information regarding its PSPS protocol and its wildfire mitigation efforts. These meetings, and SCE's planning efforts surrounding wildfires and PSPS, are conducted in compliance with PUC Section 768.6. Additionally, SCE uses these opportunities to convey the importance of community resiliency in the event of any outage, irrespective of cause, and to receive important feedback from its customers and to incorporate this feedback into its planning process and the PSPS protocol.

SCE has begun and plans to continue holding regular meetings with public safety agencies including fire agencies, law enforcement agencies and emergency management agencies to continue the dialogue around PSPS and to collaborate on mitigation strategies and event protocols. SCE will also provide updates to those cities in HFRA as needed. Meeting topics include, but are not limited to:

- How circuits were identified as being high fire risk and subject to PSPS
- Overview of criteria and other factors used to determine if a circuit will be de-energized
- Customer and agency notification process before and during an event
- Information on SCE's Incident Command System structure during an event
- Requests for local governments and other agencies to provide SCE with information on situational awareness and other concerns with de-energizing particular circuits
- The process to request circuit re-energization from SCE
- The process used to undertake re-energization of circuits after a PSPS event
- The provision of GIS layers of HFRA circuits to aid in emergency planning process

SCE's engagement with local governments includes the following:

- Information (via email) on its PSPS protocol and its wildfire mitigation efforts to representatives of approximately 235 cities, counties, and unincorporated communities with HFRA circuits (Note: Unincorporated communities are included in outreach to counties)
- Offers to meet and meetings with key city and county personnel to further review and discuss any of the topics presented
- Offers to provide maps of HFRA Circuits – both PDF and GIS layers
- Requests for local governments and other agencies to provide SCE information on critical facilities/essential service providers and other concerns resulting from de-energizing particular circuits
- Upon request, SCE has presented at city council and local Public Safety Commission meetings

SCE holds "Outage Schools" throughout the year for business and residential customers. These meetings are designed to help customers understand what to expect during an outage, including an outage related to PSPS. Outage schools will continue annually throughout SCE's service territory and topics include:

- The process for determining the extent of an outage (damage assessment)
- Information on notification process during an outage
- Details on SCE's PSPS
- Outage restoration information

4.6.5.1 Essential Service Providers

SCE considers the following customer categories as essential service providers:

- Government and other agencies providing essential fire, police, and prison services
- Government agencies essential to the national defense
- Hospitals and skilled nursing facilities
- Communication utilities, as they relate to public health, welfare, and security, including telephone utilities
- Radio and television broadcasting stations used for broadcasting emergency messages, instruction, and other public information related to the electric curtailment emergency
- Water and sewage treatment utilities identified as necessary for services such as firefighting

SCE respects the privacy of its customers and submits the categories above as those considered essential service providers rather than a complete list of customers in those categories. Because customers move in and away from locations, providing a list of customers would only be valid for the date and time for which that list was retrieved from SCE's systems.

SCE actively engages with its essential service provider community through designated single-contact resources at SCE from its Local Government Affairs department and Business Customer Division. These direct contact resources "own" the relationship with these customers, agencies and/or utilities for all business needs with SCE and in PSPS events. SCE also hosts Outage Schools throughout the year where outage notifications, communications and PSPS are discussed, and SCE is expanding its meeting invitation to the essential service provider community.

4.6.5.2 Critical Care Customers

SCE's critical care customers are those customers enrolled in SCE's Medical Baseline program whose physician has indicated that the medical equipment in use at the home is for life sustaining purposes and absent electricity for two or more hours the customer would be at risk. SCE considers these customers the most vulnerable of its medical baseline customers and therefore takes added measures to facilitate the safety of these customers.

Every year, SCE sends an annual medical baseline letter to all customers enrolled in the Medical Baseline program within SCE's service territory (currently approximately 92,000 customers). The letter encourages and reminds these customers to have an emergency back-up plan for when outages occur and requests that they contact SCE so that the SCE has their most up-to-date contact information for use in the event of power outages. Additionally, the letter reminds them that SCE can send alerts and notifications through an alternate preferred method of contact that they provide to SCE. The most recent letter was delivered in June 2018 and another round of letters will be sent in 2019.

For all of SCE's medical baseline customers, outage notifications are provided through the customers primary and alternate preferred methods of communication (email, text, SMS). If a customer with the critical care designation cannot be reached via their preferred communication method, further safeguards are taken to make contact with the customer. SCE's Consumer Affairs office will begin personal attempts to reach these customers; if unsuccessful, they will send a field representative to the customer's home to attempt in-person contact. If contact is not made at the property, SCE will leave a notice of the visit and ask the customer to contact SCE directly. In circumstances when an outage is forecast to exceed 12 hours in duration, SCE will again attempt to reach the medical baseline customer through outbound calls from Consumer Affairs, and if unreachable, will send a field representative to the customer's residence in order to perform a welfare check.

4.6.5.3 General Outreach

SCE will send an annual letter to customers that live in HFRA informing them of the following: (1) the potential for a PSPS de-energization event in their area; (2) details on the notification process during an event; and (3) criteria informing SCE's PSPS protocol. In these letters, SCE will also include information on how best to prepare for an outage regardless of cause, how to sign up for the Medical Baseline Program, SCE contact information, and directions for accessing SCE's website where additional details on SCE's wildfire mitigation activities may be found. Customer outreach is further described in Section 5.2.

4.6.5.4 Community Workshops

SCE has conducted an extensive series of community meetings within its service territory to provide information on SCE's fire mitigation activities including its potential use of the PSPS de-energization protocol. SCE subject matter experts presented at the meetings and answered questions related to a variety of topics including:

- The state's "new normal" with respect to climate change impacts on wildfires
- System hardening and engineering practices
- Vegetation management
- Situational awareness (weather monitoring)
- PSPS protocol
- Safety during outages

SCE strives to continuously improve plans and protocols around wildfire response. In support of this, SCE will regularly solicit feedback through additional meetings with public safety agencies and impacted communities to provide an opportunity for a dialogue on the event and potential process changes from lessons learned. SCE will continue to evaluate opportunities for improving our plans and protocols using this feedback, as appropriate. Community workshops are further described in Section 5.2.

4.6.5.5 PSPS/De-energization Protocol Support

4.6.5.5.1 Line Patrols

In addition to the customer outreach efforts discussed above, a critical component of SCE's PSPS protocol is to assess potential for extreme fire risk conditions with the help of line patrols and monitoring functions (including troublemen and supporting crews) in the field prior to making the decision to de-energize. Operationally, SCE will deploy line patrol crews to assess circuit conditions prior to de-energization and before restoring service to confirm it is safe to re-energize.

4.6.5.5.2 Customer Contact Center

SCE provides customer support during PSPS/de-energization events via its Customer Contact Center (CCC), and anticipates additional resources to support the incremental increase in call volumes associated with these events.

4.6.5.5.3 Mobile Generator Deployment

SCE is working collaboratively with local governments, first responders and essential service providers to provide awareness of PSPS and to educate them on the importance of developing a resiliency plan that addresses back-up power needs for their facilities which provide critical life and safety functions. Many of these customers are required by law or industry standard to have back-up generation in place to sustain critical operations in the event of a power outage, regardless of outage type. Other customers not required to have back-up generation are encouraged to consider adding this capability if they feel they have critical needs that must continue in a power outage.

However, if essential service providers are unable to sustain critical life/safety operations during an extended power outage, SCE will consider requests to provide temporary mobile backup generation. Through the existing PSPS communication plan noted above in Section 4.6.4, SCE will coordinate closely with the emergency management community at the county level to identify and prioritize back-up generation needs in the following order:

Priority Order	Essential Service Provider Category
1. Life Safety Emergencies	Hospitals Skilled Nursing Facilities Public Safety Agencies
2. Public Health Emergencies	Water/Wastewater
3. Communication Failures	Telecommunications

If the Incident Commander determines there is a critical need for temporary back-up generation for one of the essential service providers noted above, the PSPS Task Force, which resides under the Operations Section of the Incident Command Structure, will be responsible for determining the appropriate sizing and installation requirements, and work with contract partners, vendors and the appropriate internal T&D field crews to coordinate deployment and installation. Once the event has concluded and power has been restored, this same task force will confirm the generator is removed and returned to the vendor.

4.6.5.6 Community Outreach Vehicles

SCE's customers may be without power for extended periods due to wildfire mitigation efforts, including PSPS activation and/or planned outages associated with hardening the grid and installing technologies that reduce wildfire risk. Although SCE has developed a public outreach plan in support of PSPS, including overall wildfire awareness and preparation, SCE expects that some customers will need assistance in receiving critical messages from SCE, public agencies, first responders, news agencies, social media, etc. SCE plans to deploy Community Outreach Vehicles[62] equipped with back-up power so that

[62] Due to procurement challenges with the Portable Community Power Trailers, SCE, as an interim solution, is evaluating alternatives, including retrofitting existing SCE vehicles to provide these services during PSPS events or other extended outages.

customers can charge their personal devices (mobile phones, tablets, laptops, etc.) and continue to receive information/updates from SCE about the outage, listen for relevant public safety broadcasts, and/or connect with friends and family concerned with their well-being during PSPS events. The Community Outreach Vehicles can typically be deployed to affected areas within 8 hours across the service territory, and their deployment will be managed through the IMT and PSPS Task Force.

4.6.6 ACTIVITIES AND 2019 GOALS

Activity	Description	2019 Goal	Compliance Evidence
PSPS-1	De-Energization Notifications	1) Notify applicable public safety agencies and local governments of possible de-energization 2) Notify CalOES through the State Warning Center of possible de-energization 3) Notify the CPUC of possible de-energization 4) Enhance EONS to include in-language messages	1) ESRB-8 Report(s) filed with the CPUC 2) EONS Production Order/Invoice

4.7 ALTERNATIVE TECHNOLOGIES

4.7.1 PROGRAM OVERVIEW

Through ongoing assessment and refinement of its programs, SCE continues to explore technologies that will reduce the probability of an ignition event and/or reduce public exposure to a hazardous condition during periods of high fire risk. SCE has implemented and continues to assess additional engineering solutions to provide better situational awareness, faster isolation of faults, and/or minimized energy transfer. As part of this process, SCE will pilot limited deployments to build confidence that the new technology will be useful and effective in mitigating identified causes of wildfire ignitions. A summary of additional technologies being considered for studies and pilots are described below. To the extent that SCE pursues such programs and activities, they will be set forth in future years' plans.

In 2019, SCE will evaluate and consider the following technologies for application on the distribution system. If equipment described below proves to be an effective fire risk mitigation technology, it may be included in the proposed program work discussed above in Chapter 4C.

4.7.2 ADDITIONAL ACTIONS WITHIN HFRA

4.7.2.1 Alternative Technology Pilots (Activity AT-1)

4.7.2.1.1 CAL FIRE Exempt Surge Arrester

A surge arrester is a device designed to channel lightning or other surge voltages to ground to protect the circuit or equipment from flashover due to excessive voltage. Equipment that is rated as CAL FIRE exempt is designed to limit such arcs/sparks or hot particles sufficiently to prevent the ignition of flammable vegetation. SCE is piloting a CAL FIRE-exempt surge arrester in field conditions to learn more

about its operating characteristics before deploying it as a potential new standard for all HFRA. Under the pilot, SCE plans to install these surge arresters at 50 locations in 2019 to evaluate their field performance.

4.7.2.1.2 Meter Alarming for Downed Energized Conductor

Meter alarming for downed energized conductor (MADEC) is a machine-learning algorithm that leverages existing smart meter data to detect the presence of downed, energized conductors. In 2018, SCE started a pilot for a proactive program to de-energize downed conductors based on smart meter input with the MADEC algorithm. SCE plans to complete this pilot in 2019. Rapid detection of downed wire has public safety benefits and can allow for more rapid clearing of energized downed conductor to reduce ignition risk.

4.7.2.2 GSRP Wildfire Mitigation Program Study (Activity AT-2)

4.7.2.2.1 Distribution Fault Anticipation

Distribution Fault Anticipation (DFA) is a predictive algorithm that leverages electrical system measurements to recognize current and voltage signatures indicative of potential pending equipment failures. DFA alerts SCE of potential equipment weaknesses/failures to allow for proactive remediation, thus avoiding faults and minimizing ignition risks. Under this pilot, SCE is investigating the use of DFA to predict failures based on voltage and current signatures for proactive mitigation. In 2019, SCE will implement at least 10 DFA devices in HFRA as part of the pilot to evaluate their field performance. Given the potential wildfire risk mitigation benefits it provides, SCE will attempt to implement up to approximately 50 additional DFA devices in 2019.

4.7.2.2.2 Advanced Unmanned Aerial Study

As described in SCE's GSRP Application, the Advanced Unmanned Aerial Systems (UAS) study project will inform and advance SCE's existing UAS program by exploring the capabilities of Beyond Visual Line of Sight (BVLOS) flight. SCE's UAS program is developing the capability to expedite patrolling utility lines following a PSPS event or other extended outage, to more quickly and safely restore power to customers. In 2019, SCE plans to explore BVLOS UAS capabilities to patrol utility lines.

