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ATTACHMENT 4
(WMP Metrics)

Progress and outcome metrics

Contents

1 Background

The 2019 utility WMP submissions did not use a consistent set of metrics to track the outcome of utility mitigation programs. Metrics proposed by utilities primarily tracked the utility's progress to their own WMP activity targets and were more accurately termed "Program Targets" that did not actually measuring the wildfire mitigation outcomes generated by that plan. Moreover, the lack of consistent metrics used across utilities created challenges for comparing the outcomes of each utility's plan.

Metrics

The WSD will adopt three sets of metrics:

1. Progress metrics that are designed to track concrete actions toward reducing wildfire risk. Progress metrics include absolute metrics (e.g., number of grid condition findings per circuit mile)
2. Program targets, which outline utility progress toward the utility's own specific targets identified in their WMP
3. Outcome metrics that track wildfire and PSPS related outcomes on impacted communities. Outcome metrics include leading and lagging indicators of wildfire and PSPS risk and while they describe utility risk reduction, they may be collected from a variety of sources including utilities themselves, CAL FIRE, Cal OES, and others

The metrics below follow six key principles:

1. Taken together, metrics should provide a complete picture of utility's contribution to and impact on WSD and overall CPUC longer-term objectives
2. A good metric should track information that can be used to inform action, such as grid operations or capital allocation
3. Metrics should include both lagging indicators, to understand past incidents and help prevent recurrence, and also leading indicators, to understand near-misses and help avoid potential incidents
4. Going forward, data analysis should be used to determine which metrics best predict and/or reflect wildfire risk to update the list of metrics accordingly
5. Each metric should be provided in consistent units and normalized by relevant factors across utilities to ensure comparability across years and across service territories
6. Metrics should be auditable, such that the WSD and potentially third parties can independently verify all utility-reported metrics

2 Glossary of defined terms

Term	Definition
10-hour dead fuel moisture content	Moisture content of small dead vegetation (e.g. grass, leaves, which burn quickly but not intensely), which can respond to changes in atmospheric moisture content within 10 hours.
Access and functional needs populations	Per Government Code § 8593.3 and D.19-05-042, individuals who have developmental or intellectual disabilities, physical disabilities, chronic conditions, injuries, limited English proficiency or who are non-English speaking, older adults, children, people living in institutionalized settings, or those who are low income, homeless, or transportation disadvantaged, including, but not limited to, those who are dependent on public transit or those who are pregnant.
Authority Having Jurisdiction	AHJ, party with assigned responsibility, depending on location and circumstance.
Asset (utility)	Electric lines, equipment, or supporting hardware.
At-risk species	Species of vegetation that are particularly likely to contact power lines in the event of high winds and/or ignite if they catch a spark.
Baseline (ignition probability, maturity)	A measure, typically of the current state, to establish a starting point for comparison.
Carbon dioxide equivalent	Tons of greenhouse gases (GHG) emitted, multiplied by the global warming potential relative to carbon dioxide.
Contractor	Any individual in the temporary and/or indirect employ of the utility whose limited hours and/or time-bound term of employment are not considered as “full-time” for tax and/or any other purposes.
Critical facilities and infrastructure	In accordance with the interim definition adopted in D.19-05-042, those facilities and infrastructure that are essential to the public safety and that require additional assistance and advance planning to ensure resiliency during de energization events, namely: emergency services sector (police stations, fire stations, emergency operations centers), government facilities sector (schools, jails, prisons), healthcare and public health sector (public health departments, medical facilities, including hospitals, skilled nursing facilities, nursing homes, blood banks, health care facilities, dialysis centers and hospice facilities), energy sector (public and private utility facilities vital to maintaining or restoring normal service, including, but not limited to, interconnected publicly owned utilities and electric cooperatives), water and wastewater systems sector (facilities associated with the provision of drinking water or processing of wastewater including facilities used to pump, divert, transport, store, treat and deliver water or wastewater), communications sector (communication carrier infrastructure including selective routers, central offices, head ends, cellular switches, remote terminals and cellular sites), and chemical sector (facilities associated with the provision of manufacturing, maintaining, or distributing hazardous materials and chemicals).

