Risk Assessment Mitigation Phase
(Chapter SDG&E-1)
Wildfires Involving SDG&E Equipment

November 27, 2019

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Risk: Wildfire

I. INTRODUCTION

The purpose of this chapter is to present the Risk Mitigation Plan of San Diego Gas & Electric Company (SDG&E or Company) for Wildfire risk. Each chapter in this Risk Assessment Mitigation Phase (RAMP) Report contains the information and analysis that meets the requirements adopted in Decision (D.) 16-08-018 and D.18-12-014 and the Settlement Agreement included therein (the SA Decision).[1]

SDG&E has identified and defined RAMP risks in accordance with the process described in further detail in Chapter RAMP-B of this Report. On an annual basis, SDG&E's Enterprise Risk Management (ERM) organization facilitates the Enterprise Risk Registry (ERR) process, which influenced how risks were selected for inclusion in the 2019 RAMP Report, consistent with the SA Decision's directives.

The purpose of RAMP is not to request funding. Any funding requests will be made in SDG&E's General Rate Case (GRC). The costs presented in this 2019 RAMP Report are those costs for which SDG&E anticipates requesting recovery in its Test Year (TY) 2022 GRC. SDG&E's TY 2022 GRC presentation will integrate developed and updated funding requests from the 2019 RAMP Report, supported by witness testimony.[2] For the 2019 RAMP Report, the baseline costs are the costs incurred in 2018, as further discussed in Chapter RAMP-A. This 2019 RAMP Report presents capital costs as a sum of the years 2020, 2021, and 2022 as a three-year total; whereas, operations and maintenance (O&M) costs are only presented for TY 2022.

Costs for each activity that directly addresses each risk are provided where those costs are available and within the scope of the analysis required in this RAMP Report. Throughout this 2019 RAMP Report, activities are delineated between controls and mitigations, which is consistent with the definitions adopted in the SA Decision's Revised Lexicon. A "Control" is

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[1] D.16-08-018 also adopted the requirements previously set forth in D.14-12-025. D.18-12-014 adopted the Safety Model Assessment Proceeding (S-MAP) Settlement Agreement with modifications and contains the minimum required elements to be used by the utilities for risk and mitigation analysis in the RAMP and GRC.

[2] D.18-12-014 at Attachment A, A-14 ("Mitigation Strategy Presentation in the RAMP and GRC").

defined as a currently established measure that is modifying risk. A "Mitigation" is defined as a measure or activity proposed or in process designed to reduce the impact/consequences and/or likelihood/probability of an event. Activities presented in this chapter are representative of those that are primarily scoped to address SDG&E's Wildfire risk; however, many of the activities presented herein also help mitigate other risk areas as outlined in Chapter RAMP-A.

As discussed in Chapter RAMP-D, Risk Spend Efficiency (RSE) Methodology, no RSE calculation is provided where costs are not available or not presented in this RAMP Report (including costs for activities that are of the GRC and certain internal labor costs). Additionally, SDG&E did not perform RSE calculations on mandated activities. Mandated activities are defined as activities conducted in order to meet a mandate or law, such as a Code of Federal Regulation (CFR), Public Utilities Code statute, or General Order (GO). Activities with no RSE score presented in this 2019 RAMP Report are identified in Section VI below.

SDG&E has also included a qualitative narrative discussion of certain risk mitigation activities that would otherwise fall outside of the RAMP Report's requirements, to aid the California Public Utilities Commission (CPUC or Commission) and stakeholders in developing a more complete understanding of the breadth and quality of SDG&E's mitigation activities. These distinctions are discussed in the applicable control/mitigation narratives in Section V. Similarly, a narrative discussion of certain "mitigation" activities and their associated costs is provided for certain activities and programs that may indirectly address the risk at issue, even though the scope of the risk as defined in the RAMP Report may technically exclude the mitigation activity from the RAMP analysis. This additional qualitative information is provided in the interest of full transparency and understandability, consistent with guidance from Commission staff and stakeholder discussions.

A. Risk Definition

SDG&E's Wildfire risk is defined as the risk of wildfire, especially those initiated by SDG&E equipment, resulting in injuries or fatalities, widespread property destruction, and a multibillion-dollar liability.

B. Summary of Elements of the Risk Bow Tie

Pursuant to the SA Decision,[3] for each Control and Mitigation presented herein, SDG&E has identified the element(s) of the Risk Bow Tie that the mitigation addresses. Below is a summary of these elements.

Table 1: Summary of Risk Bow Tie Elements

ID	Description of Driver/Trigger and Potential Consequences
DT.1	Downed Conductor
DT.2	General Equipment Failure
DT.3	Weather-Related Failure of SDG&E Equipment
DT.4	Contact by Foreign Object
DT.5	Failure of Third-Party Attachments
DT.6	Vegetation Contact
DT.7	Not Observing Operational Procedures
DT.8	Extreme Force of Nature Events
DT.9	Lack of Internal or External Coordinated Response
DT.10	Climate Change Adaptation Impacts on Wildfires Caused by SDG&E Equipment
PC.1	Serious injuries[4] and/or fatalities
PC.2	Damage to third party real and personal property
PC.3	Damage and loss of SDG&E assets and facilities
PC.4	Operational and reliability
PC.5	Claims and Litigation
PC.6	Erosion of public confidence

[3] *Id.* at Attachment A, A-11 ("Bow Tie").

[4] A "serious injury" is defined in the California Code of Regulations as "any injury or illness occurring in a place of employment or in connection with any employment which requires inpatient hospitalization for a period in excess of 24 hours for other than medical observation or in which an employee suffers a loss of any member of the body or suffers any serious degree of permanent disfigurement, but does not include any injury or illness or death caused by the commission of a Penal Code violation, except the violation of Section 385 of the Penal Code, or an accident on a public street or highway." 8 California Code of Regulations (CCR) Section (§) 330(h).

C. Summary of Risk Mitigation Plan

Pursuant to the SA Decision,[5] SDG&E has performed a detailed pre- and post-mitigation analysis of Controls and Mitigations for each risk selected for inclusion in RAMP, as further described below. SDG&E identified baseline controls, which are expected to continue, and proposes additional projects and/or programs (*i.e.*, mitigations) for this risk as follows:

Table 2: Summary of Controls and Mitigations

ID	Control/Mitigation Name
SDG&E-1-C1	Operating Conditions
SDG&E-1-C2	Recloser Protocols
SDG&E-1-C3	Other Special Work Procedures
SDG&E-1-C4	Distribution System Inspections – Corrective Maintenance Program
SDG&E-1-C5	Distribution System Inspections – Quality Assurance/Quality Control
SDG&E-1-M1	Distribution System Inspections – Infrared/Corona
SDG&E-1-M2	Distribution System Inspections – Drone Inspections
SDG&E-1-M3	Distribution System Inspections – Circuit Ownership
SDG&E-1-C6	Substation System Inspections
SDG&E-1-C7	Transmission System Inspections
SDG&E-1-C8	Overhead Transmission and Distribution Fire-Hardening (Wood to Steel)
SDG&E-1-M4	Strategic Undergrounding
SDG&E-1-C9	Cleveland National Forest Fire-Hardening
SDG&E-1-C10 / M5	Fire Risk Mitigation
SDG&E-1-C11 / M6	Pole Risk Mitigation and Engineering
SDG&E-1-M7	Expulsion Fuse Replacement
SDG&E-1-M8	Hotline Clamps
SDG&E-1-C12 / M9	Wire Safety Enhancement
SDG&E-1-M10	Covered Conductor
SDG&E-1-C13 / M11	Fire Threat Zone Advanced Protection
SDG&E-1-M12	LTE Communication Network
SDG&E-1-M13	Public Safety Power Shutoff Engineering Enhancements
SDG&E-1-C14 / M14	Replacement and Reinforcement
SDG&E-1-M15	Backup Power for Resilience – Generator Grant, Critical Infrastructure, and HPWREN
SDG&E-1-M16	Backup Power for Resilience – Microgrids
SDG&E-1-M17	Lightning Arrester Removal/Replacement Program

[5] D.18-12-014 at Attachment A, A-11 ("Definition of Risk Events and Tranches").

ID	Control/Mitigation Name
SDG&E-1-M18	SCADA Capacitors
SDG&E-1-C15	Tree Trimming
SDG&E-1-C16	Pole Brushing
SDG&E-1-M19	Enhanced Vegetation Management
SDG&E-1-M20	Fuel Management Program
SDG&E-1-C17	Fire Science & Climate Adaptation Department
SDG&E-1-C18 / M21	Wildfire Risk Reduction Model – Operational System (WRRM – Ops) and Fire Science Enhancements
SDG&E-1-C19 / M22	Camera Networks and Advanced Weather Station Integration
SDG&E-1-C20 / M23	High-Performance Computing Infrastructure
SDG&E-1-M24	Ignition Management Program
SDG&E-1-C21/M25	Asset Management
SDG&E-1-M26	Monitoring and Correcting Deficiencies
SDG&E-1-M27	Wildfire Mitigation Personnel
SDG&E-1-M28	NMS Situational Awareness Upgrades
SDG&E-1-M29	Situational Awareness Dashboard
SDG&E-1-C22	Strategy for Minimizing Public Safety Risk During High Wildfire Conditions, PSPS and Re-Energization Protocols
SDG&E-1-C23 / M30	Communication Practices
SDG&E-1-C24	Mitigating the Public Safety Impact of PSPS Protocols
SDG&E-1-C25 / M31	Emergency Management Operations
SDG&E-1-C26	Disaster and Emergency Preparedness Plan
SDG&E-1-C27	Customer Support in Emergencies
SDG&E-1-C28 / M32	Wildfire Infrastructure Protection Teams (Contract Fire Resources)
SDG&E-1-C29 / M33	Aviation Firefighting Program
SDG&E-1-C30	Industrial Fire Brigade
SDG&E-1-C31 / M34	Wireless Fault Indicators

Finally, pursuant to the SA Decision,[6] Section VIII presents alternatives to the mitigation plan for the Wildfire risk that were considered and summarizes the reasons that the alternatives were not included in the mitigation plan.

II. RISK OVERVIEW

The 2018 enactment of Senate Bill (SB) 901 requires SDG&E to submit an annual wildfire mitigation plan (WMP) to provide comprehensive information on SDG&E's efforts to

[6] *Id.* at 33.

mitigate wildfire risk.[7] In its Order Instituting Rulemaking (OIR) to implement the WMP provisions of SB 901, the Commission recognized the urgency and severity of the wildfire risk in California, stating:

> Devastating wildfires have become a regular occurrence in California . . . wildfires have grown larger and more intense over the last several decades, resulting in loss of life and property, ecological devastation, increases in future fire risk, and significant greenhouse gas emissions.[8]

On February 6, 2019, SDG&E submitted its first WMP pursuant to SB 901, which the Commission subsequently approved in D.19-05-039. SDG&E's 2019 WMP explains, as reiterated herein, that the catastrophic wildfires that devastated San Diego County in 2007 have resulted in enduring and lasting changes throughout SDG&E's operations, systems, facilities, organization, goals, and objectives. Since 2007, SDG&E has built a Company-wide focus on addressing and minimizing wildfire-related risks, such that wildfire safety, prevention, mitigation, and recovery are top priorities for SDG&E. SDG&E is now considered a leader in proactively addressing fire threats in the communities it serves.

SDG&E's business strategies and programs continue to evolve to reflect a risk-informed approach, wherein wildfire is identified as a key safety risk for the Company. SDG&E performs a broad range of activities, subject to the direct supervision of senior management, related to fire prevention and mitigation. Such mitigation efforts include operational and engineering practices, inspections, system hardening, vegetation management, situational awareness, public safety power shutoff (PSPS), emergency preparedness and response, and customer outreach and public awareness. SDG&E shares its personnel, resources, information, communications facilities, and fire-defense assets to help enhance the capabilities of local communities to defend against any recurrences of catastrophic wildfire events in Southern California. In coordination with many stakeholders, community leaders and the public, SDG&E shares and discusses, both formally and informally, its methods, programs and mitigation efforts with interested parties. This helps

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[7] The initial requirement to submit annual wildfire mitigation plans was set forth in SB 901, California Public Utilities (P.U.) Code § 8386(b). This P.U. Code section was subsequently amended by Assembly Bill (AB) 1054.

[8] Rulemaking (R.) 18-10-007, Order Instituting Rulemaking (October 25, 2018) at 1-2.

to foster continuous improvement and maximize effectiveness. This outreach provides a platform for better coordination and idea sharing among emergency and first responder groups as well as local officials and cities and counties that are located within SDG&E's service territory.

More recently, on July 11, 2019,[9] the California State Legislature passed an urgency bill to address wildfire risk, AB 1054, which was signed into law by Governor Newsom on July 12, 2019 and became effective immediately. In AB 1054, the California Legislature stated that "[t]he increased risk of catastrophic wildfires poses an immediate threat to communities and properties throughout the state."[10] They further acknowledged that "[t]he state has dramatically increased investment in wildfire prevention and response, which must be matched by increased efforts of the electrical corporations,"[11] and "[t]he state's electrical corporations must invest in hardening of the state's electrical infrastructure and vegetation management to reduce the risk of catastrophic wildfire."[12] Specifically, the Legislature requires each electrical corporation, such as SDG&E, to "construct, maintain, and operate its electrical lines and equipment in a manner that will minimize the risk of catastrophic wildfire posed by those electrical lines and equipment"[13] as well as to "annually prepare and submit a wildfire mitigation plan…"[14] The mandates of AB 1054 are consistent with SDG&E's continually evolving efforts to manage and mitigate the threat of wildfire risk since 2007.

While SDG&E will be submitting WMPs pursuant to P.U. Code § 8386(b), SDG&E puts forth a mitigation plan for its Wildfire risk herein in compliance with D.18-12-014, D.16-08-018, and D.14-12-025. The mitigation plan presented in this Chapter began with SDG&E's 2019 WMP and has been updated to reflect new programs and strategies anticipated in 2020 through

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9 AB 1054, Stats. 2019-2020, Ch. 79 (Cal. 2019).

10 *Id.* at § 1(a)(1).

11 *Id.* at § 2(a).

12 *Id.* at § 2(b).

13 P.U. Code § 8386(a), as modified by AB 1054.

14 *Id.* at § 8386(b), as modified by AB 1054.

2022, consistent with SDG&E's TY 2022 GRC. Any updates put forth herein will also be reflected in future WMP filings.

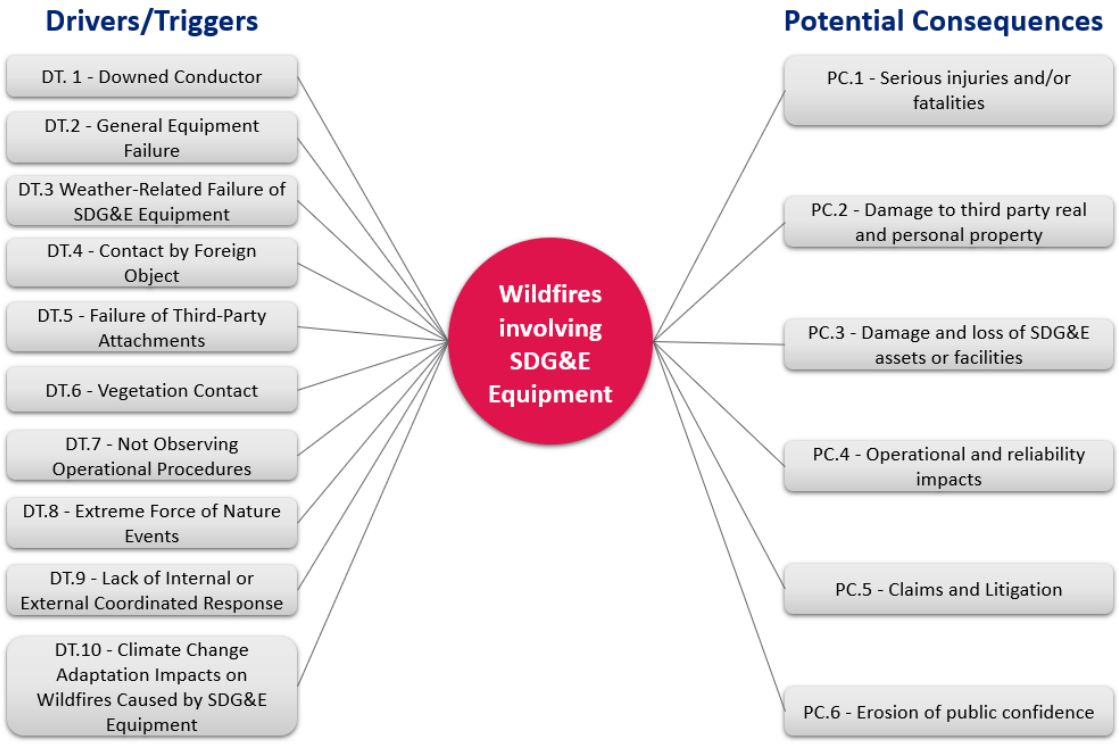
III. RISK ASSESSMENT

In accordance with the SA Decision,[15] this section describes the Risk Bow Tie, possible drivers, and potential consequences of the Wildfire risk.

A. Risk Bow Tie

The Risk Bow Tie shown in Figure 1, below, is a commonly-used tool for risk analysis. The left side of the Risk Bow Tie illustrates drivers/triggers that lead to a risk event and the right side shows the potential consequences of a risk event. SDG&E applied this framework to identify and summarize the information provided above. A mapping of each Control/Mitigation to the element(s) of the Risk Bow Tie addressed is provided in Appendix A.[16]

Figure 1: Risk Bow Tie



[15] D.18-12-014 at 33 and Attachment A, A-11 ("Bow Tie").

[16] *Id.* at Attachment A, A-11 ("Bow Tie").

B. Asset Groups or Systems Subject to the Risk

The SA Decision[17] directs the utilities to endeavor to identify all asset groups or systems subject to the risk. These assets include:

- Substation – comprises the substation asset infrastructure system, which includes transformers, breakers, batteries, relays, capacitors, disconnect switches, and associated auxiliary equipment.
- Transmission Overhead (TO) – comprises the overhead transmission asset infrastructure system, which includes conductors or wires, pole structures, lattice towers, insulators, switches, and associated auxiliary equipment.
- Distribution Overhead (DO) – comprises the overhead distribution asset infrastructure system, which includes conductors or wires, pole structures, transformers, switches, capacitors, and associated auxiliary equipment.
- Operational Technology (OT) – comprises the auxiliary control system or network to the electric assets that process operational data, which includes telecommunications, energy management systems (EMS), remote supervisory control and data acquisition (SCADA), and advanced technologies (microprocessor-based relays with synchrophasor/phasor measurement unit (PMU) capabilities, real-time automation controllers, auto-sectionalizing equipment, line monitors, direct fiber lines, and wireless communication radios).

C. Risk Event Associated with the Risk

The SA Decision[18] instructs the utility to include a Risk Bow Tie illustration for each risk included in RAMP. As illustrated in the Risk Bow Tie in Figure 1 above, the risk event (center of the bow tie) is a wildfire involving SDG&E's equipment that results in any of the Potential Consequences listed on the right. SDG&E strives to reduce or eliminate potential sources of ignition coming from its facilities, especially at times of peak weather when a small ignition can

[17] *Id.* at Attachment A, A-11 ("Definition of Risk Events and Tranches").

[18] *Id.* at Attachment A, A-11 ("Bow Tie").

turn into a catastrophic wildfire. Accordingly, while the activities discussed herein primarily address instances where SDG&E equipment was associated with an ignition, some of the activities may help all wildfires, even if SDG&E is found to not be the contributing cause. For example, SDG&E's response activities, including aviation assets, would help mitigate a wildfire in SDG&E's service territory regardless of the cause or ignition source. The Drivers/Triggers that may contribute to this risk event are further described in the section below.

D. Potential Drivers/Triggers[19]

The SA Decision[20] instructs the utility to identify which element(s) of the associated bow tie each mitigation addresses. When performing the risk assessment for Wildfire, SDG&E identified potential leading indicators, referred to as Drivers or Triggers (DT). These include, but are not limited to:

- **DT.1 – Downed Conductor:** A downed conductor (or "wire down") occurs when a conductor drops or breaks from its designed location on a pole and cross arm and ends up on the ground, sometimes in an energized mode. A wire down can result from a variety of factors, many of which are outside of SDG&E's control.
- **DT.2 – General Equipment Failure:** Electric equipment failure can be a source of a downed conductor or ignition. Failure of components such as connectors, hot line clamps, and insulators can result in wire failure and end up in a wire down situation, sometimes in the energized mode.
- **DT.3 – Weather-Related Failure of SDG&E Equipment:** Weather plays a large part in the potential failure of SDG&E equipment. Excessive wind, lightning, and exposure to weather over time can degrade the integrity of the electrical components and lead to failure of one or more of the electrical parts causing a failure of the conductor.

[19] An indication that a risk could occur. It does not reflect actual or threatened conditions.

[20] D.18-12-014 at Attachment A, A-11 ("Bow Tie").

- **DT.4 – Contact by Foreign Object:** Foreign objects coming into contact with SDG&E's facilities can also present sources of ignition. For example, Mylar balloons are highly conductive and can cause phase-to-phase faulting, on contact. In the worst-case this can cause the conductor to fail and land in an energized mode, causing arcing and sparking in dry conditions. In addition, vehicular contact can bring down conductors, and sometimes the entire pole, resulting in conductors laying on the ground in an energized mode.
- **DT.5 – Failure of Third-Party Attachments:** As mandated by the CPUC, SDG&E must allow communication infrastructure providers to attach to utility poles when space is available. These providers may not properly install or inspect their equipment. This has led to contact of these attachments with the electrical facilities, leading to fire-related incidents.
- **DT.6 – Vegetation Contact:** During storms and severe wind events, branches are shed by trees in the vicinity of SDG&E facilities. These can fall on conductors, leading to conductor failure or, in the case of palm fronds, phase-to-phase contact and a cascade of sparks. In addition, trees that are many feet away from an energized conductor sometimes uproot and fall on the conductor, causing failure or sparking.
- **DT.7 – Not Observing Operational Procedures:** SDG&E revises its protocols and procedures based on certain conditions. For example, during fire weather watch or red flag warnings, SDG&E and its contractors may not perform welding or other activities that may generate potential ignition sources. If an employee or contractor does not adhere to the operational procedure, it may cause an adverse consequence.
- **DT.8 – Extreme Force of Nature Events:** SDG&E's overhead electrical facilities are fully exposed to the elements. Significant weather and wind-related events can cause a variety of problems related to equipment failure and downed conductors. Also, continual exposure to natural elements can

degrade or weaken key components, conditions that may not be found until the following scheduled inspection and repair cycle.

- **DT.9 – Lack of Internal or External Coordinated Response:** A well-coordinated response to a downed conductor aids in the suppression of a fire as well as the de-energization of the conductor in a safe manner. Lack of coordination could lead to uncontrolled fire, electrical exposure to first responders, and possibly injury or death.
- **DT.10 – Climate Change Adaptation Impacts on Wildfires Caused By SDG&E Equipment:** Despite SDG&E's proactive approach to mitigating fire risk, increases in temperature and prolonged periods of drought in the decades to come will likely lead to high risk fire areas expanding from the foothills and mountains into the lower elevation coastal canyons and wildland interfaces that were previously considered at lower risk for fire growth. Prolonged periods of drought will also likely result in a longer wildfire season, potentially extending the focus of our threat monitoring and potential response from the fall months to year-round – with the greatest increased threat in the spring and summer months. These climate trends have already been realized across the region, culminating in a previously unseen wildfire outbreak across coastal San Diego County in May of 2014. In response to increased wildfire activity, SDG&E has year-round availability of an Erickson Skycrane helitanker (Skycrane) that can immediately address ignitions under high wildfire threat conditions. The Skycrane holds a maximum of 2,650 gallons of water and can be airborne in just 15 minutes, to mitigate the impact of a potentially fast-moving fire. SDG&E also leases a Blackhawk helicopter to assist in construction of wildfire mitigation projects but can also assist in putting out fires with the capability of holding 850 gallons of water. Based upon the most recent climate science, these trends are likely to continue and worsen into the future.

E. Potential Consequences

If one or more of the Drivers/Triggers listed above were to result in an incident, the Potential Consequences (PC), in a reasonable worst-case scenario, could include:

- Serious injuries and/or fatalities;
- Damage to third party real and personal property;
- Damage and loss of SDG&E assets or facilities;
- Operational and reliability impacts;
- Claims and Litigation; and
- Erosion of public confidence.

These Potential Consequences were used in the scoring of SDG&E's wildfire risk that occurred during the development of SDG&E's 2018 Enterprise Risk Registry.

IV. RISK QUANTIFICATION

The SA Decision sets minimum requirements for risk and mitigation analysis in RAMP,[21] including enhancements to the Interim Decision D.16-08-018.[22] SDG&E has used the guidelines in the SA Decision as a basis for analyzing and quantifying risks, as shown below. Chapter RAMP-C of this RAMP Report explains the Risk Quantitative Framework that underlies this Chapter, including how the Pre-Mitigation Risk Score, Likelihood of Risk Event (LoRE), and Consequence of Risk Event (CoRE) are calculated.

Table 3: Pre-Mitigation Analysis Risk Quantification Scores[23]

Wildfire	Low Alternative	Single Point	High Alternative
Pre-Mitigation Risk Score	5493	**7215**	10085
LoRE	**30**		

[21] *Id.* at Attachment A.

[22] *Id.* at 2-3.

[23] The term "pre-mitigation analysis," in the language of the SA Decision (Attachment A, A-12 ("Determination of Pre-Mitigation LoRE by Tranche," "Determination of Pre-Mitigation CoRE," "Measurement of Pre-Mitigation Risk Score")), refers to required pre-activity analysis conducted prior to implementing control or mitigation activity.

CoRE	183	**241**	336

A. Risk Scope & Methodology

The SA Decision requires a pre- and post-mitigation risk calculation.[24] The section below provides an overview of the scope and methodologies applied for the purpose of risk quantification.

Table 4: Risk Quantification Scope

In-Scope for purposes of risk quantification:	The risk of wildfires that meet the CPUC Fire Incident Data Collection requirement for wildfire reporting. A wildfire must be reported if all three of the following criteria are met: • A self-propagating fire of material other than electrical and/or communication facilities; • The resulting fire traveled greater than one linear meter from the ignition point; and • The utility has knowledge that the fire occurred.[25]
Out-of-Scope for purposes of risk quantification:	Wildfires that do not meet the CPUC Fire Incident Data Collection requirement for wildfire reporting are excluded from this analysis.

Step 2A of the SA Decision requires a utility to use actual results, available and appropriate data (*e.g.*, Pipeline and Hazardous Materials Safety Administration data).[26] SDG&E's safety risk assessment primarily utilized historical data provided by the California Department of Forestry and Fire Protection (CAL FIRE), which has various resources useful for analysis. A notable resource used from CAL FIRE are known as "Redbooks," which are published annually and provide fire names, cause of fire, acres burned, structures burned, and human safety information for each fire. The data from the Redbooks is also summarized by

[24] D.18-12-014 at Attachment A, A-11 ("Calculation of Risk").

[25] California Public Utilities Commission, *2014-2016 Fire Incident Data Collection, available at* https://www.cpuc.ca.gov/fireincidentsdata/.

[26] D.18-12-014 at Attachment A, A-8 ("Identification of Potential Consequences of Risk Event").

County and Region. CAL FIRE also provides maps and Geographic Information Systems (GIS) data at their Fire and Resource Assessment Program (FRAP) website.[27] GIS files provide the key element of the geographic location of each fire in CAL FIRE's records, and therefore can be used to analyze fires based on location-specific characteristics such as vegetation class or weather patterns. CAL FIRE's incident reports are also valuable because they provide additional facts about events. For example, CAL FIRE's incident page discussing the Sawday fire, which occurred in San Diego in 2019, has information regarding the ignition location and links to situational updates.[28]

Other data sources used to estimate wildfire risks are web-based news articles that discuss the facts surrounding wildfire events. Although the CAL FIRE Redbooks have fire-related facts, web-based news articles can help explain the events with more details, such as the type of structures destroyed, the extent of injuries, or the estimated cost of the event.

Regarding financial losses, it is difficult to determine the precise cost of wildfire events. Different groups have different points of view on costs and may not always include all considerations. Wildfire events primarily can have costs resulting from the following: a) property damage, b) personal injury or fatality, c) suppression costs, d) environmental damage and remediation, e) lost economic output from various reasons (including work closures and employee unavailability), and f) personal relocation due to evacuations. There is no known single source for all financial impacts from wildfire. SDG&E used available data to approximate financial impacts.

B. Sources of Input

The SA Decision[29] directs the utility to identify Potential Consequences of a Risk Event using available and appropriate data. The following provides an explanation of how likelihoods and consequences from wildfire risk were estimated. Wildfire risk is unique among the risks presented in the RAMP Report, because: a) it has an extremely wide range of impacts (*i.e.*, some

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[27] California Department of Forestry and Fire Protection, *available at* https://frap.fire.ca.gov/.

[28] California Department of Forestry and Fire Protection, *Status Updates, available at* https://www.fire.ca.gov/incidents/2019/10/25/sawday-fire/.

[29] D.18-12-014 at Attachment A, A-8 ("Identification of the Frequency of the Risk Event").

fires have no impacts while others cause serious injury and billions of dollars of damage); b) it is situationally dependent on many changing factors (*i.e.*, weather, vegetation), c) drivers to the risk are frequently outside a utility's control (*e.g.*, animal, human, and plant contacts), and d) significant impacts are rare, which leads to low-confidence estimations regarding future risk.

An outline of how the Wildfire risk was modeled and then used for the RAMP Report is outlined in the following steps:

- Data Gathering: Historical data was used as a starting point for consideration of likelihoods. Data considered was both from reportable ignitions (since 2014) and from large fire history (since 1970) reported, for example, by CAL FIRE, and described in detail above.
- Changes from historic likelihood: Changes were considered from the historic likelihood of fires. Changes from historic likelihoods are primarily due to: a) system hardening programs, including PSPS, that have been undertaken during the timeframe used (to elaborate, the timeframe used for analysis was between 1970 and 2018, and system hardening programs began in earnest in 2008); b) climate change; c) increased overhead miles relative to previous timeframes; and d) change in vegetation relative to previous timeframes. Because each of these changes are not precisely known, models were used to estimate the actual range of current likelihoods, with 10,000 estimates stored for use in the next step.
- Modeling of Consequences: Consequences were also modeled by using historical fires to create or "fit" a probability distribution from large fires considering financial loss. The probability distribution is SDG&E's estimation of the types of financial losses that may occur if a large utility-associated wildfire occurs. The probability distribution is not a precise statistical forecast, but it is a useful estimation for wildfire risk discussions. The probability distribution that is currently used is not permanent and will be modified as new information becomes available.

- Monte Carlo Simulation: In Microsoft Excel, Monte Carlo modeling was performed to identify the likelihood and consequence of large fires, using the following approach:
  - 10,000 runs, which simulate individual years, were performed.
  - 10,000 probabilities, one for each run, were created based upon the likelihood information addressed above. During each run, a random number was generated and used to compare between it and the likelihood stored for that run. If the random number is smaller than the likelihood value, the model assumes that a large wildfire occurred during that run. The average of the likelihood values used in this step is approximately 0.069, which indicates that at least one large wildfire will occur in one out of every 15 years. Some of the years that have at least one large wildfire will have multiple large wildfires in that year. The total number of large wildfires that the model produced was 935 over 10,000 runs.
  - If a large wildfire was modeled to occur, a method to determine the number of wildfires that occurred during that run was undertaken. That method created a random value drawn from the Poisson distribution with the parameter of 1 (*i.e.* $\lambda(1)$). The maximum value between that random draw and the number 1 was then used to represent the number of large wildfires that occurred during that run.
  - Depending on the number of wildfires to run (as determined in the previous step) the consequence probability distribution was then used for sampling. The sum of the sampled values was used for the financial consequence for the run and stored for further analysis.
  - Most runs returned $0 due to the fact that large fires are modeled to occur approximately once every 15 years. In the runs where a large wildfire was modeled to occur, the average financial consequence was approximately $3 billion.
  - The output from the Monte Carlo modeling was then tabulated and put into a format to be analyzed.