4.7.2.3 Alternative Technology Evaluations (Activity AT-3)

4.7.2.3.1 Rapid Earth Fault Current Limiter and Arc Suppression Coil

Rapid Earth Fault Current Limiter (REFCL) and Arc Suppression Coils (ASC) are substation devices that limit ground fault current levels and increase ground fault protection sensitivity. These technologies have the potential to substantially limit the amount of energy released in the event of a downed power line, or ground fault, and help reduce fire ignition risks. The REFCL device expands on conventional ASC technology to allow for fault location and further improve fire ignition reductions. SCE will evaluate this technology in 2019.

4.7.2.3.2 Alternate Fault Detection Technology

In 2019, SCE will evaluate alternate fault detection technologies to improve fault identification beyond traditional overcurrent protection methods. These detection systems may help identify faults more quickly and help to minimize fault energy and related ignition risks. This includes technologies for reducing fault energy associated with circuit reclosing, and fault detection schemes which employ voltage, or other measurements, to improve fault detection beyond traditional overcurrent.

4.7.2.3.3 Fire-Resistant Wood Poles with Protective Barrier

A fire-resistant wood pole is created by applying surface treatments, such as wrapping a sacrificial composite shield around the pole. The use of fire-resistant poles will enhance the resiliency of SCE's infrastructure in HFRA and help with rapid restoration. In 2019, SCE will assess the use of a fire-retardant wrap around existing wood poles as a sacrificial layer from fire.

4.7.2.3.4 Substation Class Electronic Fuses

Substation class electronic fuses are devices that are controlled by high speed electronic measurement devices. These fuses can be remotely programmed to activate enhanced fusing protection during high fire risk conditions (e.g., high wind), while limiting service reliability impacts during normal conditions. Additionally, reduced fault energy in the mainline circuitry would help reduce ignition risk. An alternate application of this current-limiting technology is the capability to remotely control energy reduction for highly loaded portions of circuitry. In 2019, SCE will evaluate substation-class electronic fuses for potential deployment in the future.

4.7.2.3.5 Single Phase Reclosers

Single phase reclosers are CAL FIRE-exempt electronic reclosers capable of "gang operation." Gang operation allows for the de-energization of all three phases due to a single-phase fault to prevent energized wire down situations. SCE intends to expand its branch line protection strategy to include single phase recloser applications by development of standard installation practices in 2019.

4.7.2.4 Alternative Technology Implementation (Activity AT-4)

4.7.2.4.1 Vibration Dampers

Vibration dampers are hardware attached to conductors (usually near insulators) to inhibit conductor fatigue from vibration. Under certain conditions vibration dampers can help keep conductor connections and attachments from degrading due to vibration. SCE intends to expand its conductor resiliency effort with vibration damper applications for existing conductors by development of standard installation practices in 2019.

4.7.2.4.2 Ridge Pin Construction

Ridge Pin construction is sometimes referred to as triangular construction due to the shape created by the conductor arrangement. This configuration increases vertical separation between the center phase conductor and the two outside conductor phases to further reduce the potential for conductor-to-conductor contact. Under this configuration, the distance between poles can be larger than span distances utilizing horizontal construction and still maintain conductor clearances in turbulent wind conditions. This type of conductor orientation can be used in difficult terrain conditions where access roads below the conductor may not allow the installation of line spacers. SCE intends to expand its conductor resiliency effort with ridge pin construction for existing conductors by the development of standard rebuild practices in 2019.

4.7.2.4.3 Expanded Connector Selection in HFRA

SCE has expanded its CAL FIRE-exempt connector options to include the bolted wedge connector. In 2019, SCE intends to refine its distribution overhead standards requirements for connector selection for HFRA application.

4.7.3 ACTIVITIES AND 2019 GOALS

In 2019, SCE will continue to explore and implement alternative technologies as part of its grid hardening efforts to reduce the probability of an ignition event and/or reduce public exposure to a hazardous condition during periods of high fire risk. The following table details performance measures for SCE's alternative technology goals.

Activity	Description	2019 Goal	Compliance Evidence
AT-1	Alternative Technology Pilots	1) Pilot installation of 50 CAL FIRE-exempt surge arrestor units in target locations 2) Pilot meter alarming for downed energized conductor	1) Results of 50 CAL FIRE-exempt surge arrestor pilot 2) Results of meter alarming pilot for downed energized conductor
AT-2	GSRP Wildfire Mitigation Program Study	1) Evaluate distributed fault anticipation technology and conduct pilot installation of at least 10 DFA devices 2) Evaluate BVLOS UAS capabilities	1) Results of distributed fault anticipation technology assessment and pilot 2) Evaluation of results of BVLOS of UAS
AT-3	Alternative Technology Evaluations	1) Evaluate REFCL/ASC 2) Evaluate alternate fault detection technology 3) Evaluate fire retardant barrier for wood poles 4) Evaluate substation-class electronic fuses 5) Evaluate branch line protection to include single phase reclosing	1) Assessment of REFCL/ASC feasibility 2) Assessment of technologies for reducing fault energy 3) Assessment and development of specifications of fire-retardant barriers for wood poles 4) Assessment of substation-class electronic fuses 5) Assessment of single phase reclosing
AT-4	Alternative Technology Implementation	1) Develop standard installation practices for Aeolian vibration dampers 2) Develop standard installation practices for ridge pin construction for conductor rebuild 3) Update DOH requirements for connector selection in HFRA	1) Publish vibration damper installation procedure 2) Publish ridge pin construction installation procedure 3) Publish updated connector selection requirements document

4.8 POST INCIDENT RECOVERY, RESTORATION AND REMEDIATION ACTIVITIES

Post-incident recovery, restoration, and remediation activities are important for SCE customer public safety and infrastructure resiliency. As such, SCE follows the recovery, restoration, and remediation guidelines established by CPUC standards for disaster and emergency preparedness plans pursuant to PUC Section 768.6 through its Storm Plan, which is included in SCE's annual GO 166 compliance filing. The plan is designed for disaster preparation and safe and efficient restoration for any type of outages caused by exogenous natural forces. Additional details on post-incident activities are provided in Section 5.2.1.1.

SCE's emergency response plans are periodically reviewed, evaluated, and updated to maintain continued effectiveness in protecting public and employee health and safety, and minimizing damage to public and private property as well as SCE infrastructure. Additionally, after incidents, SCE incorporates lessons learned into its emergency preparation and response plans to further refine its processes including post-incident activities. Additional details on emergency preparedness and disaster response activities are provided in Section 5.1.

SCE may conduct post-wildfire debris-flow assessments to identify and safeguard SCE assets in high-risk debris-flow areas after wildfires. The post-wildfire debris-flow assessment framework uses United States Geological Survey (USGS) modeling to identify areas of high-debris-flow risk. An analysis is conducted to identify substation, transmission, sub-transmission, distribution and telecom assets that could be potentially impacted. Mitigation options will be determined based on the results. Also, for areas of concern, SCE monitors predicted rainfall data.

5 EMERGENCY PREPAREDNESS AND RESPONSE

SCE strives to minimize the impacts of any disruptive event regardless of the size or scope, while consistently focusing attention on the Company's most critical systems and infrastructure. In the utility industry, including at SCE, business resiliency has traditionally been rooted in storm response. That paradigm has evolved to align more closely with emergency management programs at the local, state and national level. The terms emergency management and resiliency are broader in scope than traditional utility storm response and include preparing for all risks, threats and hazards a utility may experience.

5.1 EMERGENCY PREPAREDNESS AND RESPONSE PLAN OVERVIEW

SCE's Business Resiliency organization has led the development of emergency preparedness and response plans based on National Incident Management System (NIMS) and Incident Command System (ICS) principles and protocols as developed by the Federal Emergency Management Agency (FEMA). SCE's preparedness and response plans build upon SCE's continuity protocols and SOBs related to disaster preparedness and response, and involve input from subject matter experts across the company. This cross-functional approach to emergency preparedness and response planning has resulted in emergency action plans that facilitate an effective company-wide response to incidents of varying sizes and emergency disruptions, including wildfire response operations. Emergency preparedness and response plans are periodically reviewed, evaluated, and updated to maintain continued effectiveness in protecting public and employee health and safety, and minimizing damage to public and private property as well as SCE infrastructure.

SCE's emergency preparedness and response plans consider numerous hazards that have been identified as potentially impacting the SCE's service territory and the grid, including earthquakes, cybersecurity, and wildfires. These plans are developed to streamline SCE response efforts, inform critical actions and decision-making, determine roles and responsibilities of SCE first responders, and maximize SCE's ability to respond and recover following any type of disruptive incident. By undertaking comprehensive planning efforts and utilizing these plans, SCE aims to minimize the impacts of these incidents on customers and communities. SCE's emergency preparedness and response plans make available critical information for incident response and recovery team members to implement an efficient, effective, and safe response to any type of incident, disruption, or disaster.

5.1.1 EMERGENCY RESPONSE ORGANIZATION STRUCTURE

SCE employs the ICS as the basis for the Company's Emergency Response Organization (ERO) structure. Trained personnel are assigned the responsibility for key functions within the ICS structure to manage a wide range of incidents ranging from a routine unplanned outage to a major disaster, such as an earthquake or wildfire. Utilization of the ICS structure facilitates SCE's effective response to incidents based on their relative scale and impact to customers.

Key components of SCE's ERO structure are the Emergency Operations Center and the company's IMT. During a major incident (including wildfires), the IMT will manage the organization, assignment, direction, and tracking of relevant resources, both material-and personnel-related. IMT members are regularly trained regarding their roles and responsibilities regarding all types of hazards. The ERO structure facilitates SCE's ability to streamline response efforts and direct skilled personnel towards the most critical restoration priorities.

5.1.1.1 Incident Command System

The ICS is a standardized all-hazards incident management approach that achieves the following:

- Allows the integration of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure;
- Enables a coordinated response among jurisdictions and functional agencies, both public and private through interaction with the IMT; and
- Establishes common processes for planning and managing resources, as well as determining and setting objective and priorities

ICS is used by all levels of government—federal, state, and local—and by many non-governmental organizations and the private sector. ICS is also applicable across disciplines, typically structured to facilitate activities in five major functional areas: Command; Operations; Planning; Logistics; and Finance/Administration. These functional areas may or may not be activated based on the needs of the incident. By utilizing ICS in SCE's planning, training, and response structures, the company is better able to communicate and integrate with local, county, state, and federal response efforts. Utilizing ICS has proven to be beneficial when coordinating response efforts with SCE's government and non-governmental partners in training exercises and during real-world incidents.

5.1.1.2 Mutual Assistance

Currently, SCE is party to multiple mutual assistance agreements, which provide a mechanism to quickly obtain or supply emergency assistance prior to, during, or after an incident that affects generation, transmission, distribution or other SCE facilities. Assistance can be received or supplied in the form of personnel, equipment, materials, and other associated services. Having a robust mutual assistance program is necessary to effectively respond to and restore power following complex and/or large incidents. To access or supply mutual assistance resources, SCE maintains the following mutual assistance agreements:

- California Utilities Emergency Association (CUEA) among California utilities
- Western Region Mutual Assistance Agreement for Electric Utilities (WRMAG), a regional agreement
- Edison Electric Institute (EEI), a national mutual assistance program

These mutual assistance agreements have been pre-established in advance of future incidents, are standardized across utilities, and outline specific requirements and authorizations before crews are received or deployed. SCE regularly participates in mutual assistance calls, planning efforts, and coordinating body meetings, and has provided mutual assistance to other utilities in large-scale emergencies.

In addition to a robustly-trained SCE workforce and mutual assistance agreements, SCE can utilize contractors to assist in restoring service following a major incident, including wildfires, as described in Section 5.2.4 below.

5.2 DESCRIPTION OF HOW THE PLAN IS CONSISTENT WITH DISASTER AND EMERGENCY PREPAREDNESS PLAN PURSUANT TO PUBLIC UTILITY CODE SECTION 768.6

As described below, SCE's 2019 WMP is consistent with the PUC Section 768.6's requirements to have disaster and emergency preparedness plans. Details of these plans are reported to the Commission pursuant to GO 166.

5.2.1 PROGRAM OVERVIEW

SCE follows the restoration guidelines established by CPUC standards for disaster and emergency preparedness plans pursuant to PUC 768.6 through its Storm Plan, which is included as part of its annual GO 166 compliance filing.