Customer hours	Total number of customers, multiplied by the average number of hours (e.g. of power outage).
Data cleaning	Calibrating raw data to remove errors (including typographical and numerical mistakes).
Dead fuel moisture content	Moisture content of dead vegetation, which responds solely to current environmental conditions and is critical in determining fire potential.
Detailed inspection	In accordance with GO 165, an inspection where individual pieces of equipment and structures are carefully examined, visually and through use of routine diagnostic test, as appropriate, and (if practical and if useful information can be so gathered) opened, and the condition of each rated and recorded.
Enhanced inspection	Inspection whose frequency and thoroughness exceeds the requirements of the detailed inspection, particularly if driven by risk calculations.
Evacuation impact	Number of people evacuated, with the duration for which they are evacuated, from homes and businesses, due to wildfires.
Evacuation zone	Areas designated by CAL FIRE and local fire agency evacuation orders, to include both "voluntary" and "mandatory" in addition to other orders such as "precautionary" and "immediate threat".
Fuel density	Mass of fuel (vegetation) per area which could combust in a wildfire.
Fuel management	Removing or thinning vegetation to reduce the potential rate of propagation or intensity of wildfires.
Fuel moisture content	Amount of moisture in a given mass of fuel (vegetation), measured as a percentage of its dry weight.
Full-time employee	Any individual in the ongoing and/or direct employ of the utility whose hours and/or term of employment are considered as "full-time" for tax and/or any other purposes.
Greenhouse gas (GHG) emissions	Health and Safety Code 38505 identifies seven greenhouse gases that ARB is responsible to monitor and regulate in order to reduce emissions: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), sulfur hexafluoride (SF6), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and nitrogen trifluoride (NF3).
GO 95 nonconformance	Condition of a utility asset that does not meet standards established by General Order 95.
Grid hardening	Actions (such as equipment upgrades, maintenance, and planning for more resilient infrastructure) taken in response to the risk of undesirable events (such as outages) or undesirable conditions of the electrical system in order to reduce or mitigate those events and conditions, informed by an assessment of the relevant risk drivers or factors.
Grid topology	General design of an electric grid, whether looped or radial, with consequences for reliability and ability to support de-energization (e.g., being able to deliver electricity from an additional source).
High Fire Threat District	Per D.17-01-009, areas of the State designated by the CPUC and CAL FIRE to have elevated wildfire risk, indicating where utilities must take additional action (per GO 95, GO 165, and GO 166) to mitigate wildfire risk.
Highly rural region	In accordance with 38 CFR 17.701, "highly rural" shall be defined as those areas with a population of less than 7 persons per square mile.
Ignition probability	The relative possibility that an ignition will occur, probability is quantified as a number between 0% and 100% (where 0% indicates impossibility and 100% indicates certainty). The higher the probability of an event, the more certainty there is that the event will occur. (Often informally referred to as likelihood or chance).

Ignition-related deficiency	Any condition which may result in ignition or has previously resulted in ignition, even if not during the past five years.
Impact of ignitions	The effect or outcome of a wildfire ignition, affecting objectives, which may be expressed by terms including, although not limited to health, safety, reliability, economic and/or environmental damage.
Initiative	Measure or activity proposed or in process designed to reduce the consequences and/or probability of wildfire or PSPS.
Inspection protocol	Documented procedures to be followed in order to validate that a piece of equipment is in good condition and expected to operate safely and effectively.
Invasive species	Non-native species whose proliferation increases the risk of catastrophic wildfires.
Level 1 finding	In accordance with GO 95, an immediate safety and/or reliability risk with high probability for significant impact.
Level 2 finding	In accordance with GO 95, a variable (non-immediate high to low) safety and/or reliability risk.
Level 3 finding	In accordance with GO 95, an acceptable safety and/or reliability risk.
Life expectancy	Anticipated years that a piece of equipment can be expected to meet safety and performance requirements.
Limited English Proficiency (LEP)	Populations with limited English working proficiency based on the International Language Roundtable scale.
Live fuel moisture content	Moisture content within living vegetation, which can retain water longer than dead fuel.
Lost energy	Energy that would have been delivered were it not for an outage.
Major roads	Interstate highways, U.S. highways, state and county routes.
Match drop simulation	Wildfire simulation method that takes an arbitrary ignition and forecasts propagation and impact.
Member of the public	Any individual not employed by the utility.
Multi-attribute value function	Risk calculation methodology introduced during CPUC's S-MAP and RAMP proceedings.
Near miss	An event with significant probability of ignition, including wires down, contacts with objects, line slap, events with evidence of significant heat generation, and other events that cause sparking or have the potential to cause ignition.
Near-miss simulation	Simulation of what the consequence would have been of an ignition had it occurred.
Need for PSPS	When utilities' criteria for utilizing PSPS are met.
Noncompliant clearance	Rights-of-way whose vegetation is not trimmed in accordance with the requirements of GO 95.
Outages of the type that could ignite a wildfire	Outages that, in the judgement of the utility, could have ignited a wildfire.
Outcome metrics	Measurements of the performance of the utility and its service territory in terms of both leading and lagging indicators of wildfire, PSPS, and other consequences of wildfire risk, including the potential unintended consequences of wildfire mitigation work, such as acreage burned by utility-ignited wildfire.

