

PG&E 2024 Risk Assessment and Mitigation Phase Workshop #1

February 7th, 2024





Agenda

Topic	Presenter(s)	Time (min)	Time Slot
Opening Remarks	Safety Policy Division	5	10:00-10:25
Safety and Introduction	Ken Arnold	5	
PG&E Opening Remarks	Paul McGregor	5	
Purpose of Today's Workshop	Ken Arnold	5	
PG&E's RAMP Procedural Schedule	Ken Arnold	5	
RAMP Risk Selection Process	Paul McGregor	5	10:25-11:00
Preliminary RAMP Risks and Risk Values	Paul McGregor	10	
2020 RAMP Risks vs Preliminary 2024 RAMP Risks	Paul McGregor	5	
Cost-Benefit Approach Overview	Yumi Oum	15	
BREAK		15	11:00-11:15
Preliminary RAMP Risk Preview: Employee Safety Incident	Heather Noble, Cornelius Morgan	30	11:15-11:45
Preliminary RAMP Risk Preview: Cybersecurity Incident	Yusuf Ezzy, David Lo	30	11:45-12:15
BREAK (LUNCH)		60	12:15-1:15
Preliminary RAMP Risk Preview: Loss of Containment on Gas Transmission Pipeline	Chris Warner, Gordon Ye	30	1:15-1:45
Preliminary RAMP Risk Preview: Wildfire with PSPS and EPSS	Andy Abranches, Benson Wong	30	1:45-2:15
Preliminary RAMP Risk Preview: Failure of Electric Distribution Overhead Assets	Arvind Simhadri, Benson Wong	30	2:15-2:45
Proposed RAMP Report Outline	Sandy Allan	5	2:45-3:00
PG&E Closing Remarks	Paul McGregor	5	
SPD Closing Remarks	Safety Policy Division	5	

Assign safety roles if in person

Psychological Safety

- Practice transparency and vulnerability
- Avoid blame; learn from mistakes
- Show care and appreciation
- Invite new ideas from all
- Disagree respectfully and with curiosity
- Prioritize mental health by encouraging self-care

Fire

- Exits, escape routes, evacuation
- Fire ext.

Earthquake

- Drop, cover, hold

Medical Emergency

- First aid/CPR
- 911/share location
- AED

Security

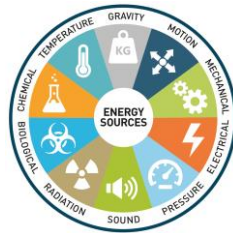
- Active shooter—get out, hide out, take out, call out
- Maintain situational awareness to mitigate hazards