5.2.1.1 SCE Storm Plan

The SCE Storm Plan is an effort to respond to emergency incidents resulting in disruptions to the electrical system. It describes the operations and policies that guide how the company plans for, addresses, and responds to emergency electrical incidents using the ICS structure adapted with utility-specific solutions. The plan is designed to facilitate safe and efficient restoration for any type of outages caused by exogenous natural forces by:

- Development of accurate situational awareness and the distribution of a consistent common operating picture;
- Consistent use of the ICS response structure, organization and principles;
- Application of pre-determined restoration priorities; and
- Application of pre-determined processes to manage emergency functions/roles:
    - Damage Assessment
    - Field Resources
    - Mutual Assistance
    - Communications

The intent of the Storm Plan is to help SCE prepare for and respond to storms cohesively across all applicable functions using common protocols, terminology, and organizational structures aligned with nationally-recognized best practices. It outlines how SCE will collaborate with the communities it serves in preparing for and responding to emergency events; this may include things such as pre-staging of field resources or equipment in advance of forecasted weather events. The Storm Plan objectives include:

- Defining the criteria for activating and deactivating the SCE Storm Plan;
- Outlining the communications strategy and notification procedures by which SCE will communicate with its customers, the public at large, appropriate state and local government agencies, essential service providers and critical care customers, and other important stakeholders in the restoration process; and
- Providing an overview of the strategies that SCE will use to employ mutual assistance to share resources with other utilities in order to expedite the restoration of service to customers.

5.2.2 EMERGENCY COMMUNICATIONS

SCE has a comprehensive plan for communicating with its customers during emergencies, especially during outages. SCE's current process includes automated outbound notification to customers through each customer's preferred method of contact when an outage occurs, as outage restoration times are determined or shifted, and upon conclusion of the outage. This schedule of notifications applies to repair

(unplanned) outages and maintenance (scheduled) outages. For maintenance outages, SCE provides advance notice to customers at least three days prior to the outage, but usually up to two weeks in advance. These notifications are followed with an automated reminder call twenty-four hours ahead of the scheduled outage. Further, SCE's Outage Map on SCE.com provides customers with information regarding outages that are affecting their service location.

Following the 2017 wildfires, SCE enhanced its emergency communication plans, focusing on building awareness about the importance of wildfire mitigation and how SCE is undertaking critical work in HFRA. Components include proactive communications and education about wildfire and emergency preparedness as well as communications and awareness during and following wildfire events. As part of GSRP, SCE implemented phase one of its new Emergency Outage Notification System (EONS) in fall 2018. This new system has the capability to execute high-volume notifications within very short timeframes, enabling SCE to reach a large number of customers in areas potentially subject to PSPS.

As discussed in Section 4.6, in 2019, SCE will enhance EONS' capabilities to expand in-language notifications based on customer preference including, but not limited to, Spanish, Mandarin, and Cantonese. SCE relies on customers' self-identification of their preferred language. SCE is committed to continuous improvement in all areas of its wildfire mitigation efforts and will examine the feasibility of using Census data, and other methods, in 2019.

5.2.3 ADDITIONAL ACTIONS TAKEN WITHIN HFRA

5.2.3.1 Communications and Education about Wildfire / Emergency Preparedness:

5.2.3.1.1 Annual Wildfire Customer Direct Mailer (Activity DEP-1)

The annual wildfire awareness direct mailer is a proactive communication solution that allows SCE to target specific areas of its territory with important customer information. As SCE began its campaign to raise wildfire awareness for customers who reside in HFRA, it sent a direct mailer that focused on the "new normal" in California, SCE wildfire mitigation efforts, and PSPS. Approximately 1.5 million customers in HFRA received this letter via direct mail. SCE plans to send the 2019 direct mailer by May 31.

5.2.3.1.2 Local Government Education and Engagement (Activity DEP-1)

SCE has held several meetings with local government officials regarding SCE's overall wildfire mitigation efforts, with discussions focused on educating local governments about the PSPS de-energization process and how the company will communicate and work with government agencies and emergency operations during outages. These meetings were helpful in understanding local government's needs before, during, and after PSPS events. SCE will continue these meetings in 2019 to further educate local government officials, enhance partnerships, increase awareness, and discuss lessons learned.

5.2.3.1.3 Community Meetings (Activity DEP-1)

SCE has conducted several community meetings in HFRA to provide SCE customers who may be impacted by a PSPS event an opportunity to hear firsthand from SCE staff and other community leaders or agencies about the "new normal" in California and what that means to them; how to be prepared and remain resilient; information about SCE's wildfire mitigation efforts; and to share their questions and concerns. These forums allow SCE to obtain up-to-date customer information that is critical for outreach during events. SCE intends to continue customer engagement efforts in HFRA in 2019 and will develop its 2019 community meeting plan and conduct meetings accordingly.

5.2.3.1.4 SCE.com

At SCE's website (SCE.com), customers can find content regarding important utility information and specifics about their individual SCE account. SCE has created a dedicated, interactive and informative landing page where customers can increase their awareness about SCE's wildfire mitigation efforts, learn techniques and considerations that can help prepare them to be more resilient during major events and receive up-to-date information regarding outages in their area. SCE is studying opportunities, and benchmarking with other utilities across the nation, on meaningful enhancements to its website in 2019 to improve the customer experience and PSPS awareness.

5.2.3.1.5 Executing Annual IMT Training Focused On Wildfire Response (Activity DEP-2)

SCE is currently updating its annual IMT training plan which focuses on wildfire mitigation and emergency preparedness. Internally, this will include seminars for IMT members that support execution of wildfire response and protocols for de-energization. Additionally, a series of training exercises utilizing wildfire scenarios that include testing de-energization protocols will be conducted in 2019. These opportunities are in addition to regular IMT trainings and exercises that are required annually as part of SCE's response organization.

5.2.3.2 Communications and Awareness During and Following Wildfire Events

SCE uses a combination of methods for reaching customers during and following wildfire events based primarily on impacted customer population. These methods are described below:

- Toll-free (1-800) phone line staffed with trained resources in SCE's customer contact center who receive calls from impacted customers as a priority; they provide customer-service-related protections to customers.
- Home page alerts on SCE.com that drive customers to a dedicated webpage regarding consumer protections.
- Targeted paid social media campaigns to areas specifically impacted by a disaster (e.g., a wildfire) to inform customers about emergency protections available to those impacted by a specific disaster.
- Trained staff deployed to local assistance centers to work in-person with impacted customers, and advertising on city/county websites about services offered by SCE at these venues.
- Media releases to inform customers about protections and to drive customers to reach SCE through its website or via the toll-free (1-800) phone line.
- Outreach to partnering community-based organizations that serve income-eligible customers to enable awareness of customer-service protections for their organizations' staff who might be working with SCE customers.

5.2.4 SHOWING THAT THE UTILITY HAS AN ADEQUATE AND TRAINED WORKFORCE TO PROMPTLY RESTORE SERVICE AFTER A MAJOR EVENT TAKING INTO ACCOUNT MUTUAL AID AND CONTRACTORS

SCE maintains an adequate and trained workforce ready to provide assistance during emergencies. As described above, SCE has a Storm Plan to respond to emergencies that can vary in scope and size and which may require the activation of mutual assistance to restore power in a safe and timely manner. SCE also has a robust ICS training program for employees identified as emergency responders and currently has approximately 540 employees that have gone through the ICS training program. These

IMT are placed on rotations, and when their teams are on call they are required to respond to the EOC within two hours, with limited exceptions. These teams are specifically structured to have multiple back-ups available, so that response and recovery efforts can be conducted 24 hours a day for several days or even weeks. Moreover, SCE has a large field workforce (both employees and contractors) that is highly skilled and able to restore service during and after a major event.[63] SCE's field workforce has many years of experience, on average, which allows it to effectively respond to major events. SCE also employs contract resources that can be reassigned to assist with a major event.

IMT and EOC capabilities are tested regularly both via real-world incidents such as windstorms, wildfires, and PSPS, and via exercises and drills that all team members are required to participate in annually. These exercises, drills, and real-world activations provide an opportunity for team members to utilize their training, refresh their skills, and learn on the job. During exercises and drills, team members are also evaluated on their performance and given real-time feedback on areas for improvement and best practices.

In addition to SCE's internal response and recovery capabilities, SCE maintains existing mutual assistance agreements with outside providers to meet restoration objectives, as described in Section 5.1. These mutual assistance agreements are activated in incidents which exceed the capacity of SCE's crews and emergency contracting capabilities. The IMT and EOC maintain visibility on the workforce and incidents, maintaining situational awareness of any staffing shortages or other potential shortages, looking ahead at potential needs and requesting appropriate support via additional internal staffing, emergency contracts, or mutual assistance. These requirements are captured in SCE's Storm Plan.

Recognizing the impacts of climate change, the increasing wildfire risk within SCE's service territory, and the potential for numerous PSPS-related EOC activations, SCE is evaluating the need for additional trained staff members and more robust capabilities in its IMT structure. To mitigate these needs, SCE is implementing additional training and exercise opportunities in 2019 to increase team capacity. (Activity DEP-3)

[63] Please see Appendix E for a list documenting the current (approximate) number of SCE field workers, support personnel and contract crews.

5.2.5 ACTIVITIES AND 2019 GOALS

Activity	Description	2019 Goal	Compliance Evidence
DEP-1	Customer Education and Engagement	1) Conduct a direct mail campaign to inform customers in HFRA 2) Develop Local Government Education and Engagement Community Meeting plan 3) Execute Local Government Education and Engagement Community Meeting according to plan	1) Copy of letter and customer list 2) Schedule/Plan of community meetings 3) Presentation materials, sign-in sheet, invitee list
DEP-2	Emergency Responder Training	1) Wildfire response training for new or existing responders 2) Conduct internal IMT Training around wildfire response and de-energization protocols	1) Training sign-in sheets 2) Training/Seminar materials, exercise notes, log of attendees/sign-in sheet
DEP-3	Bolster Incident Management & Incident Support Team members	1) Determine positions that need enhanced staffing 2) Train, exercise, and qualify new staff to meet identified need	1) List of new positions created, or number of personnel needed in existing positions 2) Roster of newly trained personnel

5.3 CUSTOMER SUPPORT IN EMERGENCIES

5.3.1 PROGRAM OVERVIEW

SCE's Emergency Disaster Relief program provides customers impacted by disasters certain protections on their SCE accounts. This program complies with Commission regulations and requirements, including, but not limited to, Resolution M-4833, Resolution M-4835, and D.18-08-004.

The following customer protections are included in SCE's Emergency Disaster Relief program: support for low-income customers, billing adjustments, deposit waivers, extended payment plans, and suspension of disconnection and non-payment fees. These protections remain in effect for one year from the date of the disaster event included in the Governor's state of emergency proclamation.

SCE works with appropriate city and county agencies to identify and verify homes and small businesses in SCE's service territory that were destroyed or damaged by wildfires. SCE conducts field verifications to validate the information and places each home or small business into one of the two following eligibility categories:

- Homes and small businesses destroyed by a disaster are considered total losses, and their accounts are flagged in SCE's Customer Service system as eligible for protections as outlined in the Emergency Disaster Relief program. These accounts remain flagged until the customers establish replacement residences or small businesses for one year from the date of the event included in the Governor's state of emergency proclamation, or as otherwise specified or extended by CPUC order.

- Homes and small businesses damaged by a disaster are not considered total losses. These accounts are flagged in SCE's system and are eligible for protections as outlined in Resolution M-4833, Resolution M-4835 and D.18-08-004.

SCE's dedicated customer support representatives are trained on emergency customer protections and provide information to customers about eligibility for SCE's Emergency Disaster Relief program, and the processes to receive appropriate assistance. Upon receipt of lists of impacted customers from relevant building and safety departments, SCE reaches out to customers directly using customer-indicated preferred contact methods to provide targeted messages about their customer-protection eligibility.

The section below includes information about these customer protection and disaster relief programs. SCE has also included information related to its outage reporting and repair processing and timing.

5.3.2 ACTIONS TAKEN TO SUPPORT CUSTOMERS DURING AND AFTER A WILDFIRE

SCE takes specific actions to support customers during and after wildfires, including:

- Providing support to low-income customers
- Facilitating billing adjustments
- Offering account deposit waivers
- Extending payment plans
- Suspending disconnection and non-payment fees
- Providing access to utility representatives
- Submitting outage reports
- Communicating repair processing and timing

These activities are described in the sections below:

5.3.2.1 Providing Support for Low-Income Customers

SCE partners with a network of more than 100 non-profit community and faith-based organizations across its service territory. Through these alliances, SCE helps eligible customers enroll in income-qualified programs, including the California Alternate Rates for Energy (CARE) program, the Family Electric Rate Assistance (FERA) program, the Energy Assistance Fund (EAF), and the Energy Savings Assistance (ESA) program.

Within SCE's Customer Service business unit, the group responsible for the CARE program identifies and flags CARE customers impacted by a disaster. All CARE program standard- and high-usage post-enrollment eligibility verification requests for these customers are frozen, which allows impacted customers who have pending verification requests to remain in the CARE program for one year from the date of the disaster event without any further affirmative customer action.

SCE partners with the United Way of Greater Los Angeles, its EAF program administrator, to provide an additional, one-time bill payment assistance amount of $100 for eligible, impacted customers. This is in addition to the standard one-time $100 EAF bill credit, amounting to a total one-time assistance amount of $200 for customers impacted by a disaster who apply and qualify for the EAF grant.

The ESA program is a direct-install program that offers income-qualified customers energy efficiency-related services and measures at no cost. The ESA program can provide benefits to income-qualified customers whose homes are damaged by wildfires, and who qualify for replacement of existing appliances. SCE educates low-income customers impacted by a disaster about the ESA program and, if customers are interested, deploys its ESA contractors to customers' homes to confirm ESA program qualification and assists in the enrollment process.