- Meeting the SA Decision's Requirements: For the RAMP Report to meet the requirements of the SA Decision,[30] aspects of the Monte Carlo output were utilized. The following steps were undertaken to meet the SA Decision's requirements:
  - Because the scope of the Wildfire risk in the RAMP Report includes all CPUC-reportable fires, and not solely large destructive fires, an adjustment was made from the other internal modeling. For purposes of the RAMP, the LoRE is set to the recent history of SDG&E's CPUC reportable fires, which is approximately 30. Because the total number of modeled large fires was 935 out of 10,000 runs, and 30 reportable fires of all sizes occur each year, this data estimates that one out of every approximately 320 reportable wildfires will be a large destructive fire.
  - CoRE was partially calculated from the Monte Carlo modeling by extracting the expected values of the output consequences. This was done differently for each attribute:
    - Financial: The expected value of all Monte Carlo outputs was determined to be $225 million.
    - Reliability: Data was extracted from SDG&E's internal reliability database for fire-related outages to determine reliability impacts.
    - Safety: Due to the large uncertainty around safety during wildfires, a rule of thumb was applied to the financial data. Based on subject matter interpretation of historical data, for each $1 billion loss due to wildfire, it was assumed that 4.25 safety units would occur. This ratio was applied to the Monte Carlo output, producing an expected value of 0.96 safety units per year.

[30] D.18-12-014 at Attachment A, A-11 ("Calculation of Risk"). Chapter RAMP-C of this Report describes the quantitative framework applied to this Wildfire risk chapter.

- CoRE Output: These obtained values were then used as inputs the Risk Quantification Framework to determine the CoRE value of 241.

V. RISK MITIGATION PLAN

The SA Decision requires a utility to "clearly and transparently explain its rationale for selecting mitigations for each risk and for its selection of its overall portfolio of mitigations."[31] This section describes SDG&E's Risk Mitigation Plan by each selected Control and Mitigation for this risk, including the rationale supporting each selected Control and Mitigation.

As stated above, SDG&E's Wildfire risk is defined as the risk of a wildfire, initiated by SDG&E equipment, resulting in fatalities, widespread property destruction, and a multibillion-dollar liability. To mitigate, minimize, and manage this risk, SDG&E takes a multi-layered approach designed to defend against single point of failure. In other words, SDG&E does not rely on one mitigation strategy in its service territory; rather, it strategically performs a variety of activities to prevent wildfires. For example, SDG&E inspects and remediates vulnerabilities on its system, while at the same time performing vegetation management activities, hardening infrastructure, and (as a last resort will de-energizing customers for safety (PSPS), if deemed necessary.

To accomplish this, SDG&E employs a three-pronged approach, integrating efforts in:

- **Operations and Engineering** – how SDG&E builds, operates and maintains its electric system to be fire-hardened;
- **Situational Awareness and Weather Technology** – focuses on SDG&E's ability to monitor and understand the fire environment; and
- **Customer Outreach and Education** – concentrates on communication and collaboration with regional stakeholders and customers.

This three-pronged approach involves programs and strategies that allow SDG&E to better understand the Wildfire risk, fire risk conditions, and fire behaviors to provide the Company and its customers with time and information to take appropriate action. For example, it allows SDG&E to construct, maintain, and operate a fire-hardened electric distribution and

[31] *Id.* at Attachment A, A-14 ("Mitigation Strategy Presentation in the RAMP and GRC").

transmission system in a manner that minimizes the possibility of igniting a fire. It also allows SDG&E to educate customers and stakeholders on the Wildfire risk as well as support customers affected by it.

SDG&E's Risk Mitigation Plan includes the whole of SDG&E's wildfire-related programs and strategies, taken together. The Risk Mitigation Plan discussed below includes both controls that are expected to continue and mitigations for the period of SDG&E's TY 2022 GRC cycle.[32] The controls are those activities that address this risk and were in place as of 2018, most of which have been developed over many years, to address this risk and including work to comply with laws that were in effect at that time.

Consistent with the presentation in its 2019 WMP,[33] SDG&E presents its Risk Mitigation Plan herein in the following categories, each of which are further described below:

- Operations and Engineering;
- Inspections;
- System Hardening;
- Vegetation Management;
- Situational Awareness and Asset Prioritization;
- Public Safety Power Shutoff; and
- Preparedness and Response.

In an effort for continuous improvement, SDG&E has revisited the above-mentioned categories and enhanced them where appropriate. For example, SDG&E has modified the category of "Situational Awareness" as presented in the 2019 WMP to "Situational Awareness and Asset Prioritization." The change to this category better aligns with how SDG&E uses situational awareness, and its tools, for planning and prioritization. Additionally, some of the activities have been re-assigned to different categories, where appropriate. An example is the

[32] *Id.* at 33. A "Control" is defined as a "[c]urrently established measure that is modifying risk." *Id.* at 16. A "Mitigation" is defined as a "[m]easure or activity proposed or in process designed to reduce the impact/consequences and/or likelihood/probability of an event." *Id.* at 17.

[33] *See* R.18-10-007, Administrative Law Judge's Ruling on Wildfire Mitigation Plan Template, and Adding Additional Parties as Respondents (January 17, 2019) at Attachment A.

aviation programs are now included in the category of Preparedness and Response, rather than in the Operations and Engineering category.

In addition, there are recent events that may change the quantity and timing of certain fire hardening mitigation strategies presented in this RAMP Chapter. Based on statewide lessons learned from October 2019 PSPS events, SDG&E is currently evaluating the possibility of mitigating PSPS customer impacts on a circuit-by-circuit basis, to include a combination of undergrounding, covered conductor, remote sectionalizing, system hardening, and backup generation. Any significant changes in program scopes, costs, and RSE calculations will be updated in SDG&E's upcoming Wildfire Mitigation Plan and GRC filings.

A. Operations and Engineering

1. SDG&E-1-C1 – Operating Conditions

As described in the 2019 WMP,[34] SDG&E monitors the potential for wildfires throughout its service territory daily and adjusts its operating behaviors accordingly, using its situational awareness capabilities and a formalized escalation approach.[35] It is in part this information that allows SDG&E to be flexible and successful in its operations. As conditions for wildfires increase, SDG&E can deploy additional layers of safeguards, or, as a last resort, it might be required to de-energize certain areas of its service territory in the interest of public safety.

SDG&E uses a variety of inputs to determine the appropriate operating environment given current and expected wildfire conditions. These tools are used for operational decision-making so that SDG&E personnel can plan and prepare. Among these inputs for situational awareness are the Fire Potential Index (FPI) and Santa Ana Wildfire Threat Index (SAWTI). These are briefly summarized below and are discussed in greater detail in activity SDG&E-1-C17 below.

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[34] R.18-10-007, San Diego Gas & Electric Company's Wildfire Mitigation Plan (February 6, 2019) ("SDG&E's 2019 WMP") at Attachment A, pp. 20-21 and 52.

[35] Costs were not identified for this activity because it is embedded in internal labor. A Risk Spend Efficiency calculation is therefore not being performed.

- **Fire Potential Index:** a daily detailed and rolling seven-day forecast prepared by SDG&E of weather conditions relevant to SDG&E's operations.
- **Santa Ana Wildfire Threat Index:** a web-based tool, developed in a public/private collaboration, that classifies the wildfire threat potential associated with the Santa Ana winds. The SAWTI is updated daily by the United States Forest Service (U.S. Forest Service) Geographic Area Coordination Center. They generate a six-day forecast of large wildfire potential, which will result in one of four classification levels from "marginal" to "extreme."

Another tool is field observations. SDG&E strategically positions field personnel throughout its service territory based on system conditions, weather, and wildfire potential, which may be considered a threat to SDG&E facilities. Field observers inform operational decisions by providing real-time input regarding onsite conditions, such as debris, vegetation, and system conditions.

SDG&E established Operating Conditions to monitor wildfire potential and, among other things, inform decisions regarding recloser settings, sensitive relay settings, testing procedures, and work restrictions. These Operating Conditions are: Normal Condition, Elevated Condition, Extreme and Red Flag Warning (RFW) Condition. Each are summarized below:

- Normal Condition (FPI forecast is in the range of 1 through 11): declared when SDG&E determines that the burn environment is not conducive for wildfires within its service territory.
- Elevated Condition (FPI forecast is in the range of 12 to 14): declared when SDG&E determines that the burn environment has become conducive to wildfires within its service territory.
- Extreme and RFW Conditions (FPI forecast is 15 or above): declared when SDG&E determines that a combination of high winds, low relative humidity, and the burn environment will create critical wildfire weather conditions in its service territory.

These Operating Conditions inform how SDG&E operates the system impacting its recloser protocols, restrictions on the type of work being performed in high risk locations, and the use of contract firefighting resources.

2. SDG&E-1-C2 – Recloser Protocols

Consistent with the description in the 2019 WMP,[36] SDG&E previously completed a large deployment of overhead distribution reclosers, focusing heavily on the High Fire Threat District (HFTD).[37] A recloser is a switching device that is designed to detect and interrupt momentary faults. The device has the ability to reclose automatically and open back up if a fault is still detected. The automated reclosing feature can be disabled, so if a device detects a fault it will trip open and remain open and minimize the potential for an ignition. These overhead distribution reclosers allow SDG&E to operate its system in a variety of configurations depending on input from its meteorologists, known localized conditions, and its declared operating condition (please refer to discussion above in control SDG&E-1-C1 – Operating Conditions). They also provide SDG&E the ability to sectionalize various elements of its distribution system to efficiently manage system operations and reliability, which results in quicker restoration times for customers. Additionally, SDG&E has associated these remote supervisory control and data acquisition (SCADA) controlled sectionalizing devices with specific wind anemometer locations, allowing for targeted applications of the Public Safety Power Shutoff (PSPS) to the areas that pose the most significant real-time system condition risk of wildfire.

Under Normal Conditions, overhead distribution reclosers operate to clear faults by isolating the fewest number of customers while reducing overall exposure to the electric system. Under Elevated Conditions or higher and now most of the year, all distribution reclosing functions are disabled on circuits located within the HFTD but may include other circuits if the burn environment is conducive to large wildfires. This is done so that if a fault occurs on the

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[36] SDG&E's 2019 WMP at Attachment A, pp. 21-22.

[37] The program of Automated Reclosers discussed in SDG&E's 2019 WMP is included in this control given that these reclosers were installed beyond the period of this rate case cycle (*i.e.*, the last five years) pursuant to the Rate Case Plan. Additionally, costs were not identified for this activity because it is embedded in internal labor. A Risk Spend Efficiency calculation is therefore not being performed.

system, the recloser automatically opens and stays open so the fault only occurs once and is not closed, creating another opportunity for a potential ignition. Disabling reclosing functions is not optimal for reliability but is performed for public safety and wildfire risk reduction when weather conditions are elevated or higher. In addition to disabling the reclosing function, SDG&E has seen a need to make overhead distribution reclosers operate faster and with greater sensitivity to clear faults in a manner that reduces the energy of the fault as much as possible. By reducing the resultant energy of a fault, the probability of causing significant damage to the surrounding area is reduced. Because of this need, SDG&E has developed the ability to enable more sensitive relay settings on overhead distribution reclosers. These sensitive relay settings improve both the sensitivity of fault detection and the speed at which faults are cleared.

3. SDG&E-1-C3 – Other Special Work Procedures

As described in the 2019 WMP,[38] SDG&E has designated the type of work activity that can be performed for each of the Operating Conditions discussed above in the control SDG&E-1-C1 – Operating Conditions.[39] As conditions increase in severity, work activities may still be performed, but some might have additional mitigation requirements. In other situations, work activity might cease. The following summarizes the work activity guidelines for each Operating Condition:

- Normal Condition: normal operating procedures are followed with baseline tools and equipment.
- Elevated Condition: certain work activities may require additional mitigation measures in order to proceed with work. The additional mitigation measures will be documented.
- Extreme or RFW Condition: most overhead work activities will cease, except where not performing the work would create a greater risk than doing so. In those cases where work needs to be performed, an SDG&E Fire Coordinator is consulted, and any required additional mitigation steps

[38] SDG&E's 2019 WMP at Attachment A, pp. 22-23.

[39] Costs were not identified for this activity because it is embedded in internal labor. A Risk Spend Efficiency calculation is therefore not being performed.

are implemented. Status of work, ceased or continued, will be documented.

These guidelines are generally sufficient for most routine types of activities performed in the wildland areas, which consist of undeveloped areas covered in native vegetation. For non-routine, or especially hazard work, SDG&E's Fire Coordination group is consulted to determine whether additional mitigation requirements are needed.

B. Inspections

1. SDG&E-1-C4 – Distribution System Inspections – Corrective Maintenance Program

As described in the 2019 WMP,[40] Commission General Order 165 requires SDG&E to perform a service territory-wide inspection of its electric distribution system, which is referred to as the Corrective Maintenance Program (CMP).[41] GO 165 establishes inspection cycles and record-keeping requirements for utility distribution equipment. In general, utilities must patrol their systems once a year in urban areas and in HFTD Tier 2 and Tier 3. Patrols in rural areas outside of HFTD Tier 2 and Tier 3 are required to be performed once every two years. However, as a long-standing practice, SDG&E performs patrols in all areas on an annual basis. In addition to the patrols, utilities must conduct detailed inspections at a minimum every 3-5 years, depending on the type of equipment. For detailed inspections, the utilities' records must specify the condition of inspected equipment, any problems found, and a scheduled date for corrective action. Utilities are also required to perform intrusive inspections of distribution wood poles depending on the age and condition of the pole and prior inspection history.

CMP helps to mitigate the Wildfire risk by providing SDG&E additional information about its electric distribution system, including in the HFTD. With this information, SDG&E's corrective actions address infractions before a potential issue can occur.

Upon completion of prescribed actions necessitated by the CMP inspections, SDG&E conducts an audit to ascertain the effectiveness of the inspections. This audit is managed by

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[40] SDG&E's 2019 WMP at Attachment A, pp. 25-26.

[41] A Risk Spend Efficiency calculation is not being performed on this activity because it is mandated pursuant to GO 165.

SDG&E's operational and engineering managers, who are responsible for certain districts. They typically select about 1.5% of the combined (overhead and underground) territories and assess their conditions to see if the appropriate improvements have been properly carried out.

Because CMP is performed throughout SDG&E's service territory, for purposes of SDG&E's RAMP showing, this control has been split between SDG&E's Wildfire and Electric Infrastructure Integrity risk chapters. This Wildfire risk chapter only includes activities and associated costs for inspections performed in the HFTD.

2. SDG&E-1-C5 – Distribution System Inspections – Quality Assurance/Quality Control

Consistent with the 2019 WMP,[42] SDG&E has implemented a Quality Assurance/Quality Control (QA/QC) inspection program in HFTD Tier 3 prior to fire season. These proactive inspections are completed on a three-year cycle, exceed the requirements of GO 165, and are designed to identify potential structural and mechanical problems before they fail. SDG&E has performed QA/QC inspections of its overhead electric distribution poles in high risk fire areas with a focus on identifying items for which maintenance would improve fire safety and reliability, with a goal of mitigating the probability that SDG&E's overhead electric system, facilities, and equipment would be the source of ignition for a fire. These inspections were conducted from 2010 through 2016 as a result of a settlement agreement adopted by the CPUC, D.10-04-047. In 2017, SDG&E decided to proactively continue the QA/QC inspections as part of its normal program. In 2018, when the CPUC adopted the current statewide fire threat map, SDG&E began applying the QA/QC three-year cycle to the newly defined HFTD Tier 3. During 2016 to 2018, SDG&E performed QA/QC inspections on an average of 15,000 poles annually (approximately one-third of the distribution poles) in its then-existing "extreme" and "very high" fire threat areas.

In addition to the inspection, SDG&E performs a system maintenance patrol (as specified by GO 165) for the entire overhead electric distribution system in the HFTD on an annual basis. Safety-related issues identified on those patrols are scheduled for follow up repair.

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[42] SDG&E's 2019 WMP at Attachment A, p. 27.

3. SDG&E-1-M1 – Distribution System Inspections – Infrared/Corona

SDG&E is piloting new periodic infrared (IR) inspections for distribution equipment, with the intent of creating a formalized program beginning in 2020. As this program is new, it was not included in SDG&E's 2019 WMP. This program consists of using IR and corona technology, with both technologies currently being used for transmission and substation inspections. IR technology identifies thermal hotspots in equipment and connections. Corona technology, while similar to IR, differs in that it identifies, using ultraviolent light, components that may have been damaged, resulting in increased tracking. SDG&E intends to utilize both technologies to inspect distribution circuits, with the goal of early detection of potential issues on electrical connections and equipment that cannot be seen from SDG&E's traditional visual inspections. Accordingly, IR and corona technology will complement existing programs by allowing SDG&E to proactively identify hotspots on circuits, connections, and equipment.

The IR and corona inspections will generate repair orders to address any infractions discovered as part of the inspection. Overall, these inspections and associated repairs will reduce the potential for equipment failure of SDG&E's overhead system, including wires down, which can cause ignitions. These inspections will be conducted primarily via land but may also be conducted from the air. Given that this is a pilot program, repairs resulting from these inspections are not estimated herein. SDG&E will provide forecasts for resulting repairs in the GRC, as appropriate.

Based on the initial results of the 2019 pilot program, SDG&E plans to annually inspect approximately twenty percent of the linear mileage of distribution circuits within the HFTD, on a five-year cycle, beginning in 2020. SDG&E will prioritize inspections in Tier 3 of the HFTD, before moving to Tier 2.

4. SDG&E-1-M2 – Distribution System Inspections – Drone Inspections

SDG&E will be using non-traditional approaches to inspections to identify infractions that are not visible via ground-based inspections. To improve visual inspections, SDG&E will be employing drones to capture imagery of every overhead structure in the HFTD from multiple angles, including from above the structure, that can help identify issues posing a potential ignition risk. This imagery data will be stored in a new centralized database application to allow for data analytics to determine trends and patterns of infractions to quickly identify systemic

issues and support more proactive replacements, including more programmatic approaches to reducing ignition risk. Drone inspections will also be performed for quality assurance of any major overhead construction project within the HFTD to confirm equipment is built to standards and any infractions are timely corrected.

SDG&E started a pilot program in 2019 (which may continue into 2020) to inspect 30,000 structures within the HFTD Tier 3. As SDG&E learns from the pilot program, a drone inspection program and cycles will be established. This pilot program is new and was not included in SDG&E's 2019 WMP.

Further, these inspections will generate repair orders to address the various infractions discovered as part of the inspection, which will reduce the risk of ignition caused by equipment or structural failure of SDG&E's overhead system. Given that this is a pilot program, repairs related to drone inspections are not estimated herein. SDG&E will provide forecasts for repairs resulting from drone inspections in the next GRC, as appropriate.

5. SDG&E-1-M3 – Circuit Ownership

This program offers the opportunity for SDG&E's field employees and management of field employees to submit circuit vulnerabilities via a Mobile Data Terminal (MDT) program or mobile application (both iOS and Android). Specifically, this program facilitates supplemental submission of circuit vulnerabilities (in addition to the existing inspection programs) so that they can be timely repaired, to prevent a potential ignition and minimize the risk of wildfire. This program accordingly allows SDG&E to leverage its workforce to self-report identified vulnerabilities related to its system. Each vulnerability would be evaluated through a consistent method and then prioritized and repaired. While the identified vulnerabilities may not be considered formal infractions, through this program, SDG&E will document and remediate any such findings before issues occur. This program is newly presented herein and was not included in the 2019 WMP.

6. SDG&E-1-C6 – Substation System Inspections

As described in the 2019 WMP,[43] SDG&E's Substation System Inspection and Maintenance Program is mandated by the CPUC through GO 174 and promotes safety for

[43] *Id.* at Attachment A, pp. 27-28.

SDG&E personnel and contractors by providing a safe operating and construction environment. This is accomplished through routine inspections at reoccurring cycles. A security check is planned once per week, and a more detailed inspection is planned monthly or bimonthly, which takes a visual look at equipment and attempts to identify any problems, like oil leaks.

Substation System Inspections, while conducted primarily for reliability, also provide incidental wildfire mitigation benefits. Specifically, this inspection program mitigates the risk of equipment failure, which has the potential to cause ignitions, by identifying equipment deterioration to make the repair or replacement before failures occur. In this instance, equipment failure can lead to fires in oil-filled substation equipment; however, those fires would be contained within the substation footprint. This is why SDG&E considers its inspection and maintenance programs to have incidental wildfire mitigation benefits when performed within the HFTD and wildland urban interface.[44]

Additional goals of this program include: meeting the requirements of GO 174, achieving a level of station availability satisfactory to SDG&E's health and safety programs and maintenance standards, and assuring compliance with all sections of the California Independent System Operator (CAISO) Transmission Control Agreement (TCA).

Because substation system inspections are performed throughout SDG&E's service territory, for purposes of SDG&E's RAMP showing, this control is also discussed in SDG&E's Electric Infrastructure Integrity risk chapter. To that end, given that this program is largely related to equipment failure, the costs for this activity are entirely included in the Electric Infrastructure Integrity risk chapter.

7. SDG&E-1-C7 – Transmission System Inspections

As described in the 2019 WMP,[45] all SDG&E transmission system facilities covered by the transmission inspection practice[46] are routinely inspected using visual and infrared inspection

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[44] Wildland urban interface refers to a zone of transition between wildland (unoccupied land) and human development, which is at risk of wildfire.

[45] SDG&E's 2019 WMP at Attachment A, p. 28.

[46] Because this control is related to assets in the jurisdiction of the Federal Energy Regulatory Commission (FERC), SDG&E is not including the associated costs, as further described in Section VI below. Accordingly, a Risk Spend Efficiency calculation is not being performed.

techniques. Infrared and air inspections are completed annually on all transmission circuits. Ground-based visual inspections are completed on three-year cycles. Non-routine inspections are scheduled depending on operational need. Inspections/patrols of all structures, attachments, and conductor spans are performed to identify facilities and equipment that may not meet California Public Resources Code (PRC) §§ 4292 and 4293 or GO 95 and GO 128 rules. When non-conformances are identified through these inspections, jobs are designed to remediate these issues based on severity levels. SDG&E annually evaluates its maintenance practice to confirm inspection and repair intervals meet or exceed regulatory requirements.

This inspection program mitigates the risk of equipment failure by identifying equipment deterioration to make the repair/replacement before failures occur. Equipment failure can lead to electrical faults, which can lead to ignitions. This is why SDG&E considers its inspection and maintenance programs to be wildfire mitigation activities when performed within the HFTD and wildland urban interface.

While transmission inspections are performed throughout SDG&E's service territory, inside and outside the HFTD, for purposes of SDG&E's RAMP, this control is discussed in both SDG&E's Wildfire and Electric Infrastructure Integrity risk chapters.

C. System Hardening

SDG&E designs and constructs its overhead electric and communications facilities to maximize public, employee, and contractor safety, as explained in the 2019 WMP.[47] In many situations, SDG&E develops standards that supersede the minimum requirements dictated by a general order, to incorporate known local conditions and further maximize safety. To reflect the more stringent design and construction standards adopted by the Commission and to improve the performance of the SDG&E electric system in terms of meeting fire-prevention goals, the SDG&E Facilities Design Manual was modified in 2012 to include an entirely new section aimed at providing guidance for hardening distribution circuits against the risk of fire. These modifications include both proactive measures designed to reduce the incidence of ignitions and reactive measures by which SDG&E can respond to and mitigate the threat of fires, such as only allowing specific types of conductor.

[47] SDG&E's 2019 WMP at Attachment A, p. 30.

SDG&E continues to evaluate and incorporate new technologies and equipment for its electric system that may improve electric reliability and safety, giving special attention to technologies that may contribute to SDG&E's fire safety goals and objectives.[48] SDG&E's electric distribution engineering department evaluates and creates new equipment and use standards for emerging and pre-commercial technologies. Using equipment failure data, the department makes recommendations regarding which technologies should be incorporated into the SDG&E system and which could be improved prior to application. SDG&E's system hardening plan was developed with these design and construction standards in mind.

1. SDG&E-1-C8 – Overhead Transmission and Distribution Fire-Hardening (Wood to Steel)

SDG&E is committed to fire-hardening its 69kV transmission and associated 12kV distribution system located in the HFTD. This hardening effort is a multi-faceted approach that starts with enhanced design criteria that accounts for greater wind speeds and includes the use of high tensile strength conductor, increased wire-to-wire spacing, and the use of steel poles. Previously, lines were constructed to withstand working loads under stress of 56 miles per hour (mph) wind speeds. The new electric lines are designed to withstand working loads under the stress of 85 mph wind speeds, and in some specific cases, up to 111 mph, based on known local wind conditions. The new lines are being designed utilizing steel poles instead of wood. Steel poles are a more reliable construction material, giving more confidence in their designed strength, and are more resilient should a fire occur, leading to faster restoration times. These new steel pole facilities are being installed in conjunction with the application of higher strength conductors and increased spacing between lines, beyond the requirements of GO 95, resulting in a decrease in the likelihood of energized lines coming into contact with one another or arcing after being struck by flying debris. In addition, SDG&E's current design standards now reflect the use of the enhanced design criteria, steel poles over wood poles, high strength conductor, and increased conductor spacing in the HFTD.

[48] *Id.* at Attachment A, p. 30.

As of October 2019, SDG&E has hardened 55% of its 69kV transmission system within the HFTD by installing over 2,900 new steel poles and plans on further investment to continue these efforts. SDG&E anticipates installing 800 steel poles in the HFTD from 2020 to 2022, consistent with the forecast stated in SDG&E's 2019 WMP.[49]

SDG&E notes that the tie lines hardened in this program are driven by FERC-jurisdictional projects, given that hardening efforts address the 69kV transmission system and the associated 12kV distribution system located in the HFTD. This Chapter provides only the CPUC-jurisdictional elements related to this program.[50]

2. SDG&E-1-M4 – Strategic Undergrounding

SDG&E is strategically evaluating certain distribution lines for undergrounding, equaling approximately six miles, where undergrounding such lines would reduce a significant risk and/or limit exposure to a PSPS event. These are highest risk circuits within Tier 3 of the HFTD that have already been subject to multiple PSPS events. The undergrounding work associated with this 2019 RAMP Report will focus on mitigating PSPS customer impacts, by supporting critical infrastructure such as community centers, schools, fire stations, gas stations, and businesses. SDG&E is forecasting this portion of its strategic undergrounding program to start construction in 2020 and to continue for many years, above the levels put forth in the 2019 WMP.[51] The rural locations within the HFTD, environmentally sensitive locations, and potentially non-advantageous terrain (*e.g.*, granite rock, equipment up a hillside) for the existing distribution overhead equipment, are all potential drivers that could delay construction. While SDG&E continues to evaluate these locations for economic and general feasibility, SDG&E is looking to potentially further increase the miles to strategically underground. This may result in a

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[49] *Id.* at Attachment A, pp. 32-33.

[50] Costs identified herein for this activity are limited to distribution-related portions under the CPUC-jurisdiction. Because the distribution components are dependent on and borne from an approved FERC-jurisdictional transmission-related program, SDG&E is not calculating a Risk Spend Efficiency on this program.

[51] SDG&E's 2019 WMP at Attachment A, p. 33. This program was referred to as Underground Circuit Line Segments in the 2019 WMP.

significant ramp-up of this initiative over several years. Any differences in the implementation goals of this program from this RAMP Report will be reflected in future WMP and GRC filings.

In addition, SDG&E's Tariff Rule 20D allows for conversion of existing primary voltage overhead facilities to underground facilities along public streets and roads, and on public lands and private property in more fire-prone areas where undergrounding is the preferred method to reduce fire risk and enhance reliability. SDG&E formed a team with expertise in the undergrounding of distribution systems and facilities and fire science to evaluate the undergrounding of circuit segments located in the HFTD within primarily the County of San Diego jurisdiction. These experts provided the County of San Diego with an understanding of the potential for undergrounding portions of the overhead system to mitigate the risk of fire, and the results are being used on circuit analysis to propose undergrounding portions where feasible. Conferences with County management and leadership are in progress to gain agreement on individual project prioritization and scope of work. Design on these conversions are scheduled to begin in 2020, with anticipated construction in 2021.

3. SDG&E-1-C9 – Cleveland National Forest Fire-Hardening

As described in the 2019 WMP,[52] SDG&E currently operates and maintains a network of electric facilities located within the Cleveland National Forest (CNF). In 2016, SDG&E received a Master Special Use Permit (MSUP) to operate and maintain facilities within CNF. Specifically, the MSUP allows SDG&E to develop a series of projects and activities aimed at increasing the safety and reliability of existing electric facilities within and near the CNF. SDG&E has received final approval for these projects and associated permits, and work has been ongoing since 2016. The projects include the fire-hardening of facilities and select undergrounding of several existing 12kV and 69kV electric facilities spread throughout an approximately 880 square-mile area in the eastern portion of San Diego County. The existing electric lines located within CNF also extend outside of CNF boundaries. Generally, the CNF program will increase the safety and reliability of SDG&E's system by fire-hardening existing electric infrastructure that currently serves the U.S. Forest Service, emergency service facilities

[52] *Id.* at Attachment A, pp. 33-34.

(i.e., fire, communication, and other), campgrounds, homes, businesses, and other customers within the CNF and surrounding areas.

The project design was based on various recommendations addressing fire prevention and the U.S. Forest Service's environmental requests. Using an analytical matrix reflecting elements of fire risks and environmental concerns, SDG&E and the U.S. Forest Service collaborated to determine which sections of the electric system should be upgraded. Each segment required a custom solution based on many factors, including the location of the customer being served by the distribution system, the topography of the land, and various biological, cultural, and environmental factors.[53]

Construction commenced on the CNF program in late 2016 and is planned to continue through 2021. Through October 2019, SDG&E has fire-hardened a total of 104.5 miles of electric transmission and distribution lines, including 59.7 miles of 69kV transmission lines and 655 structures replaced with steel and 44.8 miles of 12kV distribution lines and 283 structures replaced with steel. For 2019, SDG&E plans to replace an additional 12.2 miles of 69kV transmission lines and 200 structures as well as 13 miles of distribution lines and 90 structures.[54]

4. SDG&E-1-C10/M5 – Fire Risk Mitigation

In 2013, SDG&E established the Fire Risk Mitigation (FiRM) program, an overhead distribution, fire-hardening, and rebuilding effort. The goal of the FiRM program is to fire-harden facilities in the HFTD by replacing aged line elements, utilizing advanced technology, and designing for known local weather conditions. FiRM is also tasked with developing a multi-year plan for the rebuilding of circuits with the greatest fire-related risk. Prioritization and scoping of each FiRM project is driven largely by analysis using SDG&E's Wildfire Risk Reduction Model (WRRM).

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[53] As noted in SDG&E's 2019 WMP, the U.S. Forest Service relies on the Project Activity Level (PAL) system, which was designed to help fire and timber resource managers establish the level of industrial precaution for the following day. PAL applies to the Cleveland National Forest. *See id.* at Attachment A, p. 23.

[54] The CNF program is largely related to transmission assets in the HFTD under the jurisdiction of FERC. Costs identified and Risk Spend Efficiencies performed herein for this activity are limited to distribution-related portions under the CPUC-jurisdiction.

Factors considered in the prioritization and scoping process include, but are not limited to, recent occurrences of a "wire-down," wind and weather conditions, fire risks, outage history, conductor size and type, condition of equipment, environmental conditions, and resulting customer impacts. FiRM projects are scoped on a circuit-by-circuit basis by considering various risk factors. Risk mitigation methods include replacement or removal of small conductor and older wood poles, and employing targeted fire risk mitigation methods of the circuit, including removal of equipment, long span remediation or reinforcement, and advanced technology implementation (namely, falling conductor protection, synchrophasor/phasor measurement unit (PMU) enabled relaying/monitoring, high impedance fault detection, and light imaging detection and ranging (LiDAR) survey data captured via Unmanned Aerial Vehicles (UAVs and helicopters) before and after construction.