Ergonomics

- Proper ergo
- 30/30: move for 30 secs every 30 min

Don't report to work if testing positive for COVID-19

Energy-Based Hazard Wheel



Park in a safe location



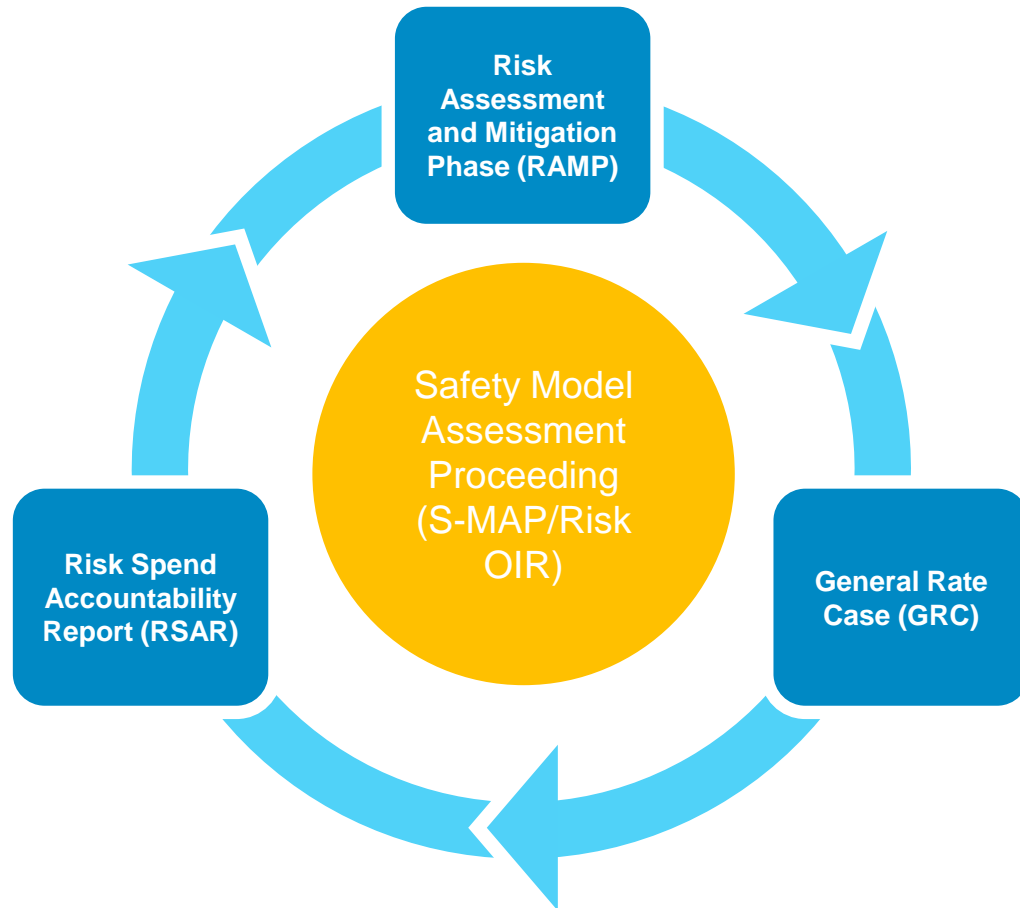
Introductions

Presenter	Title	Sponsoring Area
Paul McGregor	Sr. Director – Enterprise and Operational Risk Management (EORM)	Overall RAMP
Yumi Oum	Director – EORM Risk Analytics	Risk Modeling
Heather Noble	Sr. Director – Safety: Occupational Health	Enterprise Health and Safety
Cornelius Morgan	Sr. Director – Safety: Operational Safety	Enterprise Health and Safety
Yusuf Ezzy	Sr. Director – Cybersecurity	Cybersecurity
David Lo	Director – Cybersecurity	Cybersecurity
Chris Warner	Sr. Director – Gas Engineering	Gas Transmission
Gordon Ye	Supervisor – Risk Engineering	Gas Transmission
Andy Abranches	Sr. Director – Wildfire Risk Management	Wildfire Risk
Arvind Simhadri	Director – Distribution Overhead Asset Management	Distribution Overhead Asset Management
Benson Wong	Sr. Manager – Electric Risk Management	Wildfire/Electric Risk Management

Regulatory Requirements



With each rate-case cycle, regulatory requirements continue to evolve, promoting greater transparency, accountability and improvements in quantitative risk assessment and mitigation planning



Safety Model Assessment Proceeding (S-MAP)

Describes **agreed-upon risk assessment methodology** for all IOUs
 Establishes **accountability reporting** to track spend and risk reduction results
Risk OIR (S-MAP Phase III) Proceeding Underway

Risk Assessment and Mitigation Phase (RAMP)

Using the S-MAP approved framework, each IOU files a report identifying its top safety risks and proposed risk mitigation programs for the upcoming GRC period to solicit feedback from the CPUC and other stakeholders.
2024 RAMP Report Filing May 2024

General Rate Case (GRC)

Filed one year after the RAMP Report, IOUs provide an updated assessment of operational risks, programs to mitigate those risks, and budget requests to fund the mitigation programs
2027 GRC Filing May 2025

Risk Spend Accountability Report (RSAR)

Annual IOU filing comparing risk mitigation budgets approved in GRC and actual risk mitigation expenditures with explanation of significant differences
2023 RSAR Filing April 2024



Purpose of Today's Workshop

To gather input from the SPD, other interested CPUC staff, and interested parties on PG&E's selection of risks to be included in the 2024 RAMP.

Consistent with the Risk-Based Decision-Making Framework (RDF) outlined in D.22-12-027, Appendix A, Item No. 12:

"...the utility will preliminarily select risks to be included in the RAMP. The utility will host a publicly noticed workshop, to be appropriately communicated to interested parties...to inform the determination of the final list of risks to be included in the RAMP. ..."