5.3.2.2 Facilitating Billing Adjustments

SCE discontinues billing and closes the service accounts for customers whose homes or small businesses were destroyed by a disaster from the date of the disaster event included in the Governor's state of emergency proclamation. However, SCE maintains these customers' account information and history to support their rebuilding efforts and transfers the customers' information to their new residences or small businesses, and re-establishes their credit history.

SCE suspends bill estimation for customers impacted by disasters, including those customers who were away from their residences or businesses when evacuations were ordered. In some instances, this takes SCE additional time to compile and verify the dates when the residences and businesses were unoccupied due to a disaster. SCE works with the appropriate city and county agencies to identify and verify homes and small businesses in SCE's service territory that were destroyed or damaged by wildfires and follows up with field verifications. Upon contact from customers who receive bills based on estimated usage for the times they were evacuated, SCE conducts an account review and makes appropriate billing adjustments. If a customer is billed during the evacuation period based on actual electricity usage, SCE considers adjusting customer bills under specific circumstances, even if the customer's residence or business was not destroyed in the disaster. In addition, SCE adjusts minimum charges for evacuated customers, as appropriate.

5.3.2.3 Offering Account Deposit Waivers

SCE customers who request utility service re-activation and have been identified as impacted by wildfires are not required to provide security deposits for their accounts.

5.3.2.4 Extending Payment Plans

Though SCE identifies customers whose homes or small businesses were destroyed or damaged during the disaster, SCE relies on its customers to contact SCE and self-certify their particular, disaster-related financial situation. SCE works with impacted customers who contact SCE to establish reasonable payment arrangements based on individual customer need. SCE works with impacted customers to establish an initial payment no greater than 20 percent of the amount due, and the remaining amount due to be paid in equal installments over at least 12 billing cycles for customers with prior arrearages, and exceed at least eight billing cycles for other impacted customers. SCE customers are eligible to pay off their arrearages at any time (sooner), if they prefer.

5.3.2.5 Suspending Disconnection and Non-payment Fees

As part of its regular business practice, SCE does not assess or charge disconnection fees for destroyed homes or small businesses. Upon identification of impacted customers, SCE immediately confirms that customer accounts are flagged, suspends disconnection for non-payment, waives late fees and deposit requirements, and discontinues late payment reports to credit reporting agencies.

SCE keeps the accounts of residential and small business customers whose homes or small businesses were damaged by disaster active for one year, to support their home or small business re-building efforts.

5.3.2.6 Providing Access to Utility Representatives

Following a disaster event, SCE communicates disaster-related information to its communities via multiple channels, including, but not limited to, a designated, toll-free (1-800) SCE Customer Support phone line available Monday-Friday, 6 a.m.- 9.p.m. and Saturdays, 8 a.m.-5 p.m., and representatives deployed to Local Assistance Centers (LAC), ready to assist impacted customers to offer available protections. In addition, SCE makes the information regarding the disaster relief programs, the eligibility requirements for these programs, and how customers can inform SCE regarding their circumstances available on SCE.com.

5.3.2.7 Submitting Outage Reports

Commission requirements for outage reporting include notifications to customers about outages and reporting on outages pursuant to GO 166 and ESRB-8.

5.3.2.7.1 Notifications to Customers about Outages

SCE provides targeted and customized messages to customers regarding potential PSPS outage events, as well as repair and maintenance outages. They include notifications on potential time and duration of outages, update alerts, and restoration messages. These are communicated to customers through a variety of methods such as customer-stated, preferred methods of contact (e-mail, text, and/or SMS) and direct mailers (for maintenance outages).

Additionally, SCE posts emergency alerts, outage information, and restoration updates on its website, SCE.com, where impacted customers can view outage details.

5.3.2.7.2 G.O 166, Standards for Operation, Reliability, and Safety during Electric Emergencies and Disaster – Reporting Requirements

SCE submits reports to the CPUC within required timeframes for various outage types and circumstances, as detailed in GO 166, Standards for Operation, Reliability, and Safety during Electric Emergencies and Disaster. The following table provides a summary:

Outage Type/Circumstance	Report Requirements	Report Submitted to CPUC
Every time circuit block interruption is intended.	• Start time and anticipated curtailment or rotating outage duration • Interruptible load for firm-load rotating outage blocks/groups and sub-blocks/groups • Total amount of interruptible load curtailments or firm load outages, and major firm load interruption locations • SCE's emergency contact person and numbers	As soon as possible.
Outages expected to accrue to more than 300,000 customer hours, exceed 300	• Possible outage cause • Time and location of initiating event • Approximate number and location of impacted customers	Within one hour.

Outage Type/Circumstance	Report Requirements	Report Submitted to CPUC
megawatts of interrupted load, or affect more than 10% of customers.	• Work necessary to restore service • Estimated service restoration time • SCE's event contact person and numbers	
Emergencies involving SCE facilities or personnel, likely to be reported statewide or in more than one major media market.	• Where, when, how, and what happened • Effects on electric service • Injuries, hospitalizations, or casualties • Property damage • Steps taken to resolve the emergency • Time when the situation is expected to return to normal • SCE's emergency contact person and numbers	Within one hour.
Interruptions to bulk power supply that are likely to lead to an ISO-declared Stage 2 or 3 emergency on or before the next business day.	• Interruption cause • Time and location of initiating event • Factors that would mitigate or worsen the emergency • Location and number of customers potentially impacted • Expected duration of the low-capacity situation • SCE's event contact person and numbers	Within one hour.
Outages affecting more than 30,000 customers, or lasting over 24 hours for 2,500 customers, or expected to total over 60,000 customer hours, or for situations likely to lead to such outages.	• Interruption cause and time • Name and location of impacted facilities • Outage start and end times • Location and number of impacted customers • Number of customers for whom the outage exceeded four hours • When service will be restored • SCE's event contact person and numbers	By 9:00 a.m. the next business day.
Outages associated with Office of Emergency Services (OES)-declared states of emergency, not otherwise reportable under the criteria above	• Outage cause • Outage start and end times • Location and number of impacted customers • Number of customers for whom the outage exceeded four hours • When service will be restored • Emergency crew movement between regions • Mutual-assistance requests to other utilities • SCE's event contact person and numbers	As soon as possible.

5.3.2.7.3 ESRB-8 Reporting Requirements

IOUs are required to submit a report to the Director of SED within 10 business days after each de-energization event, and after high-threat events where the IOU provided notifications to local government, agencies, essential services, and customers of possible de-energization but no de-energization occurred. These reports must include at a minimum the following information:

- A list of the local communities' representatives the IOU contacted prior to de-energization, the date on which they were contacted, and whether the areas impacted by the de-energization are classified as Zone 1, Tier 2, or Tier 3 as per the definition in GO 95, Rule 21.2-D.
- An explanation if the IOU is not able to provide customers with notice at least 2 hours prior to the de-energization event.
- Summary of the number and nature of complaints received as the result of the de-energization event, including claims that are filed against the IOU because of de-energization.
- Detailed description of the steps the utility took to restore power.
- The address of each community assistance location during a de-energization event, describing the location (in a building, a trailer, etc.) and describing the assistance available at each location, including the days and hours that it was open.

5.3.2.7.4 Communicating Repair Processing and Timing

During and following a disaster event, repair and power restoration timelines are largely dependent on access to the damaged area, damage to SCE assets, ability to secure materials and repair resources, and customer restoration priority. Essential services and facilities associated with safety will receive a higher restoration priority, when feasible. SCE communicates repair and restoration priority status to customers via its website, SCE.com. In addition, SCE makes efforts to communicate estimated restoration times to customers through their preferred or alternate methods of contact. These communications typically take place at the beginning of an outage and continue throughout the duration of the outage period and restoration efforts.

In 2018, SCE implemented Customer Crew Communications (C3) into its Outage Management System (OMS) which allows crews to enter outage information directly into the system. This enhancement allows SCE to provide customers with more timely, accurate outage status and creates a direct flow of information from SCE's field personnel into the OMS, which then pushes information directly to customers. Further customer benefits include SCE's ability provide information on estimated arrival times and other restoration details more accurately.

On SCE's website, the dedicated outage page has undergone enhancements in 2018. The outage map progress tracker, a customer-facing graphic, now has intuitive reasoning built in that more thoroughly displays several steps in the outage process, providing customers with the current status and what to expect next. The information includes the type of outage, such as maintenance or repair, estimated restoration time, crew arrival information, and number of customers impacted. Additionally, this page continues to link customers to helpful and relevant information such as outage tips and preparedness.

6 PERFORMANCE METRICS AND MONITORING

This chapter identifies SCE's management overseeing this WMP and includes the operating unit(s) and department(s) responsible for carrying out the activities described in the previous chapters. SCE describes the controllable metrics that are different from the activity goals. Like the activity goals, these metrics are used to demonstrate compliance of this WMP. This section also describes indicators that will be used for tracking purposes. Section 6.3 then provides background information on historical measures. Lastly, Section 6.4 describes SCE's monitoring and auditing process, and corrective actions (if necessary).

6.1 SCE MANAGEMENT RESPONSIBLE FOR EXECUTING THE WILDFIRE MITIGATION PLAN

SCE's 2019 goal planning process assigns overall responsibility for the WMP at the executive level and responsibility for individual activities to specific operating units and departments.

6.1.1 EXECUTIVE LEVEL WITH OVERALL RESPONSIBILITY

Phil Herrington, SCE's senior vice president of T&D, has overall responsibility for this WMP.

6.1.2 SCE OPERATING UNIT RESPONSIBILITY SPECIFIC TO EACH COMPONENT OF THE PLAN

Mitigation Activities	Operating Unit and Department
Risk Analysis: • Expansion of Risk Analysis (RA-1)	Finance; Enterprise Risk Management
Evaluation of HFRA: • Evaluation of HFRA boundaries (EVAL-1)	T&D; Grid Modernization & Resiliency
Operational Practices: • Annual SOB 322 Review (OP-1) • Wildfire Infrastructure Protection Team Additional Staffing (OP-2)	T&D; Transmission, Substation & Operations (OP-1) Safety, Security & Business Resiliency; Business Resiliency (OP-2)
Inspections: • Distribution Enhanced Overhead Inspections and Remediation in HFRA (IN-1) • Transmission Enhanced Overhead Inspections and Remediation in HFRA (IN-2) • Quality Oversight / Quality Control program based on EOI (IN-3) • Infrared Inspection of hot spots on overhead distribution facilities and equipment (IN-4) • Infrared Inspection, Corona Scanning, and High Definition imagery of overhead	T&D; Distribution and Transmission, Substation & Operations

Mitigation Activities	Operating Unit and Department
transmission facilities and equipment (IN-5)	
System Hardening: • Covered Conductor (SH-1) • Evaluation of Undergrounding in HFRAs (SH-2) • Composite Poles and Cross Arms (SH-3) • Branch Line Protection Strategy (current limiting fuses, CLFs) (SH-4) • Remote Controlled Automatic Reclosers Installations (SH-5) • Remote Controlled Automatic Reclosers Setting Updates (SH-6) • Circuit Breaker Fast Curve (SH-7)	T&D; Distribution and Transmission, Substation & Operations
Vegetation Management: • Hazard Tree Removal program (VM-1) • Expanded Pole Brushing (VM-2) • Expanded clearance distances at time of maintenance (VM-3) • DRI quarterly inspections and removals (VM-4) • LiDAR Inspections of Transmission (VM-5)	T&D; Distribution (Vegetation Management)
Situation Awareness: • Additional Weather Stations (SA-1) • Fire Potential Index Phase II (SA-2) • Additional HD Cameras (SA-3) • High-Performing Computer Weather Modeling System (SA-4) • Develop Asset Reliability & Risk Analytics Capability (SA-5)	Safety, Security & Business Resiliency; Business Resiliency
Protocols on Public Safety Power Shut-Off: • De-Energization Notifications (PSPS-1)	Safety, Security & Business Resiliency; Business Resiliency
Alternative Technologies: • Alternative Technology Pilots (AT-1) • GS&RP Wildfire Mitigation Program Study (AT-2) • Alternative Technology Evaluations (AT-3)	T&D; Asset Management, Strategy & Engineering

Mitigation Activities	Operating Unit and Department
• Alternative Technology Implementation (AT-4)	
Emergency Preparedness: • Customer Education and Engagement (DEP-1) • Emergency Responder Training (DEP-2) • Bolster Incident Management & Incident Support Team (DEP-3)	Safety, Security & Business Resiliency; Business Resiliency (DEP-2, DEP-3) Customer Service; Customer Service Operations Division (Consumer Affairs) (DEP-1)

6.2 METRICS TO EVALUATE THE PERFORMANCE OF THE PLAN AND UNDERLINING ASSUMPTIONS

6.2.1 METRICS

This section describes the performance metrics that will be used to assess compliance with this WMP. Mitigation plans in the GSRP are currently under review by the CPUC; accordingly, the relevant GSRP-related performance metrics in this WMP may be updated in future years' plans based on the CPUC's review and eventual decision in A.18-09-002.