As of the end of October 2019, the FiRM program is approximately 28% complete, having replaced over 8,000 poles and 400 miles of reconductor. SDG&E plans to continue this effort for the foreseeable future, as there are still approximately 1,000 miles of aged high-risk conductor remaining within the HFTD in SDG&E's service territory. At this current rate of reconductoring approximately 84 miles of high-risk conductor per year, it will take SDG&E approximately 13 years to complete this focused effort with the current resources and budget. However, given the recent California fires beginning in 2017 and the elevated risk climate change has brought to the state, SDG&E has been planning to accelerate this effort to remediate these older line elements by 2025 (years 2019-2025). This accelerated plan was put forth and approved in SDG&E's 2019 WMP.[55] The increased scope of work would begin engineering and design in 2019 and construction in 2020.

5. SDG&E-1-C11/M6 – Pole Risk Mitigation and Engineering

SDG&E's Pole Risk Mitigation and Engineering (PRiME) program was developed to assess pole strength and integrity considering loading conditions, third party attachments, localized weather conditions, and remaining pole strength throughout SDG&E's service territory. PRiME does not overlap with existing programs, such as FiRM or CNF.

[55] SDG&E's 2019 WMP at Attachment A, pp. 34-35.

PRiME will focus its efforts in HFTD Tier 3 and Tier 2. Assessments and prioritization on SDG&E's highest risk poles within Tier 3 and Tier 2 of the HFTD will be completed prior to poles located outside of the HFTD. Poles identified that require construction activities after assessment and follow-up analysis[56] will be remediated as they are identified.

SDG&E anticipates performing approximately 700 pole remediations in 2019, 1,700 pole remediations in 2020, 2,100 pole remediations in 2021, and 2,100 pole remediations in 2022. At the current rate, it is anticipated that remediation activities will be completed in eleven years within the HFTD. However, SDG&E is planning to accelerate this effort to complete remediation activities by 2027 (years 2019-2027), as discussed and approved in its 2019 WMP.[57] The increased scope of work would begin engineering and design in 2019 and construction in 2020.

6. SDG&E-1-M7 – Expulsion Fuse Replacement

SDG&E's distribution system is dynamic and can experience a contact with a foreign or unimproved object, resulting in a fault. When the distribution system experiences a fault or overcurrent, there are fuses connected to the system to protect its integrity and isolate the fault. These expulsion fuses are designed to operate by creating a significant expulsion within the fuse, resulting in the fuse opening and isolating the fault, and in turn limiting further damage to other equipment. Because of this internal expulsion, the fuses are equipped with a venting system that sends a discharge of energy out of the fuse and into the atmosphere. This external discharge has the potential to ignite flammable vegetation.

To mitigate this potential, SDG&E has developed a three-year program to proactively replace existing branch expulsion fuses within the HFTD with CAL FIRE approved power fuses.[58] There are approximately 8,900 branch expulsion fuses in SDG&E's HFTD, and this new

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[56] PRiME utilizes LiDAR and outage data to perform engineering assessments to identify and prioritize structure remediations. This was referred to as Facility Analysis in the 2019 WMP. *See id.* at Attachment A, pp. 30-31.

[57] *Id.* at Attachment A, p. 35.

[58] Power fuses are equipment that have been previously granted an exemption from CAL FIRE.

program is designed to lessen the chance for an ignition source in the HFTD by reducing external discharges during fuse operation.

In 2019, this program will prioritize the replacement of the branch expulsion fuses to the CAL FIRE approved power fuses by completing the removal of non-CAL FIRE approved fuses in HFTD Tier 3 and then moving to HFTD Tier 2. SDG&E anticipates completing this program by 2021, replacing roughly 2,400 per year when including 2019. This program was presented for the first time in SDG&E's 2019 WMP. [59] SDG&E is proposing herein to continue this program consistent with its 2019 WMP.

7. SDG&E-1-M8 – Hotline Clamps

Through equipment failure analysis related to wire down outages, SDG&E has identified high risk connectors known as "hotline clamps" that SDG&E intends to replace as part of this program. These hotline clamps have been identified because they have been associated with creating a weak connection resulting in a wire down event. This wire down event can lead to an energized wire on the ground or coming into contact with a foreign object, thus becoming an ignition source.

From the data gathered during SDG&E's QA/QC inspections, SDG&E has identified approximately 3,700 structure locations with this type of connector within the HFTD. This program to replace these connectors and potentially reconductor as well as replace existing poles is planned to begin in 2019 and will continue through 2025, consistent with SDG&E's 2019 WMP.[60]

8. SDG&E-1-C12/M9 – Wire Safety Enhancement

The Wire Safety Enhancement (WiSE) program is designed to mitigate risk by hardening electric distribution overhead infrastructure and protection systems. WiSE addresses public safety risks in wildland urban interfaces where conductor or connection equipment failures may cause wildfires.

Conductor equipment failure can pose serious risks due to potential ignitions in areas that are vulnerable to fire and due to contact that could cause serious injuries or fatalities. Although

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[59] SDG&E's 2019 WMP at Attachment A, pp. 35-36.

[60] *Id.* at Attachment A, p. 36.

WiSE was originally developed to harden the distribution system outside the HFTD Tiers 2 and 3, recent events such as the California wildfires of 2017 and 2018 have provided evidence of the increasing risk to communities within the wildland urban interface. These factors, coupled with record wind speeds and dry vegetation measured in San Diego's coastal canyons in recent months, have created a need to refocus this program to mitigate potential ignitions within the wildland urban interface, a distinct area located outside the HFTD.

The resulting infrastructure enhancements under the WiSE program may include wire upgrade, connector replacements, switch placements or replacements, long span removals, strategic undergrounding, and modifications to advanced protection systems. Design considerations will be driven by area-specific conditions that could include anti-corrosion materials for connectors or conductors, replacement of wood poles where fire-hardening is beneficial, replacing bare wire with covered conductor to reduce wires down caused by foreign object contact (*e.g.*, avian, vegetation, Mylar balloon), and strengthening conductors that are vulnerable to high wind storm events.

WiSE will focus on utilizing multi-attribute risk modeling to drive optimal risk reduction, with considerations for factors including, but not limited to: historic wire down events, projected wire down failures by asset type, proximity to vegetation, condition or age of assets, inspection records, susceptibility of corrosion, meteorology conditions, length of the conductor span, proximity to dense or sensitive public areas (*e.g.*, schools, residences, parks), and conductors that cross major freeways or roadways. The risk model will be focused on these risk parameters within the wildland urban interface boundary first.

In 2019, WiSE will prioritize the highest risk circuit elements within the wildland urban interface and commence hardening efforts to replace roughly 32 miles of overhead conductor by 2022. SDG&E is planning to continue the WiSE program at a pace consistent with its 2019 WMP.[61]

9. SDG&E-1-M10 – Covered Conductor

SDG&E acknowledges the benefits of a targeted approach to installing covered conductor in areas that have electric infrastructure with high tree-strike potential (*i.e.*, near dense

[61] *Id.* at Attachment A, pp. 36-37.

vegetation) and near at-risk vegetation. SDG&E has over five miles of covered conductors installed where its overhead electrical equipment is in close proximity to dense vegetation and where outage history supports this type of installation. SDG&E believes the use of covered conductor in certain applications can be beneficial and will continue to utilize covered conductors in those applications. From dramatically reducing ignitions from a "wire-slap" to foreign objects (*e.g.*, avian, vegetation, Mylar balloons), covered conductor provides value in mitigating the potential for a fire.

At the time SDG&E filed its 2019 WMP,[62] it was at the early stages of evaluating covered conductor technology. SDG&E is updating its forecasts herein to provide additional details on the application of covered conductor, with a goal of roughly 22 miles by 2022, to further adjust construction standards and refine the scope for future applications. The scope of work is being developed utilizing SDG&E's Vegetation Risk Index (VRI) in conjunction with vegetation management data within the HFTD. While this technology continues to be evaluated, SDG&E is looking to potentially further increase the implementation of covered conductor. Any differences in the implementation goals of this program from this RAMP Report will be reflected in future WMP and GRC filings.

10. SDG&E-1-C13/M11 – Fire Threat Zone Advanced Protection

The Fire Threat Zone Advanced Protection (FTZAP) program develops and implements advanced protection technologies within electric substations and on the electric distribution system. FTZAP aims to reduce and/or mitigate the risks of utility-caused fire incidents, to create higher visibility and situational awareness in fire-prone areas, and to allow for the implementation of new relay standards in locations where protection coordination is difficult due to lower fault currents attributed to high impedance faults.

More advanced technologies, such as microprocessor-based relays with synchrophasor/phasor measurement unit (PMU) capabilities, real-time automation controllers, auto-sectionalizing equipment, line monitors, direct fiber lines, and wireless communication radios, comprise the portfolio of devices SDG&E has and will continue to install in substations and on distribution circuits to allow for a more comprehensive protection system along with

[62] *Id.* at Attachment A, pp. 37-38.

greater situational awareness via SCADA in the fire prone areas of the HFTD. This portfolio of advanced technology allows SDG&E to implement new protection systems, such as:

- **Falling Conductor Protection (FCP)** designed to trip distribution overhead circuits before broken conductors can reach the ground energized;
- **Sensitive Ground Fault Protection** for detecting high impedance faults resulting from downed overhead conductors that result in very low fault currents;
- **Sensitive Profile Relay Settings** enabled remotely on distribution equipment during red flag events to reduce fault energy and fire risk;
- **High Accuracy Fault Location** for improved response time to any incident on the system;
- **Remote Event Retrieval and Reporting** for real-time and post-event analysis of system disturbances or outages;
- **SCADA Communication** to all field devices being installed for added situational awareness; and
- **Protection Integration with Private long-term evolution (LTE)** as a means of facilitating the communication infrastructure needs (note: this activity is further described below).

SDG&E asserts that the installation of equipment capable of enabling Falling Conductor Protection (FCP) allows for the remaining technologies mentioned in the list above to likewise be enabled. Further, it should be noted that these technologies continue to be researched and developed, and therefore are subject to upgrades to increase functionality. These potential advancements may impact cost forecasts.

From 2020 to 2022, FTZAP aims to replace aging substation infrastructure such as obsolete 12kV substation circuit breakers, electro-mechanical relays, and Remote Terminal Units (RTUs). New circuit breakers incorporating microprocessor-based relays, RTUs, and communication radios facilitating the requirements of SDG&E's advanced protection systems will be installed in SDG&E substations within the HFTD. On distribution circuits within the HFTD, FTZAP coordinates with the FiRM and PRiME programs to strategically install and/or

replace sectionalizing devices, line monitors, direct fiber lines, and communication radios to facilitate the requirements of SDG&E's advanced protection systems.

SDG&E plans to enable FCP on 73 distribution circuits fed by 33 substations in the HFTD Tier 3 by 2023. By upgrading these circuits and substations with advanced SCADA devices capable of implementing FCP, SDG&E will also advance its existing capabilities with regard to remotely enabled sensitive profile settings, distribution synchrophasors, remote event retrieval, and fault location. SDG&E anticipates implementing this program consistent with the discussion in its 2019 WMP.[63]

11. SDG&E-1-M12 – LTE Communication Network

SDG&E plans to deploy a privately-owned long-term evolution (LTE) network using a licensed radio frequency (RF) spectrum. This will improve the overall reliability of SDG&E's communication network, which is critical for fire prevention and public safety. SDG&E's communication network provides the foundational communications medium to remotely detect and operate the distribution grid and direct first responders when faults occur. The LTE network will allow SDG&E to not only implement enhanced protection technology but also to deploy resources and equipment that best fits a particular incident.

The LTE network significantly increases the capacity and reliability of remote communication, which is critical for the technology discussed in the FTZAP program section. In addition, there are currently holes in the coverage of third-party communication providers in the rural areas of east county San Diego that limit SDG&E's ability to communicate with field personnel during red flag crew deployments and Emergency Operations Center activations. The installation of LTE in the HFTD Tiers 2 and 3 will reduce these gaps, allowing for more timely and reliable communication and information from SDG&E's field crews to emergency management leadership in these critical situations. This is done through the installation of LTE base stations and the installation of fiber optic infrastructure. The forecasts associated with the LTE communication network program are consistent with what SDG&E put forth in its 2019 WMP.[64]

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[63] *Id.* at Attachment A, p. 38.

[64] *Id.* at Attachment A, p. 39.

12. SDG&E-1-M13 – Public Safety Power Shutoff Engineering Enhancements

In addition to other PSPS mitigation strategies, this program mitigates the impact to customers and communities involved in PSPS events by installing additional remote sectionalizing devices within the HFTD. This allows PSPS events to be more precise and potentially localized, which reduces the outage impact to customers. SDG&E is evaluating locations for these sectionalizing devices and based upon the results of the analysis. SDG&E plans to install approximately 30 units over the three-year period from 2020-2022, with the potential for future installations dependent on updated weather information, vegetation analysis and customer impact. This program was included for the first time in SDG&E's 2019 WMP.[65]

13. SDG&E-1-C14/M14 – Replacement and Reinforcement

As explained in the 2019 WMP,[66] the Replacement and Reinforcement program replaces deteriorated wood poles as well as other asset-related components identified through SDG&E's various inspection programs (*e.g.*, CMP and QA/QC inspections). Specific to poles, wood pole damage is attributed to numerous factors including, but not limited to, the loss of original preservative treatment experienced with Penta-Cellon poles, the presence of fungi decay, and bird and/or termite damage. In addition to poles, anything that is identified through various inspections are remediated to timely clear potential infractions and vulnerabilities in SDG&E's system. To do this, jobs are created and sent to SDG&E's various districts where they are then addressed and cleared. This mainly consists of internal labor and fixing or replacing various equipment, as needed.

In 2020 and 2021, the wood pole intrusive inspections are cycling through structures located in the HFTD based on the inspection cycles (*e.g.*, 3 or 5-year cycles). Pole replacements

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[65] *Id.* at Attachment A, p. 39.

[66] *Id.* at Attachment A, p. 40. In SDG&E's 2019 WMP, this program primarily addressed pole replacements. The description of this program has been broadened herein to address remediation activities, beyond poles, that result from CMP and QA/QC inspections. These remediation or repair efforts are not new and are not forecasted to be higher as a result of the CMP and QA/QC inspection programs. The costs identified for this program are capital and O&M. However, the O&M costs are only provided for the QA/QC program for purposes of performing an RSE. An RSE is not being performed for the resulting repairs for CMP given that it is mandated pursuant to GO 165.

associated with deteriorated structures found on these intrusive inspections reduce the risk of ignitions by preventing wood pole failures. In addition, replaced poles will be constructed to SDG&E's improved site-specific design criteria, (*e.g.*, wood poles will be replaced with steel poles that meet the known local wind conditions of a particular area). For poles identified for replacement in Tier 3 of the HFTD, SDG&E intends to accelerate the replacement (including the design, engineering, and construction of the new structures) faster than the six-month time frame required by the Commission's General Orders. This will reduce the risk of wildfire by replacing poles that fail inspection and/or design criteria on an accelerated schedule within the highest risk areas.

14. SDG&E-1-M15 – Backup Power for Resilience – Generator Grant Program, Community Resource Centers, HPWREN

Fire threats may give rise to circumstances that require SDG&E to de-energize for public safety power lines that serve certain communities within the HFTD. To mitigate some of the impacts to affected communities during de-energization events, SDG&E is pursuing Backup Power for Resilience initiatives with the intent of establishing support in areas that will help mitigate the impact of these extreme weather events on its most impacted communities, while also providing overall grid resiliency and other electrical distribution grid operations and services.

Generator Grant Program

As discussed in the 2019 WMP, SDG&E created the Generator Grant Program in response to feedback received from residential customers previously impacted by Public Safety Power Shutoff events. While impacted customers may desire to obtain generators, all do not possess the financial capability to acquire one. The Generator Grant Program (GGP) was launched as a pilot program earlier in 2019 as a first attempt at reaching these impacted communities on a limited basis so that SDG&E may learn from this program and adjust in future years. The program is administered by a neutral third party to grant residential customers (*e.g.*, medical baseline customers) the funding for the express need to acquire and be able to use a portable generator during outages, in particular PSPS events.

SDG&E understands that there are inconveniences associated with de-energization, and this program is one way to provide tools to help mitigate the impact while enhancing customer

resilience. That said, SDG&E strongly encourages all customers to take important steps to ready themselves before the wildfire season, such as creating an emergency kit and a thorough family emergency plan. It is the intent that such actions, when coupled with this program, will lead to a better prepared household.

The Generator Grant Program will help a subset of SDG&E's Access and Functional Needs (AFN) customers charge cell phones and other small electronic devices while they enact their personal emergency plans and also demonstrate that SDG&E is starting to look at solutions and test renewable, portable generator options, to aid customers' resiliency during Public Safety Power Shutoff events.

Although the pilot program is limited, as briefly discussed in SDG&E's 2019 WMP,[67] SDG&E intends to extend this program in 2020 and 2021, factoring in customer feedback and lessons learned. After surveying participants, it was discovered that the program was well-received. Household items that were commonly powered by the portable generators were refrigerators, medical devices, televisions, and communication devices. Based upon this positive feedback received, SDG&E will seek to expand the pilot program into a full program implementation.

Community Resource Centers

SDG&E plans to implement this Backup Power for Resilience program specifically to provide backup power to Community Resource Centers (CRCs) and other critical infrastructure in areas impacted by PSPS. SDG&E's plan to deploy these backup facilities furthers the integration of technology in support of the safe and reliable electric operations. Given that CRCs are intended to supply the public with a reprieve from the effects of PSPS, SDG&E believes it is critical to provide backup power to such facilities.

SDG&E is also expanding upon or developing new programs and strategies, leveraging backup power for resilience to mitigate the risk associated with Public Safety Power Shutoffs. These programs are specifically related to resilient internet connectivity at fire stations, the expansion of the Community Resource Center Network and the potential development of a grant program for portable generators targeted at select residential customers.

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[67] *Id.* at Attachment A, pp. 40-41.

While this program was included in SDG&E's 2019 WMP,[68] it is anticipated to be further expanded in the 2020 through 2022 timeframe.

HPWREN

SDG&E, in collaboration with University of California San Diego (UCSD), supports the High-Performance Wireless Research and Education Network (HPWREN). This is the communication backbone that supports a comprehensive mountaintop camera network and wireless communication network that provides internet to fire stations across the backcountry of San Diego County. Sixteen of the mountaintop cameras are known as pan-tilt-zoom "Alert SDG&E Cameras," which are capable of remote directional and zoom control. These cameras enhance situational awareness for both SDG&E, local fire agencies, and the public as access to the camera feeds is publicly available. The network of cameras is most widely known for its ability to allow first responders to identify and triangulate the location of wildfires.

This program enhances connectivity and reliability of the HPWREN network by implementing backup power for single points of failure via solar power and the replacement of additional outdated equipment enabling redundant feeds. Additional upgrades included within this project will replace outdated uninterruptible power supplies (UPS) and network switches at strategic backbone sites. One additional site planned for upgrade includes the installation of a new multilayer link which will eliminate a single point of failure for internet connectivity to 10 fire stations. The HPWREN program will continue enhancements and upgrades in 2020 and for the foreseeable future as this program provides vital situational awareness and enhances community resiliency.

This program is new and was added after the submission of SDG&E's 2019 WMP.

15. SDG&E-1-M16 – Backup Power for Resilience – Microgrids

This Backup Power for Resilience[69] program will provide backup power in the form of microgrids to critical infrastructure (*e.g.*, fire stations, urgent care centers, and others) in and near

[68] *Id.* at Attachment A, pp. 40-41.

[69] The National Academy of Sciences defines "resilience" as the ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events.

areas impacted by PSPS. These microgrid projects focus on investing in infrastructure to provide backup power to strategic locations. To determine these strategic locations, SDG&E analyzes potential areas using the following criteria:

- Identify the critical facilities and the impact of PSPS events in that area;
- Determine the proximity of the locations (to determine necessary undergrounding);
- Identify available land and its proximity to the point of interconnection;
- Determine the load profile and electric needs of these facility;
- Determine solution (*e.g.*, solar with storage, generator with storage, storage); and
- Determine the feasibility of the solution from a cost perspective.

SDG&E has considered many critical facilities using the criteria above. However, there are three projects that SDG&E is proposing at this time, Cameron Corners being the largest. Cameron Corners is located in the HFTD, in the eastern part of San Diego County. The microgrid includes a medical care facility, fire station as well as local food establishments, convenient stores and gas stations. The project will consist of a 725 kW AC solar photovoltaic array with 2,000 kWh energy storage resource. The fully renewable microgrid solution will support resiliency at these key facilities and therefore will provide significant benefits to the surrounding rural community. During a de-energization event, the facilities will be able to seamlessly island from the distribution grid. The project is expected to be in operation by the end of 2020.

SDG&E notes that microgrids are of particular interest to the Legislature and the Commission. The Legislature enacted SB 1339, which requires the Commission, in consultation with the California Energy Commission, and the California Independent System Operator, by December 1, 2020, to take a number of specific actions to facilitate the commercialization of microgrids for distribution customers of large electrical corporations. To implement this directive, the Commission initiated R.19-09-009. This rulemaking will "include[] programs, rules, and rates related to microgrids that will help the accomplish the state's broader policy

goals."[70] Therefore, it appears that the Legislature and the Commission are supportive of the use of microgrids. SDG&E believes its microgrid projects will aid in achieving broader state policy goals.

Consistent with the Backup Power for Resilience projects above in activity SDG&E-1-M15, these microgrid projects will help customers most impacted by extreme fire weather and PSPS events receive resilience benefits. This program was briefly included in SDG&E's 2019 WMP[71] and is being further expanded in this RAMP filing.

16. SDG&E-1-M17 – Lightning Arrester Removal/Replacement Program

In designing its electric distribution system, SDG&E incorporates unique equipment to protect the infrastructure from external forces. This equipment ranges from shields for avian protection to covered conductor. Each type of equipment has its own unique role. One type of device that protects the distribution system from external forces, such as damages caused by the effects of a lightning strike or a surge from a fault, is a lightning arrester. These devices are installed on the distribution system throughout the SDG&E service territory. Some locations have more installations than others based on the increased probability of lightning strikes, in order to protect other major equipment from abnormal surges and failing. When thermally overloaded, as a result of an excessive increase in energy experienced during an event, these units can become an ignition source. The existing design of arresters require additional measures to protect the distribution system from becoming an ignition source.

Through SDG&E's effort of continuing to improve and explore alternate solutions and evaluate new technology, a new product was introduced that received CAL FIRE approval. Utilizing this new product, SDG&E is proposing a program to replace these arrestors in strategic locations within the HFTD with a CAL FIRE approved lightning arrester. The CAL FIRE approved device comes with an external device that operates prior to the arrester overloading, dramatically reducing the potential of becoming an ignition source.

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[70] R.19-09-009, Order Instituting Rulemaking Regarding Microgrids Pursuant to Senate Bill 1339 (September 12, 2019) at 2.

[71] SDG&E's 2019 WMP at Attachment A, pp. 40-41.

This program, newly presented in this filing, is planning to start design and construct in 2020 and ramping up installation to potentially replace all at risk locations in 10 years.

17. SDG&E-1-M18 – SCADA Capacitors

The SCADA capacitors program will replace existing non-SCADA capacitors with a more modern SCADA switchable capacitor. The current capacitors are designed to provide continuous voltage and power factor correction for the distribution system. During a failure of a capacitor from either mechanical, electrical, or environmental overstress, an internal fault is created resulting in internal pressure and the potential to rupture the casing. This rupture of molted metal has the potential to be an ignition source. The modernization of these capacitors will introduce a monitoring system to check for imbalances and internal faults and open based on the protection settings. In addition, the SCADA capacitor will provide a method for remote isolation and monitoring of the system providing additional situational awareness during extreme weather conditions. The program will first prioritize replacing fix capacitors within the system to capacitors with switches. Both types of capacitors will be modernized to a SCADA switchable capacitor.

This new program is intended to commence in 2020 and be completed by 2022. SDG&E is planning on modernizing 98 capacitors in the HFTD, approximately 30 in each 2020 and 2021, and 38 in 2022. SDG&E will start by replacing fixed capacitors, which are considered to be the most at-risk capacitors in SDG&E's service territory, followed by switchable capacitors. Given this program is new, it was not included in SDG&E's 2019 WMP.

D. Vegetation Management

1. SDG&E-1-C15 – Tree Trimming

SDG&E performs a variety of controls that are accounted for in the Tree Trimming Balancing Account (TTBA). These controls stem from compliance requirements largely outlined in the PRC § 4293, GO 95, Rule 35, and North American Electric Realiability Corporation (NERC) FAC003-4, which require SDG&E to actively maintain a vegetation management program aimed at keeping trees and brush clear of electric power lines. Because tree trimming is performed throughout SDG&E's service territory annually, for purposes of SDG&E's RAMP showing, this control has been split between SDG&E's Wildfire and Electric

Infrastructure Integrity risk chapters, 60% and 40%, respectively. This allocation was applied consistently with other activities in this Chapter (*e.g.*, CMP and Asset Management). Consistent with SDG&E's 2019 WMP,[72] the activities within tree trimming are discussed in greater detail below.

Tree Database

Beginning in 1998, SDG&E developed and implemented an internal vegetation work management system to track and manage trees that are in proximity to its electric infrastructure. SDG&E's database contains records for approximately 460,000 known, specific trees located near its electric power lines. SDG&E's inventory database and work management system are referred to collectively as PowerWorkz, which includes an Esri-based electronic mapping mobile application and server-based workflow tool. Inventory trees are defined as those with the potential of impacting the power lines by encroachment and/or tree failure within three years of the inspection date. All trees in SDG&E's database are monitored using known species growth rates, with additional consideration given to the amount of rainfall occurring during periods affecting overall tree growth, and past pruning practices. Each inventory tree is assigned a unique alpha-numeric identification number within the electronic database, which allows the activity history of each tree to be tracked. Accordingly, this database allows SDG&E to monitor and identify which trees to address in efforts to reduce vegetation-related ignitions. Inspections and maintenance activities are performed annually for purposes of regulatory compliance.

Patrols and Pruning

To comply with Commission rules as well as state and federal laws, SDG&E developed and maintains a vegetation management work plan, which is a schedule-based approach to its operations so that applicable lines within its service territory are inspected each year. SDG&E divides its service territory into 133 distinct zones known as Vegetation Management Areas (VMA). SDG&E's activities in each VMA are driven by a master schedule that identifies specific activities that are calendared to take place in each VMA every year. The activities include: pre-inspection, audit of pre-inspection work, tree pruning and removal, pole brushing, and post-trim and brushing audits. These activities are managed within PowerWorkz.

[72] *Id.* at Attachment A, pp. 41-45.

During the pre-inspection activity, trees in proximity to SDG&E's powerlines are inspected and evaluated and the tree condition in the database is updated accordingly. Each tree is visited on an annual cycle. The annual inspections include routine maintenance and hazard tree assessments to verify that trees will remain compliant for the duration of the cycle and/or pruned according to standards and clearances. Trees that will not maintain compliant or that have the potential to impact powerlines within the annual pruning cycle are identified and assigned to the tree contractor to work. If a tree requires urgent work the inspector has the latitude to issue the job to the tree contractor for priority completion. Emergency pruning occurs when a tree requires immediate attention to clear an infraction or poses an imminent threat to the electrical facilities.

SDG&E tree contractors follow American National Standards Institute (ANSI) A300 industry tree standards and the concept of directional pruning, which fosters the health of a tree while maximizing clearance and extending the pruning cycle. All tree branches overhanging conductors are considered a potential risk; therefore, SDG&E removes all branches that cross the vertical plane of the conductors from the conductor to the top of the tree. Once the work is completed, the tree crew updates the tree information and records the work performed in a mobile data terminal (MDT), then uploads this information into the Vegetation Work Management System. Where prudent and achievable, SDG&E prunes trees 12 feet (or more) to remain compliant with CPUC minimum clearance requirements. The post-pruning clearances obtained by the tree contractor are determined by factors such as species, tree growth, wind sway, and proper pruning practices. On average, SDG&E prunes approximately 175,000 trees each year and removes approximately 8,500 non-compatible trees.

The scoping operations for removing trees includes the chipping of all material and removal of the debris off-site. The only material left on site is the larger wood (> 6-8-inch diameter). Any large debris left on slopes is positioned to prevent movement of the material by gravity. All debris associated with pruning and removal operations is removed from watercourses to prevent flooding or degradation of water quality. Tree removal operations that may occur in sensitive environmental areas are reviewed to determine protocols that must be followed to protect species and habitat.

Within the HFTD, SDG&E performs routine and non-routine hazard tree inspections annually. These inspections are performed by Internationally Society of Arboriculture (ISA) Certified Arborists. Theses inspections include a 360-degree assessment of every tree within the "strike zone" of the conductors. The strike zone includes the area adjacent to powerlines both inside and outside the rights-of-way for trees that are tall enough to potentially strike the overhead facilities. Work identified during the non-routine inspections is completed prior to the start of the peak Santa Ana fire season (September 1). SDG&E requires its contractors to perform hazard tree assessment and fire awareness training annually.

SDG&E has historically utilized a contractor workforce to perform its vegetation management program activities of tree pre-inspection, tree pruning and removals, pole brushing, and quality assurance. SDG&E notes there are general concerns regarding the availability of contractors given that all the utilities within the State are working expeditiously on vegetation management activities. In the future, SDG&E may seek ways to mitigate this potential exposure to resource constraints. Further, SDG&E will likely experience additional upward cost pressures due, in part, to the enactment of SB 247. While the exact impacts of this law are still unclear, it may be interpreted that compensation for represented qualified line clearance tree trimmers will significantly increase.

Technology

SDG&E periodically utilizes LiDAR as a tool in its vegetation management operations. This technology is used to augment and enhance the inspection activity by determining the empirical spatial relationship between trees and power lines. SDG&E is researching future use of LiDAR to identify change detection on trees and as an audit tool, as well as for identifying pole movement and equipment condition. Currently, LiDAR acquisition, classifying of the data, and modeling of the data is very time consuming. SDG&E is working to improve the turnaround time for the LiDAR information so that it can be used in the field to inform decision-making.

As another tool in the management of its inventory trees, SDG&E has in recent years implemented the use of Tree Growth Regulators (TGR), which is a chemical application that dramatically reduces the new shoot growth of trees. Results have shown that the use of TGR can reduce the frequency of pruning on some species of up to three years. An added benefit of using

TGR is that it provides growth reduction, root and leaf enhancement, and in some instances can help with disease and insect protection.

SDG&E has begun to integrate data science into its vegetation management operations. SDG&E is utilizing the information from its tree inventory database, outage history and meteorology data to develop a Vegetation Risk Index (VRI) of the highest tree risk areas of its service territory. The goal of this initiative is to leverage machine learning and artificial intelligence techniques to correlate SDG&E's extensive vegetation and meteorological datasets to gain additional insights on how atmospheric conditions impact growth rate of certain species and to identify certain high-risk vegetation areas.

Quality Assurance

SDG&E utilizes a third-party contractor to perform quality assurance audits of all its vegetation management activities. These audits include a statistical analysis of a representative sampling of all completed work. A minimum random sampling of 10% is audited to determine compliance with scoping requirements. During the post-prune audit, the Certified Arborist also performs a cursory inspection of all the power lines within the VMA for any trees that will not remain in compliance with applicable regulatory requirements for the duration of the annual cycle. The results are then reviewed with SDG&E and the contractor to determine if any additional work is required.

Hazard Tree Removal and Right Tree-Right Place

Hazard tree evaluation is a critical component of SDG&E's vegetation management program operations to reduce tree-related outages and avoid fire ignitions. SDG&E has a robust tree removal program that targets problematic species such as eucalyptus and palms. SDG&E follows the industry-established "Right Tree-Right Place" program to assist customers in the selection of compatible tree species with the goal of minimizing interference with electrical infrastructure and maximizing energy savings and environmental benefits. SDG&E also offers free tree replacements if an existing tree cannot be maintained safely near powerlines.

SDG&E performs additional off-cycle patrols of select species (such as bamboo and century plants) that have fast and unpredictable growth rates and are difficult to manage near powerlines. These patrols help target and remove problematic species before they become a

danger. Because of the potential threat to the power lines from detached fronds, SDG&E also proactively pursues the removal of palms located far outside its rights-of-way.