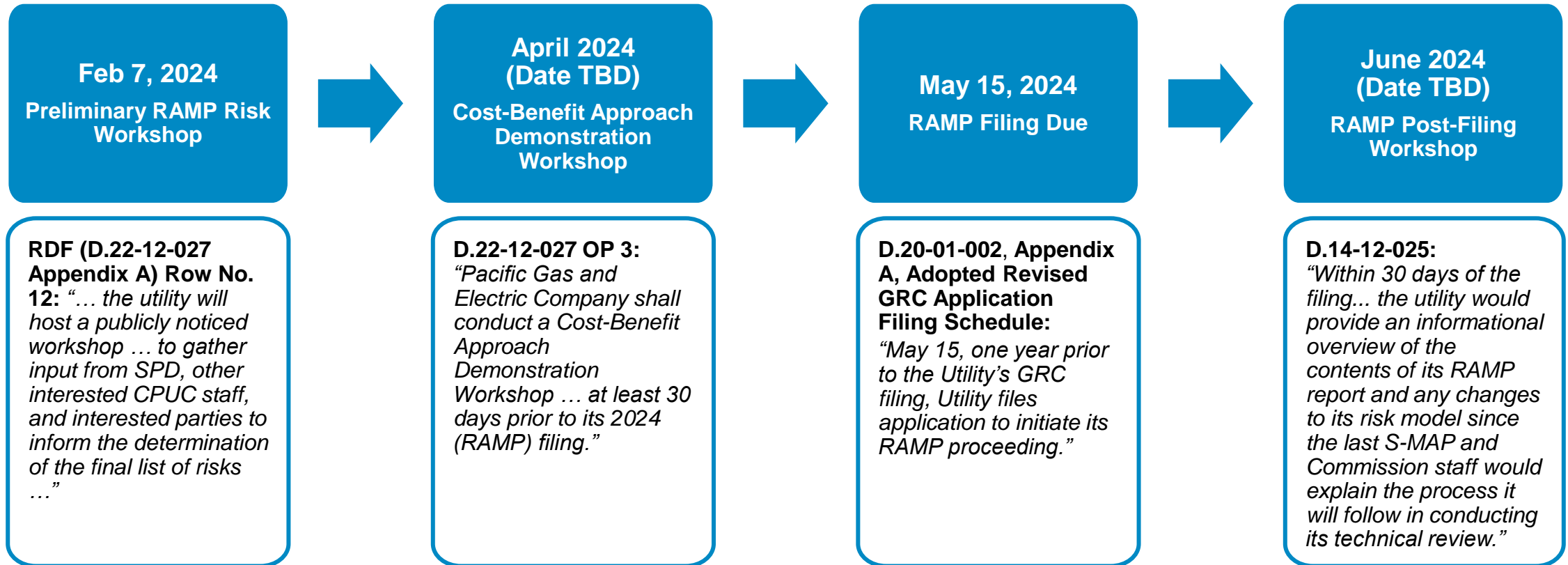
Based on input received from SPD, other interested CPUC staff, and interested parties, the utility will make its determination of the final list of risks to be addressed in its RAMP. The rationale for taking or disregarding input during the workshop will be addressed in the utility's RAMP."

Today's presentation will focus on the selection process for PG&E's preliminary RAMP risks and a presentation of a subset of risks that were selected. The presentation includes a brief overview of the key elements of the Cost-Benefit Approach (CBA) that influence RAMP scoring and ultimately selection. However, PG&E will present a detailed overview of its CBA implementation in the April public workshop.



PG&E's RAMP Procedural Schedule

Today's workshop will mark the start of a series of events that will promote transparency and accountability



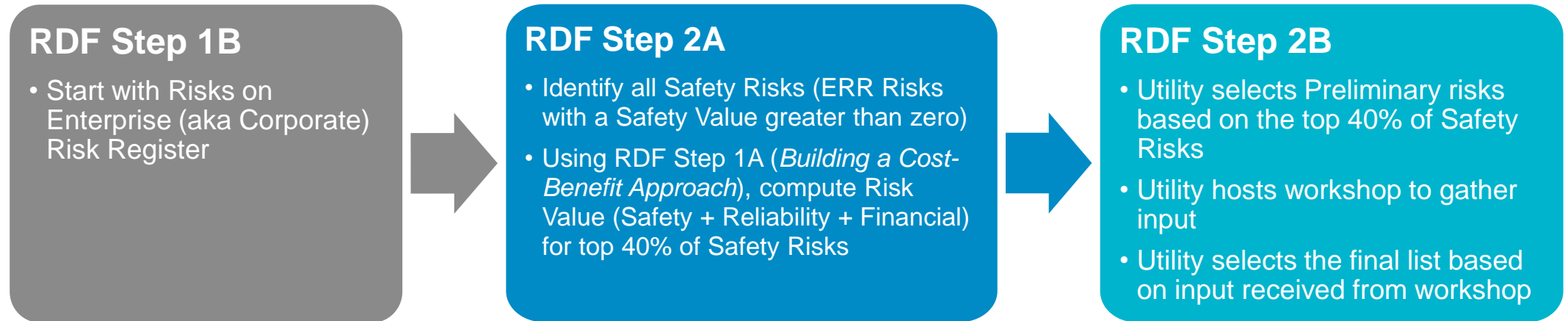
Risk Selection



RAMP Risk Selection Process

PG&E followed the regulatory requirements for RAMP Risk Selection

RDF Row No. 9: “...the utility will sort its ERR risks in descending order by the monetized Safety Risk Value. For the top 40% of ERR risks with a Safety Risk Score greater than zero, the utility will compute a monetized Risk Value using at least the Safety, Reliability and Financial Attributes...”