In order to assess compliance with this WMP, SCE has included a set of performance metrics that are both "controllable" and "quantifiable." A controllable metric is one that SCE has the ability to control or influence the outcome through planned activities. A quantifiable metric is one that is measurable. Uncontrollable metrics are those that are outside of SCE's control. For example, the number of car hit pole events or the number of RFW days. SCE's metrics defined in this chapter are intended to track progress to specific goals to evaluate this WMP's performance.

In addition to metrics, this section describes indicators that do not evaluate compliance performance in 2019 because drivers contributing to the indicators include uncontrollable factors, making it difficult to set accurate, achievable, and numerical goals in 2019. Indicators are included in this WMP to evaluate trends that can help inform current and future strategies and programs. For example, SCE will continue to track and analyze the number of ignitions using the CPUC-reportable ignitions criteria as an indicator. However, given that a subset of ignitions can be caused by uncontrollable events unrelated to SCE's electrical equipment, this value will continue to be tracked in 2019 for informational purposes, and is not being used as a 2019 performance-based compliance metric with a specific target in this section.

Cumulatively, the success of the individual programs and activities in this WMP are expected to result in an overall reduction of controllable fire ignition events. Table 6.6 below summarizes the work streams and associated performance metrics. Not all activities described in previous chapters are considered performance metrics and do not appear in the table below. Both activities and performance metrics are relevant to WMP compliance evaluation. Further below SCE describes these metrics.

Table 6-6
Metrics

Work Stream	Performance Metric	Unit of Measurement	2019 Goal
Vegetation Management	Enhanced Vegetation Management	The number of trees removed as part of HTMP (VM-1)	7,500 trees
	Quality Control Inspections in HFRA	Circuit miles inspected	400 Transmission circuit miles 450 Distribution circuit miles
	Drought CEMA Program Trees Removed in HFRA	The number of trees removed as part of DRI	30,000 trees forecast
System Hardening	Wildfire Covered Conductor Program (WCCP) Miles Hardened	The number of circuit miles replaced with covered conductor (SH-1)	At least 96 circuit miles re-conductored
Operational Practices	Fuses Installed	The count of fuses installed on un-fused branch lines (SH-4)	At least 7,500 fuses
Situational Awareness	Weather Stations Installed	Count of weather stations installed (SA-1)	At least 315 weather stations
	HD Cameras Installed	Count of HD cameras installed (SA-3)	At least 62 HD Cameras
Patrols & Inspections	Enhanced Overhead Inspections (EOI) in HFRA	Inspect all Distribution, sub-transmission and transmission overhead lines in HFRA	100% of overhead lines in HFRA inspected

6.2.1.1 Vegetation Management

Vegetation, particularly palm fronds, are common foreign objects that contact conductors. Dry vegetation can also act as fuel in case of a wildfire. Therefore, enhancing SCE's vegetation management program is a priority in HFRA. Vegetation Management activities include tree trimming and tree removal in proximity to utility power lines and weed abatement around overhead structures in HFRA. SCE employs contractors to perform the work and performs quality control inspections on the completed work. To measure the success of SCE's vegetation management activities, the following three metrics will be used: (1) Enhanced Vegetation Management, (2) QC inspections in HFRA, and (3) Drought CEMA Program trees removed in HFRA.

6.2.1.1.1 Enhanced Vegetation Management

This metric measures the number of trees (including palms) removed as part of HTMP. HTMP expands vegetation management activities to assess the structural condition of trees in HFRA that are not dead or dying, but could nevertheless fall into or otherwise impact electrical facilities and potentially lead to ignitions and outages. These trees can be located up to 200 feet on either side of SCE's electrical facilities, significantly beyond the 4-foot clearance requirement in HFRA. The Hazard Tree Mitigation Program is described in more detail in Section 4.4.

6.2.1.1.2 Quality Control Inspections in HFRA

SCE will perform Quality Control compliance inspections in HFRA to verify compliant contractor work. The 2019 goal is to inspect vegetation adjacent to approximately 400 transmission circuit miles and approximately 450 distribution circuit miles.

6.2.1.1.3 CEMA Program Trees Removed in HFRAs

As described in Section 4.4, SCE established the DRI as a separate and distinct program from SCE's ongoing vegetation management activities. Under the DRI, SCE plans to remove approximately 30,000 trees in HFRA in 2019 that are dead, dying, or diseased, and that could impact SCE's electrical facilities.

6.2.1.2 System Hardening

SCE's system hardening programs are designed to reduce the risk of wildfire ignitions associated with be electrical infrastructure.

6.2.1.2.1 Wildfire Covered Conductor Program Miles Hardened

As discussed in Chapter 3, 53 percent of fire ignition events from 2015 to 2017 were on distribution voltage-level infrastructure in HFRA and due to contact from external objects (e.g., palm fronds, metallic balloons, debris) and an additional two percent from wire-to-wire contact. To reduce the probability of these ignitions, SCE is replacing existing overhead conductor with covered conductor that insulates and protects electrical lines against contacts from foreign objects and against power lines coming into contact with each other during high wind events. This program's performance will be measured by the execution of replacing overhead bare conductor with covered conductor in HFRA which has a 2019 goal of installing at least 96 circuit miles of covered conductor.

6.2.1.3 Operational Practices

6.2.1.3.1 Fuses Installed

Equipment or facility failure accounts for 30 percent of fire ignition events associated with electrical infrastructure based on SCE's CPUC-reportable ignitions data from 2015 to 2017. A fuse serves to protect an overloaded circuit by interrupting the flow of electricity. Fuses have the ability to limit the amount of energy associated with a fault, which minimizes the ignition potential. Currently, many of SCE's HFRA circuits have un-fused branch lines. SCE plans to install CLF on these un-fused branch lines to further minimize ignition risk. The 2019 performance metric that will be used to measure this program's effectiveness is the number of fuses installed in HFRA. The 2019 goal is to install at least 7,500 CLFs in HFRA.

6.2.1.4 Situational Awareness

The above mitigation activities can significantly lessen the likelihood of fire ignition events, but there are factors, such as severe weather events, that are uncontrollable. SCE relies on technologies and weather experts to better anticipate and plan for these occurrences. The following activities can help improve situational awareness prior to and during such events.

6.2.1.4.1 Weather Stations Installed

SCE is focused on accessing real time information about wildfire risk at a more granular level. This will help SCE better understand how weather conditions might impact utility infrastructure and public safety in HFRA. Additional details on the benefits of these weather stations are in Section 4.5. The performance

metric proposed to measure how effectively this program is executed is the number of weather stations installed, with a goal of at least 315 units in 2019.

6.2.1.4.2 HD Cameras Installed

As discussed in Section 4.5, additional HD cameras in HFRA may help fire agencies respond more quickly if an ignition occurs. The performance metric to measure how effectively this program is executed is the number of cameras installed, with a target of 62 HD cameras installed in 2019.

6.2.1.5 Patrols and Inspections

6.2.1.5.1 Enhanced Overhead Inspections in HFRA

SCE plans to inspect all distribution, sub-transmission and transmission overhead lines in HFRA in 2019. Any issues found through these enhanced inspections will follow SCE's existing process for work prioritization as described in Section 4.2.

6.2.2 INDICATORS

SCE will use indicators to track values that are not used to evaluate WMP compliance performance in 2019. Additional analysis over time is needed to potentially adjust indicators for uncontrollable factors before considering proposing them as performance goals in future plan filings.

Table 6-7
Indicators

Indicators	Unit of Measurement
Wire Downs on Circuits in HFRA	Count of wire down events on HFRA circuits
Ignitions on Circuits in HFRA	Count of all ignitions on HFRA circuits associated with contact from object or equipment failures
Counts of all faults on Circuits in HFRA	Count of all faults on HFRA circuits associated with contact from object or equipment failures

6.2.2.1 Wire Downs on Circuits in HFRA

The Wire Downs indicator is a count of all events involving conductors that contact the ground or foreign object on circuits in HFRA.

6.2.2.2 Ignitions on Circuits in HFRA

A count of CPUC-reportable ignitions in SCE's service territory that meet the following conditions:

a. A self-propagating fire of material other than electrical and/or communication facility; and
b. The resulting fire traveled greater than one linear meter from the ignition point; and
c. The utility has knowledge that the fire occurred

SCE's ignition data collection process includes a variety of fields to track ignition data including start time, location, size, and drivers covering contact from object and equipment. To the extent the information is known, SCE documents it in its system.

6.2.2.3 Counts of all faults in HFRA Circuits categorized by driver

SCE will track counts of all faults on HFRA circuits associated with contact from object or equipment failures.

6.3 HISTORICAL INDICATORS AND METRICS

Fire mitigation has been an integral part of SCE's operational practices for years. SCE collects fire-related data to improve its wildfire mitigation efforts. This section documents the CPUC-reportable ignitions as the current and historical primary indicator used to track wildfires associated with electrical equipment.

6.3.1 CPUC REPORTABLE IGNITIONS INDICATORS

The primary indicator that the Commission tracks for wildfires associated with electrical infrastructure is known as "reportable ignitions."[64] A reportable ignition is any event where utility facilities are associated with the following conditions:

(a) A self-propagating fire of material other than electrical and/or communication facility, and

(b) The resulting fire traveled greater than one linear meter from the ignition point, and

(c) The utility has knowledge that the fire occurred.

SCE began tracking ignitions in May 2014. Because the 2014 dataset reflected partial annual counts, SCE used data from 2015 to 2017 in its risk analyses; these risk analyses influenced the wildfire mitigation programs and mitigation measures proposed within the GSRP Application. CPUC-reportable ignition data from 2015 to 2017 tracked 302 ignitions associated with SCE utility equipment, with 133 of these ignitions located within HFRA. SCE is in the process of analyzing 2018 fire ignition data. In addition to incorporating additional 2018 historical ignition data reportable to the CPUC, SCE will supplement this analysis in 2019 as described in Section 3.2.

6.3.2 OUTAGE DATABASE AND RELIABILITY METRICS

ODRM is a database that is used to gather information about electrical outages. Since January 2006, SCE has recorded all unplanned outages that affect a single line transformer or more on SCE's electrical system. For all such outages, every restoration step, the associated time, customers affected and associated outage cause (if known) are recorded.

6.4 COMPARISON OF THE WILDFIRE MITIGATION PLAN WITH THE FIRE PREVENTION PLAN (FPP)

SCE's 2017 FPP describes measures implemented to mitigate the threat of overhead powerline-associated ignitions and/or equipment-related ignitions within SCE's service territory. The FPP outlined SCE's use of applicable RFW methods in HFRA and assigned responsibilities of organizational units in preventing ignitions:

- D.12-01-032 required SCE to prepare a FPP to identify 3-second wind gusts in real time and address situations where all three of the following conditions occur simultaneously: 1) 3-second wind gusts exceeding the structural or mechanical design standards for the affected overhead powerline facilities, 2) these 3-second gusts occur during a period of high fire danger, and 3) the affected facilities are located within a high fire threat area.

[64] *See* D.13-02-015. Reportable ignitions do not include fires that cause damage to utility facilities but whose ignition is not associated with utility facilities are excluded from this requirement.

- D14-05-020 modified D.12-01-032 and eliminated the requirement to identify 3-second wind gusts in real time if a utility does not deploy fire-prevention measures that rely on real time observations of wind gusts. D.14-05-020 required SCE to "identify the parts of its service territory where it is reasonably foreseeable that the following conditions may occur simultaneously: 1) 3-second wind gusts exceed the structural or mechanical design standards for the affected overhead powerline facilities, 2) these 3-second gusts occur during a RFW, 3) the affected facilities are in a high fire threat area; and 4) that "[i]n making this determination, the utility shall use a minimum probability of 3 percent over a 50-year period that 3-second wind gusts which exceed the design standards for the affected facilities will occur during a RFW in a high fire-threat area."

In 2018, SCE completed a comprehensive update to its FPP that included many elements in this WMP. The 2018 FPP update encompassed all CPUC requirements identified in previous versions of the FPP and included additional strategies and programs focused on fire prevention, including the following items:

- System hardening
- Recent engineering and technical solutions
- Vegetation Management program improvements
- Operational enhancements (e.g., PSPS)
- Situational Awareness Center upgrades
- Weather monitoring and modeling improvements
- External engagement and outreach

A comparison of all elements included in the 2018 FPP and this WMP can be found in Appendix F.

6.5 COMPLIANCE, CORRECTIONS AND MONITORING PROCESSES AND PROCEDURES

6.5.1 MONITORING AND AUDITING OF THE PLAN

Protecting public and employee safety is a core value for SCE. This WMP is focused on identifying, prioritizing and executing mitigation programs and activities to further protect the public, customers, employees and contractors, and the grid from evolving and increasing wildfire risk. In accordance with SB 901, SCE's performance metrics described herein will measure the effectiveness of SCE's strategies and programs described in previous chapters.