Overcapacity	When the energy transmitted by utility equipment exceeds that of its nameplate capacity.
Patrol inspection	In accordance with GO 165, a simple visual inspection of applicable utility equipment and structures that is designed to identify obvious structural problems and hazards. Patrol inspections may be carried out in the course of other company business.
Percentile conditions	Top X% of a particular set (e.g. wind speed), based on a historical data set with sufficient detail.
Planned outage	Electric outage announced ahead of time by the utility.
Preventive maintenance (PM)	The practice of maintaining equipment on a regular schedule, based on risk, elapsed time, run-time meter readings, or number of operations. The intent of PM is to "prevent" maintenance problems or failures before they take place by following routine and comprehensive maintenance procedures. The goal is to achieve fewer, shorter, and more predictable outages.
Priority essential services	Critical first responders, public safety partners, critical facilities and infrastructure, operators of telecommunications infrastructure, and water utilities/agencies.
Program targets	Measurements of activity identified in WMPs and subsequent annual updates, in terms of volume or scope of work, such as number trees trimmed or miles of power lines hardened.
Progress metrics	Measurements that track how much utility wildfire mitigation activity has changed the conditions of utility wildfire risk exposure or utility ability to manage wildfire risk exposure, in terms of leading indicators of ignition probability and wildfire consequences.
Property	Private and public property, buildings and structures, infrastructure, and other items of value that were destroyed by wildfire, including both third-party property and utility assets.
PSPS risk	The potential for the occurrence of a PSPS event expressed in terms of a combination of various outcomes of the event and their associated probabilities.
PSPS weather	Weather that exceeds a utility's risk threshold for initiating a PSPS.
Red Flag Warning	RFW, level of wildfire risk from weather as declared by the National Weather Service.
RFW Circuit Mile Day	Sum of miles of utility grid subject to Red Flag Warning each day (e.g. 2 RFW circuit mile days could come from an RFW on 2 miles for 1 day, or from 1 mile on 2 separate days).
Risk-spend efficiency	An estimate of the cost-effectiveness of initiatives, calculated by dividing the mitigation risk reduction benefit by the mitigation cost estimate based on the full set of risk reduction benefits estimated from the incurred costs.
Rule	Section of public utility code requiring a particular activity or establishing a particular threshold.
Run-to-failure	A maintenance approach that replaces equipment only when it fails.
Rural region	In accordance with GO 165, "rural" shall be defined as those areas with a population of less than 1,000 persons per square mile as determined by the United States Bureau of the Census.
Safety Hazard	A condition that poses a significant threat to human life or property.
Simulated wildfire	Propagation and impact of a wildfire ignited at a particular point ('match drop'), as simulated by fire spread software.

Span	The space between adjacent supporting poles or structures on a circuit consisting of electric line and equipment. "Span level" refers to asset-scale granularity.
System Average Interruption Duration Index (SAIDI)	System-wide total number of minutes per year of sustained outage per customer served.
Third-party contact	Contact between a piece of electrical equipment and another object, whether natural (tree branch) or human (vehicle).
Time to expected failure	Time remaining on the life expectancy of a piece of equipment.
Top 30% of proprietary fire potential index	Top 30% of FPI or equivalent scale (e.g., “Extreme” on SCE’s FPI; “extreme”, 15 or greater, on SDG&E’s FPI; and 4 or above on PG&E’s FPI).
Trees with strike potential / hazard trees	Trees that could either 'fall in' to a power line, or have branches detach and 'fly in' to contact a power line in high-wind conditions.
Unplanned outage	Electric outage that occurs with no advance notice from the utility (e.g. blackout).
Urban region	In accordance with GO 165, "urban" shall be defined as those areas with a population of more than 1,000 persons per square mile as determined by the United States Bureau of the Census.
Utility-ignited wildfire	Wildfires ignited by utility infrastructure or employees, including all wildfires determined by AHJ investigation to originate from ignition caused by utility infrastructure.
Vegetation risk index	Risk index indicating the probability of vegetation-related outages along a particular circuit, based on the vegetation species, density, height, and growth rate.
Vegetation management	Trimming and clearance of trees, branches, and other vegetation that poses the risk of contact with electric equipment.
Weather normalization	Adjusting metrics based on relative weather risk, with RFW circuit mile days as the normalization factor
Wildfire consequence	The effect or outcome of a wildfire affecting objectives, which may be expressed, by terms including, although not limited to health, safety, reliability, economic and/or environmental damage.
Wildfire risk	The potential for the occurrence of a wildfire event expressed in terms of a combination of various outcomes of the wildfire and their associated probabilities.
Wildfire-only WMP programs	Activities, practices, and strategies that are only necessitated by wildfire risk, unrelated to or beyond that required by minimum reliability and/or safety requirements. Such programs are not indicated or in common use in areas where wildfire risk is minimal (e.g., territory with no vegetation or fuel) or under conditions where wildfires are unlikely to ignite or spread (e.g., when rain is falling).
Wildland urban interface (WUI)	A geographical area identified by the state as a “Fire Hazard Severity Zone”, or other areas designated by the enforcing agency to be a significant risk from wildfires, established pursuant to Title 24, Part 2, Chapter 7A.
Wire down	Instance where an electric transmission or distribution conductor is broken and falls from its intended position to rest on the ground or a foreign object.