Steps PG&E Applied to Select Preliminary RAMP Risks

Regulatory requirement

PG&E identified **11 risks** as the top 40% of ERR risks with a Safety Risk Value greater than zero dollars.

Risks below the 40% threshold

The top 40% of ERR risks includes ***Electric Transmission System-wide Blackout***, which is not funded under the jurisdiction of the GRC proceeding. To ensure GRC-funded safety risks are adequately represented, PG&E also included ***Failure of Electric Distribution Underground Assets*** to its preliminary RAMP risk selection.



Preliminary 2024 RAMP Risks and Risk Values

This table provides information required by RDF Step 2B, Row 12:

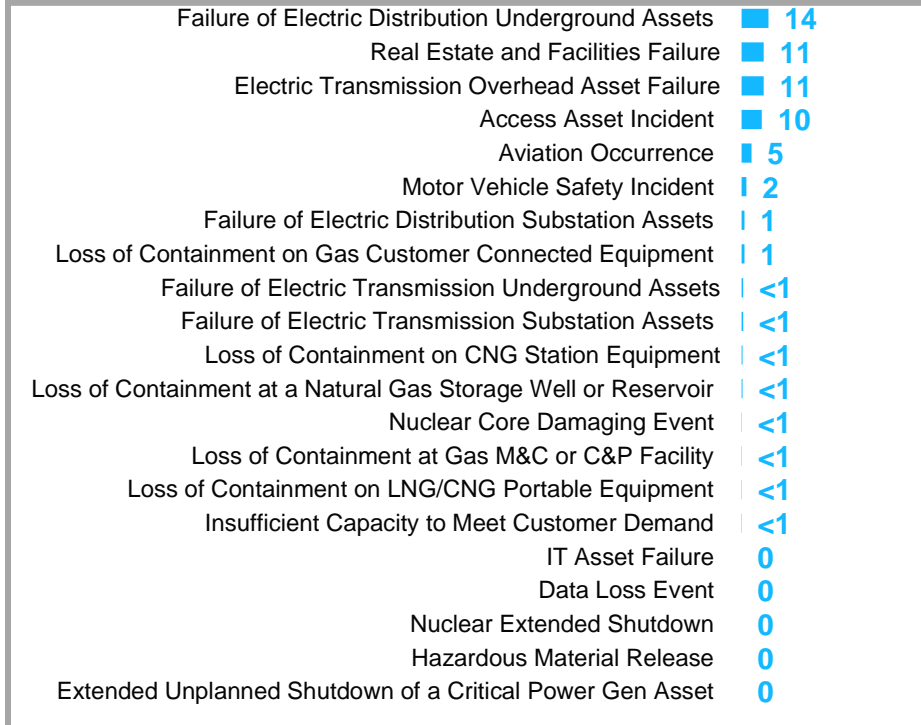
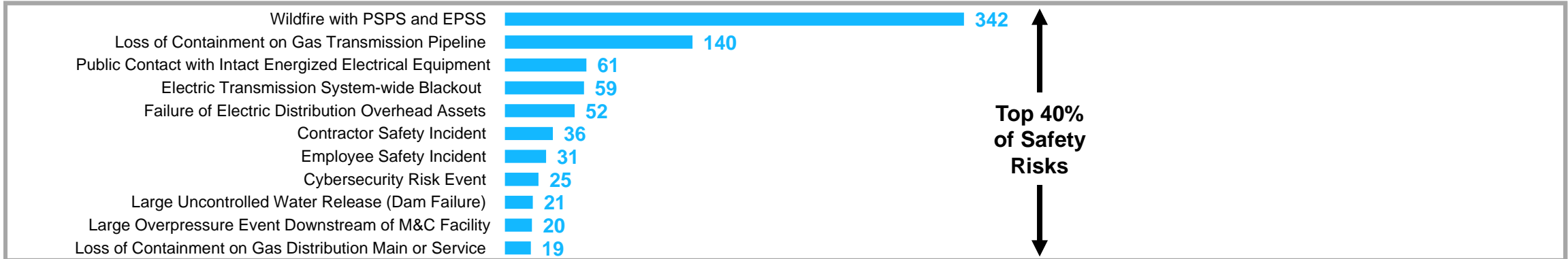
1. Preliminary list of RAMP risks
2. The monetized Safety Risk Value for each risk in the ERR
3. The monetized Risk Value for the top ERR risks identified through the process in Row 9 (top 40% of ERR risks with a Safety Risk Value greater than zero dollars)