SCE will use a performance dashboard as the platform to track progress on the wildfire mitigation metrics/activities included in this WMP and to illustrate progress in a visual manner. Progress towards 2019 goals of individual activities and higher-level metrics will be updated and reported on a monthly basis to SCE senior leadership. In accordance with PUC Section 8386, SCE will file a report with the CPUC addressing SCE's compliance with its 2019 WMP by March 31, 2020.

In addition to the required compliance report, SCE will maintain the compliance documentation described for each activity and make such documentation available to the independent evaluator upon request.

Additionally, SCE's internal Audit Department provides independent evaluations and assessments of risk management, governance, and controls to improve the effectiveness of Company operations. The annual audit plan is developed with input from SCE management and approved by the Board of Directors' Audit Committee each February. The annual audit plan may include evaluation of specific mitigation programs or activities included in the WMP.

6.5.2 IDENTIFYING AND CORRECTING ANY DEFICIENCIES IN THE PLAN

Progress towards 2019 goals of individual activities and higher-level metrics will be monitored by the PMO and management to enable SCE to address any potential performance challenges. All stakeholders are empowered to suggest improvement opportunities, including: field crews conducting work in HFRA, management reviewing results or trends, or formal internal or external auditors. The owner of each mitigation program or activity will be responsible for developing and implementing corrective actions for improvement opportunities encountered during implementation or for metrics that are off-track or trending negatively.

Ensuring implementation of corrective actions and overall monitoring of the metrics will be the responsibility of the applicable organization. These organizations will report to T&D executive leadership through existing channels.

6.5.3 MONITORING AND AUDITING THE EFFECTIVENESS OF WILDFIRE MITIGATION PROGRAMS

SCE has already started executing many aspects of this WMP, and the Company will continue to assess and evaluate the effectiveness of each mitigation program or activity. As noted in Section 6.2.2, analysis of indicators over time will help inform the effectiveness of SCE's mitigation strategies and programs and will provide data to continually improve and adjust these efforts accordingly. By evaluating trends of events linked to specific drivers for circuits that have gone through one or more wildfire mitigation programs and activities, SCE will assess how effective the mitigations are at preventing future ignitions. SCE's ability to measure the effectiveness of wildfire mitigation programs will be limited in 2019 and will require years of observation in HFRA to develop a complete view on the effectiveness of SCE's wildfire risk mitigation efforts.

7 ANY OTHER INFORMATION THAT THE CPUC MAY REQUIRE

7.1 COST INFORMATION

The following table provides potential cost implications of the strategies and programs described in Chapter 4 of this WMP.

7.1.1 EXPLANATION OF HOW DOUBLE TRACKING IN MEMORANDUM ACCOUNTS IS PREVENTED

SCE's new mitigation strategies/programs identified in Table 7-1 include three memorandum accounts (MA) that SCE will use to track its incremental costs, as appropriate. These memorandum accounts include the GSRP MA, SB 901 MA, and the Fire Hazard Prevention Memorandum Account (FHPMA). SCE has and will set up separate accounting in its SAP system to track cost for each MA. The separate accounting will ensure that SCE does not account for these incremental costs more than once. Moreover, SCE will seek cost recovery for the incremental costs in the SB 901 MA and the FHPMA in its 2021 GRC. In its 2021 GRC, SCE will be delineate these separate incremental costs by the activities described in the WMP and will demonstrate that the costs are incremental. Prior to seeking cost recovery, SCE will also assess and review the entries to these memorandum accounts for quality oversight purposes and will make adjustments should it find errors. SCE will have a similar accounting structure to ensure incremental costs recorded to its FHPMA are not also recorded elsewhere. Additionally, SCE will monitor these accounts and make adjustments when appropriate if costs are determined to be non-incremental.

SB 901 Activity Identifier	Activity/Program	2019 Cost (Capital) ($M) ($Nominal) (2019 Goal)	2019 Cost (O&M) ($M) ($Nominal) (2019 Goal)	2019 Cost (Capital) ($M) ($Nominal) (2019 Expansion/ Acceleration)	2019 Cost (O&M) ($M) ($Nominal) (2019 Expansion/ Acceleration)	Costs Currently reflected in Revenue Requirement	Funding that is or will be Addressed in Another Case	Memo accounts where the cost of program/ strategy are being tracked
AT-1	Alternative Technology Pilots	0.2	N/A	N/A	N/A	2018 GRC Pending	2018 GRC and/or 2021 GRC	Potentially SB 901 MA
AT-2	GSRP Wildfire Mitigation Program Study	N/A	0.6	1.4	N/A	No	GSRP Application and potentially pending 2018 GRC and/or 2021 GRC	GSRP MA and potentially SB 901 MA
AT-3	Alternative Technology Evaluations	N/A	0.0	N/A	N/A	Cross-organization labor costs included in 2018 GRC Pending (labor costs not included in cost estimate)	2018 GRC and/or 2021 GRC	Potentially SB 901 MA
AT-4	Alternative Technology Implementation	N/A	Cross-organization labor costs included in 2018 GRC	N/A	N/A	2018 GRC Pending	2018 GRC	N/A
IN-1	Distribution Enhanced Overhead Inspections and Remediation in HFRA	102.8	144.9	N/A	N/A	No	2018 GRC and/or 2021 GRC	SB 901 MA
IN-2	Transmission Enhanced Overhead Inspections and Remediation in HFRA	9.9	25.0	N/A	N/A	No	2018 GRC and/or 2021 GRC	SB 901 MA
IN-3	Quality Oversight / Quality Control of EOI	N/A	Part of Division Overhead costs included in 2018 GRC	N/A	N/A	2018 GRC Pending	2018 GRC	N/A
IN-4	Infrared Inspection of energized overhead distribution facilities and equipment	N/A	0.5	N/A	N/A	No	GSRP Application	GSRP MA
IN-5	Infrared Inspection, Corona Scanning, and High Definition imagery of energized overhead Transmission facilities and equipment	N/A	5.7	N/A	N/A	No	2021 GRC	SB 901 MA
N/A	AGP – Drive by of overhead Distribution facilities and equipment	N/A	Included in ODI	N/A	N/A	2018 GRC Pending	2018 GRC	N/A
N/A	Automatic Reclosers Replacement Program	2.4	N/A	N/A	N/A	2018 GRC Pending	2018 GRC	N/A
N/A	Capacitor Bank Replacement Program	18.1	N/A	N/A	N/A	2018 GRC Pending	2018 GRC	N/A
N/A	Detailed inspection of Transmission facilities and equipment	N/A	5.7	N/A	N/A	2018 GRC Pending	2018 GRC	N/A
N/A	Deteriorated Pole Program	251.2	N/A	N/A	N/A	2018 GRC Pending	2018 GRC	N/A
N/A	Insulator Washing	N/A	1.2	N/A	N/A	2018 GRC Pending	2018 GRC	N/A
N/A	IPI – Intrusive pole inspections to identify rot and decay	N/A	6.1	N/A	N/A	2018 GRC Pending	2018 GRC	N/A
N/A	ODI – Detailed inspections of Distribution overhead facilities and equipment	N/A	8.6	N/A	N/A	2018 GRC Pending	2018 GRC	N/A
N/A	Overhead Conductor Program	143.9	N/A	N/A	N/A	2018 GRC Pending	2018 GRC	N/A
N/A	PCB Transformers Replacement Program	1.5	N/A	N/A	N/A	2018 GRC Pending	2018 GRC	N/A
N/A	Performance of joint patrols with fire agencies	N/A	See Supplemental Inspections of HFRA line item	N/A	N/A	2018 GRC Pending	2018 GRC	N/A
N/A	Pole Brushing	N/A	See Supplemental Inspections of HFRA line item	N/A	N/A	2018 GRC Pending	2018 GRC	N/A
N/A	Pole Loading Program	N/A	26.4	N/A	N/A	2018 GRC Pending	2018 GRC	N/A
N/A	PSPS/De-energization Protocol Support Costs	N/A	4.3	N/A	N/A	No	GSRP Application	GSRP MA
N/A	Road and Right-of-Way Maintenance	N/A	3.9	N/A	N/A	2018 GRC Pending	2018 GRC	N/A
N/A	Substation Inspection and Maintenance	N/A	2.2	N/A	N/A	2018 GRC Pending	2018 GRC	N/A

SB 901 Activity Identifier	Activity/Program	2019 Cost (Capital) ($M) ($Nominal) (2019 Goal)	2019 Cost (O&M) ($M) ($Nominal) (2019 Goal)	2019 Cost (Capital) ($M) ($Nominal) (2019 Expansion/ Acceleration)	2019 Cost (O&M) ($M) ($Nominal) (2019 Expansion/ Acceleration)	Costs Currently reflected in Revenue Requirement	Funding that is or will be Addressed in Another Case	Memo accounts where the cost of program/ strategy are being tracked
N/A	Supplemental inspections of HFRA	N/A	69.1 (Distribution) 11.3 (Transmission)	N/A	N/A	2018 GRC Pending	2018 GRC	N/A
N/A	Transmission Line Rating Remediation	157.9	8.2	N/A	N/A	2018 GRC Pending	2018 GRC	N/A
OP-1	Annual SOB 322 Review	N/A	Cross-organization labor costs included in 2018 GRC	N/A	N/A	2018 GRC Pending	2018 GRC	N/A
OP-2	Wildfire Infrastructure Protection Team Additional Staffing	N/A	0.5	N/A	N/A	No	GSRP Application	GSRP MA
PSPS-1	De-Energization Notifications	N/A	1.3	N/A	N/A	No	GSRP Application	GSRP MA
SA-1	Additional Weather Stations	5.4	0.6	6.0	0.6	No	GSRP Application	GSRP MA
SA-2	Fire Potential Index Phase II	N/A	0.6	N/A	N/A	No	GSRP Application	GSRP MA
SA-3	Additional HD Cameras	2.3	2.6	2.8	4.3	No	GSRP Application	GSRP MA
SA-4	High-Performing Computer Weather Modeling System	3.8	0.1	N/A	N/A	No	GSRP Application	GSRP MA
SA-5	Develop Asset Reliability & Risk Analytics Capability	0.5	N/A	N/A	N/A	No	GSRP Application	GSRP MA
SH-1	Covered Conductor	47.4	1.0	133.7	2.7	No	GSRP Application and potentially pending 2018 GRC and/or 2021 GRC	GSRP MA and potentially SB 901 MA
SH-2	Evaluation of Undergrounding in HFRA	0.0	0.0	3.1	0.1	No	2021 GRC	SB 901 MA
SH-3	Composite Poles and Crossarms	5.1	0.1	15.6	0.3	No	GSRP Application and potentially pending 2018 GRC and/or 2021 GRC	GSRP MA and potentially SB 901 MA
SH-4	Branch Line Protection Strategy	46.1	0.9	52.3	1.1	No	GSRP Application	GSRP MA
SH-5	Remote Controlled Automatic Reclosers Installations	4.9	0.1	N/A	N/A	No	2021 GRC	FHPMA
SH-6	Remote Controlled Automatic Reclosers Setting Updates	N/A	0.3	N/A	N/A	No	GSRP Application	GSRP MA
SH-7	Circuit Breaker Fast Curve	9.1	0.2	N/A	N/A	No	GSRP Application	GSRP MA
VM-1	Hazard Tree Mitigation program (HTMP)	N/A	25.5	N/A	56.9	No	GSRP Application	GSRP MA
VM-2	Expanded Pole Brushing	N/A	0.9	N/A	9.6	No	2021 GRC	SB 901 MA
VM-3	Expanded clearance distances at time of maintenance	N/A	28.0	N/A	N/A	No	2021 GRC	FHPMA
VM-4	DRI quarterly inspections and removals	N/A	41.5	N/A	N/A	No	Drought CEMA	Drought CEMA
VM-5	LiDAR Inspections of Transmission	N/A	3.7	N/A	N/A	No	2021 GRC	SB 901 MA

Appendix A

List of Acronyms

LIST OF ACRONYMS

A.	Application
AB	Assembly Bill
ACS	Arc Suppression Coils
AGP	Annual Grid Patrol
Air Operati	SCE's Air Operations department
ANSI	American National Standards Institute
AR	automatic reclosers
BLF	Branch Line Fuses
BVLOS	Beyond Visual Line of Sight
C3	Customer Crew Communications
CAISO	California Independent System Operator
CAL FIRE	California Department of Forestry and Fire Protection
Cal OES	California Office of Emergency Services
CARE	California Alternate Rates for Energy
CB	Cicuit Breaker
CCC	Customer Contact Center
CEII	critical energy infrastructure information
CEMA	Catastrophic Event Memorandum Account
CLF	current-limiting fuses
CPUC	California Public Utilities Commission or Commission
CSWC	California State Warning Center
CUEA	California Utilities Emergency Association
D.	Decision
DDS	Distribution Design Standards
DFA	Distribution Fault Anticipation
DIMP	Distribution Inspection and Maintenance Program
DOH	Distribution Overhead Constuction Standards
DRI	Drought Relief Initiative
EEI	Edison Electric Institute
EOC	SCE's Emergency Operations Center
EOI	enhanced overhead inspections
EONS	Emergency Outage Notification System
EPUC/IS	Energy Producers and Users Colation and Indicated Shippers
ERO	Emergency Response Organization
ESA	Energy Savings Assistance
FEMA	Federal Emergency Management Agency
FERA	Family Electric Rate Assistance
FERC	Federal Energy Regulatory Commission
FHPMA	Fire Hazard Prevention Memorandum Account
FHSZ	Fire Hazard Severity Zone
FPI	Fire Potential Index
FPP	Fire Prevention Plan
FRP	fiber reinforced polymer
GIS	Geographic and Information System
GO	General Order
GRC	General Rate Case
GSRP	Grid Safety and Resiliency Program