3 Progress metrics to track implementation

All progress metrics are based on information that is proprietary to the utility or shall be collected and reported by the utility. All progress metrics are also leading indicators of ignition probability and/or wildfire consequence, such that they can produce insights into the likelihood and/or impact of potential near-misses or incidents and provide some guidance about options to mitigate against them and/or the unintended consequences of efforts to mitigate against them.

Table 1 Progress metrics to track implementation

#	Progress metric name	Unit(s)	Sources	Collection frequency	Example options for audit
1	Grid condition findings from inspection	Number of Level 1, 2, and 3 findings per mile of circuit in HFTD, and per total miles of circuit for each of the following inspection types: 1. Patrol inspections 2. Detailed inspections 3. Other inspection types	Utility reporting	Monthly	Deep-dive audits of select portions of utility grid
2	Vegetation clearance findings from inspection	Percentage of right-of-way with noncompliant clearance based on applicable rules and regulations at the time of inspection	Utility reporting	Monthly	Deep-dive audits of select portions of right-of-way
3	Extreme weather prediction accuracy	Percentage of total PSPS predictions that are false positives or false negatives 2 days before a potential PSPS event	Utility reporting	Post-event	NWS, UCSD, CAL FIRE Predictive Services
4	Extent of grid modularization	Number of sectionalizing devices per circuit mile and number of automated grid control equipment in: 1. HFTD 2. Non-HFTD	Utility reporting	Quarterly	Deep-dive audits of select portions of utility grid
5	Equipment operating load above nameplate capacity	Number of circuit hours operated above nameplate capacity in HFTD areas	Utility reporting	Quarterly	Deep-dive audits of select portions of utility grid, CAISO

#	Progress metric name	Unit(s)	Sources	Collection frequency	Example options for audit
		Average % above nameplate capacity when equipment operated above nameplate capacity in HFTD areas			
6	Risk-spend efficiency of resources deployed towards wildfire mitigation efforts	Dollars per incremental life saved Dollars invested per estimated dollars of rebuilt structures avoided Dollars per customer hour of PSPS avoided	Utility reporting	Quarterly	Calculation inputs and methodology for re-computing by third-party
7	Extent of hardening across grid	Percent of all grid assets in HFTD areas using proven and demonstrated wildfire-resistant equipment	Utility reporting	Monthly	Deep-dive audits of select portions of utility grid
8	Community engagement activity and effectiveness	Percent of residents made aware of PSPS and emergency response procedures in advance of events, according to post-event surveys Percent of residents agreeing to participate in utility wildfire risk-reduction activities (e.g., allowing access to property for utility hazard tree remediation)	Utility reporting	Quarterly	Resident survey, Fire Safety Councils, audit of wildfire risk reduction activity
9	Emergency planning and preparedness	Number of emergency response deficiencies reported by Cal OES, suppression agencies, and other emergency response personnel when plans tested or activated	Utility reporting	Post-event	CAL FIRE, Cal OES, employee survey, Fire Safety Councils
10	Data collection and reporting	Percent of data requested in SDR and WMP collected in initial submission Number of data elements shared publicly by utilities	Utility reporting	Quarterly	Database access and records, party listserv, and surveys

4 Outcome metrics to track wildfire risk reduction outcomes

The goal of outcome metrics is to track wildfire and PSPS-related outcomes on impacted communities, including monitoring for potential unintended consequences of wildfire mitigation activities. These metrics include leading indicators and lagging indicators and may be sourced directly from each utility or sourced from other agencies. Therefore, the outcome metrics are organized into four categories, as follows:

Group 1A: Generally sourced from utility, leading indicators
Group 1B: Generally sourced from utility, lagging indicators
Group 2A: Generally sourced from a variety of other stakeholders, leading indicators
Group 2B: Generally sourced from a variety of other stakeholders, lagging indicators

Source:	**Utility**	**Other stakeholders**
Leading	1A	2A
Lagging	1B	2B

Leading indicators can produce insights into the likelihood and/or impact of potential near-misses or other avoided wildfire and PSPS incidents. Leading indicators are particularly helpful in identifying trends before rare, high impact events like wildfires happen and help to understand the statistical significance of any actual events.