SDG&E Vegetation Management activities have greatly reduced tree-caused outages over the years. In the early 1990's, prior to industry regulation, SDG&E encountered (on average) 400-500 tree-caused outages annually. After the establishment of its vegetation program, SDG&E experienced a dramatic reduction in tree-related outages, with the best year-to-date in 2013, with only 25 outages. SDG&E conducts a thorough investigation of all tree-related outages and maintains an investigation database to track and record the events. The information helps identify the mechanics of outages and how to prevent future occurrences.

2. SDG&E-1-C16 – Pole Brushing

As described in the 2019 WMP,[73] and consistent with PRC § 4292, SDG&E utilizes the same Work Management System as tree inspections and maintenance to manage and track the inventory of all poles that require inspection and brush clearing in the State Responsibility Area.[74] The current inventory is approximately 31,000 distribution poles with nonexempt subject hardware. Inspectors determine which poles will require brushing and which are clear and require no work, updating the record in the data base. A work order is assigned to the Pole Brush Contractor to perform the clearing of identified poles requiring brush clearing.

SDG&E currently performs three activities to more effectively manage subject poles annually. This includes mechanical pole brushing, chemical application, and a re-clearing of pole brushing. Mechanical pole brushing involves clearing all vegetation from around the pole base, removing all tree limbs that encroach the cylinder up to a height of eight feet and remove all encroaching dead or diseased tree limbs from eight feet up to the top of the pole. Mechanical brushing is typically performed in the spring months. The contractor will then apply an Environmental Protection Agency (EPA) approved herbicide, the chemical application. SDG&E treats approximately 10,000 poles with a pre-emergent herbicide to minimize vegetative re-growth and reduce overall maintenance costs. The chemical application is typically done just

[73] *Id.* at Attachment A, pp. 45-46.

[74] A Risk Spend Efficiency calculation is not being performed on this activity because it is mandated pursuant to PRC § 4292.

before the rain season (during the fall and winter months) so that the application is activated and effective. Not all subject poles can be treated with herbicide due to environmental constraints, which include considerations such as slope, proximity to water, proximity to trees and other vegetation, and customer approval. Following this, re-clearing is performed in summer months by removing any additional flammable vegetation which has grown into, or blown into, the required clearance area since the last maintenance activity occurs. The need to revisit a subject pole multiple times is not uncommon, due to leaf litter blown back into the managed clearance zone during windy conditions and the growth of weeds and grasses that cannot be easily controlled by mechanical clearing or herbicide treatments. Trees adjacent to subject poles also require pruning to keep dead, dying or diseased tree limbs, branches, and foliage from encroaching into the radius of the cleared circle from the ground up to the height of the electrical conductors. This process aims to reduce growth of vegetation to minimize the potential of vegetation-related ignitions.

3. SDG&E-1-M19 – Enhanced Vegetation Management

In its 2019 WMP,[75] SDG&E proposed enhancements to its current vegetation management practices related to inspections, patrols, and trimming (specifically in the HFTD) as well as training. SDG&E proposed that, during the annually scheduled routine inspections, the pre-inspection scope for all VMAs would be increased to include trees within the strike zone of transmission and distribution electric facilities. Trees tall enough to strike overhead electric lines will be assessed for hazardous conditions and tree crown height will be reduced or removed to prevent a line strike from either whole tree failure or limb break out. This would include dead, dying and diseased trees, live trees with a structural defect, and locations with dense tree population that could strike as a result of wind exposure. Greater consideration would be given to environmental conditions that can impact a tree's relationship to the electric facilities, such as wind sway and line sag. The Commission approved SDG&E's enhanced vegetation management proposal on a pilot basis.[76]

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[75] SDG&E's 2019 WMP at Attachment A, pp. 43 and 46 - 47.

[76] *See generally* D.19-05-039 at 8-10.

This same scope and criteria will be applied during an off-cycle tree patrol of all VMAs within SDG&E's service territory. These additional patrols will be timed to occur mid-cycle, with the routine inspection, so that all lines are reviewed twice annually in accordance with the enhanced scope.

SDG&E's tree-trim scope will be increased to achieve a 25-foot clearance post-prune, where feasible, between trees and electric facilities within the HFTD. This is a significant increase over the average 12 feet post-prune clearance that SDG&E currently achieves. There may be some barriers to achieving this goal. Environmental agencies, land agencies, and customers may oppose the tree pruning to this new clearance; however, SDG&E hopes to work through these issues to achieve the desired wildfire risk mitigation. Given that tree growth is by some degree uncertain and is a product of items outside of SDG&E's control (*e.g.*, weather), additional post-prune clearance provides another layer of mitigation to prevent a vegetation contact with SDG&E's overhead equipment. All tree operations will employ the concept of directional pruning, where all branches growing towards the lines will be rolled back to direct the growth away from the lines and to increase the post-trim clearance. These activities are expected to incrementally decrease the risk of tree branches contacting electric facilities, whether by growth encroachment, limb failure, or complete tree failure.

In addition, during elevated or extreme weather events that could lead to a designated RFW, SDG&E's vegetation management contractors are kept informed of the conditions, allowing them time to relocate crews into safe work areas. In instances of emergency tree pruning during extreme fire conditions, additional fire equipment and/or support from the contracted, professional fire services may be utilized.

In advance of a forecasted RFW, SDG&E will determine if vegetation management patrols are warranted to reassess tree conditions in advance of, during, or immediately following red flag events. SDG&E's Meteorology team will work with the Fire Coordination and Vegetation Management departments to determine where this activity should occur. These inspections are incremental to the routine cyclical inspections.

Further, SDG&E provides electrical equipment training to CAL FIRE representatives so that SDG&E is maintaining proper clearances of vegetation to conductors and equipment prior to the start of the fire season. While CAL FIRE inspections have been jointly performed with

SDG&E, this training is intended for CAL FIRE to better understand the operation of the electric system and which equipment should be targeted to best prevent an ignition source. This training can be used by CAL FIRE while they are conducting their day-to-day operations and inspections and is dependent on CAL FIRE's participation. CAL FIRE has communicated it will not be available for training in 2019 but will make themselves available in 2020 and future years.

This enhanced vegetation management program is consistent with the intent presented in the 2019 WMP. However, as SDG&E has begun implementing enhancements to its current practices, additional refinements made to reflect the items needed to move forward. These include additional tools, fleet, and some additional crews. As such, the costs were expanded as compared to what was estimated in the 2019 WMP.

4. SDG&E-1-M20 – Fuel Management Program

Protection of SDG&E's electric system from wildfires is critical to system reliability and first responder and public safety. Accordingly, SDG&E (in partnership with fire departments, fire safe councils, and other stakeholders) is implementing a comprehensive fuels management program to reduce wildfire fuel accumulations. This program removes, thins, or treats vegetation along SDG&E rights of way and adjacent fire-prone corridors. The reduction of wildland fuel in these areas has the potential to slow the spread of a fire and make it more likely to be contained. It also reduces the risk of electricity flowing through a smoke column and coming to ground.

This program is further expanding compared to levels described in the 2019 WMP.[77] The expanded efforts are due in part to the progress of the program, developed through partnering with cooperating agencies (*e.g.*, fire departments, CalTrans, local, state and tribal governments, and land management agencies).

E. Situational Awareness Protocols

1. SDG&E-1-C17 – Fire Science & Climate Adaptation Department

In recognition of the drought conditions, increased tree mortality, and ever-changing climate conditions, SDG&E established a Fire Science and Climate Adaption (FS&CA) department in 2018 comprised of meteorologists, community resiliency experts, fire

[77] SDG&E's 2019 WMP at Attachment A, pp. 24-25.

coordinators, and project management personnel, as stated in the 2019 WMP.[78] This department's purpose is responding to and strategizing for SDG&E's fire preparedness activities and programs. As climate change, and community growth continue to impact the region, the FS&CA department must likewise evolve to address and provide situational awareness around emerging threats to utility infrastructure. This team will continuously evaluate new and emerging technologies, operationalizing as necessary and warranted. The FS&CA department performs a variety of activities that are accounted for in the department's cost centers. These activities are described in greater detail below.

Meteorological Capabilities and Technologies

The FS&CA department is responsible for SDG&E's meteorological capabilities and technologies,[79] including the development and management of various situational awareness tools. SDG&E owns and operates a network of 190 weather stations that are physically located on electric distribution and transmission poles and provide temperature, humidity, and wind observations every 10 minutes. This allows weather conditions to be monitored in near real-time on every distribution circuit and transmission line across the fire-prone areas of the SDG&E service territory. Each weather station location was carefully selected by SDG&E meteorologists based on their knowledge of the local terrain and its influence on meteorological conditions. By mid-2021, SDG&E is expected to increase the number of its owned and operated weather stations to approximately 225.

SDG&E's weather data is available to all SDG&E employees, weather agencies, fire agencies, educational facilities, and the general public. There are a number of locations and applications where the data may be viewed, including the publicly available SDG&E Weather Awareness System at https://sdgeweather.com. This site includes graphical images to visualize data and links to additional data, camera sites, and forecasts, and is scalable for a variety of devices, including tablet or hand-held.

The SDG&E weather network will continue to evolve in the years to come to maintain effective situational awareness and data quality. As the region faces the impacts of a changing

[78] *Id.* at Attachment A, p. 47.

[79] *See id.* at Attachment A, pp. 47-48.

climate, plans are being made to expand the weather network into high-impact wildland urban interfaces where more extreme weather and fire conditions may occur. Strategic weather station relocations are also planned to account for changes on the landscape and an increased understanding of climatological wind patterns in the SDG&E service territory.

Fire Potential Index

As described in the 2019 WMP,[80] the Fire Potential Index (FPI) was developed by SDG&E subject matter experts to communicate the wildfire potential on any given day to promote safe and reliable operations. This rolling seven-day forecast product, which is produced daily, classifies the fire potential based on weather and fuels conditions and historical fire occurrences within each of SDG&E's eight operating districts. This is also shared with local fire agencies, emergency responders, and the National Weather Service.

The FPI reflects key variables, such as the state of seasonal grasses across the service territory (green-up), fuels (ratio of dead fuel moisture component to live fuel moisture component), and weather (sustained wind speed and dew point depression). Each of these variables is assigned a numeric value and those individual numeric values are summed to generate a fire potential value from zero (0) to seventeen (17), each of which expresses the degree of fire threat expected for each of the seven days included in the forecast. The numeric values are classified as "normal," "elevated," and "extreme."

The FPI development team, consisting of SDG&E meteorologists and fire coordinators, has validated the FPI values and its usefulness by recreating historical values dating back to 2002. The historical results bore a very strong correlation to actual fire events in terms of the severity of past fires and, in particular, provided very accurate information as to when the risks of uncontrolled and large-scale fires were high. SDG&E ties proactive and reactive operational practices and measures to the FPI values, with the further expectation that SDG&E will be able to reduce the likelihood its facilities and operations will be the source of ignition for a fire during times when the risk of fire (as measured by the FPI) is elevated or extreme.

Moving forward, SDG&E will continue to incorporate the latest available wildfire science, enhancing the predictors that contribute to the FPI, including live fuel moisture and the

[80] *Id.* at Attachment A, p. 49.

state of seasonal grasses across the service territory. Modernizing the data inputs and better leveraging the high-performance computing environment will enable predictive analysis and artificial intelligence in the future.

Santa Ana Wildfire Threat Index

SDG&E, in concert with the U.S. Department of Agriculture, the U.S. Forest Service, and the University of California Los Angeles (UCLA), and in collaboration with CAL FIRE, the Desert Research Institute, and the National Weather Service, unveiled a web-based tool in September 2014 to classify the fire threat potential associated with the Santa Ana winds that are directly linked to the largest and most destructive wildfires in Southern California. The SAWTI, as explained in the 2019 WMP,[81] categorizes Santa Ana winds based on anticipated fire potential and uses several meteorological and fuel moisture variables generated from the Weather Research and Forecasting (WRF) Model to forecast the index out to 6 days. In addition to the index, a 30-year climatology of weather and fuels has been developed to help put current and future events into perspective.

The SAWTI calculates the potential for large wildfire activity based on the strength, extent, and duration of the wind, dryness of the air, dryness of the vegetation, and greenness of the grasses. Similar to the hurricane-rating system (category 1-5), the SAWTI compares current environmental data to climatological data and correlates it with historical wildfires to rate the Santa Ana wind event on a scale from "marginal" to "extreme." To help the region prepare for hazardous conditions, information from the SAWTI is issued daily to fire agencies and other first-responders, which has led to improved preparedness and operational decisions due to a better understanding of the timing and scale of a potentially catastrophic wildfire fueled by Santa Ana winds.

SDG&E will continue to collaborate with regional stakeholders so that the SAWTI is properly maintained and incorporates the latest available wildfire science.

[81] *Id.* at Attachment A, pp. 49-50.

Climate Change Adaptation

SDG&E analyzes and evaluates fire-related data to determine if there are observable trends that can be linked with current climate change phenomena.[82] For example, between January 1, 2018 and December 16, 2018, 6,266 fires were reported by CAL FIRE across the state of California with a burn area totaling 876,131 acres. This is a decrease of 16 fires during the same period in 2017, but an increase of 554,474 acres burned and stands 375% of the 5-year averages of fires and acres burned with 2017's acreage being 111% of the 5-year averages.[83] Thus far in 2019, there have been 4,173 fires burning 38,610 acres, with fuel moistures and fire conditions being about a month behind their pace last year. While these numbers are exacerbated by dry conditions produced by well-below average rainfall statewide during the winter of 2017-2018, data ranging back to 1984 across San Diego County confirms that the number of high fire potential days each year has increased since the early 2000s. These trends are projected to continue as a combination of climate-related factors leads to increases in both fire season duration and severity through the end of the century.[84]

Regarding wildfire risk, California's Fourth Climate Assessment says that, "Broadly, wildfire risk will likely increase in the future as climate warms. The risk for large catastrophic wildfires driven by Santa Ana wind events will also likely increase as a result of a drier autumns leading to low antecedent precipitation before the height of the Santa Ana wind season (December and January)."[85] Because Santa Ana wind events typically deliver the warmest conditions to the coastal communities (they are responsible for 50% of days over 85° F in May

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[82] *See id.* at Attachment A, pp. 51-52.

[83] CAL FIRE Incident Information: Number of Fires and Acres, *available at* https://www.fire.ca.gov/incidents/2018/.

[84] Melillo et al. 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment*. U.S. Global Change Research Program, 841 pp. doi:10.930/JOZ31WJ2; Kent 2015: *Climate Change and Fire in the Southwest*. ERI Working Paper No. 34. Ecological Restoration Institute and Southwest Fire Science Consortium, Northern Arizona University: Flagstaff, AZ. 6 pp. http://www.swfireconsortium.org/. CEP (Climate Education Partners) 2014: *San Diego, 2050 is Calling.* https://www.sandiego.edu/2050/.

[85] California's Fourth Climate Change Assessment, *San Diego Region Report* at 6, *available at* https://www.energy.ca.gov/sites/default/files/2019-07/Reg%20Report-%20SUM-CCCA4-2018-009%20SanDiego.pdf.

and 70% of those days in October), increases in fire potential may also extend to the coastal canyons and wildland urban interface areas that historically have not been as high of a wildfire concern. The warmer temperatures are also expected to enhance evaporation and transpiration even outside of Santa Ana events, which will deplete fuel moistures at faster rates. When coupled with longer dry periods, increases in tree mortality due to drought, and increased warmth, this will result in longer fire seasons across the region.

California's Fourth Climate Assessment also suggests that in addition to increased fire risk as a result of climate conditions, fire risk also increases due to increased population density in higher fire risk areas. This is because a majority of major fires in the Southern California region are a result of human activity, with "the two ignition sources that are associated with the largest area burned are from sparks from equipment, such as power saws or machine with gas or electric motors, and power lines."[86] The study shows that by the end of the century the expected area burned per wildfire in the San Diego region will increase by up to 50%.[87] Areas with low to medium structure density are at the highest risk. Given the current and expected future impacts of climate change, the FS&CA department actively and regularly communicates Operating Conditions to enable more informed operational decision-making.

Fire Science & Coordination

SDG&E employs a full-time staff of five fire prevention professionals, Fire Coordinators.[88] These fire coordinators are experienced firefighters and serve as a direct link between SDG&E and emergency-response agencies. They also serve as SDG&E's single point of contact for fire agencies on emergency incidents, utilize Incident Command System protocols, provide periodic updates to both firefighters and SDG&E personnel, establish radio and communications assignments, assist in the coordination of activities related to de-energizing and re-energizing power lines, coordinate with fire agencies for repopulation plans, and update on-scene personnel, control centers, service dispatch, and the SDG&E regional operations centers as to the status of each incident.

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[86] *Id.* at 27.

[87] *Id.* at 28.

[88] *See* SDG&E's 2019 WMP at Attachment A, pp. 24 and 67.

The Fire Science and Coordination team is active in the development of fire science based analytical tools, root cause analysis of ignition events, fire ignition data analytics, the development of fire prevention plans, professional forums, seminars, and fire safety training throughout SDG&E's service territory to incorporate this intelligence into the development and prioritization of mitigation strategies. They also participate in engineering and operational meetings to advise SDG&E personnel regarding fire threats and prevention. Through constant communication between SDG&E and emergency-response agencies in its service territory, the Fire Science and Coordination team is able to develop and implement best practices, reduce the risk of wildfire, and keep first responders safer when working around utility equipment.

2. SDG&E-1-C18/M21 – Wildfire Risk Reduction Model – Operational System (WRRM – Ops) and Fire Science Enhancements

Significant intelligence related to wildfire potential is gathered from SDG&E's WRRM-Ops model. This model integrates the latest weather and GIS technology to understand wildfire growth patterns across the region (running 6,000 fire growth simulations per second, simulating 10 million fires in a single night). WRRM-Ops assesses the areas of highest fire danger before a wildfire begins so that preventative measures can be taken to enhance public safety and reliably operate the electric system. This model uses simulations generated from weather conditions, historical fire, and vegetation data to evaluate wildfire risk within the SDG&E service territory.

WRRM-Ops is also able to simulate the growth and potential impact of a wildfire anywhere in the SDG&E service territory should an ignition begin. Integrating all of the aforementioned weather data developed by SDG&E, the WRRM-Ops model can conduct an analysis to determine the immediate threats, enabling quick decision-making to help decrease the impacts of wildfire.

Because WRRM-Ops has proven to be a beneficial tool for SDG&E, it is now being utilized by utilities, regulators and emergency responders across the state. SDG&E intends to expand WRRM-Ops beyond the levels described in the 2019 WMP[89] to provide significant enhancements for this technology, including additional enhancements in fire science and data analytics. SDG&E's Fire Science & Coordination and Meteorology teams plan to partner with

[89] *Id.* at Attachment A, p. 50.

academia and fire agencies to further expand and share fire modeling capabilities. Enhancements will also include the creation of the SDG&E Fire Science and Innovation Lab to foster the continued evolution of fuel moisture modeling, weather stations, cameras, vegetation management data and LiDAR data to continuously improve our situational awareness.

3. SDG&E-1-C19/M22 – Camera Networks and Advanced Weather Station Integration

As explained in the 2019 WMP,[90] SDG&E utilizes a total of 107 cameras that enhance situational awareness around wildfire. Twenty of these cameras are owned by SDG&E, while 87 cameras are supported by SDG&E in collaboration with the UCSD as part of the HPWREN (see mitigation SDG&E-1-M15 above). Of these 87 cameras, 72 are static and 16 are high-definition pan-tilt-zoom "Alert SDG&E Cameras," which are capable of remote directional and zoom control.

The Alert SDG&E Camera network is a state-of-the-art camera network designed to monitor wildfire activity and enhance situational awareness for SDG&E and its first responders and the communities they serve. SDG&E partnered with UCSD and the University of Nevada to deploy this network of 16 live-stream pan-tilt-zoom mountaintop cameras, which allows for quicker identification and triangulation of wildfires. Alert SDG&E Cameras are heavily used by CAL FIRE's Monte Vista Dispatch Center to aid in better locating and sizing up wildfires for initial attack prior to the arrival of first responders.

The SDG&E weather network has been an integral aspect of the Community Fire Safety Program over the last decade. The weather information is used to calibrate models such as the FPI and the SDG&E Outage Prediction Model which gives the Company the ability to anticipate when critical fire weather conditions or strong storms are approaching the area, allowing proactive preparedness measures to be taken.

In the 2020-2022 time period, SDG&E seeks to further modernize its weather network beyond the levels put forth in the 2019 WMP.[91] This weather network, which currently consists of 190 weather stations, brings superior situational awareness for weather conditions impacting

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[90] *Id.* at Attachment A, p. 50.

[91] *Id.* at Attachment A, p. 53.

SDG&E's electric and gas system. The weather network also serves as a data foundation for high-performance computer modeling that supports multiple analytical tools used across the organization. SDG&E plans to modify its weather system by adding and rebuilding weather stations and replacing aging sensors and equipment with the latest technology. This will include new dataloggers, thermometers, hygrometers, anemometers, batteries, solar panels, modems, and in some cases pyranometers.

4. SDG&E-1-C20/M23 – High-Performance Computing Infrastructure

SDG&E owns three high-performance computing clusters used to generate high quality weather data that is incorporated directly into operations. Collectively, nearly 2,000 compute core hours of high-performance computing are used per day to generate operational products, including the SAWTI, FPI, and WRRM-Ops. The forecast data generated by the supercomputers is shared with several partners, including the U.S. Forest Service, which disseminate the data through their public website, and the National Weather Service.

SDG&E plans to continue the production of forecast products into the foreseeable future. As science evolves and new technologies become available, SDG&E will use its computing clusters to integrate the new methodologies in order to maintain forecast reliability and situational awareness.

In 2022, SDG&E plans to replace its existing supercomputers which, at that point, will be at the end of their useful lives. Such a program is needed because it is essential to the ongoing development of fire science and big data analytics. The output from this high-performance computing program is required to enable the continuous evolution of fire science and analytical fire preparedness tools such as the FPI and SAWTI. The replacement of these supercomputers was not included in the 2019 WMP.[92]

5. SDG&E-1-M24 – Ignition Management Program

In 2019, SDG&E began to establish an Ignition Management Program (IMP). The purpose of this program is to track ignitions and potential ignitions as well as to perform root cause analysis on each ignition or potential ignition to detect patterns or correlations. Such ignition or potential ignition events will be documented and analyzed. When patterns or

[92] *Id.* at Attachment A, p. 48.

correlations are identified, the outcomes are communicated and assigned to mitigation owners from the business unit most logically positioned to eliminate or reduce future events of a similar nature.

In its 2019, SDG&E mentioned that it was considering additional staff to support the IMP.[93] In mid-2019, SDG&E employed a Fire Ignition Management Program Coordinator to implement and manage this program. With the staff in place, now a pilot of the IMP is underway. SDG&E expects to learn from the IMP pilot and expand the program during the next GRC cycle. The expansion of the IMP would include additional IT-related support to house and process data associated with findings from the program. However, given that the IMP program is in a pilot stage, SDG&E is unable to forecast future IT-related costs at this time. SDG&E will update its forecasts for the IMP in future GRC and WMP filings.

6. SDG&E-1-C21/M25 – Asset Management

In 2017, SDG&E formed its Asset Management Program team, as a central group, to develop and implement a holistic and sustainable asset management system for electric assets with an integrative approach for governance, strategy, analytics and continuous improvement. The new asset management system is being developed to conform with ISO 55000, an international standard that specifies the requirements for the establishment, implementation, maintenance, and improvement of an asset management system. Benefits of such a system may include enhanced asset safety, improved performance, managed risk, demonstrated compliance, and improved efficiencies and effectiveness of asset utilization and operations. Asset management is a critical element of SDG&E's focus on creating sustainable and high-quality asset safety for electric operations, and optimizing asset utilization, while mitigating asset-related risks. This is also one element of SDG&E's vision for an electric safety management system, as further discussed in SDG&E's Chapter RAMP-F (Safety Culture). A comprehensive asset management system, which includes process improvements, data analytics and system solutions, will provide the access to and integration of data throughout the asset life cycle to develop analysis and a health index for critical assets.

[93] *Id.* at Attachment A, p. 24.

SDG&E is developing an asset health index (AHI) on its assets to identify and compare assets based on its likelihood of failure. An AHI is a score designed to track the condition and performance of an asset by applying statistical modeling and predictive analytics to multiple sources of data and used as a basis for asset management strategies. The key benefits of employing AHI include the ability to measure overall health of assets, recognize asset data parameters associated with failure modes, detect failures, and relatively compare between assets of same class in a consistent manner. Asset risk is determined when AHI and the associated asset failure consequence or impact are jointly considered. Based on this asset risk information, asset replacement or rehabilitation strategies would be evaluated, prioritized, and implemented to manage the asset in a manner that aligns with SDG&E's overall risk management strategy, supports risk-informed platform for managing assets, and reinforces safe operations, maintenance and proactive replacement strategies. Integrating this asset risk information with other inputs, such as circuit risk index for situational awareness, especially within fire-prone areas, will inform the appropriate asset-related operational decision-making and strategies for enhanced reliability and safe operations of assets on given current and expected wildfire conditions.

SDG&E's asset management program is forecasted to further expand from its description in SDG&E's 2019 WMP,[94] due to anticipated incremental data exploratory analyses and data integration of key asset attributes from multiple sources and associated costs of systems needed to further develop AHIs and sustainably support the asset data analytics.

Because asset management efforts will benefit SDG&E's entire service territory, SDG&E's RAMP showing has divided costs from this activity between the Wildfire and Electric Infrastructure Integrity RAMP risk chapters, 60% and 40%, respectively. These percentage allocations are based on the HFTD area, which accounts for about 60% of the overall service territory area in terms of electric distribution miles.

[94] *Id.* at Attachment A, p. 32.

7. SDG&E-1-M26 – Monitoring and Correcting Deficiencies

As part of its 2019 WMP, SDG&E proposed specific measures as a way to monitor the effectiveness of its WMP.[95] In monitoring all of these measures, SDG&E is able to determine the general effectiveness of the overall WMP, identify potential issues and deficiencies before too much time has occurred, and plan corrective remedies as needed. Beyond the seven key measures ready noted, SDG&E also plans to closely monitor each of its programs and initiatives detailed within the overall WMP so as to verify the progress of each program over time. All of these components collectively will allow SDG&E to determine the effectiveness of the programs brought forth this far and allow SDG&E to determine where new programs and initiatives can be developed to further expand its overall wildfire plan.

To effectively evaluate its mitigation plan, SDG&E proposes herein, consistent with its 2019 WMP,[96] to develop a database and tool for purposes of monitoring. Such tools will require some external support likely in the beginning stages. SDG&E believes these tools are necessary to monitor compliance with its WMPs now and in future years.

8. SDG&E-1-M27 – Wildfire Mitigation Personnel

SDG&E's workforce and organizational structure has evolved significantly since its first fire mitigation efforts. As explained in the SDG&E's 2019 WMP, in the infancy of these efforts, SDG&E largely utilized cross-functional teams that continued to transform into additional formal programs and personnel.[97] In 2019, SDG&E recognized that a new department focusing on fire mitigation, fire mitigation strategies, program measurement, and vegetation management would prove useful in assessing the overall effectiveness and direction of SDG&E's WMP.

In July 2019, this new department was formed using management personnel already deeply familiar with the WMP and would then add personnel as the needs arose. This new organization has been named the Wildfire Mitigation and Vegetation Management department.

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95 *Id.* at Attachment A, pp. 75-80.

96 *Id.* at Attachment A, p. 81.

97 *Id.* at Attachment A, pp. 31-32 and 71-72.

Overseen by the Director of the Wildfire Mitigation and Vegetation Management, four groups will address aspects of the overall WMP effort:

- The Wildfire Mitigation Programs group will be involved with the various regulatory proceedings that address wildfire as well as legislative and media inquiries.
- The Vegetation Management group will manage the current tree and vegetation management inspection and trim program and will begin to address SDG&E's newly formed fuels management program.
- The WMP Strategic group will develop metrics, lead vision projects, promote new ways to enhance fire safety and explore advancements to further drive improvement and change.
- The WMP Accountability group will be responsible for monitoring fire-related metrics, tracking WMP activities, complying with reporting requirements, provide for governance specifications and procedures, and act in a lead capacity on audits of the WMP programs.

It is anticipated that the new Wildfire Mitigation and Vegetation Management department will be fully functional by the end of the first quarter of 2020

9. SDG&E-1-M28 – NMS Situational Awareness Upgrades

SDG&E's Outage/Distribution Management system uses Oracle's Network Management System (NMS) as the operational tool to manage planned and unplanned outages. Today, SDG&E's weather data, including FPI and wind speed data, are leveraged extensively, through manual processes, to set operational restrictions and make operational decisions. SDG&E plans on building key weather integrations into the NMS system to enable more accurate and real-time operational decision-making to implement reclosing policies, sensitive relay settings policies, and work cancellation decisions during extreme weather events.

In 2020, key integrations will be developed to provide NMS visibility into operational conditions to make informed operational decisions related to wildfire risk. In addition, this improved functionality will provide better visibility into active planned and unplanned work in the HFTD, to identify potential risks during events. In 2021-2022, the generation of switch plans will be automated to turn off reclosing and enable sensitive relay profiles in the HFTD. These

tools will enable the necessary situational awareness to make operational changes during high risk events and provide real-time visibility into current conditions in the field, to make informed operational decisions. This program is newly presented herein and was not included in the 2019 WMP.

10. SDG&E-1-M29 – Situational Awareness Dashboard

Current Public Safety Power Shutoff protocols utilize several factors listed in activity SDG&E-1-C22 below. SDG&E is currently seeking to expand operational awareness capabilities to include risk factors of electric system failure and/or risks related to foreign causes of electric system failure, which serve to inform PSPS decisions. SDG&E plans to expand its current operational awareness by building visual dashboards that integrate the Vegetation Risk Index (VRI), historical wind conditions, and the ability to identify areas that contain vulnerable electric infrastructure. These systems will also have the capability to geolocate infrastructure with poor historical system performance and to identify at-risk infrastructure by extrapolating asset failure analytics. Additionally, SDG&E is seeking to develop, document, and deploy a circuit risk index that will quickly aggregate this data for the purposes of operationally quantifying this risk into a single metric that can be tied to various system isolation points.

The PSPS situational awareness dashboard will be built in 2019, incorporating VRI, historical wind conditions, and some elements of at-risk infrastructure. In 2020, the asset management program (see activity SDG&E-1-C21/M25 above) will identify and automate several data sources that generate risk quantification, system performance, system design and nameplate information, and maintenance data, to begin aggregating these data sources into a single location for use by a circuit risk indexing tool. Once aggregated in 2021-2022, SDG&E will employ data science to find correlations between system performance and various risk factors. This data will be utilized to create a data model that will create components of a Circuit Risk Index, which is planned for end-of-year 2022 deployment.

This program is newly presented herein and was not included in the 2019 WMP.

F. Public Safety Power Shutoff

1. SDG&E-1-C22 – Strategy for Minimizing Public Safety Risk During High Wildfire Conditions, Public Safety Power Shutoff and Re-energization Protocols

As described in the 2019 WMP,[98] SDG&E has an obligation to operate its system safely. This obligation requires SDG&E to de-energize circuits (*i.e.*, turn off power) when necessary to protect public safety (Public Safety Power Shutoff or PSPS). Any decision to de-energize circuits for public safety is made in consultation with SDG&E's Emergency Operations Center (EOC), Meteorology, and SDG&E leadership. Typically, it is expected, but not required, that the FPI would be "extreme" or that there would be a "red flag warning" in effect when a PSPS decision is made.

A PSPS is a last resort measure to reduce wildfire risk. SDG&E considers a wide variety of inputs to determine whether to de-energize portions of its system. SDG&E leverages a multitude of situational awareness data and input from its subject matter experts when considering the need for a PSPS event. In determining whether to employ a PSPS in any area of its service territory, SDG&E considers a variety of factors such as:

- Weather conditions;
- Vegetation conditions;
- Field observations;
- Information from first responders;
- Flying debris;
- Meteorology;
- Expected duration of conditions;
- Location of any existing fires; and
- Wildfire activity in other parts of the state affecting resource availability.