HD	high definition
HFRA	High Fire Risk Areas
HFTD	High Fire Threat District
HHZ	High Hazard Zones
HPCC	High Performance Computing Cluster
HTMP	Hazard Tree Management Program
I.	Investigation
ICS	Incident Command System
IMT	Incident Management Team
IOUs	Investor-Owned Utilities
IPI	Intrusive Pole Inspection program
IR	Infrared
ISA	Internationl Society of Arborculture
LAC	Local Assistance Center
LiDAR	light detection and ranging technology
MA	Memorandum Account
MADEC	meter alarming for downed energy conductor
MAVF	Multi-Attribute Value Framework
MVCD	Minimum Violation Clearance Distance
NERC	North American Reliability Corporation
NFPA	National Fire Protection Association
NIFC	National Interagency Fire Center
NIMS	National Incident Management System
OCP	Overhead Conductor Program
ODI	Overhead Detail Inspection program
ODRM	Outage Database and Reliability Metrics
OEM	Offices of Emergency Management
OIR	Order Instituting Rulemaking
OMS	Outage Management System
PCB	polychlorinated biphenyls
PG&E	Pacific Gas and Electric Company
PLP	Pole Loading Program
PMO	Program Mangement Office
PRC	Public Resources Code
PSPS	Publlic Safety Power Shut-Off
PTZ	pan-tilt-zoom
PUC	Public Utilities Code
QC	quality control
R.	Rulemaking
RAMP	Risk Assessment Mitigation Phase
RAR	remote-controlled automatic reclosers
RAWS	Remote Automated Weather Stations
REFCL	Rapid Earth Fault Current Limiter
RFW	Red Flag Warnings
ROW	rights-of-way
Ruling	January 17, 2019 Administrative Law Judge Ruling
SAWTI	Santa Ana Wildfire Threat Index

SB 901	Senate Bill 901
SCADA	supervisory control and acquisition data
SCE	Southern California Edison Company or Company
SDG&E	San Diego Gas & Electric Company
SED	Safety and Enforcement Division
SIMP	Substation Inspection and Maitenance Program
S-MAP	Safety Model Assessment Proceedings
SOB	Standard Operating Bulletin
SoCalGas	Southern California Gas Company
T&D	SCE's Transmission and Distribution business unit
TIMP	Transmission Inspection and Maintenance Program
TURN	The Utility Reform Network
UAS	Advanced Unmanned Aerial Systems
UAV	unmanned aerriel vehicle
UDI	Underground Inspection Program
USFS	U.S. Forest Service
USGS	United States Geological Survey
WCCP	Wildfire Covered Conductor Program
WECC	Western Electricity Coordinating Council
WMP	Wildfire Mitigation Plan
WRF	Weather Research and Forecasting
WRMAG	Western Region Mutual Assistance Agreement for Electric Utilities

Appendix B

Categorization of Strategies and Programs

SB 901 Category	SB 901 Activity Identifier	Activity/Program	Existing or New Work	Asset Addressed (Ex. lines, poles, etc.)	Previously Included in RAMP?	Evaluation Metric	Assumptions Underlying Metric
Design and Construction	AT-1	Alternative Technology Pilots	Existing	Surge arrestors, MADEC	No	1) Pilot installation of 50 CAL FIRE-exempt surge arrestor units in target locations 2) Pilot meter alarming for downed energized conductor	Engineering research
Design and Construction	AT-2	GSRP Wildfire Mitigation Program Study	New	All distribution line equipment/hardware	No	1) Evaluate distributed fault anticipation technology and conduct pilot installation of at least 10 DFA devices 2) Evaluate BVLOS UAS capabilities	Based on GSRP
Design and Construction	AT-3	Alternative Technology Evaluations	New	Vibration dampers, Line spacers, fuses , single phase reclosers, poles and crossarms	No	1) Evaluate REFCL/ASC 2) Evaluate alternate fault detection technology 3) Evaluate fire retardant barrier for wood poles 4) Evaluate substation-class electronic fuses 5) Evaluate branch line protection to include single phase reclosing	Engineering research
Design and Construction	AT-4	Alternative Technology Implementation	Existing	Vibration dampers, Line spacers, fuses , single phase reclosers, poles and crossarms	No	1) Develop standard installation practices for Aeolian vibration dampers 2) Develop standard installation practices for ridge pin construction for conductor rebuild 3) Update DOH requirements for connector selection in HFRA	Engineering research
Design and Construction	N/A	Automatic Reclosers Replacement Program	Existing	Automatic Reclosers	No	N/A: Existing program / not new program	N/A
Design and Construction	N/A	Capacitor Bank Replacement Program	Existing	Capacitor Banks	No	N/A: Existing program / not new program	N/A
Design and Construction	N/A	Deteriorated Pole Program	Existing	Poles	No	N/A: Existing program / not new program	N/A
Design and Construction	N/A	Insulator Washing	Existing	Insulators	No	N/A: Existing program / not new program	N/A
Design and Construction	N/A	Overhead Conductor Program	Existing	Conductor, poles, equipment	Yes	N/A: Existing program / not new program	N/A
Design and Construction	N/A	PCB Transformers Replacement Program	Existing	Transformers	No	N/A: Existing program / not new program	N/A
Design and Construction	N/A	Road and Right-of-Way Maintenance	Existing	Roads, line clearances	No	N/A: Existing program / not new program	N/A
Design and Construction	N/A	Transmission Line Rating Remediation	Existing	Transmission lines	No	N/A: Existing program / not new program	N/A
Design and Construction	SH-1	Covered Conductor	New	Conductor	Yes	Install at least 96 circuit miles of covered conductor in HFRA	Availability of material and design, engineering, and construction resources
Design and Construction	SH-2	Evaluation of Undergrounding in HFRA	New	Conductor	No	Conduct evaluation of undergrounding for HFRA	Management judgement
Design and Construction	SH-3	Composite Poles and Crossarms	New	Poles and crossarms	Yes	Install at least 1,100 composite poles	Circuit miles of covered conductor installed and material availability
Design and Construction	SH-4	Branch Line Protection Strategy	New	Fuses and Fuse Savers	Yes	Install at least 7,500 CLF in HFRA locations	Forecast included in GSRP
Design and Construction	SH-5	Remote Controlled Automatic Reclosers Installations	New	Remote Automatic Reclosers	Yes	Install at least 50 new RARs	Expansion of branch line segments for de-energization
Design and Construction	SH-6	Remote Controlled Automatic Reclosers Setting Updates	New	Remote Automatic Reclosers	Yes	Update at least 150 existing RAR Settings	Forecast included in GSRP
Design and Construction	SH-7	Circuit Breaker Fast Curve	New	Relays and Substation Automation	Yes	1) Develop engineering plan to upgrade remaining CB relays and update settings 2) Conduct CB upgrades and setting updates according to plan	Further assessment of remaining CB relays requires each unit to be reviewed
Inspection and Maintenance	IN-1	Distribution Enhanced Overhead Inspections and Remediation in HFRA	New	Circuits	No	1) Complete visual inspection of all distribution circuits in HFRA before 5/31 2) Remediate all conditions that create a fire risk in accordance with CPUC requirements	Assets are identified in SAP with a high fire indicator
Inspection and Maintenance	IN-2	Transmission Enhanced Overhead Inspections and Remediation in HFRA	New	Circuits	No	1) Complete visual inspection of all transmission circuits in HFRA before 5/31 2) Remediate all conditions that create a fire risk in accordance with CPUC requirements	Assets are identified in SAP with a high fire indicator
Inspection and Maintenance	IN-3	Quality Oversight / Quality Control of EOI	Existing	Transmission & Distribution Structures	No	1) Perform quality review on approximately 7,500 Transmission and Distribution structures in HFRA based on EOI inspections	Assets are identified in SAP with a high fire indicator
Inspection and Maintenance	IN-4	Infrared Inspection of energized overhead distribution facilities and equipment	New	Circuit Lines	Yes	1) Inspect 50% of overhead circuit lines in HFRA 2) Remediate conditions as required based on inspection results	Forecast included in GSRP

SB 901 Category	SB 901 Activity Identifier	Activity/Program	Existing or New Work	Asset Addressed (Ex. lines, poles, etc.)	Previously Included in RAMP?	Evaluation Metric	Assumptions Underlying Metric
Inspection and Maintenance	IN-5	Infrared Inspection, Corona Scanning, and High Definition imagery of energized overhead Transmission facilities and equipment	New	Circuit Lines	No	1) Complete IR, Corona, and HD image scanning of all overhead transmission lines in HFRA that are loaded to 40% of rated capacity or higher 2) Integrate remediation with EOI activities	Management judgement
Inspection and Maintenance	N/A	AGP – Drive by of overhead Distribution facilities and equipment	Existing	Overhead Distribution equipment and above ground underground equipment	No	N/A: Existing program / not new program	N/A
Inspection and Maintenance	N/A	Detailed inspection of Transmission facilities and equipment	Existing	Above ground and underground Transmission equipment	No	N/A: Existing program / not new program	N/A
Inspection and Maintenance	N/A	IPI – Intrusive pole inspections to identify rot and decay	Existing	Wood Distribution and Transmission/Distribution wood poles	No	N/A: Existing program / not new program	N/A
Inspection and Maintenance	N/A	ODI – Detailed inspections of Distribution overhead facilities and equipment	Existing	Overhead Distribution equipment and above ground underground equipment	No	N/A: Existing program / not new program	N/A
Inspection and Maintenance	N/A	Performance of joint patrols with fire agencies	Existing	Conductor, poles, towers and equipment	No	N/A: Existing program / not new program	N/A
Inspection and Maintenance	N/A	Pole Brushing	Existing	Conductor, poles, equipment	No	N/A: Existing program / not new program	N/A
Inspection and Maintenance	N/A	Pole Loading Program	Existing	Wood, composite, Light Weight Steel poles	No	N/A: Existing program / not new program	N/A
Inspection and Maintenance	N/A	Substation Inspection and Maintenance	Existing	Distribution Relays	No	N/A: Existing program / not new program	N/A
Inspection and Maintenance	N/A	Supplemental inspections of HFRA	Existing	Conductor, poles, towers and equipment	No	N/A: Existing program / not new program	N/A
Inspection and Maintenance	VM-1	Hazard Tree Mitigation program (HTMP)	New	Conductor, poles, equipment	Yes	1) Perform at least 125,000 tree-specific threat assessments in HFRA 2) Perform at least 7,500 risk-based tree removals or mitigations in HFRA	Threat assessments derived from an anticipated production rate for 2019 Risk-based removal forecast from GSRP
Inspection and Maintenance	VM-2	Expanded Pole Brushing	New	Conductor, poles, equipment	No	1) Inspect all poles that require 10 feet of radial brush clearance at the base of the pole (at least 25,000) 2) Clear brush as necessary to achieve 10 feet of clearance	Based on acceleration of existing program
Inspection and Maintenance	VM-3	Expanded clearance distances at time of maintenance	New	Conductor, poles, equipment	No	Obtain tree-to-line clearance distance of 12 feet, as achievable, in HFRA at time of maintenance for line voltages of 2.4kV to 69kV	Pursuant to D.17-12-024, pp. 100-102, 12' is a CPUC recommendation
Inspection and Maintenance	VM-4	DRI quarterly inspections and removals	Existing	Conductor, poles, equipment	No	1) Perform all quarterly DRI inspections. 2) Remove identified dead, dying, or diseased trees in accordance with SCE's vegetation management program	Based on DRI program inspection cadence
Inspection and Maintenance	VM-5	LiDAR Inspections of Transmission	New	Conductor, poles, equipment	No	LiDAR inspect at least 1,000 conductor miles in HFRA (results from LiDAR inspections will be used to inform of subject trees assessed under the Hazard Tree Mitigation program)	Management judgement
Operational Practices	OP-1	Annual SOB 322 Review	Existing	N/A	No	Review and update SOB 322 to reflect lessons learned from past elevated fire weather threats and integrate, where applicable, new and improved data from its situational awareness resources	N/A
Operational Practices	OP-2	Wildfire Infrastructure Protection Team Additional Staffing	New	N/A	No	Hire one additional Meteorologist	Based on GSRP
Operational Practices	PSPS-1	De-Energization Notifications	New	N/A	Yes	1) Notify applicable public safety agencies and local governments of possible de-energization 2) Notify CalOES through the State Warning Center of possible de-energization 3) Notify the CPUC of possible de-energization 4) Enhance EONS to include in-language messages	Based on GSRP