Lagging indicators quantify the impact of wildfires and/or wildfire mitigation actions by measuring actual impacts incurred, for example due to a wildfire or PSPS event. Lagging indicators can help generate insights about how to prevent or mitigate future events and/or the unintended consequences of efforts to mitigate against them.

Table 2 Outcome metrics to track wildfire risk reduction outcomes

Metric type	#	Outcome metric name	Unit(s)	Sources	Collection frequency	Example options for audit
Group 1A: Generally sourced from utility, leading indicators						
1. Near misses	1.a.	Number of all events (such as unplanned outages, faults, conventional blown fuses, etc.) that could result in ignition, by type according to utility-provided list (total)	Number per year	Utility reporting	Quarterly	Utility repair logs, smart meters, consumer surveys
	1.b.	Number of all events (such as unplanned outages, faults, conventional blown fuses, etc.) that could result in ignition, by type according to utility-provided list (normalized)	Number per RFW circuit mile day per year	Utility reporting	Quarterly	Utility repair logs, smart meters, consumer surveys
	1.c.	Number of wires down (total)	Number of wires down per year	Utility reporting	Quarterly	Utility repair logs, smart meters, consumer surveys
	1.d.	Number of wires down (normalized)	Number per RFW circuit mile day per year	Utility reporting	Quarterly	Utility repair logs, Smart meters, consumer surveys
2. Utility inspection findings	2.a.	Number of Level 1 findings that could increase the probability of ignition discovered per circuit mile	Average number of Level 1 findings that could increase the probability of ignition discovered by	Utility reporting	Quarterly	Deep-dive audits of select portions of utility grid; utility inspection logs

Metric type	#	Outcome metric name	Unit(s)	Sources	Collection frequency	Example options for audit
			all inspections per circuit mile per year			
	2.b.	Number of Level 2 findings that could increase the probability of ignition discovered per circuit mile	Average number of Level 2 findings that could increase the probability of ignition discovered by all inspections per circuit mile per year	Utility reporting	Quarterly	Deep-dive audits of select portions of utility grid; utility inspection logs
	2.c.	Number of Level 3 findings that could increase the probability of ignition discovered per circuit mile	Average number of Level 3 findings that could increase the probability of ignition discovered by all inspections per circuit mile per year	Utility reporting	Quarterly	Deep-dive audits of select portions of utility grid; utility inspection logs
3. Risk spend efficiency of WMP programs	3.a.	Average risk spend efficiency of all WMP programs being undertaken by utility	Incremental cost per grid-wide 1% reduction in utility ignition in HFTD areas	Utility reporting	Quarterly	GRC, wildfire memorandum accounts, third party recalculation
	3.b.	Average risk spend efficiency of wildfire-only WMP programs being undertaken by utility	Incremental cost per grid-wide 1% reduction in utility ignition in HFTD areas	Utility reporting	Quarterly	GRC, third party recalculation
4. Planned renewable energy procurement	4.a.	Contracts for future purchases of renewable energy	% of total estimated electricity procurement per year	Utility reporting	Quarterly	Contract review
5. Customer hours of PSPS based	5.a.	Percent of customers experiencing PSPS given 95th percentile fire weather conditions along	Percent of all customers	Utility reporting and modeling, using agreed	Annual	Third party expert evaluation using

Metric type	#	Outcome metric name	Unit(s)	Sources	Collection frequency	Example options for audit
on stress test conditions		entire grid using utility PSPS decision protocols		historical weather conditions		utility PSPS decision protocol
	5.b.	Percent of customers experiencing PSPS given 99th percentile fire weather conditions along entire grid using utility PSPS decision protocols	Percent of all customers	Utility reporting and modeling, using agreed historical weather conditions	Annual	Third party expert evaluation using utility PSPS decision protocol
Group 1B: Generally sourced from utility, lagging indicators						
6. Customer hours of PSPS and other outages	6.a.	Customer hours of planned outages including PSPS (total)	Total customer hours of planned outages per year	Utility reporting	Quarterly	Consumer survey, additional data from smart meters
	6.b.	Customer hours of planned outages including PSPS (normalized)	Total customer hours of planned outages per RFW circuit mile day per year	Utility reporting	Quarterly	Consumer survey, additional data from smart meters
	6.c.	Customer hours of unplanned outages, not including PSPS (total)	Total customer hours of unplanned outages per year	Utility reporting	Quarterly	Consumer survey, additional data from smart meters
	6.d.	Customer hours of unplanned outages, not including PSPS (normalized)	Total customer hours of unplanned outages per RFW circuit mile day per year	Utility reporting	Quarterly	Consumer survey, additional data from smart meters
	6.e.	Increase in System Average Interruption Duration Index (SAIDI)	Change in minutes compared to the previous year	Utility reporting	Quarterly collection	Third party auditor, consumer survey, smart meter data