Utility operating experience is required to analyze all the various inputs and decide how to manage risk to the communities affected.

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98 *See id.* at Attachment A, pp. 54-55.

If SDG&E determines it is necessary to employ a PSPS for portions of its system, re-energization will take place after the SDG&E weather network shows that wind speeds have decreased and SDG&E weather forecasts indicate that winds will not re-accelerate at or above dangerous levels. All lines that have been de-energized are inspected for damage before re-energization may occur. Once a line is patrolled and any needed repairs are made the area will be patrolled again and then be re-energized.

2. SDG&E-1-C23/M30 – Communication Practices

In advance of the peak of fire season, in accordance with P.U. Code § 8386(c)(16)(B) and D.19-05-039, SDG&E will conduct ongoing education campaigns in a minimum of eight languages (English, Spanish, Mandarin, Cantonese, Korean, Tagalog, Vietnamese and Russian) regarding how to be prepared for emergencies in the event of a wildfire, natural disaster or major outage.

SDG&E's comprehensive wildfire communication program consists of a multi-pronged approach and is divided into three phases – prior to, during, and following the extreme weather event. The purpose of the communications program is to educate and help the public prepare for, respond to, and recover from a Public Safety Power Shut Off and/or wildfire event. In the days leading up to a forecasted PSPS and during an active event, SDG&E establishes and maintains contact with customers and community stakeholders that it believes may be impacted. Communication is maintained with public safety partners, impacted customers, affected populations (non-customers), critical facilities and infrastructure, Access and Functional Needs (AFN) populations, and community partners. Various communication platforms are utilized to communicate through the various stages of an event. Subject matters covered in communications regarding an event include, but are not limited to: event timing, the wildfire mitigation activities SDG&E is employing, and resources available to support the impacts of a PSPS. SDG&E also communicates with key stakeholders, public officials, and first responders through a variety of channels and personnel to align with their established communication protocols.

In advance of fire season, SDG&E initiates its targeted wildfire safety education and outreach campaign. The campaign begins in July and runs through November. It targets all customers and stakeholders in the service territory and enlists multiple tactics to inform residents

and businesses in the region. The outreach campaign includes: print advertising, paid and organized social media, online display and video paid searches, radio spots, a High Fire Threat District newsletter, bill inserts, collateral materials for outreach events (*e.g.,* open houses and community wildfire safety fairs), collateral for vegetation management outreach, collateral for Access and Functional Needs populations, content for the sdge.com/wildfire-safety webpage and an SDG&E wildfire safety documentary leveraged for TV spots, theater trailers, and outreach events. Print advertising for the outreach campaign is provided in eight languages: English, Spanish, Mandarin, Cantonese, Korean, Vietnamese, Tagalog and Russian. The in-language advertising is placed in corresponding in-language community publications.

Extreme weather conditions can change at any time, and SDG&E's top priority is safety. SDG&E's goal is to provide impacted communities with advanced notifications. In the event of a Public Safety Power Shutoff, SDG&E will advise public safety authorities, first responders, affected communities and local municipalities in the impacted areas.

Notice to Customers

Dependent on conditions, SDG&E will communicate with customers in advance of an event – 48, and 24 hours as well as 1-4 hours in advance when possible, prior to shutting off power, upon starting safety inspections of affected powerlines and upon re-energization, as practicable.[99] The Company will also reach out to the AFN populations and the organizations that serve them during the same intervals. We communicate these notifications to customers in eight language (English, Spanish, Mandarin, Cantonese, Vietnamese, Korean, Tagalog and Russian). SDG&E has launched an ongoing campaign asking customers to update their contact information and sign up for outage notifications at *sdge.com/MyAccount*.

SDG&E uses this information to reach its customers using the Emergency Notification System (ENS) through phone, text and/or email in advance of a Public Safety Power Shutoff, if conditions allow, and throughout the event until power is restored.

In addition to notifying customers directly, outage updates are provided through social media, local news, radio and SDG&E's website at *sdge.com* and *sdgenews.com*.

[99] *See* D.19-05-042 at Appendix A, pp. A-7 to A-8.

Power Shutoff events may be avoided if weather conditions improve. In that instance, SDG&E would notify customers that weather conditions have improved in their area, and SDG&E do not anticipate the need to turn off their power for safety.

SDG&E also encourages customers to visit *sdge.com/wildfire-safety* for tips on putting together an emergency preparedness plan for their home or business.

Note that SDG&E may not have advance opportunity to provide notice when CAL FIRE or a local agency requests a Public Safety Power Shutoff due to an active wildfire or other emergency response situation. Additionally, if a problem is identified that poses an immediate safety risk, SDG&E may have to turn off the power immediately. For instance, a car crashing into a power pole may require immediate de-energization for safety.

Notice to State, Counties, and Cities

When conditions allow, SDG&E will make every attempt to notify cities, counties and emergency response partners about a potential Public Safety Power Shutoff. The Company will also reach out to government and agency contacts alerting them that conditions are being monitored that may either cause outages or require SDG&E to de-energize for safety in the coming days.

Notice to Customers Who Provide Critical Services

SDG&E has identified and has direct contact with companies and organizations that provide critical services, such as healthcare, fire stations, schools and universities, water agencies, and communications providers, within a potentially impacted area. SDG&E wants to be sure its customers providing critical services know that a Public Safety Power Shutoff may occur during extreme weather conditions, so they can take steps to prepare, such as securing backup generation. SDG&E also asks critical services customers to confirm an appropriate point of contact for these types of notifications, along with the correct contact information, so that SDG&E can provide early warning notifications, when and where possible, depending on conditions.

Notice to Medical Baseline Customers

SDG&E takes additional steps to reach customers enrolled in the Medical Baseline program. Customers are asked to evaluate the safety of their situation and have an emergency plan ready in case of an outage. When communicating with Medical Baseline customers, the

Emergency Notification Service captures a positive physical response when the customer is contacted. If a positive response is not obtained, a second live attempt is made through SDG&E's Customer Call Center. If no contact is achieved with the second attempt, SDG&E field personnel are dispatched to the address of record to deliver the message in person.

During a Public Safety Power Shutoff event, there may be a need to provide additional support to an impacted community. SDG&E may open a Community Resource Center near the affected area, if conditions prolong the estimated outage duration. Community Resource Center activations will be communicated via the SDG&E website, social media, local news and radio and the SDG&E News Center. At these Centers, residents will have access to water, light snacks and charge small electronic devices, as well as receive the most up-to-date information about the power shutoff.

Additionally, SDG&E communicates the differences between an unplanned outage and a Public Safety Power Shutoff. Despite SDG&E's best efforts to maintain reliable service, unexpected outages happen. These unplanned outages are caused by various circumstances beyond SDG&E's control, such as traffic accidents, damage to power lines and Mylar balloons caught in overhead wires. In contrast to an unplanned outage, a Public Safety Power Shutoff occurs after careful planning and analysis of the various threats to public safety. If a Public Safety Power Shutoff takes place, it will be uniquely identified on our outage map with a different marker. SDG&E encourages the public to learn more about planned and unplanned outages at sdge.com/outage-map.

Finally, a component of SDG&E's communication program for wildfire safety includes contributing to and supporting the statewide Public Safety Power Shutoff campaign established in 2019. The overarching message communicated to the public in SDG&E's service territory is that all Californians need to take important steps to get ready before the wildfire season, such as creating an emergency kit and having a thorough emergency plan. The statewide campaign refers the public to learn more about preparing for the threat of wildfire and Public Safety Power Shutoffs at www.prepareforpowerdown.com.

While SDG&E's communication practices were presented in the 2019 WMP,[100] this activity is being expanded herein to implement the legislative mandates in P.U. Code § 8386(c)(16)(B), D.19-05-039 (SDG&E's 2019 WMP Decision), and D.19-05-042 (De-Energization Phase 1 Decision). Accordingly, SDG&E is now implementing the various directives, including participating in a new statewide education campaign on de-energization.

3. SDG&E-1-C24 – Mitigating the Public Safety Impact of PSPS Protocols

As described in the 2019 WMP,[101] SDG&E manages and mitigates the impacts of a PSPS event through collaboration with key stakeholders in the wildfire response community. SDG&E partners on a regular and ongoing basis with the following agencies to address a range of fire prevention and emergency activities:

- **San Diego County Fire Chiefs' Association** – SDG&E provides monthly written and oral updates while encouraging feedback and comments on planning, response, recovery, and communications programs;
- **CAL FIRE and the San Diego County Fire Authority** – SDG&E engages in daily communications related to aerial firefighting and contract management of the year-round Skycrane and Blackhawk programs;
- **County Unified Disaster Council** – SDG&E receives and provides quarterly updates on regional planning and response programs while building relationships with 18 cities, the County of San Diego, and participating Special Districts;
- **County Office of Emergency Services** – SDG&E communicates and meets as needed, but no less than quarterly to discuss and agree on emergency planning, response, recovery, and communications needs;
- **All Fire Agencies in San Diego County** – SDG&E meets annually with fire agencies in San Diego County (including cities, fire districts, military, and tribal) to provide in-service training and exercises on electric and

[100] SDG&E's 2019 WMP at Attachment A, pp. 55-56

[101] *Id.* at Attachment A, pp. 56-58.

natural gas safety, response, Incident Command integration with utilities, and communications, to coordinate response during wildfire and other emergencies;

- **All Law Enforcement Agencies in San Diego County** – SDG&E engages in various activities including outreach efforts, trainings, and data sharing with the San Diego County Sheriff's department and all municipal law enforcement agencies; and
- **Fire Dispatch Centers** – SDG&E provides bi-annual communications training and requirements related to electric and natural gas incidents and emergencies to fire dispatch centers.

G. Preparedness and Response

1. SDG&E-1-C25/M31 – Emergency Management Operations

SDG&E manages emergencies in alignment with the state Standardized Emergency Management System (SEMS) and federal National Incident Management System (NIMS), to coordinate across all levels of utility, government, and agency activity. The Company utilizes a utility-compatible Incident Command System (ICS) structure as an all-hazards framework to manage emergency incidents and events. ICS is the combination of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure and serves as the mechanism to direct those functions during an emergency response. Further details regarding ICS are discussed in SDG&E's RAMP risk chapter Customer and Public Safety (Chapter SDG&E-5).

The SDG&E Emergency Management organization is responsible for coordinating emergency management activities and activation of the Emergency Operations Center. The department's mission is to support effective, efficient, and collaborative planning, preparedness, response, and recovery processes for all hazards and risks, including those associated with the Wildfire risk and Red Flag Warning incidents, enterprise-wide. Collectively, this department leads efforts and strategies to prepare for, respond to, and recover from all risks, hazards, and incidents that may impact SDG&E operations.

SDG&E's EOC serves as the location from which centralized emergency management is coordinated. To respond and recover effectively from all hazards and threats, like wildfires,

SDG&E established an EOC with cross-functional teams representing every major business line within the Company and functioning within a utility-compatible ICS. The activation of the EOC assembles the internal subject matter experts to assess and provide situational awareness to internal and external stakeholders, overarching incident objectives, planning, anticipation, response, communications, and coordination.[102] External Emergency Management partners, such as the County of San Diego Office of Emergency Services (OES) and California OES (Cal OES) are provided with situational awareness up to 24-72 hours in advance or as soon as operationally feasible; additionally, those partners are embedded within SDG&E's EOC during emergency conditions.

SDG&E is further expanding this activity[103] from the description in the 2019 WMP,[104] to include four additional full-time equivalents (FTEs). Three FTEs are needed to support SDG&E's Aviation Services and were staffed in 2019. SDG&E's aviation program, as it relates to wildfire, is now considered to be a year-round program and includes two firefighting assets. Aviation staff also works extended hours when necessary. Thus, the expansion of this program includes additional FTEs, more days, longer hours, and additional assets. An additional FTE is also needed in Emergency Management, to address a continued focus on Wildfire, including PSPS events, and the increased labor hours expended on these activities. This FTE will help in developing training, leading exercises, and supporting activations, as well as to help develop plans related to non-wildfire risk factors including cybersecurity, earthquake, natural gas, tsunami, terrorism, active shooter, and other man-made and natural disasters.

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[102] To prepare for and support emergencies, GIS is used to provide information about SDG&E's system. *See id.* at Attachment A, pp. 29-30.

[103] While Emergency Management supports all disasters, for purposes of this RAMP presentation, Emergency Management activity costs are included in the Wildfire risk chapter. This is because the majority of SDG&E's EOC activations are related to Wildfire. Accordingly, and for simplification in this filing, costs presented in this Chapter are not allocated to other risks.

[104] SDG&E's 2019 WMP at Attachment A, pp. 58-59.

2. SDG&E-1-C26 – Disaster and Emergency Preparedness Plan

As described in the 2019 WMP,[105] the Company's Emergency Response Plan (CERP) and risk-specific response plans provide a framework by which SDG&E can effectively coordinate the Company's pre-incident and response/recovery activities to a given threat or hazard.[106] Pursuant to the CERP, the Utility Incident Commander or Officer-in-Charge (OIC), is ultimately responsible for incident management and support activities respectively. While a Utility Incident Commander or OIC may delegate authority, they cannot delegate the responsibilities outlined in the Wildfire Annex or the CERP.

With respect to community outreach and public awareness, SDG&E has created a multi-level approach related to fire threats, fire prevention, and emergency preparedness. Plans for community outreach and public awareness occur before, during, and after a wildfire. Such efforts include videos, collateral, and print advertising before and after wildfires. These materials have previously educated customers about how to be prepared for wildfires and encouraged them to sign up for outage notifications and updates through SDG&E's My Account portal. SDG&E anticipates continuing these outreach messages, as described above in activity SDG&E-1-C23/M31 Communication Practices above, to further prepare customers for PSPS events.

Key elements of SDG&E's multi-level approach to community education and outreach include the following

- Fire safety stakeholder's coordination – SDG&E has worked with various stakeholders, such as local schools, water districts, disability rights advocates, consumer groups, and fire departments, to develop a joint fire prevention plan. SDG&E has implemented many of the solutions identified by the stakeholders, including deactivating automated reclosers and undergrounding portions of the electric system where feasible.
- Partners with organizations dedicated to readiness and response – SDG&E partners with approximately 98 non-profit organizations dedicated to

[105] *Id.* at Attachment A, pp. 59-68.

[106] Costs were not identified for this activity because it is embedded in internal labor.

readiness and response to wildfires and emergencies. SDG&E is also a member of California Utilities Emergency Association (CUEA), who serves as a point of contact for critical infrastructure utilities and the Cal OES and other governmental agencies before, during, and after an event.

- First responder outreach program – SDG&E works with local, state, and federal fire agencies, regional dispatch centers, law enforcement, and other emergency management partner agencies so that effective command, coordination, and communications are in place in preparing for and responding to incidents.
- Community outreach – SDG&E supports non-profit organization whose programs promote emergency preparedness and safety at home and in communities within its service territory, including Tribal Lands. In addition, SDG&E held community workshops regarding its PSPS practices. SDG&E incorporated much feedback from those workshops into its public safety initiatives.
- Community Resource Centers (CRCs) – as a result of community feedback, SDG&E has established CRCs to help communities in real-time during extreme weather events. To date, eleven customer-owned facilities in the HFTD have been utilized, located specifically in areas most likely to be affected by a PSPS to serve as CRCs. SDG&E operates these centers to offer impacted customers a place to gather, charge cell phones, and obtain current information and comfort items such as bottled water, light snacks, and ice for temporary refrigeration. These CRCs are powered by portable generation provided by SDG&E and are located in areas that are not within reasonable travel distances from areas that are not impacted by PSPS.
- Community communications – SDG&E provides regular, proactive communications to residents and businesses located in the HFTD. These communications provide information about emergency preparedness.

Further, SDG&E's workforce is an integral part of its disaster and emergency preparedness. Under the ICS framework, SDG&E's approach to a well-trained workforce involves integrating training sessions and exercises for field Utility Incident Commanders, EOC responders, and executives. All field operational responders are required to participate in Utility ICS training and follow Electric Standard Practice No. 113.1 (ESP 113.1), which specifically addresses wildland fire prevention and safety. The annual ICS training cycle of operational leaders, field responders, and supporting personnel includes cross-functional training workshops, and exercises covering all-hazards as well as the deployment of field training advisors for purposes of continuous improvement on practical application in the field. In addition, SDG&E actively trains its workforce with the appropriate electric distribution and transmission operational skills.

3. SDG&E-1-C27 – Customer Support in Emergencies

SDG&E provides emergency residential and non-residential customer protections and availability communications for wildfire victims, as ordered by the CPUC.[107] Examples of protections include billing adjustments, deposit waivers, extended payment plans, suspension of disconnection and nonpayment fees, and specific support for low income and medical baseline customers.[108] This is also described in SDG&E's 2019 WMP.[109]

SDG&E will provide descriptions of the protections offered to affected customers on a special landing page on its website, SDG&E.com (with a contact telephone number for more details of eligibility and protections available) and promote the page with social media campaigns. In addition, SDG&E will make every effort possible to contact impacted customers to bring awareness regarding these protections. An Energy Service Specialist (ESS) or an account executive will make these calls.

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[107] Commission Resolution M-4835 (January 11, 2018). SDG&E filed Advice Letter 3177-E on January 26, 2018 in compliance with Resolution M-4835, which was made effective December 7, 2018.

[108] Costs were not identified for this activity because they are not tracked in that manner.

[109] SDG&E's 2019 WMP at Attachment A, pp. 68-71.

4. SDG&E-1-C28/M32 – Wildfire Infrastructure Protection Teams (Contract Fire Resources)

SDG&E contracts for wildfire prevention and ignition mitigation services, Contract Fire Resources, which are paired with SDG&E personnel during times of elevated wildfire potential. SDG&E may extend Contract Fire Resources coverage depending on Operating Conditions or when specific needs arise. These Contract Fire Resources accompany SDG&E construction crews and other electric workers to provide site-specific fire prevention and ignition mitigation during the workday and after hours. During RFW events or when the FPI is "Extreme," additional Contract Fire Resources are deployed with SDG&E personnel to mitigate the risk of fire from emergency work. The fire prevention personnel that serve as Contract Fire Resources largely mirror the classification of an ICS Type VI Fire Engine, which carries two qualified firefighters, firefighting hose, valves, and approximately 300 gallons of water.

This program is being further expanded from the level presented in SDG&E's 2019 WMP,[110] from about five months to now approximately six months. Beginning in 2019 and continuing through the years 2020 through 2022, SDG&E is planning to increase both the number of days and the number of Contract Fire Resources on property for each of those days. The Contract Fire Resources role will remain the same and will focus on prevention and ignition mitigation. Contract Fire Resources will continue to be paired with SDG&E field personnel to mitigate the risk of a fire ignition origination for SDG&E activities.

5. SDG&E-1-C29/M33 – Aviation Firefighting Program

The threat of wildfire risk throughout California and the region is ongoing and year-round. When wildfires occur north of SDG&E's service territory, there is the potential that CAL FIRE may divert other aerial firefighting resources to emerging wildfires in other parts of the state. This can lead to reduced aerial firefighting capability in the San Diego region. Accordingly, SDG&E has developed and implemented an effective, year-round aerial firefighting program to support the fire agencies in its service territory.

[110] *Id.* at Attachment A, p. 23.

SDG&E has two aerial assets available for the purpose of helping fight fires. As described in David Geier's TY 2019 GRC testimony,[111] SDG&E has a lease, started in 2018, for year-round use of an Erickson Sikorsky S-64 crane helitanker (Skycrane). Starting in June of 2019, SDG&E also has a year-round lease for a Sikorsky UH-60 Blackhawk helitanker (Blackhawk). Both firefighting assets are Type 1 helicopters (also known as helitankers), which are defined as carrying over 700 gallons of water to fight fires. The Skycrane has the capability of dropping up to 2,650 gallons of water, and the Blackhawk has the capability of dropping 850 gallons of water. Additionally, the Blackhawk has night fly capability.

SDG&E has an agreement with the County of San Diego, CAL FIRE, and the Orange County Fire Authority for aerial firefighting within SDG&E's service territory. Dispatch of SDG&E's aviation firefighting assets is performed through CAL FIRE and supports their initial attack strategy to keep wildfires at less than 10 acres. SDG&E maintains a Flight Operations duty to assist in dispatching availability of the assets, 365 days per year. This allows the assets to be launched rapidly once dispatched by CAL FIRE. For 2018, the Skycrane responded to dispatch 33 times, dropping a total of 248,621 gallons of water during 278 drops. Through October 2019, the Skycrane and Blackhawk together dropped a total of 220,453 gallons of water during 279 drops.

SDG&E's aviation program herein is consistent with the levels put forth in the 2019 WMP.[112]

6. SDG&E-1-C30 – Industrial Fire Brigade

SDG&E has contracted an Industrial Fire Brigade (IFB), which is available 24 hours a day, 365 days a year. The IFB differs from the Contract Fire Resources in that the IFB is specially trained to fight fires involving electrical equipment (in particular substations and large transformers) as well as flammable liquids, whereas Contract Fire Resources are focused on site-specific fire prevention and ignition mitigation. The IFB members are stationed at facilities near the geographical center of SDG&E's service territory and are fully equipped to handle utility-related fire emergencies.

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[111] Application (A.) 17-10-007/-008 (cons.), Ex. 360 (SDG&E Geier Supplemental Direct).

[112] SDG&E's 2019 WMP at Attachment A, pp. 23-24.

The IFB incorporates a portable fire suppression trailer equipped with 300 gallons of Class B alcohol resistant firefighting foam, 500 pounds of chemical extinguishing agent, a 500 gallon-per-minute monitor, and hoses designed to work with hydrants or other fire apparatus. SDG&E also provides three additional trailers to strategic fire agencies that are proximate to key SDG&E facilities to aide in emergency response.

The IFB also develops comprehensive pre-emergency response plans for each SDG&E substation and large-scale energy storage facility.

SDG&E expects this control to continue at the level described in the 2019 WMP.[113]

7. SDG&E-1-C31/M34 – Wireless Fault Indicators

This program will install wireless fault indicators on SDG&E's electric distribution system. These devices are used to continuously monitor distribution circuits and provide an alarm signal when faults occur, so damage can be more efficiently and accurately located. During extreme events, the location provided by the wireless fault indicator can be used in conjunction with data from high definition cameras to determine whether an electric system fault has led to an ignition, and to facilitate dispatch of fire suppression resources to a fire location as soon as possible. Determining the exact location quickly can save minutes in response time, which can be critical to preventing an ignition from turning into a wildfire. These indicators are powered by the line to which they are attached, connected via wireless network, and stream data back to electric distribution operations for increased situational awareness.

The wide deployment of wireless fault indicators in the HFTD complements SDG&E's sectionalizing by adding a high volume of monitored points on each distribution circuit. In addition, the majority of the distribution circuits within the HFTD are long overhead circuits, requiring additional visibility to locate failed equipment. Capturing this data would allow electric distribution operators to dispatch electric troubleshooters closer to the exact fault location, which supports quicker identification and isolation of damage during RFW events and

[113] *Id.* at Attachment A, p. 24.

elevated system conditions. This program is consistent with the levels presented in the 2019 WMP[114] and is expected to be completed in 2021, with roughly 1,800 units installed.

VI. POST-MITIGATION ANALYSIS OF RISK MITIGATION PLAN

As described in Chapter RAMP-D, SDG&E has performed a Step 3 analysis where necessary, pursuant to the SA Decision.[115] In this Section, SDG&E provides a qualitative description of the risk reduction benefits for each of the activities presented in Section V and RSEs, where applicable.

A. Mitigation Tranches and Groupings

The Step 3 analysis provided in the SA Decision[116] instructs the utility to subdivide the group of assets or the system associated with the risk into Tranches. Risk reduction from controls and mitigations and RSEs are determined at the Tranche level. For purposes of the risk analysis, each Tranche is considered to have homogeneous risk profiles (*i.e.*, the same LoRE and CoRE).

SDG&E's numerous efforts described herein are all aimed to reduce the risk of Wildfires. This risk is largely focused in the areas within SDG&E's service territory that are most prone to wildfire, the HFTD, which was identified and approved by the Commission in D.17-12-024. Because of how this risk was scoped, *i.e.*, related to the HFTD, this risk is addressed in a single tranche. Non-HFTD-related efforts are generally in scope of the Electric Infrastructure Integrity risk.

In this risk Chapter, risk reduction benefits for each Wildfire control and mitigation are presented in three different ways. Specifically, either: (1) a qualitative description of risk reduction benefits is provided, *i.e.,* no RSE was calculated; (2) an RSE is presented on the particular activity; or (3) an RSE is provided on a grouping of activities. Each presentation is discussed in greater detail below.

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[114] *Id.* at Attachment A, p. 53.

[115] *See* D.18-12-014 at Attachment A, A-11 – A-13.

[116] *Id.* at Attachment A, A-11 ("Definition of Risk Events and Tranches").

Given the vast number of activities SDG&E performs to mitigate Wildfire risk, SDG&E grouped like activities with like risk profiles into mitigation programs. Generally, grouping was performed because either the activity: (1) is not stand-alone (*i.e.*, is dependent on or related to another activity); or (2) does not reduce risk by itself (*i.e.*, it is a supporting activity). An example of a type of activity that supports but does not reduce activity on its own is inspections. For inspections, the activity that reduces risk is the associated repair work, not the inspection itself. Therefore, the costs of the inspections and the repair work were grouped together where appropriate and available. Another example of interdependent activities/programs described herein is the FTZAP and the LTE communications network. For the Falling Conductor Protection (FCP) to be largely operational, the use of a highly available and secure LTE communications network is required.

To illustrate the concept of grouping, SDG&E created the following groupings shown below in Table 5 for determining RSEs for the Wildfire risk. If not included in the table below or in the foregoing parts of this Section, an RSE was calculated for each program individually.

Table 5: Summary of Groupings

ID	Mitigation/Control	Grouping
SDG&E-1-C5	Distribution System Inspections – QA/QC	Non-Mandated Inspections
SDG&E-1-M1	Distribution System Inspections – IR/Corona	
SDG&E-1-M2	Distribution System Inspections – Drone Inspections	
SDG&E-1-M3	Distribution System Inspections – Circuit Ownership	
SDG&E-1-C14/M14	Replacement and Reinforcement	
SDG&E-1-C10/M5	FiRM	FiRM Group
SDG&E-1-M24	Ignition Management Program (60% of program costs)	
SDG&E-1-C21/M25	Asset Management (60% of program costs)	
SDG&E-1-M26	Monitoring and Correcting Deficiencies (60% of program costs)	
SDG&E-1-M27	Wildfire Mitigation Personnel (60% of program costs)	

ID	Mitigation/Control	Grouping
SDG&E-1-C11/M6	PRiME	PRiME Group
SDG&E-1-M24	Ignition Management Program (40% of program costs)	
SDG&E-1-C21/M25	Asset Management (40% of program costs)	
SDG&E-1-M26	Monitoring and Correcting Deficiencies (40% of program costs)	
SDG&E-1-M27	Wildfire Mitigation Personnel (40% of program costs)	
SDG&E-1-C13/M11	FTZAP	System Protection and Communication
SDG&E-1-M12	LTE Communications Network	
SDG&E-1-M15	Backup Power for Resilience – Generator Grant, Community Resource Centers, HPWREN	PSPS
SDG&E-1-C17	Fire Science & Climate Adaptation Department	
SDG&E-1-C18/M21	WRRM - Ops and Fire Science Enhancement	
SDG&E-1-C19/M22	Camera Networks and Advanced Weather Station Integration	
SDG&E-1-C20/M23	High-Performance Computing Infrastructure	
SDG&E-1-M29	Situational Awareness Dashboard	
SDG&E-1-C22	Strategy for Minimizing Public Safety Risk During High Wildfire Conditions, PSPS and Re-Energization Protocols	
SDG&E-1-C23/M30	Communication Practices	
SDG&E-1-C24	Mitigating the Public Safety Impact of PSPS Protocols	
SDG&E-1-C25/M31	Emergency Management Operations	
SDG&E-1-C26	Disaster and Emergency Preparedness Plan	
SDG&E-1-C27	Customer Support in Emergencies	

For purposes of this post-mitigation analysis, SDG&E looked at historical safety performance results and the improvements year-over-year to calculate an overall risk reduction

benefit of performing these activities.[117] SDG&E then looked at existing/continuing programs (*i.e.*, controls), and assumed that similar results would be achieved (*i.e.*, assumed a percentage of risk reduction benefit by continuing the activity). SDG&E also accounted for the risk increase that would occur over time if it stopped performing these activities. For new and/or incremental mitigations, SDG&E expects to achieve further risk reduction. The risk reduction benefits for each identified control/mitigation is included under each program heading.

B. Post-Mitigation Analysis Results – No RSEs

1. SDG&E-1-C1 – Operating Conditions

a. Description of Risk Reduction Benefits

Key Operating Conditions provide situational awareness to all employees and stakeholders that are impacted by potential wildfire risks in SDG&E's service territory, so that the appropriate precautions are employed. SDG&E adjusts the way it operates in regard to recloser protocols and special work procedures based on the Operating Conditions. Without these adjustments, it is possible that the number of ignitions could increase during conditions that could increase the threat of wildfire. Generally, during times of higher wildfire risk, as measured through situational awareness tools (*e.g.*, FPI), SDG&E operates more conservatively to avoid ignitions, resulting in a reduction to Wildfire risk and increased public, contractor, and employee safety.

Costs were not identified for this activity because it is embedded in internal labor. Therefore, an RSE calculation is not being performed.

b. Elements of the Bow Tie Addressed

Operating Conditions addresses several of the Drivers/Triggers and Potential Consequences shown in Figure 1 (the Risk Bow Tie) above. By utilizing situational awareness tools to inform operational decision-making, this activity reduces the likelihood of a wildfire by targeting the Drivers/Triggers of not observing procedures (DT.7), extreme force of nature events (DT.8), lack of internal or external coordinated response (DT.9), and climate change

[117] *Id.* at Attachment A, A-12 ("Determination of Post-Mitigation LoRE," "Determination of Post-Mitigation CoRE," "Measurement of Post-Mitigation Risk Score," "Measurement of Risk Reduction Provided by a Mitigation").

adaptation impacts (DT.10). Additionally, performing work under various Operating Conditions decreases the likelihood of Potential Consequences should a wildfire occur, such as damage to third party real and personal property (PC.2), claims and litigation (PC.5), and erosion of public confidence (PC.6).

2. SDG&E-1-C2 – Recloser Protocols

a. Description of Risk Reduction Benefits

Reclosing policies are in place to minimize the potential for an ignition under increased fire potential; which, in turn, increases public, contractor, and employee safety. SDG&E modifies its operations to reflect the risk identified in the declared Operating Condition. For reclosers, SDG&E implements two distinct mitigations. First, under Elevated Operating Conditions or higher, all distribution reclosing functions are disabled on circuits located within the HFTD but may include other circuits, if the burn environment is conducive to wildfire. The benefit of disabling reclosing is to proactively discontinue a device that has the potential of becoming an ignition source under certain conditions. The second mitigation is to implement sensitive and fast system protection settings with the goal of reducing the potential of a fault leading to an ignition. These extra sensitive settings limit the arc flash energy by reducing the isolation time. Following these recloser protocols can therefore result in safety-related benefits.

Costs were not identified for this activity because they are embedded in internal labor. Therefore, an RSE calculation is not being performed.

b. Elements of the Bow Tie Addressed

Recloser protocols address several of the Drivers/Triggers and Potential Consequences shown in Figure 1 (Risk Bow Tie) above. By operating reclosers in accordance with established protocols, this activity reduces the threat of Wildfire risk by targeting the Drivers/Triggers of downed conductor (DT.1), general equipment failure (DT.2), weather-related failure of SDG&E equipment (DT.3), contact by foreign object (DT.4), failure of third-party attachments (DT.5), vegetation contact (DT.6), and extreme force of nature events (DT.8). This activity also reduces the likelihood of Potential Consequences should a Wildfire occur, including damage to third party real and personal property (PC.2), claims and litigation (PC.5), and erosion of public confidence (PC.6).