<i>Risk Values are Preliminary. Not for Any Use Other than this Workshop.</i>					
	Safety Rank	PG&E Enterprise Risk Register (ERR) Risk	Preliminary RAMP Risk	TY Baseline (2027) Safety Risk Value (\$M)	TY Baseline (2027) Total Risk Value (\$M)
Top 40% of Safety Risks	1	Wildfire with PSPS and EPSS	✓	342	9,737
	2	Loss of Containment on Gas Transmission Pipeline	✓	140	188
	3	Public Contact with Intact Energized Electrical Equipment	✓	61	61
	4	Electric Transmission System-wide Blackout	✓	59	2,181
	5	Failure of Electric Distribution Overhead Assets	✓	52	3,275
	6	Contractor Safety Incident	✓	36	36
	7	Employee Safety Incident	✓	31	39
	8	Cybersecurity Risk Event	✓	25	1,026
	9	Large Uncontrolled Water Release (Dam Failure)	✓	21	438
	10	Large Overpressure Event Downstream of Gas Measurement and Control Facility	✓	20	21
	11	Loss of Containment on Gas Distribution Main or Service	✓	19	109
	12	Failure of Electric Distribution Underground Assets	✓	14	745
	13	Real Estate and Facilities Failure		11	
	14	Electric Transmission Overhead Asset Failure		11	
	15	Access Asset Incident		10	
	16	Aviation Occurrence		5	
	17	Motor Vehicle Safety Incident		2	
	18	Failure of Electric Distribution Substation Assets		1	
	19	Loss of Containment on Gas Customer Connected Equipment		1	
	20	Failure of Electric Transmission Underground Assets		<1	
	21	Failure of Electric Transmission Substation Assets		<1	
	22	Loss of Containment on CNG Station Equipment		<1	
	23	Loss of Containment at a Natural Gas Storage Well or Reservoir		<1	
	24	Nuclear Core Damaging Event		<1	
	25	Loss of Containment at Gas M&C or C&P Facility		<1	
	26	Loss of Containment on LNG/CNG Portable Equipment		<1	
	27	Insufficient Capacity to Meet Customer Demand		<1	
	N/A	IT Asset Failure		0	
	N/A	Data Loss Event		0	
	N/A	Nuclear Extended Shutdown		0	
	N/A	Hazardous Material Release		0	
	N/A	Extended Unplanned Shutdown of a Critical Power Gen Asset		0	

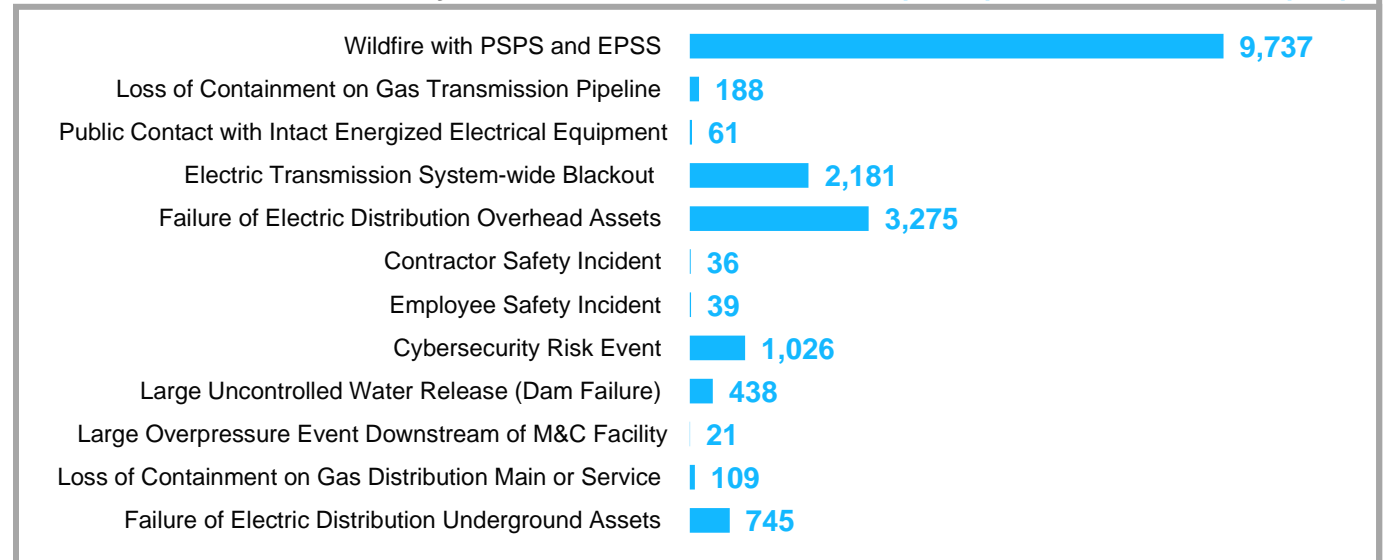


Preliminary 2024 RAMP Risks and Risk Values

ERR Risks TY Baseline (2027) Safety Risk Value (\$M)