Metric type	#	Outcome metric name	Unit(s)	Sources	Collection frequency	Example options for audit
7. Electricity cost to ratepayers	7.a.	Increase in electric costs to ratepayer due to wildfires (total)	Dollar value rates increase attributable to wildfires per year	Utility reporting	Collected at GRC cadence	TURN, utility reports, consumer surveys
	7.b.	Increase in electric costs to ratepayer due to wildfires (normalized)	Dollar value rates increase attributable to wildfires per RFW circuit mile per year	Utility reporting	Collected at GRC cadence	TURN, utility reports, consumer surveys
	7.c.	Increase in electric costs to ratepayer due to wildfire mitigation activities (total)	Dollar value rates increase attributable to WMPs per year	Utility reporting	Collected at GRC cadence	TURN, utility reports, consumer surveys
8. Actual renewable energy procurement	8.a.	Electricity procured from renewable sources	Percentage of total electricity procured per year	Utility reporting	Annual	Review of contracts with generation companies
Group 2A: Generally sourced from a variety of other stakeholders, leading indicators						
9. Impact of utility ignitions based on ignition simulation	9.a.	Potential impact of ignitions (total)	Number of people residing in evacuation zones of wildfires simulated for each ignition per year, based on in-house or contractors' fire spread models	CAL FIRE and utility reporting	Annual	Satellite data, Fire Safety Council interviews, utility ignition reporting and fire spread modelling
	9.b.	Potential impact of ignitions (normalized)	Number of people residing in evacuation zones of wildfires simulated for each	CAL FIRE and utility reporting	Annual	Satellite data, Fire Safety Council interviews, utility ignition reporting

Metric type	#	Outcome metric name	Unit(s)	Sources	Collection frequency	Example options for audit
			ignition per RFW circuit mile day per year			and fire spread modelling
	9.c.	Potential impact of ignitions in HFTD (subtotal)	Number of people residing in evacuation zones of wildfires simulated for each ignition in HFTD per year	CAL FIRE and utility reporting	Annual	Satellite data, Fire Safety Council interviews, utility ignition reporting and fire spread modelling
	9.c.i.	Potential impact of ignitions in HFTD Zone 1	Number of people residing in evacuation zones of wildfires simulated for each ignition in HFTD Zone 1 per year	CAL FIRE and utility reporting	Annual	Satellite data, Fire Safety Council interviews, utility ignition reporting and fire spread modelling
	9.c.ii.	Potential impact of ignitions in HFTD Tier 2	Number of people residing in evacuation zones of wildfires simulated for each ignition in HFTD Tier 2 per year	CAL FIRE and utility reporting	Annual	Satellite data, Fire Safety Council interviews, utility ignition reporting and fire spread modelling
	9.c.iii.	Potential impact of ignitions in HFTD Tier 3	Number of people residing in evacuation zones of wildfires simulated for each ignition in HFTD Tier 3 per year	CAL FIRE and utility reporting	Annual	Satellite data, Fire Safety Council interviews, utility ignition reporting and fire spread modelling

Metric type	#	Outcome metric name	Unit(s)	Sources	Collection frequency	Example options for audit
	9.d.	Potential impact of ignitions in HFTD (subtotal, normalized)	Number of people residing in evacuation zones of wildfires simulated for each ignition in HFTD per RFW circuit mile day per year	CAL FIRE and utility reporting	Annual	Satellite data, Fire Safety Council interviews, utility ignition reporting and fire spread modelling
	9.d.i.	Potential impact of ignitions in HFTD Zone 1 (normalized)	Number of people residing in evacuation zones of wildfires simulated for each ignition in HFTD Zone 1 per RFW circuit mile day per year	CAL FIRE and utility reporting	Annual	Satellite data, Fire Safety Council interviews, utility ignition reporting and fire spread modelling
	9.d.ii.	Potential impact of ignitions in HFTD Tier 2 (normalized)	Number of people residing in evacuation zones of wildfires simulated for each ignition in HFTD Tier 2 per RFW circuit mile day per year	CAL FIRE and utility reporting	Annual	Satellite data, Fire Safety Council interviews, utility ignition reporting and fire spread modelling
	9.d.iii.	Potential impact of ignitions in HFTD Tier 3 (normalized)	Number of people residing in evacuation zones of wildfires simulated for each ignition in HFTD Tier 3 per RFW circuit mile day per year	CAL FIRE and utility reporting	Annual	Satellite data, Fire Safety Council interviews, utility ignition reporting and fire spread modelling
	9.e.	Potential impact of ignitions in non-HFTD (subtotal)	Number of people residing in evacuation zones of wildfires	CAL FIRE and utility reporting	Annual	Satellite data, Fire Safety Council interviews, utility