3. SDG&E-1-C3 – Other Special Work Procedures

a. Description of Risk Reduction Benefits

Work restrictions are in place based on Operating Conditions to maximize public, contractor, and employee safety. As conditions increase in severity, work activities may still be performed, but some might have additional requirements to mitigate risk. Some of these requirements include the presence of Contract Fire Resources, with the purpose of preventing and addressing work-related ignitions. In other situations, work activity might cease altogether to prevent potential ignitions due to the increased fire risk.

Costs were not identified for this activity because it is embedded in internal labor. Therefore, an RSE calculation is not being performed.

b. Elements of the Bow Tie Addressed

Other special work procedures are established to address several of the Drivers/Triggers and Potential Consequences shown in Figure 1 (Risk Bow Tie) above. Establishing special work procedures in various Operating Conditions reduces the likelihood that a wildfire will occur by targeting the Drivers/Triggers of vegetation contact (DT.6), not observing procedures (DT.7), extreme force of nature events (DT.8), lack of internal or external coordinated response (DT.9), and climate change adaptation impacts (DT.10). This activity also reduces the likelihood of Potential Consequences should a wildfire occur, including damage to third party real and personal property (PC.2), claims and litigation (PC.5), and erosion of public confidence (PC.6).

4. SDG&E-1-C4 – Distribution System Inspections – Corrective Maintenance Program

a. Description of Risk Reduction Benefits

Distribution System Inspections mitigate the risk of equipment failure by proactively identifying equipment deterioration. This allows for the repair/replacement before failures occur. Equipment failure can lead to electrical faults, which can lead to ignitions. Through inspections, SDG&E can plan for replacements and repairs rather than being reactive. Planning for such repair work allows SDG&E to anticipate any potential lead times for materials, to be flexible operationally as repair work is being done, and to provide notice ahead of any potential ramifications (*e.g.*, planned outages).

Because this program is mandated pursuant to GO 165, an RSE calculation is not being performed.

b. Elements of the Bow Tie Addressed

The Corrective Maintenance Program addresses several of the Drivers/Triggers shown in Figure 1 (Risk Bow Tie) above. This preventative inspection program reduces the likelihood that a wildfire will occur by targeting the Drivers/Triggers of downed conductor (DT.1), general equipment failure (DT.2), weather-related failure of SDG&E equipment (DT.3), contact by foreign object (DT.4), failure of third-party attachments (DT.5), vegetation contact (DT.6), extreme force of nature events (DT.8), and climate change adaptation impacts (DT.10).

5. SDG&E-1-C6 – Substation System Inspections

a. Description of Risk Reduction Benefits

Substation System Inspections mitigate the risk of equipment failure by proactively identifying equipment deterioration. This allows for the repair/replacement before failures occur. Equipment failure can lead to electrical faults, which can lead to ignitions. Through inspections, SDG&E can plan for replacements and repairs rather than reacting to a failure. Planning for such repair work allows SDG&E to anticipate any potential lead times for materials, to be flexible operationally as repair work is being done, and to provide notice ahead of any potential ramifications (*e.g.*, planned outages).

Cost and RSE-related information for this control are provided in the Electric Infrastructure Integrity RAMP risk chapter (Chapter SDG&E-4).

b. Elements of the Bow Tie Addressed

Substation system inspections address several of the Drivers/Triggers shown in Figure 1 (Risk Bow Tie) above. This preventative inspection program reduces the likelihood that a wildfire will occur by targeting the Drivers/Triggers of downed conductor (DT.1), general equipment failure (DT.2), weather-related failure of SDG&E equipment (DT.3), contact by foreign object (DT.4), vegetation contact (DT.6), extreme force of nature events (DT.8), and climate change adaptation impacts (DT.10).

6. SDG&E-1-C7 – Transmission System Inspections

a. Description of Risk Reduction Benefits

Transmission System Inspections mitigate the risk of equipment failure by proactively identifying equipment deterioration. This allows for repair or replacement of equipment before failures occur. Equipment failure can lead to electrical faults, which can lead to ignitions. Through inspections, SDG&E can plan for replacements and repairs rather than reacting to a failure. Planning for such repair work allows SDG&E to anticipate any potential lead times for materials, to be flexible operationally as repair work is performed, and to provide notice ahead of any potential ramifications (*e.g.*, planned outages).

Because this control is related to assets in the jurisdiction of the FERC, SDG&E is not including the associated costs from this activity in this Report, as further described in Section VI below. Accordingly, a Risk Spend Efficiency calculation is not being performed.

b. Elements of the Bow Tie Addressed

Transmission system inspections address several of the Drivers/Triggers shown in Figure 1 (Risk Bow Tie) above. This preventative inspection program reduces the likelihood that a wildfire will occur by targeting the Drivers/Triggers of downed conductor (DT.1), general equipment failure (DT.2), weather-related failure of SDG&E equipment (DT.3), contact by foreign object (DT.4), vegetation contact (DT.6), extreme force of nature events (DT.8), and climate change adaptation impacts (DT.10).

7. SDG&E-1-C8 – Overhead Transmission and Distribution Fire-Hardening (Wood to Steel)

a. Description of Risk Reduction Benefits

The Overhead Transmission and Distribution Fire-Hardening program reduces the risk of wildfire in multiple ways. First, the new structures are designed to meet the known local wind conditions in the area, reducing the probability of structure and equipment failure when exposed to extreme wind loading, which happens under certain Santa Ana wind conditions. Structure and equipment failure can lead to ignitions, and when combined with the extreme wind can lead to wildfires. Designing and building lines to withstand the extreme winds mitigates this risk. In addition, SDG&E is replacing wood poles with steel, which is a more reliable material in terms of load capacity and a more resilient material should a fire occur. SDG&E is also utilizing high

tensile strength steel core conductors which reduce the risk of wires-down, a known source of ignitions. Moreover, SDG&E is utilizing expanded phase spacing which reduces the risk of phase to phase faults, another potential ignition source. SDG&E is fire-hardening the transmission system within the HFTD, where the risk for wildfires is greatest.

Costs identified herein for this activity are limited to distribution-related portions under the CPUC's jurisdiction. Because the distribution components are dependent on and borne from an approved FERC-jurisdictional transmission-related program, SDG&E is not calculating an RSE on this program.

b. Elements of the Bow Tie Addressed

The wood-to-steel program addresses several of the Drivers/Triggers and Potential Consequences shown in Figure 1 (Risk Bow Tie) above. By implementing these hardening efforts, this program reduces the likelihood that a wildfire will occur by targeting the Drivers/Triggers of downed conductor (DT.1), general equipment failure (DT.2), weather-related failure of SDG&E equipment (DT.3), failure of third-party attachments (DT.5), extreme force of nature events (DT.8), and climate change adaptation impacts (DT.10). This activity also decreases the likelihood of Potential Consequences should a wildfire occur, including serious injuries and/or fatalities (PC.1), damage to third party real and personal property (PC.2), damage and loss of SDG&E assets or facilities (PC.3), operational and reliability impacts (PC.4), claims and litigation (PC.5), and erosion of public confidence (PC.6).

8. SDG&E-1-C16 – Pole Brushing

a. Description of Risk Reduction Benefits

For the pole brushing program, SDG&E's work management system and scheduled routine maintenance reduces the risk for managed poles being overlooked and/or not being maintained. The program also provides assurance that a pole will maintain the annual compliance by means of herbicide application (where possible) and re-clear activity for poles that are not treated by herbicide, so that vegetation is kept clear within the radius. These measures help prevent the propagation of an ignition escaping the cleared radius with the added benefit of protection to the pole from an encroaching wildfire, providing safety and reliability to customers.

Because this program is mandated pursuant to PRC § 4292, an RSE calculation is not being performed.

b. Elements of the Bow Tie Addressed

Pole brushing addresses several of the Potential Consequences shown in Figure 1 (Risk Bow Tie) above by limiting a potential fuel source. Such efforts decrease the likelihood of Potential Consequences should a wildfire occur, including serious injuries and/or fatalities (PC.1), damage to third party real and personal property (PC.2), damage and loss of SDG&E assets or facilities (PC.3), operational and reliability impacts (PC.4), claims and litigation (PC.5), and erosion of public confidence (PC.6).

C. Post-Mitigation Analysis Results – Individual Programs

1. SDG&E-1-M4 – Strategic Undergrounding

a. Description of Risk Reduction Benefits

The objective of undergrounding distribution circuits in strategic locations allow SDG&E to dramatically reduce SDG&E equipment as an ignition source. Removing the possibility of the overhead conductors failing, poles from failing and vegetation contacting SDG&E equipment, reduces possibilities of ignition. These factors, and performing construction in strategic locations, allow for this program to provide safety benefits to employees and the public. This program has the added benefit of reducing the need for PSPS as a mitigation under extreme weather conditions, potentially eliminating PSPS impacts for some customers. This program also allows for reducing areas required to be patrolled or stationed during PSPS events. The reduction in patrolled locations has the potential to reduce the duration to energize distribution lines that were de-energized during the PSPS event and reduce extended exposure to SDG&E employees.

b. Elements of the Bow Tie Addressed

Strategic undergrounding addresses several of the Drivers/Triggers and Potential Consequences shown in Figure 1 (Risk Bow Tie) above. By removing the risk of ignition related to an overhead electric equipment, this program reduces the likelihood that a wildfire will occur by targeting the Drivers/Triggers of downed conductor (DT.1), general equipment failure (DT.2), weather-related failure of SDG&E equipment (DT.3), contact by foreign object (DT.4), failure of

third-party attachments (DT.5), vegetation contact (DT.6), not observing procedures (DT.7), extreme force of nature events (DT.8), and climate change adaptation impacts (DT.10). This activity also decreases the likelihood of Potential Consequences should a Wildfire occur, including serious injuries and/or fatalities (PC.1), damage to third party real and personal property (PC.2), damage and loss of SDG&E assets or facilities (PC.3), operational and reliability impacts (PC.4), claims and litigation (PC.5), and erosion of public confidence (PC.6).

c. RSE Inputs and Basis

Scope	Underground 4.66 miles of HFTD distribution system.
Effectiveness	100% of wildfire risk is reduced when the system is undergrounded. 80% of wildfire risk is in HFTD Tier 3. 60% of wildfire risk exists after accounting for PSPS. 0.28% of Tier 3 miles in the HFTD will be undergrounded.
Risk Reduction	0.2% based on the effectiveness above.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.32	**7215.25**	10085.12
Post-Mitigation	**LoRE**		**29.940**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5482.28	**7200.75**	10064.85
	RSE	17.52	**23.01**	32.16

2. SDG&E-1-C9 – Cleveland National Forest Fire-Hardening

a. Description of Risk Reduction Benefits

Cleveland National Forest Fire-Hardening program is hardening transmission and distribution lines that traverse the forest land, much of which is located in Tier 3 of the HFTD, and experiences some of the highest winds in SDG&E's service territory. This program utilizes a combination of overhead and underground applications. For the overhead hardening

component, the new structures are designed to meet the known local wind conditions in the area, reducing the probability of structure and equipment failure when exposed to extreme wind loading, which happens under certain Santa Ana wind conditions. Structure and equipment failure can lead to ignitions, and when combined with the extreme wind can lead to wildfires. Designing and building lines to withstand the extreme winds mitigates this risk. In addition, SDG&E is replacing wood poles with steel, which is a more reliable material in terms of load capacity, and a more resilient material should a fire occur. SDG&E is also utilizing high tensile strength steel core conductors which reduce the risk of wires down, a potential source of ignitions. Moreover, SDG&E is utilizing expanded phase spacing which reduces the risk of phase-to-phase faults, another potential ignition source. The undergrounding goes even further than overhead hardening, by reducing the risk of equipment failures leading to ignitions and eliminating the risk of ignitions caused by foreign object in lines.

Costs identified herein for this activity are limited to distribution-related portions under the CPUC's jurisdiction. Because this program has distribution components that are independent from an approved FERC-jurisdictional transmission-related program, SDG&E is calculating an RSE on the distribution-only portions of this program.

b. Elements of Bow Tie Addressed

CNF addresses several of the Drivers/Triggers and Potential Consequences shown in Figure 1 (Risk Bow Tie) above. Through these hardening efforts, this program reduces the likelihood that a wildfire will occur by targeting the Drivers/Triggers of downed conductor (DT.1), general equipment failure (DT.2), weather-related failure of SDG&E equipment (DT.3), failure of third-party attachments (DT.5), extreme force of nature events (DT.8), and climate change adaptation impacts (DT.10). This activity also decreases the likelihood of Potential Consequences should a wildfire occur, including serious injuries and/or fatalities (PC.1), damage to third party real and personal property (PC.2), damage and loss of SDG&E assets or facilities (PC.3), operational and reliability impacts (PC.4), claims and litigation (PC.5), and erosion of public confidence (PC.6).

c. RSE Inputs and Basis

Scope	0.15% of distribution in Tier 3 of HFTD to be hardened. 0.09% of distribution in Tier 3 of HFTD to be undergrounded. Total of 39.7 miles to have work performed.
Effectiveness	Estimated risk reduction of hardened overhead for 21%, and 48% for undergrounding.
Risk Reduction	Overall estimated risk reduction is 0.7%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.32	**7215.25**	10085.12
Post-Mitigation	**LoRE**		**30.2244**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5534.42	**7269.22**	10160.56
	RSE	11.14	**14.63**	20.44

3. SDG&E-1-M7 – Expulsion Fuses

a. Description of Risk Reduction Benefits

SDG&E's distribution system can experience electrical faults (*i.e.*, equipment operating outside its design criteria) that result in the operation of an expulsion fuse to isolate the faulted location, leading to an outage. An expulsion fuse is a one-time use sacrificial device designed to isolate circuit segments from dangerous levels of fault current. The operation of an expulsion fuse discharges hot particles towards the ground, which has the potential to ignite nearby fuels, under dry field conditions. Utilizing an approved CAL FIRE expulsion fuse that has been tested

and designated as an exempt classification (*i.e.*, classified as fire-safe by the primary fire protection agency) reduces the ignition risk from the expulsion fuse operation.

b. Elements of the Bow Tie Addressed

The implementation of CAL FIRE-approved expulsion fuses addresses several of the Potential Consequences shown in Figure 1 (Risk Bow Tie) above. This hardening program decreases the likelihood of Potential Consequences should a wildfire occur, including serious injuries and/or fatalities (PC.1), damage to third party real and personal property (PC.2), damage and loss of SDG&E assets or facilities (PC.3), claims and litigation (PC.5), and erosion of public confidence (PC.6).

c. RSE Inputs and Basis

Scope	All expulsion fuses in Tier 3 to be replaced. Approximately 2% of wildfire risk in HFTD Tier 3 is attributed to expulsion fuse incidents.
Effectiveness	Replacing with non-expulsion fuses is estimated as 95% effective.
Risk Reduction	Overall estimated risk reduction is 0.9%, when accounting for HFTD Tier 3 and PSPS.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.32	**7215.25**	10085.12
Post-Mitigation	**LoRE**		**29.7264**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5443.23	**7149.45**	9993.15
	RSE	92.16	**121.05**	169.19

4. SDG&E-1- M8 – Hotline Clamps

a. Description of Risk Reduction Benefits

Previous construction for hotline clamps connected directly to the overhead distribution system to transfer power from one bare wire location to either a transformer or another bare wire location. This direct connection to the bare wire resulted in wire down events. Replacing this equipment and removing the direct connection to the bare wire will result in removing the root cause for wire down events associated with this equipment and eliminate one cause associated with wires down in the HFTD area.

b. Elements of the Bow Tie Addressed

The implementation of the hotline clamps program addresses several of the Drivers/Triggers and Potential Consequences shown in Figure 1 (Risk Bow Tie) above. This hardening program reduces the likelihood that a wildfire will occur by targeting the Drivers/Triggers of downed conductor (DT.1) and general equipment failure (DT.2). This activity also decreases the likelihood of Potential Consequences should a wildfire occur, including serious injuries and/or fatalities (PC.1), damage to third party real and personal property (PC.2), damage and loss of SDG&E assets or facilities (PC.3), claims and litigation (PC.5), and erosion of public confidence (PC.6).

c. RSE Inputs and Basis

Scope	All hotline clamps in HFTD Tier 3 and 70% in HFTD Tier 2 are to be replaced. Approximately 0.07% of wildfire risk in HFTD is due to hotline clamp failures that lead to wires down.
Effectiveness	Replacing hotline clamps with updated standard will reduce wires down by 100%.
Risk Reduction	Overall risk reduction is estimated as 0.35%, when accounting for HFTD and PSPS.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17

	Risk Score	5493.32	**7215.25**	10085.12
Post-Mitigation	**LoRE**		**29.895**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5474.10	**7190.00**	10049.83
	RSE	137.89	**181.11**	253.15

5. SDGE-1-C12/M9 – WiSE

a. Description of Risk Reduction Benefits

The Wire Safety Enhancement (WiSE) program addresses significant wildfire concerns in the wildland urban interface and coastal canyons within the service territory. These locations are in close proximity to residential homes and the public leading to a smaller acreage of burning, but higher potential for property damage. The WiSE program replaces small conductor with a historically high risk of failure, with high tensile strength conductor, reducing the risk of wires down that could lead to ignitions.

A multi-attribute risk model was developed to target the best areas for the program. Conductor risk assessment, circuit historic wires down, pole age, area wind gust speeds, and fire vulnerability were all included in the model. Proximity to existing housing is also considered. SDG&E's FiRM program's design preference guidelines have been implemented for this program.

b. Elements of the Bow Tie Addressed

WiSE addresses several of the Drivers/Triggers and Potential Consequences shown in Figure 1 (Risk Bow Tie) above. This hardening program reduces the likelihood that wildfire will occur by targeting the Drivers/Triggers of downed conductor (DT.1), general equipment failure (DT.2), weather-related failure of SDG&E equipment (DT.3), and extreme force of nature events (DT.8). This activity also decreases the likelihood of Potential Consequences should a wildfire occur, including operational and reliability impacts (PC.4), claims and litigation (PC.5), and erosion of public confidence (PC.6).

c. RSE Inputs and Basis

Scope	Approximately 5% of wildfire risk resides outside the HFTD, and 0.8% of system is addressed by this activity.
Effectiveness	Estimated risk reduction of hardened overhead in non-HFTD is 0.2%.
Risk Reduction	Overall estimated risk reduction is 0.02%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.32	**7215.25**	10085.12
Post-Mitigation	**LoRE**		**29.994**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5492.23	**7213.81**	10083.11
	RSE	1.96	**2.57**	3.59

6. SDGE-1-M10 – Covered Conductor

a. Description of Risk Reduction Benefits

A covered conductor system with an improved three layers of protection over the bare conductor and a fully covered system when transitioning from one span to another provides a reduction in several potential drivers of ignitions. This program aims to target the largest driver of ignitions within SDG&E's service territory, contact from objects. Covered conductor will assist in mitigating this driver but requires strategic development of scope to install in the at-risk locations. In addition, the specific type of covered conductor is new for SDG&E and requires updates to construction standards and associated work methods. For these reasons, the project is small in scope for the first several years, but it will ramp up thereafter.

b. Elements of the Bow Tie Addressed

Implementing covered conductor will address several of the Drivers/Triggers and Potential Consequences shown in Figure 1 (Risk Bow Tie) above. By further hardening overhead electric equipment, it reduces the likelihood that a wildfire will occur by targeting the Drivers/Triggers of downed conductor (DT.1), general equipment failure (DT.2), weather-related failure of SDG&E equipment (DT.3), contact by foreign object (DT.4), vegetation contact (DT.6), and extreme force of nature events (DT.8). Regarding vegetation-related Drivers/Triggers, please note that covered conductor primarily mitigates the risk of small branches causing phase-to-phase faults; it does not necessarily mitigate large branches and trees falling and coming into contact with electrical overhead equipment. In addition, this activity decreases the likelihood of Potential Consequences should a Wildfire occur, including serious injuries and/or fatalities (PC.1), damage to third party real and personal property (PC.2), damage and loss of SDG&E assets or facilities (PC.3), operational and reliability impacts (PC.4), claims and litigation (PC.5), and erosion of public confidence (PC.6).

c. RSE Inputs and Basis

Scope	Approximately 0.01% of overhead system in HFTD Tier 3 to be replaced.
Effectiveness	Estimated risk reduction of covered conductor in HFTD Tier 3 is 34%.
Risk Reduction	Overall estimated risk reduction is 0.36%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.32	**7215.25**	10085.12
Post-Mitigation	**LoRE**		**29.892**	
	CoRE	183.11	**240.51**	336.17

	Risk Score	5473.55	**7189.28**	10048.82
	RSE	24.30	**31.91**	44.61

7. SDG&E-1- M13 – PSPS Engineering Enhancements

a. Description of Risk Reduction Benefits

During a PSPS event, isolation points are utilized to de-energize equipment from extreme weather. In some situations, the only isolation point is at the substation requiring the entire circuit to be de-energized. This program works together with information from nearby weather stations to potentially reduce impacted areas by allowing for de-energizing in strategic locations and providing power to customers who may not be within the at-risk locations. In addition, this program allows for the potential of a quicker restoration of service when a PSPS event is over, because the footprint required to patrol and confirm that the de-energized area may be safely re-energized is also reduced. Even though this mitigation does not reduce the risk of wildfire, it allows SDG&E to be precise in its use of the PSPS mitigation, limiting the PSPS impacts only to the infrastructure, and its associated customers, which are exposed to the highest risk during the event.

b. Elements of the Bow Tie Addressed

Implementing the PSPS Engineering Enhancements program will address some of the Potential Consequences shown in Figure 1 (Risk Bow Tie) above. By installing additional remote sectionalizing devices within the HFTD, it reduces the likelihood of Potential Consequences should a Wildfire occur including operational and reliability impacts (PC.4) and erosion of public confidence (PC.6).

c. RSE Inputs and Basis

Scope	Activity does not reduce wildfire risk directly but reduces impact from PSPS. For description of this activity, refer to Section V and subpart a "Description of Risk Reduction Benefits" above.
Effectiveness	N/A
Risk Reduction	N/A

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.32	**7215.25**	10085.12
Post-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.33	**7215.25**	10085.13
	RSE	0.00	**0.00**	0.00

8. SDG&E-1- M16 – Backup Power for Resilience – Microgrids

a. Description of Risk Reduction Benefits

SDG&E utilizes PSPS as a last resort measure to mitigate fire risk and ignition sources, to reduce impacts to customers. Microgrids to support critical infrastructure in areas affected by de-energization events can help mitigate the negative impacts on its customers. Microgrids provide meaningful benefits to impacted communities because they can lessen the burden of de-energization events. For example, a microgrid that supports a fire station and Urgent Care Center can help sustain emergency services in the local community; a fueling station can provide necessary refueling for residents' vehicles and backup electric generators; a telecommunications hub can provide continued cell service to residents; a convenience store can provide necessities such as ice, food, batteries and other essentials; food establishments can serve as congregating areas and provide community members a place of relief during a grid outage. These are examples of the qualitative benefits that one microgrid project (here, the Cameron Corners Microgrid in the HFTD) can provide and the positive impact it will have on the surrounding community.

SDG&E is identifying such areas in the HFTD that have multiple critical facilities that are in or near the high wildfire threat areas. Microgrids in these targeted locations that meet discrete criteria (*i.e.*, locations that would provide ongoing service to multiple critical facilities in an area that can be islanded prudently and safely) can offer a designated place of refuge and support ongoing essential services during PSPS events.

b. Elements of the Bow Tie Addressed

Implementing backup power for resilience in the form of microgrids will address some of the Potential Consequences shown in Figure 1 (Risk Bow Tie) above. Microgrids reduce the likelihood of Potential Consequences should a Wildfire occur including operational and reliability impacts (PC.4) and erosion of public confidence (PC.6).

c. RSE Inputs and Basis

Scope	Activity does not reduce wildfire risk directly but reduces impact from PSPS. For description of this activity, refer to Section V and subpart a "Description of Risk Reduction Benefits," above.
Effectiveness	N/A
Risk Reduction	N/A

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.32	**7215.25**	10085.12
Post-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.33	**7215.25**	10085.13
	RSE	0.00	**0.00**	0.00

9. SDG&E-1-M17 – Lightning Arrester Removal/Replacement Program

a. Description of Risk Reduction Benefits

Removing at-risk equipment from the system provides a safer environment for ratepayers and the community. The function of the lightning arrester is to absorb abnormal surges on the distribution system. These surges can lead to an overload, resulting in debris or shrapnel being sent into the environment. This hot debris can ignite nearby fuels under dry conditions. The new CAL FIRE approved lightning arrestors mitigate these impacts, reducing the risk of ignitions.

b. Elements of the Bow Tie Addressed

Implementing the lightning arrester removal/replacement program will address several of the Drivers/Triggers and Potential Consequences shown in Figure 1 (Risk Bow Tie) above. The removal of these assets reduces the likelihood that a wildfire will occur, by targeting the Driver/Trigger of general equipment failure (DT.2). This activity also decreases the likelihood of Potential Consequences should a wildfire occur, including serious injuries and/or fatalities (PC.1), damage to third party real and personal property (PC.2), damage and loss of SDG&E assets or facilities (PC.3), claims and litigation (PC.5), and erosion of public confidence (PC.6).

c. RSE Inputs and Basis

Scope	An estimated 2.6% of wildfire risk is due to lightning arrestor incidents, and approximately 4% of those in the HFTD will be replaced.
Effectiveness	Estimated effectiveness of 100% where new lightning arrestors were installed.
Risk Reduction	Overall estimated risk reduction is 0.05%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.32	**7215.25**	10085.12

Post-Mitigation	**LoRE**		**29.9856**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5490.69	**7211.79**	10080.29
	RSE	19.31	**25.36**	35.44

10. SDG&E-1-M18 – SCADA Capacitors

a. Description of Risk Reduction Benefits

Capacitors are designed to provide voltage support and improve power factors throughout SDG&E's service territory. During a failure of a capacitor from either mechanical, electrical, or environmental overstress, an internal fault is created, resulting in internal pressure and the potential that the casing may rupture. This rupture of molted metal has the potential to become an ignition source. The modernization of these capacitors will introduce system protection devices that check for imbalances and internal faults. Should a fault occur, the protection devices will isolate the capacitor from the system, de-energizing the capacitor and eliminating the failure mode that could lead to ignitions.

b. Elements of the Bow Tie Addressed

Implementing SCADA capacitors will address several of the Drivers/Triggers and Potential Consequences shown in Figure 1 (Risk Bow Tie) above. This program reduces the likelihood that a wildfire will occur by targeting the Driver/Trigger of general equipment failure (DT.2). This activity also decreases the likelihood of Potential Consequences should a wildfire occur, including serious injuries and/or fatalities (PC.1), damage to third party real and personal property (PC.2), damage and loss of SDG&E assets or facilities (PC.3), claims and litigation (PC.5), and erosion of public confidence (PC.6).

c. RSE Inputs and Basis

Scope	An estimated 0.66% of wildfire risk is due capacitor incidents in the HFTD. Activity will replace all older non-SCADA capacitors.
Effectiveness	80% risk reduction per replacement.
Risk Reduction	Overall estimated risk reduction is 0.3%, when accounting for PSPS.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.32	**7215.25**	10085.12
Post-Mitigation	**LoRE**		**29.9097**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5476.79	**7193.53**	10054.77
	RSE	39.02	**51.26**	71.64

11. SDG&E-1-C15 – Tree Trimming

a. Description of Risk Reduction Benefits

Routine and proactive off-cycle inspections, pruning and removal have shown to greatly reduce the number of trees causing outages on SDG&E's electrical system. Since 1995, SDG&E has seen a significant reduction in tree-caused outages, down from 500 recorded annually to a historical record low of 25 in the year 2013. The overall benefits include maintaining full compliance with regulatory agencies, improved reliability to customers, and a lower risk for a potential vegetation contact resulting in a possible ignition.

b. Elements of the Bow Tie Addressed

Tree trimming addresses several of the Drivers/Triggers and Potential Consequences shown in Figure 1 (Risk Bow Tie) above. Tree trimming efforts reduce the likelihood that a wildfire will occur by targeting the Drivers/Triggers of downed conductor (DT.1), general equipment failure (DT.2), weather-related failure of SDG&E equipment (DT.3), vegetation contact (DT.6), and extreme force of nature events (DT.8). This activity also decreases the likelihood of Potential Consequences should a wildfire occur, including serious injuries and/or fatalities (PC.1), damage to third party real and personal property (PC.2), damage and loss of

SDG&E assets or facilities (PC.3), operational and reliability impacts (PC.4), claims and litigation (PC.5), and erosion of public confidence (PC.6).

c. RSE Inputs and Basis

Scope	100% of Tree Trimming in the HFTD.
Effectiveness	Ceasing the current tree trimming program would result in an increase of vegetation-caused outages to the level that existed prior to the program's implementation.
Risk Reduction	The wildfire risk is estimated to increase 50% if the program was ceased.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.32	**7215.25**	10085.12
Post-Mitigation	**LoRE**		**15**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	2746.66	**3607.63**	5042.56
	RSE	151.32	**198.75**	277.80

12. SDG&E-1- M19 – Enhanced Vegetation Management

a. Description of Risk Reduction Benefits

SDG&E's enhanced vegetation management program includes post-prune clearance to 25 feet in the HFTD and the off-cycle patrols. This program will result in reduced vegetation encroachments into the regulatory minimum clearances, reduced damages caused to the overhead electrical by tree branch failures, and reduced tree-related outages. All these efforts will help to reduce tree-related ignitions. Other benefits include improved reliability (*e.g.*, improved SAIFI, the System Average Interruption Frequency Index), increased tree worker safety (internal and

private), and increased public safety. In addition, this program will also allow SDG&E to reduce the frequency of visits to customers' properties and extended annual pruning cycles.

Further, enhanced vegetation management provides more information. For example, SDG&E's Vegetation Risk Index (VRI) has helped to identify and target five known species in the SDG&E data base that result in the majority of tree caused outages; Eucalyptus, Palms, Pines, Oaks, and Sycamore. SDG&E also leverages technology, including meteorological capabilities, to identify specific circuits with risk for tree-strike potential.