Preliminary RAMP Risks TY Baseline (2027) Total Risk Value (\$M)





Preliminary RAMP Risk Chapters

For discussion today

Employee Safety Incident

Any PG&E employee incident resulting in a serious injury or fatality to a PG&E employee, PG&E contractor, or a member of the public, excluding incidents resulting from asset failure or equipment malfunction.

Cybersecurity Incident

A cybersecurity incident that impacts PG&E's core business functions, resulting in a loss of control of company data or systems used for gas, electric, and business operations.

Loss of Containment (LOC) on Gas Transmission Pipeline

Failure of a gas transmission pipeline resulting in a LOC, with or without ignition, that could lead to significant impact on public safety, employee or contractor safety, property damages, financial losses, and the inability to deliver natural gas to customers.

Wildfire with PSPS and EPSS

Wildfire that may endanger the public, private property, sensitive lands or environment originating from PG&E assets or activities. It also encompasses the benefits and consequences of operational mitigations such as Public Safety Power Shutoff (PSPS) and Enhanced Powerline Safety Settings (EPSS).

Failure of Electric Distribution Overhead Assets

Failure of distribution overhead assets or lack of remote operation functionality may result in public or workforce safety issues, property damage, environmental damage, or inability to deliver energy.

For inclusion in 2024 RAMP Report

Electric Operations

Public Contact with Intact Energized Electrical Equipment

Public Contact with Intact Energized Electrical Equipment is focused on public exposure to energized electrical equipment under normal operating conditions and is not a result of an asset failure.

Electric Transmission System-wide Blackout

A system-wide disturbance leading to a cascading event that causes a blackout of PG&E's electrical system with the inability to restore the grid in a timely fashion.

Failure of Electric Distribution Underground Assets

Failure of distribution underground, (including radial and network) assets or lack of remote operation functionality may result in public or workforce safety issues, property damage, environmental damage, or inability to deliver energy.

Gas Operations

Loss of Containment (LOC) on Gas Distribution Main or Service

Failure of a gas distribution main or service resulting in a loss of containment, with or without ignition, that can lead to significant impact on public safety, workforce safety, property damages, financial losses, and the inability to deliver natural gas to customers.

Large Overpressure Event Downstream of Gas Measurement and Control Facility

A large overpressure event downstream of a gas measurement and control (M&C) facility that can lead to significant impact on public safety, workforce safety, property damages, financial losses, and the inability to deliver natural gas to customers.

Energy Supply

Large Uncontrolled Water Release

A large uncontrolled water release adversely impacting the company, the public, or federal lands.