Metric type	#	Outcome metric name	Unit(s)	Sources	Collection frequency	Example options for audit
			simulated for each ignition in non-HFTD per year			ignition reporting and fire spread modelling
	9.f.	Potential impact of ignitions in non-HFTD (normalized)	Number of people residing in evacuation zones of wildfires simulated for each ignition in non-HFTD per RFW circuit mile day per year	CAL FIRE and utility reporting	Annual	Satellite data, Fire Safety Council interviews, utility ignition reporting and fire spread modelling
Group 2B: Generally sourced from a variety of other stakeholders, lagging indicators						
10. Utility-ignited wildfire fatalities	10.a.	Fatalities due to utility-ignited wildfire (total)	Number of fatalities per year	Classification by fire authority having jurisdiction, utility reporting	Post-incident collection	Satellite data, Cal OES, CAL FIRE
	10.b.	Fatalities due to utility-ignited wildfire (normalized)	Number of fatalities per RFW circuit mile day per year	Classification by fire authority having jurisdiction, utility reporting	Post-incident collection	Satellite data, Cal OES, CAL FIRE
11. Fatalities from utility wildfire mitigation activities	11	Fatalities due to utility wildfire mitigation activities (total)	Number of fatalities per year	Utility OSHA reporting	Post-incident collection	OSHA, utility reporting
12. OSHA-reportable injuries from utility	12.a.	OSHA-reportable injuries due to utility wildfire mitigation activities (total)	Number of OSHA-reportable injuries per year	Utility OSHA reporting	Post-incident collection	OSHA, utility reporting

Metric type	#	Outcome metric name	Unit(s)	Sources	Collection frequency	Example options for audit
wildfire mitigation activities	12.b.	OSHA-reportable injuries due to utility wildfire mitigation activities (normalized)	Number of OSHA-reportable injuries per year per 1000 line miles of grid	Utility OSHA reporting	Post-incident collection	OSHA, utility reporting
13. Value of assets destroyed by utility-ignited wildfire, listed by asset type	13.a.	Value of assets destroyed by utility-ignited wildfire (total)	Dollars of damage or destruction per year	CAL FIRE reporting; financial experts	Post-incident collection	Satellite data, insurance claims, state funding claims
	13.b.	Value of assets destroyed by utility-ignited wildfire (normalized)	Dollars of damage or destruction per RFW circuit mile day per year	CAL FIRE reporting; financial experts	Post-incident collection	Satellite data, insurance claims, state funding claims
14. Structures damaged or destroyed by utility-ignited wildfire	14.a.	Number of structures destroyed by utility-ignited wildfire (total)	Number of structures destroyed per year	CAL FIRE reporting	Post-incident collection	Satellite data, insurance claims, state funding claims
	14.b.	Number of structures destroyed by utility-ignited wildfire (normalized)	Number of structures destroyed per RFW circuit mile day per year	CAL FIRE reporting	Post-incident collection	Satellite data, insurance claims, state funding claims
15. Public impacted by utility-ignited wildfire evacuation	15.a.	Number of people residing in evacuation zone of utility-ignited wildfire (total)	Number of people in evacuation zones of utility ignited wildfire	CAL FIRE and Cal OES reporting	Post-incident collection	State evacuation notices, population density map
	15.b.	Number of people residing in evacuation zone of utility-ignited wildfire (normalized)	Number of people per RFW circuit mile day per year	CAL FIRE and Cal OES reporting	Post-incident collection	State evacuation notices, population density map
	15.c.	Impact of evacuations for utility-ignited wildfire (total)	Person-hours per year	CAL FIRE and Cal OES reporting	Post-incident collection	State evacuation notices, population density map
	15.d.	Impact of evacuations for utility-ignited wildfire (normalized)	Person-hours per RFW circuit mile day per year	CAL FIRE and Cal OES reporting	Post-incident collection	State evacuation notices, population density map