The Vegetation Management team is focusing its efforts to perform enhanced vegetation management including, where appropriate, tree removal and tree replacement projects. The tree removal and replacement projects will, over time, modify the landscape improving electrical safety and service reliability, while adding value to the customer property.

b. Elements of the Bow Tie Addressed

Implementing enhanced vegetation management efforts will address several of the Drivers/Triggers and Potential Consequences shown in Figure 1 (Risk Bow Tie) above. This program would reduce the likelihood that wildfire will occur by targeting the Drivers/Triggers of downed conductor (DT.1), general equipment failure (DT.2), weather-related failure of SDG&E equipment (DT.3), vegetation contact (DT.6), and extreme force of nature events (DT.8). This activity also decreases the likelihood of Potential Consequences should a wildfire occur, including serious injuries and/or fatalities (PC.1), damage to third party real and personal property (PC.2), damage and loss of SDG&E assets or facilities (PC.3), claims and litigation (PC.5), and erosion of public confidence (PC.6).

c. RSE Inputs and Basis

Scope	Approximately 13% of wildfire risk is due to vegetation incidents.
Effectiveness	Estimated 5% reduction in wildfire due to implementation of this activity.
Risk Reduction	Overall estimated risk reduction is 5%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.32	**7215.25**	10085.12
Post-Mitigation	**LoRE**		**28.500**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5218.66	**6854.49**	9580.87
	RSE	51.39	**67.50**	94.35

13. SDG&E-1-M20 – Fuel Management Program

a. Description of Risk Reduction Benefits

SDG&E's fuel management program will reduce wildfire risk in multiple ways. First, should a fault occur on the electric system for any reason, this program aims to reduce the chance of an ignition by mitigating the availability of fuel to ignite. Thinning out or completely removing non-native vegetation, which often does not survive as well as native vegetation through the long dry periods associated with the southern California climate, minimizes some of the more dangerous dry dead fuels, which are more likely to ignite. The second benefit is on the fire suppression side; fuels management can reduce the speed and size of a developing fire should an ignition occur near SDG&E's facilities. Reducing the initial speed of the wildfire propagation adds critical minutes to allow for fire suppression resources to arrive on scene and to contain fires before they escalate to potentially catastrophic levels.

b. Elements of the Bow Tie Addressed

The fuel management program addresses several of the Drivers/Triggers and Potential Consequences shown in Figure 1 (Risk Bow Tie) above. This program reduces the likelihood that a wildfire will occur by targeting the Drivers/Triggers of vegetation contact (DT.6) and

climate change adaptation impacts (DT.10). This activity also decreases the likelihood of Potential Consequences should a wildfire occur, including serious injuries and/or fatalities (PC.1), damage to third party real and personal property (PC.2), damage and loss of SDG&E assets or facilities (PC.3), operational and reliability impacts (PC.4), claims and litigation (PC.5), and erosion of public confidence (PC.6).

c. RSE Inputs and Basis

Scope	Estimated 95% of wildfire risk is in scope of Fuel Management.
Effectiveness	Approximately 1% of pole locations will have managed fuel using this program. Of those locations, estimated 40% risk reduction when Fuel Management is applied.
Risk Reduction	Overall estimated risk reduction is 0.38%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.32	**7215.25**	10085.12
Post-Mitigation	**LoRE**		**29.9088**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5476.63	**7193.32**	10054.47
	RSE	13.93	**18.29**	25.57

14. SDG&E-1-M28 – NMS Situational Awareness Upgrades

a. Description of Risk Reduction Benefits

This program aims to provide an accurate and timely response as SDG&E's Operating Conditions indicate higher fire potential including disabling reclosing, enabling sensitive relay profiles, cancelling work in appropriate regions and also incorporating situational awareness data for use in operational tools to make appropriate decisions in real time. Integrating operating

conditions into Oracle's Network Management System (NMS) helps to streamline operational changes based on current conditions to facilitate the appropriate response during critical times, which ultimately enhances public and employee safety.

b. Elements of the Bow Tie Addressed

NMS situational awareness upgrades address several of the Drivers/Triggers shown in Figure 1 (Risk Bow Tie) above. These activities reduce the likelihood that a wildfire will occur by targeting the Drivers/Triggers of lack of internal or external coordinated response (DT.9) and climate change adaptation impacts (DT.10).

c. RSE Inputs and Basis

Scope	Activity does not directly reduce risk but contributes to overall awareness of electric system. For description of this activity, refer to Section V and subpart a "Description of Risk Reduction Benefits" above.
Effectiveness	N/A
Risk Reduction	N/A

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.32	**7215.25**	10085.12
Post-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.33	**7215.25**	10085.13
	RSE	0.00	**0.00**	0.00

15. SDG&E-1-C28/M32 – Wildfire Infrastructure Protection Teams

a. Description of Risk Reduction Benefits

Contract Fire Resources are paired with SDG&E personnel when they perform activities that present the risk of igniting a fire. The primary objective of using Contract Fire Resources is to prevent activities being performed by SDG&E and its contractors from causing an ignition event. Secondarily, these crews have the capability and training to safely mitigate a small ignition, should one occur. Through the use of Contract Fire Resources, the risk of ignition and the likelihood of a fire spreading are reduced.

b. Elements of the Bow Tie Addressed

Wildfire infrastructure protection teams address several of the Drivers/Triggers and Potential Consequences shown in Figure 1 (Risk Bow Tie) above. These teams reduce the likelihood that a wildfire will occur by targeting the Drivers/Triggers of lack of internal or external coordinated response (DT.9) and climate change adaptation impacts (DT.10). They also decrease the likelihood of Potential Consequences should a wildfire occur, including serious injuries and/or fatalities (PC.1), damage to third party real and personal property (PC.2), damage and loss of SDG&E assets or facilities (PC.3), operational and reliability impacts (PC.4), claims and litigation (PC.5), and erosion of public confidence (PC.6).

c. RSE Inputs and Basis

Scope	An estimated 0.95% of wildfire risk is addressed with the Wildfire Infrastructure Protection Teams. This portion of the risk arises from instances when utility actions might contribute to ignitions - such as when restoration or construction efforts are undertaken. The protection teams are on site to reduce this risk.
Effectiveness	The Wildfire Infrastructure Protection Team is estimated to be 80% effective at preventing an ignition when they are present during utility work during wildfire conditions in the HFTD.
Risk Reduction	Overall estimated risk reduction is 0.76% based on the information above.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.32	**7215.25**	10085.12
Post-Mitigation	**LoRE**		**29.772**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5451.58	**7160.41**	10008.48
	RSE	34.46	**45.27**	63.27

16. SDG&E-1-C29/M33 – Aviation Firefighting Program

a. Description of Risk Reduction Benefits

The Aviation Firefighting Program dedicates two Type 1 firefighting helicopters (helitankers) to the SDG&E service territory. These helitankers are an integral part of the CAL FIRE strategy of initial attack and keeping fires to less than ten acres throughout SDG&E's service territory. Type 1 helitankers have the largest water drop capability and allow rapid response and effective dispensing of water on a fire. This response allows CAL FIRE to attack the fire and protect people and structures from a potentially spreading fire. Additionally, the rapid suppression of wildfires reduces the loss of utility infrastructure, which helps to reduce the consequences of an ignition and facilitates safe, reliable utility service. These helitanker assets are available to the SDG&E service territory 365 days per year with no threat of moving off contract or to other areas of the state.

b. Elements of the Bow Tie Addressed

SDG&E's aviation firefighting program addresses several of the Drivers/Triggers and Potential Consequences shown in Figure 1 (Risk Bow Tie) above. By working with stakeholders, such as CAL FIRE, to provide firefighting assets, this program reduces the likelihood that a wildfire will occur by targeting the Drivers/Triggers of lack of internal or

external coordinated response (DT.9) and climate change adaptation impacts (DT.10). In addition, this program decreases the likelihood of Potential Consequences should a wildfire occur, including serious injuries and/or fatalities (PC.1), damage to third party real and personal property (PC.2), damage and loss of SDG&E assets or facilities (PC.3), operational and reliability impacts (PC.4), claims and litigation (PC.5), and erosion of public confidence (PC.6).

c. RSE Inputs and Basis

Scope	It is estimated that 100% of the wildfire risk is potentially affected by fire suppression aviation.
Effectiveness	SMEs estimate that 4% of wildfire risk is reduced with the current aviation firefighting program. Quantitatively, this reduction is shown by reducing the likelihood.
Risk Reduction	Overall risk reduction is estimated to be 4%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.32	**7215.25**	10085.12
Post-Mitigation	**LoRE**		**28.800**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5273.59	**6926.64**	9681.72
	RSE	27.33	**35.89**	50.17

17. SDG&E-1-C30 – Industrial Fire Brigade

a. Description of Risk Reduction Benefits

The Industrial Fire Brigade (IFB) is a contract resource that is available 24/7/365 for response to fire emergencies within SDG&E's substations and other large installations. In the event of an ignition, the IFB is requested and works with the SDG&E Fire Coordinator and the

fire agency having jurisdiction to assist with the safe and efficient extinguishment of the fire. Being able to quickly address the active fire in the utility installations prevents the fire from spreading and becoming a wildfire. The rapid extinguishment also facilitates timely repair and restoration of the system and prevents extended outages.

b. Elements of the Bow Tie Addressed

The industrial fire brigade addresses several of the Potential Consequences shown in Figure 1 (Risk Bow Tie) above. This program reduces the likelihood of Potential Consequences should a wildfire occur, including serious injuries and/or fatalities (PC.1), damage to third party real and personal property (PC.2), damage and loss of SDG&E assets or facilities (PC.3), operational and reliability impacts (PC.4), claims and litigation (PC.5), and erosion of public confidence (PC.6).

c. RSE Inputs and Basis

Scope	Estimated 0.2% of wildfire risk is addressed through the IFB, which focuses primarily on substation and other industrial settings that have a reduced risk of spreading to wildfire.
Effectiveness	Estimated 57% effectiveness in situations where the IFB is utilized.
Risk Reduction	Overall estimated risk reduction is 0.15%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.32	**7215.25**	10085.12
Post-Mitigation	**LoRE**		**30.0342**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5499.59	**7223.48**	10096.62
	RSE	18.35	**24.11**	33.70

3.

18. SDG&E-1-C31/M34 – Wireless Fault Indicators

a. Description of Risk Reduction Benefits

Wireless fault indicators are a proven technology that helps narrow the search area to determine where a system failure has occurred, so SDG&E can quickly identify a search area and dispatch crews to find system failures. This technology is important to SDG&E's operational mitigation measures that decrease wildfire ignition risk. SDG&E employs measures such as the use of sensitive protection schemes and the removal of reclosing on circuit devices, which increase the frequency of forced outages, decrease the damage caused by system failures, and increases customer impact from "temporary" faults (faults that remove themselves from the system such as a metallic balloon contact). During times of heightened wildfire risk, SDG&E also patrols all infrastructure for damage prior to restoring power. In instances where large areas are de-energized due to sensitive protective relay settings, wireless fault indicators are used to concentrate focus to a much smaller portion of the electric circuit, which allows for: a faster response to the site if an ignition exists; a greater chance of determining and correcting a fault cause (when damage on the overhead electric system is not immediately obvious); and, potentially, faster customer restoration (which could offset customer reliability impacts caused by wildfire mitigation measures).

b. Elements of the Bow Tie Addressed

Wireless fault indicators address several of the Drivers/Triggers and Potential Consequences shown in Figure 1 (Risk Bow Tie) above. These activities reduce the likelihood that a wildfire will occur by targeting the Drivers/Triggers of lack of internal or external coordinated response (DT.9) and climate change adaptation impacts (DT.10). Wireless fault indicators also decrease the likelihood of Potential Consequences should a wildfire occur, including serious injuries and/or fatalities (PC.1), damage to third party real and personal property (PC.2), damage and loss of SDG&E assets or facilities (PC.3), operational and reliability impacts (PC.4), claims and litigation (PC.5), and erosion of public confidence (PC.6).

c. RSE Inputs and Basis

Scope	Activity does not directly reduce risk but contributes to overall awareness of electric system. For description of this activity, refer to

	Section V and subpart a "Description of Risk Reduction Benefits," above.
Effectiveness	N/A
Risk Reduction	N/A

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.32	**7215.25**	10085.12
Post-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.33	**7215.25**	10085.13
	RSE	0.00	**0.00**	0.00

D. Post-Mitigation Analysis Results – Grouping of Programs

1. Non-Mandated Inspections

This grouping consists of all non-mandated inspections of SDG&E overhead distribution equipment in the HFTD. All of SDG&E's non-mandated inspection programs mitigate the risk of equipment failure by identifying equipment deterioration, which allows for the repair/replacement before failures occur. Equipment failure can lead to electrical faults, which can lead to ignitions. All of the programs in this mitigation plan bring a unique improvement or enhancement to the current mandated five-year overhead visual inspection cycles. Given that the goals of these programs are consistent, *i.e.*, proactively finding and remediating issues on the electric system before a failure can occur, these programs were grouped together for purposes of RSE calculations. Also, the programs of IR/Corona, drone inspections, and circuit ownership are pilot inspections that commenced in 2019, for which there is little to no data available at this time regarding the level of repairs resulting from these non-mandated inspections. Therefore,

these non-mandated inspections were grouped with the QA/QC program, to capture the repair and remediation work (*i.e.*, the risk reducing activity).

a. Description of Risk Reduction Benefits

QA/QC

QA/QC inspections improve on mandated inspections in three ways. The cycle of the inspection is increased, from once every five years to once every three years. More frequent inspection cycles allow less time for a potential infraction to go unnoticed. The second benefit is the QA/QC program focused in the highest risk area of the service territory, HFTD Tier 3. When infractions are found and repaired from these inspections, those repairs have the highest impact because they occur in the areas where ignitions are more likely to lead to the wildfires. The third benefit is that QA/QC inspections are focused entirely on infractions that could lead to ignitions, which means the inspection is more focused on Wildfire risk reduction than the mandated inspections.

IR/Corona

The IR/Corona program improves on mandated inspections by utilizing technology to see infractions that could lead to equipment failures and ignitions that cannot be seen through visual inspections. From a visual inspection, connections can look secure. But an IR/Corona inspection can detect hot connections caused by corrosion or other contaminates that could lead to connector failures and wires down.

Drone Inspections

The drone inspection program improves on mandated inspections by utilizing a drone to get an entirely new perspective on the overhead electrical equipment. Current visual inspection methods are limited to a view from the bottom looking up at the infrastructure. Through the pilot, the drone inspections have already revealed potential issues that could have only been identified by a top-down perspective, such as hollowed-out pole tops, deep cracks in the tops of cross arms, and flashed-over insulators. This new view will allow SDG&E to more comprehensively address these issues proactively, rather than reacting to a failure.

Circuit Ownership

This program allows SDG&E personnel to self-report system vulnerabilities and encourages employees to speak up if they see anything. By following up on these vulnerabilities, SDG&E learns more about its system and timely clears potential issues before a failure can occur. This provides enhanced system reliability and safety and addresses issues that otherwise could potentially result in an ignition.

Replacement and Reinforcement

This program remediates infractions found from existing inspection programs (*i.e.*, the Corrective Maintenance Program and QA/QC inspections). The benefit is that at-risk equipment identified in an inspection is replaced, thus reducing the likelihood that an issue would occur shortly thereafter. All infractions are fixed for the benefit of system safety and to maximize employee, contractor, and public safety.

The remediation costs related to the Corrective Maintenance Program are not included in the determination of an RSE, because it is a mandated inspection program. Further, because SDG&E is proposing new programs herein that provide fresh perspectives on finding potential issues on SDG&E's system (*i.e.*, IR/Corona, drone, and circuit ownership inspections), it is unknown at this time how to best estimate what remediation efforts will be needed in the future. SDG&E also believes that historical data is not indicative of future levels of remediation efforts, because utilizing historical visual inspection remediation rates would not be an apples-to-apples comparison of this infrared and corona inspection. Costs related to remediation efforts for the new inspection programs would currently be speculative and thus are not included. SDG&E plans to develop cost estimates from the current pilot programs and develop better-informed estimates in the GRC.

b. Elements of Risk Bow Tie Addressed

SDG&E's non-mandated inspections address several of the Drivers/Triggers shown in Figure 1 (Risk Bow Tie) above. As proactive inspections, all these programs reduce the likelihood that a wildfire will occur by targeting the Drivers/Triggers of downed conductor (DT.1), general equipment failure (DT.2), and weather-related failure of SDG&E equipment (DT.3). In addition to addressing DT.1 through DT.3, QA/QC inspections, drone inspections, and circuit ownership also address the Drivers/Triggers of contact by foreign object (DT.4),

failure of third-party attachments (DT.5), vegetation contact (DT.6), extreme force of nature events (DT.8), and climate change adaptation impacts (DT.10). Replacement and Reinforcement, in addition to being associated with DT.1 through DT.3, also mitigate the Drivers/Triggers of failure of third-party attachments (DT.5) and extreme force of nature events (DT.8).

c. RSE Inputs and Basis

Scope	Every overhead asset will be inspected per the program schedule.
Effectiveness	It is estimated that these inspections will reduce risk by 0.75%.
Risk Reduction	Estimated reduction of 0.75%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.32	**7215.25**	10085.12
Post-Mitigation	**LoRE**		**29.775**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5452.13	**7161.14**	10009.49
	RSE	15.60	**20.49**	28.64

2. FiRM and PRiME Groups

Certain efforts do not by themselves reduce risk, yet they play an important role in SDG&E's goals of minimizing Wildfire risk. Such initiatives include the ignition management program (SDG&E-1-M24), asset management (SDG&E-1-C21 / M25), monitoring and corrective deficiencies (SDG&E-1-M26), and wildfire mitigation personnel (SDG&E-1-M27). These activities, taken as a whole, assist in implementing SDG&E's Wildfire Risk Mitigation Plan, particularly FiRM and PRiME. For example, asset management helps to prioritize the replacement of poles, which is then used in the implementation of FiRM and PRiME. As stated above, because these four initiatives alone do not reduce risk, for purposes of calculating RSEs,

SDG&E made two groupings, a FiRM group and PRiME group, and allocated the costs of these programs 60% to FiRM and 40% to PRiME. The allocation was based on a weighted average of the total costs of FiRM and PRiME (*i.e.*, when combined, FiRM equaled approximately 60% of the total costs). While these four activities benefit more than FiRM and PRiME, these hardening efforts represent the most significant programs from a cost perspective.

a. Description of Risk Reduction Benefits

FiRM

The FiRM program targets small conductor for replacement, which through analysis of historical data has been identified as an asset with a higher likelihood of failure as compared to other types of conductor, a leading cause of wire down events and a potential ignition source. The program is prioritized based on computer models allowing SDG&E to determine the locations with the greatest impacts should a fire occur. This approach maximizes risk reduction by targeting assets with the highest probability of failure and prioritizing the replacements in the areas of greatest impact. This program replaces the conductor with high tensile strength conductor, enhances phase spacing to reduce the risk of foreign object in line contacts and is designed to meet the extreme local wind conditions that can occur during Southern California's Santa Ana wind conditions, all of which reduces the chances of ignitions caused by failures on the electric system.

PRiME

It is the goal of the PRiME program to remediate the highest risk poles in the HFTD. The highest risk poles are those most likely to cause a failure during a weather event. The PRiME program is designing to all current GO 95 standards and known local wind conditions to significantly reduce fire risk of the pole. Additionally, other associated risks such as wire spacing and clearances between poles are designed to meet current specifications.

Both the FiRM and PRiME programs are using sophisticated technology such as LiDAR and PLS-CADD to remediate risks. SDG&E has many distribution poles and lines that were designed well before LiDAR and PLS-CADD were created. The recent adoption of these tools allows SDG&E to design distribution infrastructure with the same level of detail as transmission infrastructure. These tools enable a systemwide look at associated poles which may be impacted as poles ahead and behind are remediated.

Ignition Management Program

The Ignition Management Program will capture data related to ignitions and near-ignitions originating from SDG&E equipment. This data will be analyzed to determine root cause, and findings will be addressed by the appropriate subject matter expert. By assessing potential trends in ignitions, this program will help SDG&E be more informed about its wildfire risk and better able to target, prioritize, and evaluate mitigations intended to reduce the risk of ignitions.

Asset Management

An AHI is a score designed to track the condition and performance of an asset by applying statistical modeling and predictive analytics to multiple sources of data and used as a basis for asset management strategies. The key benefits of employing AHI include the ability to measure overall health of assets, recognize asset data parameters associated with failure modes, detect failures, relatively compare between assets of same class in a consistent manner, and utilize analytics to measure operational condition. Using AHI on its assets, SDG&E can identify and compare assets based on its likelihood of failure. Asset risk is then determined when AHI and the associated asset failure consequence or impact are jointly considered. Integrating this asset risk information with other inputs, such as circuit risk index for situational awareness, especially within fire-prone areas, will inform the appropriate asset-related operational decision-making and strategies for enhanced reliability and safe operations of assets on given current and expected wildfire conditions.

Monitoring and Correcting Deficiencies

This program provides SDG&E a tool to monitor and track metrics and effectiveness of SDG&E's wildfire mitigation programs. This will then help inform prioritization and evaluate what is working and potentially what measures need to be re-worked. It will also verify compliance with the metrics put forth in SDG&E's WMP.

Wildfire Mitigation Personnel

This department was formed to provide a central point of contact for mitigating the risk of Wildfire at SDG&E, including developing and enhancing SDG&E's wildfire mitigation strategies. Additionally, these new full-time equivalents will be responsible for implementing

SDG&E's wildfire risk reducing activities. This demonstrates SDG&E's commitment to mitigating this risk as well as its intent to be accountable for executing its Wildfire Mitigation Plan. The department will help SDG&E reduce ignitions, improve asset health in the HFTD, and enhance public safety.

b. Elements of the Bow Tie Addressed

The grouping of FiRM and PRiME address several of the Drivers/Triggers and Potential Consequences shown in Figure 1 (Risk Bow Tie) above. All these programs reduce the likelihood that a wildfire will occur by targeting the Drivers/Triggers of downed conductor (DT.1), general equipment failure (DT.2), weather-related failure of SDG&E equipment (DT.3), failure of third-party attachments (DT.5), and extreme force of nature events (DT.8). In addition to addressing DT.1 through DT.3, DT.5, and DT.8, FiRM also addresses the Driver/Trigger of climate change adaptation impacts (DT.10). The ignition management program, asset management, monitoring and correcting deficiencies, and wildfire mitigation personnel, in addition to being associated with DT.1 through DT.3, DT.5, and DT.8, also mitigate the Drivers/Triggers of contact by foreign object (DT.4), vegetation contact (DT.6), not observing procedures (DT.7), and climate change adaptation impacts (DT.10). Moreover, with the exception of the ignition management program, all the activities in this grouping decrease the likelihood of Potential Consequences should a wildfire occur, including serious injuries and/or fatalities (PC.1), damage to third party real and personal property (PC.2), damage and loss of SDG&E assets or facilities (PC.3), operational and reliability impacts (PC.4), claims and litigation (PC.5), and erosion of public confidence (PC.6).

c. RSE Inputs and Basis

FiRM Group

Scope	FiRM will be applied to approximately 27% of HFTD Tier 3.
Effectiveness	It is estimated that the FiRM program will reduce risk by 80% in the areas that it is performed.
Risk Reduction	Estimated risk reduction of 5.7%, while accounting for PSPS in HFTD Tier 3.

PRiME Group

Scope	PRiME to be applied to approximately 18% of HFTD Tier 3 poles.
Effectiveness	It is estimated that PRiME will reduce risk by 80% to the poles that are hardened.
Risk Reduction	Estimated risk reduction of 1.9%, while accounting for PSPS in HFTD Tier 3.

d. Summary of Results

FiRM Group

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.32	**7215.25**	10085.12
Post-Mitigation	**LoRE**		**28.278**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5178.05	**6801.15**	9506.31
	RSE	25.69	**33.74**	47.16

PRiME Group

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.32	**7215.25**	10085.12
Post-Mitigation	**LoRE**		**29.430**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5388.95	**7078.16**	9893.51
	RSE	13.70	**18.00**	25.15

3. System Protection and Communication

The grouping of System Protection and Communication consists of the FTZAP and the LTE communications network programs. These programs are interdependent, as many of the elements of the FTZAP program, such as Falling Conductor Protection, require the use of the LTE communications network to be largely operational. Because these two programs associated with each other operationally, they were grouped together to calculate the RSE.

a. Description of Risk Reduction Benefits

FTZAP utilizes technology to enhance system protection. One example of FTZAP technology is FCP. FCP is meant to detect and isolate energized conductors in the event an overhead conductor break. This improves public safety in that when wire failures occur, the wire is de-energized before it can reach the ground.

As explained above, FTZAP and the LTE communications network programs are interconnected. The LTE communications program is foundational to the implementation of FTZAP. In addition to being integral for FCP, the LTE communication network supports advance SCADA controls and the ability to send PMU data over a wireless network.

The LTE communications network allows SDG&E to enhance the current reliability and security of several foundational technologies meant to manage the electrical grid, enhance safety for the public and our crews, and allow the implementation of new protection systems that rely on high-speed broadband networks. The LTE program consolidates multiple wireless networks into one, which helps to streamline support and management. It is also being implemented with a Highly Available (HA) design. This means longer uptimes on backup power and multiple layers of redundancy. Through this new network, our operators will have higher resolution data that will increase their situational awareness around potential events in the field. In addition, the LTE network provides for crew safety by enabling Mission Critical Push to Talk (MCPTT), as its HA design can allow communications when other networks are congested.

b. Elements of the Bow Tie Addressed

The FTZAP and LTE communication network programs will address several of the Drivers/Triggers and Potential Consequences shown in Figure 1 (Risk Bow Tie) above. Through the use of technology to enhance system protection, the likelihood that a wildfire will occur by targeting the Drivers/Triggers of downed conductor (DT.1), general equipment failure (DT.2),

and extreme force of nature events (DT.8) is reduced. The LTE communication network also addresses the Driver/Trigger of lack of internal or external coordinated response (DT.9). In addition, these activities decrease the likelihood of Potential Consequences should a wildfire occur including serious injuries and/or fatalities (PC.1), damage to third party real and personal property (PC.2), damage and loss of SDG&E assets or facilities (PC.3), operational and reliability impacts (PC.4), claims and litigation (PC.5), and erosion of public confidence (PC.6).

c. RSE Inputs and Basis

Scope	Approximately 25% of HFTD Tier 3 will have FTZAP installed.
Effectiveness	FTZAP is estimated to reduce risk by 90% where it is applied.
Risk Reduction	Estimated risk reduction is 5.8%, while accounting for PSPS and risk levels in HFTD Tier 3.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.32	**7215.25**	10085.12
Post-Mitigation	**LoRE**		**28.2517**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5173.19	**6794.77**	9497.40
	RSE	20.15	**26.47**	37.00

4. Public Safety Power Shutoff (PSPS)

PSPS activities are grouped because they have the common goal of improving PSPS processes, either from a decision-making or customer impact perspective. Many of the programs (Backup Power for Resilience – Generator Grant, Community Resource Centers, High-Performance Wireless Research and Education Network; Communication Practices; Mitigating

the Public Safety Impact of PSPS Protocols; and Customer Support in Emergencies) are designed to help to mitigate customer impacts related to a PSPS event. Other programs (Fire Science & Climate Adaptation Department, WRRM – Ops and Fire Science Enhancement, High-Performance Computing Infrasture, Situational Awareness Dashboard, Emergency Management Operations, and Disaster and Emergency Preparedness Plan) provide tools so that SDG&E can make informed decisions either during or in preparation of a PSPS event. Further, the act of de-energization and re-energization, presented herein as the "Strategy for Minimizing Public Safety Risk, PSPS and Re-Energization Protocols" program, does not include costs, and was grouped with other programs that include costs and enable this action. Lastly, because these programs are related and many of the programs by themselves do not reduce risks, they were grouped to determine the RSE.

a. Description of Risk Reduction Benefits

Backup Power for Resilience – Generator Grant, Community Resource Centers, High-Performance Wireless Research and Education Network (HPWREN)

Backup Power for Resilience will generally provide an alternative power source to certain segments of customers in the HFTD who are potentially impacted by PSPS events. Doing so will have reliability benefits for those customers. It will also provide secondary safety benefits given that these programs are targeted to help critical customers and infrastructure.

Generator Grant Program

The Access and Functional Needs (AFN) segment of the communities SDG&E serves in the HFTD have been identified as being disproportionately impacted by PSPS events. The Generator Grant Program will provide a renewable battery and solar charging briefcase capable of storing electricity to help this customer segment ride through short duration events. This program, if successful, may also prevent the AFN customer segment from having to rely on inexpensive, fossil fuel powered, backup generators. Standard combustible fuel powered generators naturally increase fire risk in the backcountry, particularly if they are used in an unsafe manner. This program may therefore help eliminate the need for future purchases of fossil fuel powered generators for short duration events.

Community Resource Centers

CRCs help to mitigate PSPS event impacts to customers, so that they can charge cell phones, gather snacks and water, and acquire general information – including PSPS event updates – directly from an SDG&E representative. Opening CRCs in SDG&E's communities is the right thing to do, as it lessens the burden and provides solutions for customers when their lives are impacted by PSPS events.

High-Performance Wireless Research and Education Network (HPWREN)

The HPWREN program reduces the risk that an ignition within SDG&E's service territory might rapidly expand to a wildfire. This network of cameras and communication technology enable the rapid identification and triangulation of a wildfire, which then enables first responders to react quickly. Additionally, the backbone communication network supports back country fire station communications and training, which directly impacts the first responders' ability to respond to reports of any wildfire quickly and effectively.

Fire Science & Climate Adaptation Department

The integration of subject matter experts into SDG&E operations has been very beneficial to safely operating the electric system in a high fire risk environment. Having a team of meteorologists and firefighters adds to situational awareness and decision support, helping keep SDG&E's communities safe and informed. This expertise enables the utility to anticipate, prepare and react to critical wildfire conditions through a mosaic of analytical and situational awareness tools. The use of these tools, such as the original utility weather network, the mountain top camera network, the Fire Potential Index and the Santa Ana Wildfire Threat Index, is expanding statewide. Evolution, innovation and integration of new science will continue to be required moving forward, to keep our communities safe in the face of climate change.

WRRM – Ops and Fire Science Enhancement

SDG&E pioneered the use of fire behavior modeling in utility operations through the initial development of the Wildfire Risk Reduction Model. The technology has proven critical and is now expanding across the state and across the wildfire agencies. Continued development of this technology will be paramount to the ongoing preparedness that enables SDG&E's system operators to remain informed. The big data capabilities of this tool have supported the safe

implementation of various SDG&E programs, including PSPS, and will continue to support programs into the future.

Camera Networks and Advanced Weather Station Integration

Over the past ten years, beginning in 2010, SDG&E has built the largest utility weather network existing anywhere in the world. The data SDG&E has collected and operationalized over the last decade has significantly contributed to SDG&E's wildfire mitigation initiatives, including prioritizing system hardening efforts and implementing PSPS. The original weather network equipment has now come to end of life, and a full rebuild of the weather network is required, with new equipment. This new weather network will be critical to the safe and reliable operation of the electric system over the next decade and beyond.

High-Performance Computing Infrastructure

SDG&E's High-Performance Computing Program has been foundational to creating analytical tools that have sharpened SDG&E's situational awareness, and now, that of utilities across the state and the country. The analytics conducted on these computers provide advance warning of critical fire conditions that enables an operational response. This technology evolves very quickly, and new computers will be required in 2022 to maintain SDG&E's program.

Situational Awareness Dashboard

Situational awareness dashboards increase the accuracy and timeliness of PSPS decisions. PSPS serves as a preventive mitigation measure by isolating electric infrastructure during times of heightened wildfire risk, stopping that infrastructure from serving as a wildfire ignition source. Dashboarding helps to inform operational decisions by quantifying the relative risks of a foreign- or infrastructure-caused source of equipment failure. It also quickly informs operations of the proper isolating devices necessary to use to mitigate that risk, increasing the speed of decision-making and communication related to PSPS.

Strategy for Minimizing Public Safety Risk, PSPS and Re-Energization Protocols

Strategies regarding PSPS and re-energization protocols are designed to maximize safety. As mentioned above, PSPS is used as a last resort and is generally limited to specific time periods experiencing an elevated or higher FPI. While PSPS may negatively impact near-term reliability, it provides safety benefits, by eliminating electrical equipment as an ignition source.

Specifically, it provides benefits related to employee, contractor, and public safety, as well as safety to SDG&E's system. For re-energizations, SDG&E requires patrols to take place prior to a re-energization. The patrol evaluates whether, from a safety perspective, SDG&E's equipment should be re-energized. These prescriptive protocols strive to keep communities and SDG&E's employees safe.

Communication Practices, Mitigating the Public Safety Impact of PSPS Protocols, and Customer Support in Emergencies

As recognized by the Commission, "[d]e-energization has far reaching and significant impacts on affected communities."[118] To help mitigate such impacts resulting from PSPS and wildfire events, SDG&E employs many programs and strategies. Communication-related efforts are one such tool. SDG&E believes communication with customers and stakeholder groups is critical. The Commission agrees, stating the following in D.19-05-042, the Phase 1 decision of the De-Energization Rulemaking:

> The utilities must work to build relationships with public safety partners, critical facilities, community-based organizations (preferably in partnership with public safety partners) and the public, including AFN populations, in order to ensure that all are as prepared as possible to face a de-energization event if and when it occurs;[119]
>
> and
>
> The utilities must develop partnerships with public safety partners at the local and state level to enable these agencies and entities to sufficiently prepare for de-energization event;[120]
>
> and
>
> The Commission, therefore, requires that the utilities work with public safety partners, including CAL FIRE and CalOES, to develop outreach and educational materials to make citizens aware of how to prepare for a prolonged loss of power in advance of the 2019 wildfire season.[121]

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[118] D.19-05-042 at 68.

[119] *Id.* at 90.

[120] *Id.*

[121] *Id.* at 92.

SDG&E will comply with the Commission's directives above and strives to continuously improve its communications.

Another strategy SDG&E utilizes to mitigate PSPS events is to provide customer support during emergencies, including wildfires. These customer support programs offered by SDG&E may not reduce ignitions, but they do help impacted customers during a time of need. SDG&E endeavors to make a positive difference in the communities it serves and support its customers. These goodwill programs allow SDG&E to assist where it can to positively impact customers.