SB 901 Category	SB 901 Activity Identifier	Activity/Program	Existing or New Work	Asset Addressed (Ex. lines, poles, etc.)	Previously Included in RAMP?	Evaluation Metric	Assumptions Underlying Metric
Response and Recovery	N/A	PSPS/De-energization Protocol Support Costs	New	N/A	Yes	Line Patrols, Customer Call Center support, Mobile Generator Deployment, Community Outreach Vehicles	Based on GSRP
Situational/Conditional Awareness	SA-1	Additional Weather Stations	New	Weather stations	Yes	Install at least 315 Units in HFRA	Reduced GSRP forecast pursuant to supply chain constraints
Situational/Conditional Awareness	SA-2	Fire Potential Index Phase II	New	N/A	Yes	Enhance capabilities of FPI by increasing granularity, adding historical climatology data, and expanding to cover all of SCE's service territory	Based on GSRP
Situational/Conditional Awareness	SA-3	Additional HD Cameras	New	HD Cameras	Yes	Install at least 62 cameras on 31 Towers to monitor HFRA	Forecast included in GSRP
Situational/Conditional Awareness	SA-4	High-Performing Computer Weather Modeling System	New	N/A	Yes	Procure and install High Performance Computing Cluster weather and fuels modeling system	Based on GSRP
Situational/Conditional Awareness	SA-5	Develop Asset Reliability & Risk Analytics Capability	New	N/A	No	Complete implementation of the Asset Reliability and Risk Analytics tools	Based on GSRP

Appendix C

List of SCE Design, Engineering and Construction Standards

(as of Jan 18, 2019)

SCE Design, Engineering and Construction Standards List

As of Jan. 18, 2019

Distribution Overhead Construction Standards (DOH)
Distribution Operations and Maintenance Policies and Procedures (DOM)
Distribution Underground Construction Standards (DUG)
Electrical Service Requirements (ESR)
Distribution Design Standards (DDS)
Underground Structures Standards (UGS)
Pole Loading Manual (PLM)
Applicant Distribution Design Standards (ADS)
Distribution Substation Planning Criteria and Guidelines Document (DSP)
Electrical Construction Station (ECS)
Electrical Design Station Layout (EDSL)
Electrical Design Station Wiring (EDSW)
Contact Diagrams for Control and Instrument Switches (M-4505)
Internal Wiring Diagrams for Relays (M-6379)
Substation Operations and Maintenance Policy and Procedures (SOM)
Electrical Construction Station (ECS 3-A)
Electrical Construction Station (ECS 3-B)
Electrical Construction Station (ECS 3-C)
Electrical Design Station Wiring (EDSW-A)
Electrical Design Station Wiring (EDSW-B)
Electrical Design Station Wiring (EDSW-C)
Transmission Overhead Construction Standards (TOH)
Transmission Underground Construction Standards (TUG)
Transmission Design and Right-of-Way Manual (TDR)
Transmission Operations and Maintenance Policies and Procedures (TOM)
Transmission Overhead Construction Standards (TOH)
Transmission Planning Criteria (TPC)
Transmission System Protection Philosophy & Relay Setting Guidelines
Transmission Telecommunications Construction Standards (TTCS)
Transmission Telecommunications Planning and Design Manual (TTPD)
Subtransmission Planning Criteria and Guidelines
Subtransmission System Line Relay Criteria & Guidelines
Subtransmission System Protection Philosophy & Relay Setting Guidelines

Appendix D

Fast Growing Trees

Tree Species Names and Growth Rates

Species Name	Growth Rate
Acacia-Bbw	Medium
Ailanthus	Fast
Albizzia	Medium
Alder, White	Medium
Almond	Medium
Ash	Fast
Aspen	Slow
Athel	Medium
Avocado	Medium
Bamboo	Fast
Banana	Slow
Bay	Slow
Birch	Slow
Bird of Paradise	Medium
Bottle	Slow
Bottlebrush	Sbw
Brisbane Box	Medium
Buckeye	Slow
Camphor	Medium
Carob	Medium
Carrotwood	Medium
Casuarina	Medium
Catalpa	Medium
Cedar	Slow
Century Plant	Slow
Cherry	Medium
Chinaberry	Medium
Citrus	Slow
Coral	Medium
Cottonwood	Fast
Cow Itch	Slow
Crape Myrtle	Slow
Cypress	Slow
Deodara	Slow
Dogwood	Slow
Elder, Box	Medium
Elderberry	Medium
Elm	Fast
Eucalyptus	Fast
Eugenia	Medium
Ficus	Medium
Fg	Medium
Fir	Slow
Floss, Silk	Medium
Ginkgo	Slow
Golden Rain	Slow
Grevillea	Fast
Hackberry	Medium
Jacaranda	Fast
Joshua	Slow
Juniper	Slow
Lemon	Medium
LiqAmber-Gum	Medium
Locust	Fast
Magnolia	Slow
Maple	Medium
Melaleuca	Medium
Mesquite	Medium
Mimosa	Slow
Monkey Puzzle	Slow
Mulberry	Fast
Myoporum	Slow
Oak	Slow
Oleander	Slow
Olive	Medium
Orange	Medium
Orchid	Medium
Other	Medium
Palm	Fast
Palo Verde	Slow
Pear	Medium
Pecan	Fast
Pepper	Fast
Persimmon	Medium
Pine	Medium
Pistache	Medium
Pistachio	Medium
Pittysporum	Medium
Plum	Medium
Podocarpus	Medium
Poplar	Fast
Privet	Medium
Redwood	Medium
Rubber	Medium
Salt Cedar	Medium
Sequoia	Slow
Spruce	Medium
Sumac	Medium
Sycamore	Fast
Tallow	Medium
Tulip	Fast
Unknown	Medium
Vine	Fast
Walnut	Fast
Willow	Fast
Yucca	Slow
Zelkova	Medium

Approximate Growth Rate:
(S} Slow: 0 to 3 feet Annually
(M) Medium: 3.1 to 6 feet Annually
(F) Fast: More than 6 feet Annually

Appendix E

SCE Field Workers, Support Personnel and Contract Crews

(as of Jan 18, 2019)

Distribution - Field Crews	**3976**	
Foreman Electl Crew	157	Trained resources to work on SCE's high voltage, overhead and underground distribution system. They perform inspections and maintenance, assess system damages, make repairs to restore service, and serve as SCE's first responders.
Journeyman Lineman	554	
Troubleman	200	
Splcr Sr Cble	18	
Streetlight Repairman	27	
Lineman, Apprentice	207	Serve as compliments to field crews, training under the direct supervision of Journeyman Lineman and Foreman.
Groundman	352	Compliments the field crews as part of their training, working in direct supervision of the Journeyman Lineman and Foreman.
Sup, Field	77	Provides management, field safety, and operational oversight and technical support for field crews in each of the SCE's district locations.
Sup, General Foreman	69	
Form Troubleman Training	4	
PSPECs	103	Coordinates outages, laying out jobs and customer contacts
Sup, Project General Sup	38	Oversees contract crews site training, safety
Field Service Rep	138	1st responders - identify problems and stand by to ensure site is secure
Meter Technicians	99	
MGR - Metering Field Ops	3	
Sr Sup, Ops	27	
Sr Sup, Engy Del / Distrib	17	
Planners/Designers	680	Damage assessments - support the field crews by conducting assessments, order material, and other admin support
Construction Material Coordinator	56	
Construction/Maintenance Clerk/Specialist/Supervise	257	
Supervise Construct/Maint Acct	50	
Meter Support Specialist	7	
Spclst Fld Svcs Support	4	
Inspector-Surveillance	32	
Contractors	800	Avg 200 crew (4-Man Crew)
Transmission, Substations & Operations - Field Crews	**1353**	
Journeyman Lineman	102	Trained resources to work on SCE's high voltage, overhead and underground distribution system. They perform inspections and maintenance, assess system damages, make repairs to restore service, and serve as SCE's first responders.
Splcr Sr Cble	33	
Patrolman Sr	32	
Right of Way Equipment Operator	5	
Safety & Environmental Specialist	2	
Groundman	11	Compliments to field crews, training under the direct supervision of Journeyman Lineman (i.e. JM Battery Electricians, Construction Electricians, Substation Cable Splicers) and Foreman.
Lineman, Apprentice	65	
Apprentice Substn Elctrcn	30	
Electn Appr Battry	3	
Electn Appr Cnstrn	6	
Hlpr Electl Constr	20	
Splcr Appr Subs Cable	3	
Sup, General Foreman	13	Provides management, field safety, and operational oversight and technical support for maintenance & test crews.
Substation Electrician	154	
Sup, Apparatus	5	
Sup, Cnstrn	12	
Sup, Substn Ops	5	
Sup, Tech Spec	1	
Supr Road R/W	4	
Sr Sup, Maint / Test	45	
PSPECs	9	Coordinates outages, laying out jobs and customer contacts
Electn Battry	6	1st responders - identify problems, stand by to ensure site is secure, analyze grid flow, and support construction (i.e. civil)
Electn Constrn	44	
Form Dstrbn Aprts	16	
Mech Structural	17	
Operator, System	131	
Opr Substation	112	
Opr Trainee	5	
Power Sys Ops Specialist	45	
Power Systems Planner 3	4	
Splcr Subs Cable	8	
Techn Dstrbn Aprts	42	
Techn Electl Aprats Test/Test A	4	
Technician, Test	92	
Technician, Test Supervising	56	
Transformer Helper	6	
Transformer Specialist	15	
Transformer Specialist Foreman	4	
Utilityman Terrtrl	16	
Welder Cnstrn	3	
Working Foreman - CFF	6	
Working Form CFF Elect Const	4	
Materials Mgmt, Advisor	12	Damage assessments - support the field crews by conducting assessments, order material, and other admin support
Planners	81	
Contractors	64	Avg 16 crews (4-Man Crew)
Telecom	13	
Form Cable	8	1st responders - identify problems, stand by to ensure site is secure, analyze grid flow, and construction
Planner	1	
Trans Telecom PSPEC	4	
Grand Total	**5342**	

Appendix F

Comparison of WMP to 2018 Fire Prevention Plan

Program/Strategy	Comparison of WMP to Prior Fire Prevention Plan
OPERATIONAL PRACTICES	
Red Flag Warning Program	WMP / FPP
Operation of Sub-Transmission Voltage Lines - Red Flag	WMP / FPP
Operation of Distribution Voltage Lines - Red Flag	WMP / FPP
Recloser Restrictions (e.g., Fast Curve Settings)	WMP / FPP
Aircraft Operations	WMP / FPP
Public Safety Power Shut-Off Protocol & Notifications	WMP / FPP
Monitoring and Enhancements	WMP Only
Wildfire Infrastructure Protection Teams	WMP / FPP
PLANS FOR INSPECTIONS OF ELECTRICAL INFRASTRUCTURE	
Distribution Inspection and Maintenance Program	WMP / FPP
Overhead Detail Inspection Program	WMP / FPP
Annual Grid Patrol	WMP Only
Underground Detail Inspection Program	WMP Only
Distribution Maintenance	WMP Only
Transmission Inspection and Maintenance Program	WMP / FPP
Substation Inspection and Maintenance	WMP Only
Intrusive Pole Inspection Program	WMP / FPP
Pole Loading Program	WMP / FPP
Quality Oversight / Quality Control	WMP Only
High Fire Risk Area (HFRA) - Enhanced Overhead Inspections	WMP Only
HFRA - Infrared Inspection Program	WMP / FPP
SYSTEM HARDENING (SAFETY, RELIABILITY & RESILIENCY)	
Overhead Conductor Program	WMP / FPP
Deteriorated Pole Program	WMP Only
Wildfire Covered Conductor Program	WMP / FPP
Underground Conductor	WMP / FPP
Poles	WMP Only
Protection and Isolation	WMP / FPP
Alternative Technologies	WMP / FPP
VEGETATION MANAGEMENT PLAN	
Compliance: NERC FAC-003-4	WMP / FPP
Compliance: CPUC General Order 95, Rule 35	WMP / FPP
Compliance: Public Resource Code 4292	WMP / FPP
Compliance: Public Resource Code 4293	WMP / FPP
Weed Abatement Program	WMP / FPP
Enhanced Vegetation Management Activities in HFRAs	WMP / FPP
Operation Santa Ana	WMP / FPP
Hazard Tree Removals	WMP / FPP
Pole Brushing	WMP / FPP
Expanded Clearance Distances at Time of Maintenance	WMP Only
DRI Quarterly Inspections and Tree Removals	WMP Only
LiDAR Inspection Program	WMP / FPP
PROTOCOLS ON SITUATIONAL AWARENESS	
HFRA - Weather Stations	WMP / FPP
HFRA - Meteorological Resources	WMP / FPP
HFRA - Deployment and Support of Situational Awareness Cameras	WMP / FPP

PROTOCOLS ON PUBLIC SAFETY POWER SHUT-OFF	
Strategy to Minimize Public Safety Risk...	WMP / FPP
Strategy to Provide for Safe and Effective Re-energization…	WMP / FPP
SCE Standards Relative to Customer Communications…	WMP / FPP
Protocols for Mitigating the Public Safety Impacts…	WMP / FPP