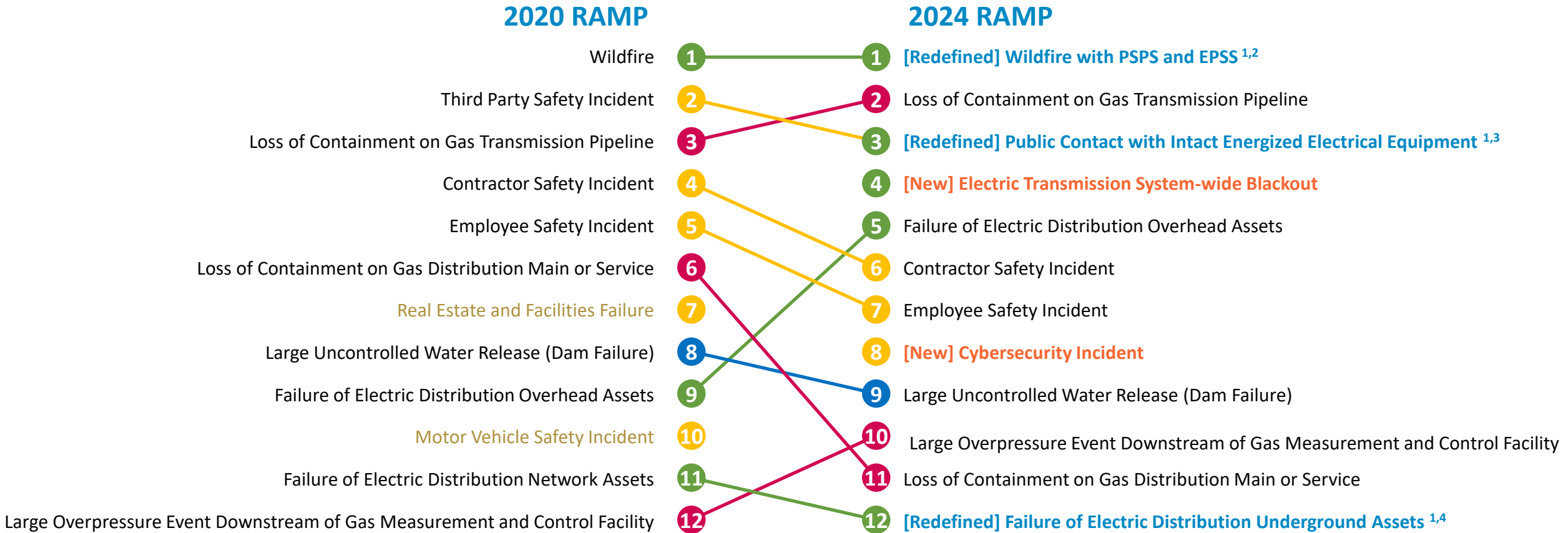
Shared Services

Contractor Safety Incident

Any PG&E contractor incident resulting in a serious injury or fatality to a PG&E contractor, a PG&E employee, or a member of the public, excluding incidents resulting from asset failure or equipment malfunction.



2020 RAMP vs Preliminary 2024 RAMP Risks and Rankings



Legend

- Electric Operations
- Gas Operations
- Energy Supply
- Shared Services

Notes to Results

1. Risk event definitions/scope have changed since the 2020 RAMP.
2. Wildfire risk score now also reflects consequences of Public Safety Power Shutoff (PSPS) and Enhanced Powerline Safety Settings (EPSS).
3. For Public Contact, the scope was narrowed to focus on members of the public and third-party contractors experiencing serious injuries or fatalities resulting from interactions with intact energized electric facilities, not involving asset failure.
4. Two risk models that were previously separate, Failure of Electric Distribution Network Assets and Failure of Electric Distribution Underground Assets, have been assembled into a single model.

Preliminary

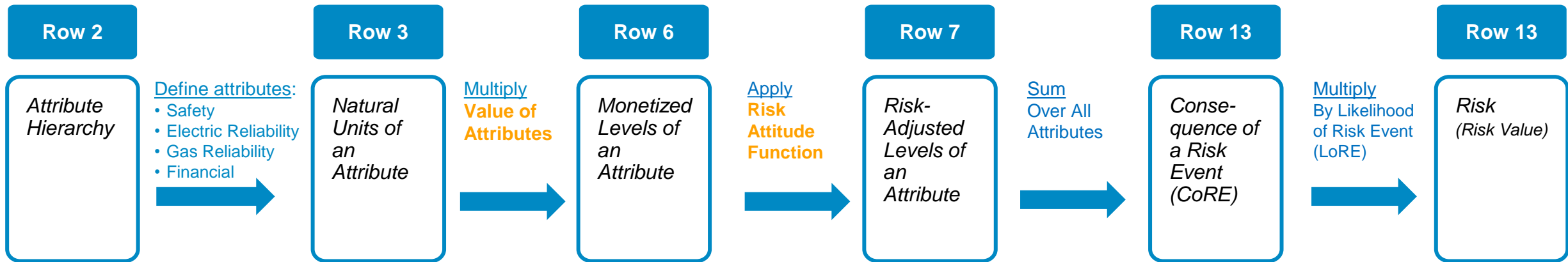
Cost-Benefit Approach and Risk Modeling





Cost-Benefit Approach: Overview

PG&E implemented the Cost-Benefit Approach adopted in D.22-12-027 for Calculating Risk



PG&E will cover its Cost-Benefit Approach in detail at its Cost-Benefit Approach Demonstration Workshop planned for April 2024 (Per D.22-12-027 OP 3)



Integrating Indirect Safety Sub-Attribute

PG&E is Incorporating Reliability-Induced Safety Impacts into its Consequence Modeling

Relevant Regulatory Context

- D.14-12-025: *“We recognize, however, that reliability-related issues can affect safety. In such situations, those reliability issues should be included in the assessment of safety”*
- Joint Motion filed by CalPA, FEITA requested that PG&E analyze the full safety, health and financial consequences of PSPS. In ruling A.20-06-012, CPUC found it is appropriate for PG&E to provide GRC testimony concerning updated risk analysis estimating consequences of calling PSPS events.
- PG&E included safety consequences from reliability events in the PSPS model in its 2023 GRC and WMPs.