Metric type	#	Outcome metric name	Unit(s)	Sources	Collection frequency	Example options for audit
16. Acreage burned by utility-ignited wildfire	16.a.	Acreage burned by utility-ignited wildfire (total)	Acres burned per year	CAL FIRE	Post-incident collection	Satellite data, post-incident investigation
	16.b.	Acreage burned by utility-ignited wildfire (normalized)	Acres burned per RFW circuit mile day per year	CAL FIRE	Post-incident collection	Satellite data, post-incident investigation
17. Number of utility wildfire ignitions	17.a.	Number of ignitions (total) according to existing ignition data reporting requirement	Number per year	CAL FIRE and utility reporting	Post-incident collection	Satellite data, Fire Safety Council interviews, utility ignition reporting
	17.b.	Number of ignitions (normalized)	Number per RFW circuit mile day per year	CAL FIRE and utility reporting	Post-incident collection	Satellite data, Fire Safety Council interviews, utility ignition reporting
	17.c.	Number of ignitions in HFTD (subtotal)	Number in HFTD per year	CAL FIRE and utility reporting	Post-incident collection	Satellite data, Fire Safety Council interviews, utility ignition reporting
	17.c.i.	Number of ignitions in HFTD Zone 1	Number in HFTD Zone 1 per year	CAL FIRE and utility reporting	Post-incident collection	Satellite data, Fire Safety Council interviews, utility ignition reporting
	17.c.ii.	Number of ignitions in HFTD Tier 2	Number in HFTD Tier 2 per year	CAL FIRE and utility reporting	Post-incident collection	Satellite data, Fire Safety Council interviews, utility ignition reporting
	17.c.iii.	Number of ignitions in HFTD Tier 3	Number in HFTD Tier 3 per year	CAL FIRE and utility reporting	Post-incident collection	Satellite data, Fire Safety Council interviews, utility ignition reporting

Metric type	#	Outcome metric name	Unit(s)	Sources	Collection frequency	Example options for audit
	17.d.	Number of ignitions in HFTD (subtotal, normalized)	Number in HFTD per RFW circuit mile day per year	CAL FIRE and utility reporting	Post-incident collection	Satellite data, Fire Safety Council interviews, utility ignition reporting
	17.d.i.	Number of ignitions in HFTD Zone 1 (normalized)	Number in HFTD Zone 1 per RFW circuit mile day per year	CAL FIRE and utility reporting	Post-incident collection	Satellite data, Fire Safety Council interviews, utility ignition reporting
	17.d.ii.	Number of ignitions in HFTD Tier 2 (normalized)	Number in HFTD Tier 2 per RFW circuit mile day per year	CAL FIRE and utility reporting	Post-incident collection	Satellite data, Fire Safety Council interviews, utility ignition reporting
	17.d.iii.	Number of ignitions in HFTD Tier 3 (normalized)	Number in HFTD Tier 3 per RFW circuit mile day per year	CAL FIRE and utility reporting	Post-incident collection	Satellite data, Fire Safety Council interviews, utility ignition reporting
	17.e.	Number of ignitions in non-HFTD (subtotal)	Number in non-HFTD per year	CAL FIRE and utility reporting	Post-incident collection	Satellite data, Fire Safety Council interviews, utility ignition reporting
	17.f.	Number of ignitions in non-HFTD (normalized)	Number in non-HFTD per RFW circuit mile day per year	CAL FIRE and utility reporting	Post-incident collection	Satellite data, Fire Safety Council interviews, utility ignition reporting
18. Estimated GHG emissions from utility-ignited wildfire	18.a.	GHG emissions from utility-ignited wildfires (total)	Estimated tons of carbon dioxide equivalent emitted per year	Cal ARB	Annual	CNRA calculations, USGS, independent analysis
	18.b.	GHG emissions from utility-ignited wildfires (normalized)	Estimated tons of carbon dioxide equivalent	Cal ARB	Annual	CNRA calculations, USGS, independent analysis

Metric type	#	Outcome metric name	Unit(s)	Sources	Collection frequency	Example options for audit
			emitted per RFW circuit mile day per year			
19. Transportation impacted by PSPS	19.a.	Critical transportation infrastructure impacted due to PSPS	Driver and rider-hours lost (in ridership per hour multiplied by incremental increase in commute time by hours closed) per year	Cal OES	Post-incident collection	California Transit Association, contemporary Google maps estimated travel time estimates
	19.b.	Major roads impacted due to PSPS (normalized)	Driver and rider-hours lost (in ridership per hour multiplied by incremental increase in commute time by hours closed) per RFW circuit mile day per year	Cal OES	Post-incident collection	California Transit Association, contemporary Google maps estimated travel time estimates
20. Critical infrastructure impacted	20.a.	Critical infrastructure impacted by PSPS	Number of critical infrastructure locations impacted per hour multiplied by hours offline per year	Utility, Cal OES	Post-incident collection	Utility data, Cal OES, survey of critical infrastructure personnel
	20.b.	Critical infrastructure impacted by PSPS (normalized)	Number of critical infrastructure locations impacted per hour multiplied by hours offline per RFW circuit mile day per year	Utility, Cal OES	Post-incident collection	Utility data, Cal OES, survey of critical infrastructure personnel