Emergency Management Operations

To accomplish comprehensive and sustainable emergency readiness, SDG&E must maintain a continuous cycle of planning, training, and exercising. This is necessary so that the Company's responders understand and maintain competency in their emergency response roles and responsibilities. The development, implementation, and sustainment of Company-wide emergency management preparedness and operational policies and procedures combined with effective training and exercise programs allows SDG&E (those from the Field Incident Command and Emergency Operations Center, to Company leadership) and SDG&E's first responder partner agencies to respond and recover in a safe, timely and effective manner from wildfire, PSPS, and other man made or natural events that may impact SDG&E's ability to provide services to its customers.

Disaster and Emergency Preparedness Plan

Through the development and maintenance of Disaster and Emergency Preparedness Plans, SDG&E and its workforce understand their roles and responsibilities during incidents, emergencies, disasters, and catastrophes that may impact the safety of customers, employees and the reliability of SDG&E's infrastructure. Disaster and Emergency Preparedness Plans combined with SDG&E's effective training and exercise programs, which include all First Responders in its service territory, help maintain a high level of safety, competency and confidence in our field and Emergency Operations Center responders during emergency and disaster responses. Additionally, these programs provide increased efficiencies of response, control, and restoration of services.

b. Elements of the Bow Tie

A majority of the activities within the PSPS grouping reduce the likelihood that a wildfire will occur by targeting certain Drivers/Triggers shown in Figure 1 (Risk Bow Tie) above. The activities of Fire Science & Climate Adaptation Department, Wildfire Risk Reduction Model – Operational System (WRRM – Ops) and Fire Science Enhancements, Camera Networks and Advanced Weather Station Integration, High-Performance Computing Infrastructure, and Situational Awareness Dashboard all, at a minimum, address the Drivers/Triggers of lack of internal or external coordinated response (DT.9) and climate change adaptation impacts (DT.10). Communication Practices and Mitigating the Public Safety Impact of PSPS Protocols decrease the likelihood that the Drivers/Triggers of not observing procedures (DT.7) and lack of internal or external coordinated response (DT.9) will occur, while Emergency Management Operations, Disaster and Emergency Preparedness Plan, and Customer Support in Emergencies address only the Driver/Trigger of lack of internal or external coordinated response (DT.9).

The PSPS grouping also addresses several of the Potential Consequences provided in Figure 1 (Risk Bow Tie) above. Specifically, all the activities in this grouping decrease the likelihood of the Potential Consequence erosion of public confidence (PC.6). A majority of the activities, including Fire Science & Climate Adaptation Department, Wildfire Risk Reduction Model – Operational System (WRRM – Ops) and Fire Science Enhancements, Camera Networks and Advanced Weather Station Integration, High-Performance Computing Infrastructure, Situational Awareness Dashboard, Mitigating the Public Safety Impact of PSPS Protocols, Emergency Management Operations, and Disaster and Emergency Preparedness Plan reduce the likelihood of the following Potential Consequences, should a wildfire occur: serious injuries and/or fatalities (PC.1), damage to third party real and personal property (PC.2), damage and loss of SDG&E assets or facilities (PC.3), claims and litigation (PC.5), and erosion of public confidence (PC.6). The activities of Strategy for Minimizing Public Safety Risk During High Wildfire Conditions, PSPS and Re-Energization Protocols addresses all of the Wildfire risks' identified Potential Consequences: serious injuries and/or fatalities (PC.1), damage to third party real and personal property (PC.2), damage and loss of SDG&E assets or facilities (PC.3), operational and reliability impacts (PC.4), claims and litigation (PC.5), and erosion of public confidence (PC.6). Appendix A presents a table that includes each activity in this grouping and

the corresponding Drivers/Triggers and/or Potential Consequences addressed from the Risk Bow Tie.

c. RSE Inputs and Basis

Scope	A large majority of wildfire risk can be addressed with PSPS.
Effectiveness	PSPS is utilized in select locations during high-risk weather, with final decisions to PSPS made in real time. The effectiveness of PSPS is 100% for the time and the areas in which it is applied.
Risk Reduction	Estimated risk reduction of 50%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.32	**7215.25**	10085.12
Post-Mitigation	**LoRE**		**15.000**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	2746.66	**3607.63**	5042.56
	RSE	100.08	**131.45**	183.73

VII. SUMMARY OF RISK MITIGATION PLAN RESULTS

SDG&E's Risk Mitigation Plan takes into account recent data and trends related to Wildfire, affordability impacts, possible labor constraints and the feasibility of mitigations. SDG&E has performed RSEs in compliance with the S-MAP decisions, but ultimate mitigation selection can be influenced by other factors, including funding, labor resources, technology, planning, compliance requirements, and operational and execution considerations.

SDG&E's Risk Mitigation Plan can be subject to constraints. Many activities in this Risk Mitigation Plan can have significant lead times (in excess of a year) to obtain necessary materials or approval (*e.g.*, permitting) prior to commencing work. This is especially true with respect to System Hardening initiatives and the Fuel Management program. SDG&E's ability to timely

implement this Wildfire Risk Mitigation Plan may be dependent on factors like permitting, landowner agreements, and fire weather. In addition, SDG&E is experiencing a shortage of available, qualified contractors to perform work. For example, there is already significant competition in the State to obtain qualified design, engineering, and construction resources, as well as vegetation management resources. SDG&E expects this trend to continue in future years. Further, many of SDG&E's mitigants are costly. SDG&E strives to balance implementing fire mitigation measures with the associated costs of such measures. To do so, SDG&E prioritizes its work by addressing the highest risks first. To that end, SDG&E is strategic about employing its mitigation programs – which programs, where, and how much – and considers affordability when doing so.

Table 6 below provides a summary of the Risk Mitigation Plan, including controls and mitigations activities, associated costs, and the RSEs, by tranche.

SDG&E does not account for and track costs by activity; rather, SDG&E accounts for and tracks costs by cost center and capital budget code. The costs shown in Table 6 were estimated using assumptions provided by SMEs and available accounting data.

Table 6: Risk Mitigation Plan Summary[122]
(Direct 2018 $000)[123]

ID	Mitigation/Control	Tranche	2018 Baseline Capital [124]	2018 Baseline O&M	2020-2022 Capital [125]	2022 O&M	Total[126]	RSE[127]
SDG&E-1-C1	Operating Conditions	T1	0	0	0-0	0-0	0-0	-
SDG&E-1-C2	Recloser Protocols	T1	0	0	0-0	0-0	0-0	-
SDG&E-1-C3	Other Special Work Procedures	T1	0	0	0-0	0-0	0-0	-
SDG&E-1-C4	Distribution System Inspection - CMP	T1	0	1,600	0-0	380-460	380-460	-
SDG&E-1-C5	Distribution System Inspection - QA/QC	T1	0	450	0-0	330-400	330-400	15.60-28.64
SDG&E-1-M1	Distribution System Inspection - IR/Corona	T1	0	0	0-0	220-270	220-270	See RSE in SDG&E-1-C5
SDG&E-1-M2	Distribution System Inspection - Drone Inspections	T1	0	0	1,500-1,800	6,500-7,900	8,000-9,700	See RSE in SDG&E-1-C5
SDG&E-1-M3	Distribution System Inspection - Circuit Ownership	T1	0	0	0-0	480-580	480-580	See RSE in SDG&E-1-C5
SDG&E-1-C6	Substation System Inspection	T1	*See* Electric Infrastructure Integrity risk chapter (Chapter SDG&E-4)					

[122] Recorded costs and forecast ranges were rounded. Additional cost-related information is provided in workpapers. Costs presented in the workpapers may differ from this table due to rounding.

[123] The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2018 dollars and have not been escalated to 2019 amounts.

[124] Pursuant to D.14-12-025 and D.16-08-018, the Company provides the 2018 "baseline" capital costs associated with Controls. The 2018 capital amounts are for illustrative purposes only. Because capital programs generally span several years, considering only one year of capital may not represent the entire activity.

[125] The capital presented is the sum of the years 2020, 2021, and 2022, or a three-year total. Years 2020, 2021 and 2022 are the forecast years for SDG&E's Test Year 2022 GRC Application.

[126] Total = 2020, 2021 and 2022 Capital + 2022 O&M amounts.

[127] The RSE ranges are further discussed in Chapter RAMP-C and in Section VI above.

ID	Mitigation/Control	Tranche	2018 Baseline Capital [124]	2018 Baseline O&M	2020-2022 Capital [125]	2022 O&M	Total[126]	RSE[127]
SDG&E-1-C7	Transmission System Inspection	T1	0	0	0-0	0-0	0-0	-
SDG&E-1-C8	Overhead Transmission and Distribution Fire-Hardening	T1	0	0	3,000-3,700	0-0	3,000-3,700	-
SDG&E-1-M4	Strategic Undergrounding	T1	0	0	17,000-21,000	0-0	17,000-21,000	17.52-32.16
SDG&E-1-C9	Cleveland National Forest Fire-Hardening	T1	15,000	0	81,000-98,000	0-0	81,000-98,000	11.14-20.44
SDG&E-1-C10 / M5	Fire Risk Mitigation	T1	52,000	0	250,000-300,000	0-0	250,000-300,000	25.69-47.19
SDG&E-1-C11/M6	Pole Risk Mitigation and Engineering	T1	2,600	0	160,000-190,000	0-0	160,000-190,000	13.70-25.15
SDG&E-1-M7	Expulsion Fuse Replacement	T1	0	0	12,000-14,000	0-0	12,000-14,000	92.16-169.19
SDG&E-1-M8	Hotline Clamps	T1	0	0	0-0	2,400-3,600	2,400-3,600	137.89-253.15
SDG&E-1-C12/M9	Wire Safety Enhancement	T1	32	0	12,000-15,000	0-0	12,000-15,000	1.96-3.59
SDG&E-1-M10	Covered Conductor	T1	0	0	17,000-21,000	0-0	17,000-21,000	24.30-44.61
SDG&E-1-C13/M11	Fire Threat Zone Advanced Protection	T1	1,100	0	29,000-35,000	0-0	29,000-35,000	20.15-37.00
SDG&E-1-M12	LTE Communication Network	T1	0	0	86,000-104,000	0-0	86,000-104,000	See RSE in SDG&E-1-C13 / M11
SDG&E-1-M13	Public Safety Power Shutoff Engineering Enhancements	T1	0	0	1,200-2,100	0-0	1,200-2,100	0.00-0.00
SDG&E-1-C14/M14	Replacement and Reinforcement	T1	10,000	0	29,000-35,000	190-240	29,000-35,000	See RSE in SDG&E-1-C5
SDG&E-1-M15	Backup Power for Resilience - Generator Grant	T1	0	0	16,000-24,000	1,000-1,600	17,000-26,000	See RSE in SDG&

ID	Mitigation/Control	Tranche	2018 Baseline Capital [124]	2018 Baseline O&M	2020-2022 Capital [125]	2022 O&M	Total[126]	RSE[127]
	Program, CRCs, HPWREN							E-1-C22
SDG&E-1-M16	Backup Power for Resilience - Microgrids	T1	0	0	26,000-31,000	150-180	26,000-31,000	0.00-0.00
SDG&E-1-M17	Lightning Arrester Removal / Replacement Program	T1	0	0	2,900-3,500	0-0	2,900-3,500	19.31-35.44
SDG&E-1-M18	SCADA Capacitors	T1	0	0	4,700-5,600	0-0	4,700-5,600	39.02-71.64
SDG&E-1-C15	Tree Trimming	T1	0	29,000	0-0	16,000-20,000	16,000-20,000	151.32-277.80
SDG&E-1-C16	Pole Brushing	T1	0	3,800	0-0	3,400-4,100	3,400-4,100	-
SDG&E-1-M19	Enhanced Vegetation Management	T1	0	0	0-0	4,800-5,800	4,800-5,800	51.39-94.35
SDG&E-1-M20	Fuel Management Program	T1	0	0	0-0	1,100-1,300	1,100-1,300	13.93-25.57
SDG&E-1-C17	Fire Science and Climate Adaptation Department	T1	0	1,700	0-0	1,600-1,800	1,600-1,800	See RSE in SDG&E-1-C22
SDG&E-1-C18/M21	WRRM - Ops and Fire Science Enhancement	T1	0	0	4,500-6,000	0-0	4,500-6,000	See RSE in SDG&E-1-C22
SDG&E-1-C19/M22	Camera Networks and Advanced Weather Station Integration	T1	0	0	2,100-2,600	0-0	2,100-2,600	See RSE in SDG&E-1-C22
SDG&E-1-C20/M23	High-Performance Computing Infrastructure	T1	22	0	5,100-7,300	0-0	5,100-7,300	See RSE in SDG&E-1-C22
SDG&E-1-M24	Ignition Management Program	T1	0	0	0-0	290-350	290-350	See RSE in

ID	Mitigation/Control	Tranche	2018 Baseline Capital [124]	2018 Baseline O&M	2020-2022 Capital [125]	2022 O&M	Total[126]	RSE[127]
								SDG&E-1-C10 / M5 & SDG&E-1-C11 / M6
SDG&E-1-C21/M25	Asset Management	T1	0	580	8,800-11,000	520-550	9,300-12,000	See RSE in SDG&E-1-C10 / M5 & SDG&E-1-C11 / M6
SDG&E-1-M26	Monitoring and Correcting Deficiencies	T1	0	0	0-0	710-860	710-860	See RSE in SDG&E-1-C10 / M5 & SDG&E-1-C11 / M6
SDG&E-1-M27	Wildfire Mitigation Personnel	T1	0	0	0-0	950-1,200	950-1,200	See RSE in SDG&E-1-C10 / M5 & SDG&E-1-C11 / M6
SDG&E-1-M28	NMS Situational Awareness Upgrades	T1	0	0	1,400-1,700	0-0	1,400-1,700	0.00-0.00
SDG&E-1-M29	Situational Awareness Dashboard	T1	0	0	5,700-6,900	290-350	6,000-7,300	See RSE in SDG&

ID	Mitigation/Control	Tranche	2018 Baseline Capital [124]	2018 Baseline O&M	2020-2022 Capital [125]	2022 O&M	Total[126]	RSE[127]
								E-1-C22
SDG&E-1-C22	Strategy for Minimizing Public Safety Risk During High Wildfire Conditions, PSPS and Re-Energization Protocols	T1	0	0	0-0	0-0	0-0	100.08-183.73
SDG&E-1-C23/M30	Communication Practices	T1	0	190	0-0	4,500-5,400	4,500-5,400	See RSE in SDG&E-1-C22
SDG&E-1-C24	Mitigating the Public Safety Impact of PSPS Protocols	T1	0	0	0-0	0-0	0-0	See RSE in SDG&E-1-C22
SDG&E-1-C25/M31	Emergency Management Operations	T1	0	2,400	0-0	2,700-3,300	2,700-3,300	See RSE in SDG&E-1-C22
SDG&E-1-C26	Disaster and Emergency Preparedness Plan	T1	0	0	0-0	0-0	0-0	See RSE in SDG&E-1-C22
SDG&E-1-C27	Customer Support in Emergencies	T1	0	0	0-0	0-0	0-0	See RSE in SDG&E-1-C22
SDG&E-1-C28/M32	Wildfire Infrastructure Protection Teams	T1	0	910	0-0	1,100-1,300	1,100-1,300	34.46-63.27
SDG&E-1-C29/M33	Aviation Firefighting Program	T1	3,600	5,100	0-0	7,200-8,700	7,200-8,700	27.33-50.17
SDG&E-1-C30	Industrial Fire Brigade	T1	0	320	0-0	310-370	310-370	18.35-33.70
SDG&E-1-C31/M34	Wireless Fault Indicators	T1	440	0	1,100-1,400	0-0	1,100-1,400	0.00-0.00

ID	Mitigation/Control	Tranche	2018 Baseline Capital [124]	2018 Baseline O&M	2020-2022 Capital [125]	2022 O&M	Total[126]	RSE[127]
	TOTAL COST		85,000	46,000	780,000-940,000	57,000-71,000	830,000-1,010,000	

It is important to note that SDG&E is identifying potential ranges of costs in this Risk Mitigation Plan and is not requesting funding herein. SDG&E will integrate the results of this proceeding, including requesting approval of the activities and associated funding, in the next GRC.

SDG&E also notes that there are activities related to this Wildfire risk that will be carried over to the GRC, for which the costs are primarily internal labor (*e.g.*, employee time spent for internal training, performing inspections or monitoring). The costs associated with these internal labor activities are not captured in this Chapter because SDG&E does not track labor in this manner. These activities related to the Wildfire risk are: Operating Conditions; Recloser Protocols; Other Special Work Procedures; Strategy for Minimizing Public Safety Risk During High Wildfire Conditions. Public Safety Power Shutoff and Re-enerization Protocols; Mitigating the Public Safety Impact of PSPS Protocols; Disaster and Emergency Preparedness Plan; and Customer Support in Emergencies. Additionally, there are non-CPUC jurisdictional activities described in the RAMP Report; the costs associated with these activities are not presented, as they will not be carried over to the GRC. These mitigation activities related to this risk are transmission system inspections and the transmission portions of various projects, such as Wood to Steel and CNF.

In addition, as discussed in Section VI above, Table 7 below summarizes the activities for which an RSE is not provided:

Table 7: Summary of RSE Exclusions

Control/Mitigation ID	Control/Mitigation Name	Reason for No RSE Calculation
SDG&E-1-C1	Operating Conditions	Excluded internal labor – no identified cost

SDG&E-1-C2	Recloser Protocols	Excluded internal labor – no identified cost
SDG&E-1-C3	Other Special Work Procedures	Excluded internal labor – no identified cost
SDG&E-1-C4	Distribution System Inspections - Corrective Maintenance Program	Mandated activity pursuant to GO 165
SDG&E-1-C6	Substation System Inspections	Mandated activity pursuant to GO 174, see EII risk chapter
SDG&E-1-C7	Transmission System Inspections	FERC/Non-GRC activity – no identified cost
SDG&E-1-C8	Overhead Transmission and Distribution Fire-Hardening (Wood to Steel)	FERC/Non-GRC activity – no identified cost
SDG&E-1-C16	Pole Brushing	Mandated activity pursuant to PRC § 4292

VIII. ALTERNATIVE ANALYSIS

Consistent with D.14-12-025 and D.16-08-018, SDG&E considered alternatives to the mitigations for the Wildfire risk. Typically, analysis of alternatives occurs when implementing activities to obtain the best result or product for the cost. The alternatives analysis for this Risk Mitigation Plan also considered modifications to the presented plan and constraints, such as budget and resources.

The scenario of undergrounding the overhead electric infrastructure in the HFTD in its entirety, as a means to eliminate Wildfire risk in the most prone areas, has been previously discussed but was not considered as a formal alternative in this Report. While there would be notable benefits to undergrounding in the HFTD, the idea is largely infeasible and would be extremely costly. Undergrounding the entire HFTD would cost in the tens of billions of dollars. In addition, given the terrain, remote location, and environmental requirements (*e.g.*, permitting and environmental impacts), SDG&E may not be able to execute undergrounding in the entire HFTD. Further, large-scale undergrounding would take a long time to construct, during which SDG&E and the public would continue to bear unaddressed risk. Rather than undergrounding the entire HFTD, SDG&E's Risk Mitigation Plan utilizes a targeted approach to strategically

underground critical areas while leveraging other hardening techniques, such as FiRM, covered conductor, and technology solutions.

A. SDG&E-1-A1 – In-Line Disconnect Removal/Replacement Program

SDG&E has different types of equipment throughout its service territory used as sectionalizing devices. One specific sectionalizing device is called an in-line disconnect. These devices provide a sectionalizing location on a distribution circuit and are normally closed (*i.e.*, they are not used in conjunction with a recloser or a voltage regulator as a bypass). During an outage restoration or in locations with limited clearances, these devices have been used to assist with sectionalizing efforts to reduce the numbers of customers impacted during an outage or when requested by field crews to provide isolation points. This specific type of sectionalizing device is not installed directly on the pole like other devices, but rather is installed on the conductor roughly 20 inches away from the pole, similarly to a splice/connector.

With roughly 160 in-line disconnects in the HFTD, SDG&E considered proposing a program to remove these in-line disconnects within the HFTD. The removal of these units pertains to the equipment not being CAL FIRE approved and the potential for an ignition to occur.

This program was dismissed because SDG&E found different means to address the issue. While in-line disconnects can cause sparks upon operation, SDG&E is not aware of in-line disconnects being a source of an ignition while closed and energized. Given that the risk only occurs while operating these disconnects under voltage, SDG&E has implemented work restrictions, as described in activity SDG&E-1-C3 above, which restricts these types of operation during FPI elevated or higher. With work restrictions, this alternative would be unnecessary, as the risk is otherwise mitigated.

1. RSE Inputs and Basis

Scope	Estimated 1% of wildfire risk is due to incidents involving in-line disconnects. Approximately 3% of in-line disconnects in HFTD Tier 3 and 2.7% of in-line disconnects in HFTD Tier 2 to be replaced.
Effectiveness	Estimated effectiveness of 100% where in-line disconnects are replaced.
Risk Reduction	Overall risk reduction is estimated to be 0.01%.

2. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.32	**7215.25**	10085.12
Post-Mitigation	**LoRE**		**29.996**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5492.54	**7214.21**	10083.68
	RSE	7.79	**10.24**	14.31

B. SDG&E-1-A2 - Bridged Fuse Removal/Replacement Program

As stated in alternative SDG&E-1-A1, SDG&E has different types of equipment throughout its service territory that are used as sectionalizing devices. Another type of equipment is a bridged fuse (*i.e.*, a solid blade disconnect), which provides a sectionalizing location on a distribution circuit. During outage restoration or isolation of known damaged equipment, these units have assisted operations with reducing the customer impact and providing isolation points for crews to perform construction or maintenance work. These types of sectionalizing devices are installed to replace fuses when coordination from downstream fuses cannot occur. There are roughly 400 bridge fuses within the HFTD.

SDG&E considered proposing to remove these bridged fuses within the HFTD through a formal replacement program. The removal of these units pertains to the equipment not being CAL FIRE approved and potentially becoming an ignition source. After an operation requiring these devices to be opened and then closed, the limited visibility and existing design of the devices can result in a poor connection. If the contacts are not properly connected and then energized, there is potential for a hot connection that could potentially fail.

However, SDG&E is not moving forward with this program because this type of failure has never caused an ignition, so the historical data does not support this type of program. In addition, SDG&E is implementing another distribution inspection mitigation measure, referred to as the IR/Corona program (see activity SDG&E1-M5), which should detect this type of failure before it happens, thus mitigating much of the same risk as the considered alternative program.

1. RSE Inputs and Basis

Scope	An estimated 0.03% of wildfire risk is due to bridged fuses.
Effectiveness	80% risk reduction per replacement.
Risk Reduction	Estimated overall risk reduction of 0.01%, when accounting for PSPS.

2. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.32	**7215.25**	10085.12
Post-Mitigation	**LoRE**		**29.997**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5492.78	**7214.53**	10084.12
	RSE	12.95	**17.01**	23.78

C. SDG&E-1-A3 – Increase Frequency of QA/QC Inspections

SDG&E considered modifying its QA/QC inspection program to increase the frequency of inspections within the HFTD Tier 3. Under this alternative, the frequency of inspections within the HFTD Tier 3 would increase from a three-year cycle to an annual cycle. The rationale for accelerating the inspection cycle would be to identify any infractions that pose an ignition risk sooner to eliminate the ignition risk. This would represent a significant increase in inspections, moving from approximately 15,000 poles annually to 45,000 poles annually.

After further consideration, SDG&E decided to dismiss accelerating the QA/QC program at this time. As shown above in the Risk Mitigation Plan, SDG&E is piloting new inspection programs including IR/Corona and drones. By utilizing new technology, SDG&E intends to provide a different way to assess its system that may be preferred in the interim to annual QA/QC inspections. Following the pilot of these new inspection programs, SDG&E will reevaluate to see if changes to its inspection programs are warranted. Further, because the HFTD QA/QC inspections are performed on a three-year cycle, and CMP also includes inspections in the HFTD on a five-year cycle, certain structures in the HFTD would already be reviewed more frequently than a three-year cycle. Accordingly, SDG&E dismissed accelerating its QA/QC inspections at this time, in favor of its Risk Mitigation Plan.

1. RSE Inputs and Basis

Scope	Annual inspection program schedule.
Effectiveness	The preliminary estimate is that these inspections will reduce risk by 0.025%.
Risk Reduction	Preliminary estimated reduction of 0.025%.

2. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**30.000**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5493.32	**7215.25**	10085.12
Post-Mitigation	**LoRE**		**29.9925**	
	CoRE	183.11	**240.51**	336.17
	Risk Score	5491.95	**7213.45**	10082.60
	RSE	15.82	**20.78**	29.04

Table 8: Alternative Mitigation Summary[128]
(Direct 2018 $000)[129]

ID	Alternative	2020-2022 Capital[130]	2022 O&M	Total[131]	RSE[132]
SDG&E-1-A1	In-Line Disconnect Removal/Replacement Program	2,200-2,600	0-0	2,200-2,600	7.79-14.31
SDG&E-1-A2	Bridged Fuse Removal / Replacement Program	890-1,100	0-0	890-1,100	12.95-23.78
SDG&E-1-A3	Increase Frequency of QA/QC Inspections	0-0	1,000-1,200	1,000-1,200	15.82-29.04

[128] Forecast ranges were rounded. Additional cost-related information is provided in workpapers. Costs presented in the workpapers may differ from this table due to rounding.

[129] The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2018 dollars and have not been escalated to 2019 amounts.

[130] The capital presented is the sum of the years 2020, 2021, and 2022, or a three-year total.

[131] Total = 2020, 2021 and 2022 Capital + 2022 O&M amounts.

[132] The RSE ranges are further discussed in Chapter RAMP-C and in Section VI above.

APPENDIX A: SUMMARY OF ELEMENTS OF RISK BOW TIE ADDRESSED

ID	Control/Mitigation Name	Drivers/Triggers/Potential Consequences Addressed
SDG&E-1-C1	Operating Conditions	DT.7, DT.8, DT.9, DT.10, PC.2, PC.5, PC.6
SDG&E-1-C2	Recloser Protocols	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.8, PC2, PC.5, PC.6
SDG&E-1-C3	Other Special Work Procedures	DT.6, DT.7, DT.8, DT.9, DT.10, PC.2, PC.5, PC.6
SDG&E-1-C4	Distribution System Inspections – Corrective Maintenance Program	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.8, DT.10
SDG&E-1-C5	Distribution System Inspections – Quality Assurance/Quality Control	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.8, DT.10
SDG&E-1-M1	Distribution System Inspections – Infrared/Corona	DT.1, DT.2, DT.3
SDG&E-1-M2	Distribution System Inspections – Drone Inspections	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.8, DT.10
SDG&E-1-M3	Distribution System Inspections – Circuit Ownership	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.8, DT.10
SDG&E-1-C6	Substation System Inspections	DT.1, DT.2, DT.3, DT.4, DT.6, DT.8, DT.10
SDG&E-1-C7	Transmission System Inspections	DT.1, DT.2, DT.3, DT.4, DT.6, DT.8, DT.10
SDG&E-1-C8	Overhead Transmission and Distribution Fire-Hardening (Wood to Steel)	DT.1, DT.2, DT.3, DT.5, DT.8, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
SDG&E-1-M4	Strategic Undergrounding	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.7, DT.8, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
SDG&E-1-C9	Cleveland National Forest Fire-Hardening	DT.1, DT.2, DT.3, DT.5, DT.8, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
SDG&E-1-C10/M5	Fire Risk Mitigation	DT.1, DT.2, DT.3, DT.5, DT.8, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
SDG&E-1-C11/M6	Pole Risk Mitigation and Engineering	DT.1, DT.2, DT.3, DT.5, DT.8, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
SDG&E-1-M7	Expulsion Fuse Replacement	PC.1, PC.2, PC.3, PC.5, PC.6
SDG&E-1-M8	Hotline Clamps	DT.1, DT.2, PC.1, PC.2, PC.3, PC.5, PC.6
SDG&E-1-C12/M9	Wire Safety Enhancement	DT.1, DT.2, DT.3, DT.8, PC.4, PC.5, PC.6

ID	Control/Mitigation Name	Drivers/Triggers/Potential Consequences Addressed
SDG&E-1-M10	Covered Conductor	DT.1, DT.2 DT.3, DT.4, DT.6, DT.8, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
SDG&E-1-C13/M11	Fire Threat Zone Advanced Protection	DT.1, DT2, DT.8; PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
SDG&E-1-M12	LTE Communication Network	DT.1, DT.2, DT.8 DT.9, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
SDG&E-1-M13	Public Safety Power Shutoff Engineering Enhancements	PC.4, PC.6
SDG&E-1-C14/M14	Replacement and Reinforcement	DT.1, DT.2, DT.3, DT.5, DT.8
SDG&E-1-M15	Backup Power for Resilience – Generator Grant, Critical Infrastructure, and HPWREN	PC.4, PC.6
SDG&E-1-M16	Backup Power for Resilience – Microgrids	PC.4, PC.6
SDG&E-1-M17	Lightning Arrester Removal/Replacement Program	DT.2, PC.1, PC.2, PC.3, PC.5, PC.6
SDG&E-1-M18	SCADA Capacitors	DT.2, PC.1, PC.2, PC.3, PC.5, PC.6
SDG&E-1-C15	Tree Trimming	DT.1, DT.2, DT.3, DT.6, DT.8, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
SDG&E-1-C16	Pole Brushing	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
SDG&E-1-M19	Enhanced Vegetation Management	DT.1, DT.2, DT.3, DT.6, DT.8, PC.1, PC.2, PC.3, PC.5, PC.6
SDG&E-1-M20	Fuel Management Program	DT.6, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
SDG&E-1-C17	Fire Science & Climate Adaptation Department	DT.7, DT.8, DT.9, DT.10, PC.1, PC.2, PC.3, PC.5, PC.6
SDG&E-1-C18/M21	Wildfire Risk Reduction Model – Operational System (WRRM – Ops) and Fire Science Enhancements	DT.9, DT.10, PC.1, PC.2, PC.3, PC.5, PC.6
SDG&E-1-C19/M22	Camera Networks and Advanced Weather Station Integration	DT.9, DT.10, PC.1, PC.2, PC.3, PC.5, PC.6
SDG&E-1-C20/M23	High-Performance Computing Infrastructure	DT.9, DT.10, PC.1, PC.2, PC.3, PC.5, PC.6
SDG&E-1-M24	Ignition Management Program	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.7, DT.8, DT.10

ID	Control/Mitigation Name	Drivers/Triggers/Potential Consequences Addressed
SDG&E-1-C21/M25	Asset Management	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.7 DT.8, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
SDG&E-1-M26	Monitoring and Correcting Deficiencies	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.7 DT.8, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
SDG&E-1-M27	Wildfire Mitigation Personnel	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.7 DT.8, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
SDG&E-1-M28	NMS Situational Awareness Upgrades	DT.9, DT.10
SDG&E-1-M29	Situational Awareness Dashboard	DT.9, DT.10, PC.1, PC.2, PC.3, PC.5, PC.6
SDG&E-1-C22	Strategy for Minimizing Public Safety Risk During High Wildfire Conditions, PSPS and Re-Energization Protocols	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
SDG&E-1-C23/M30	Communication Practices	DT.7, DT.9, PC.5, PC.6
SDG&E-1-C24	Mitigating the Public Safety Impact of PSPS Protocols	DT.7, DT.9, PC.1, PC.2, PC.3, PC.5, PC.6
SDG&E-1-C25/M31	Emergency Management Operations	DT.9, PC.1, PC.2, PC.3, PC.5, PC.6
SDG&E-1-C26	Disaster and Emergency Preparedness Plan	DT.9, PC.1, PC.2, PC.3, PC.5, PC.6
SDG&E-1-C27	Customer Support in Emergencies	DT.9, PC.6
SDG&E-1-C28/M32	Wildfire Infrastructure Protection Teams (Contract Fire Resources)	DT.9, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
SDG&E-1-C29/M33	Aviation Firefighting Program	DT.9, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
SDG&E-1-C30	Industrial Fire Brigade	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
SDG&E-1-C31/M34	Wireless Fault Indicators	DT.9, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6