Quantification Approach

- PG&E reviewed widespread US blackout events to estimate the relationship between safety consequences and outage extent. The data sources represent a wide array of events with many varied drivers of injuries and fatalities other than electric power outages.
- PG&E modeled this uncertainty relating mortality to outages using an exponential distribution with mean of 6 EF/1 billion CMI, assembling relevant data from the following blackouts:
 - 2003 US Northeast Blackout, 2011 Southwest Blackout, 2012 Superstorm Sandy, 2012 Derecho Windstorms, 2017 Hurricane Irma, 2021 Texas
- PG&E delineated the safety consequences from short and long duration outages¹ by assigning indirect safety consequences for 8+ hour duration outages.

(1) Source: Do, V., McBrien, H., Flores, N.M. et al. Spatiotemporal distribution of power outages with climate events and social vulnerability in the USA. *Nat Commun* 14, 2470 (2023). <https://doi.org/10.1038/s41467-023-38084-6>



PG&E Adopted Monetized Value of Attributes

PG&E adopted attribute values based on the requirements outlined in D.22-12-027

D.22-12-027 approves the use of specific methodologies and sources of information to determine **a standard dollar value of each risk Attribute (Safety, Electric Reliability, and Gas Reliability)**.

Safety

Calculated using the Department of Transportation (DOT) guidance for the Value of a Statistical Life (VSL), adjusted for: 1) California price and real wage data, and 2) the base year of the RAMP filing.

2023 CA-Adjusted VSL:

\$15.3 million (1,2,3,6)

Electric Reliability

Calculated using the Lawrence Berkeley National Laboratory (LBNL) Interruption Cost Estimate (ICE) Calculator, expressed in dollars per customer-minute interrupted.

2023 \$/CMI

\$3.23 (1,4,6)

Gas Reliability

For gas reliability, the Risk OIR Phase II Decision directs IOUs to use the implied dollar value from their most recent RAMP MAVF risk score calculations.

PG&E expresses the implied gas reliability value in dollars per customer impacted:

2023 \$/customer:

\$1,542 (1,5,6)

Notes to Results:

(1) Amounts shown are preliminary standard dollar values (i.e. not risk-adjusted dollars).

(2) \$2022 VSL calculated by adjusting the \$2021 DOT VSL using inflation (CPI) and real wage growth data from the Bureau of Labor Statistics (BLS), per DOT guidance.

(3) \$2022 California-adjusted VSL calculated by applying price and income modifiers derived from CPI and weekly earning data from the BLS and California Department of Industrial Relations

(4) PG&E updated some of the ICE Calculator input data with PG&E-specific information such as customer class composition and annual energy usage, C&I industry percentages, temporal outage distribution and average interruption frequency. ICE Calculator year 2016 results were adjusted to \$2022 using BLS CPI data.

(5) \$2022 Gas Reliability value calculated by adjusting the 2020 MAVF-implied values, which is in 2020 dollars, using BLS CPI data.

(6) Standard dollar values were inflated from \$2022 to \$2023 using an average annual CPI forecast of 2.3% from *The 2023 Long-Term Budget Outlook* published by the Congressional Budget Office (CBO).

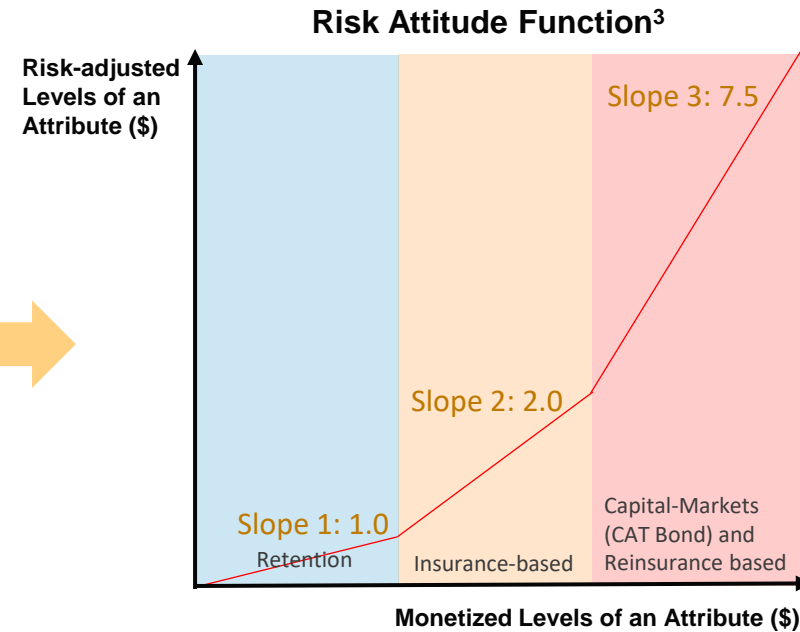
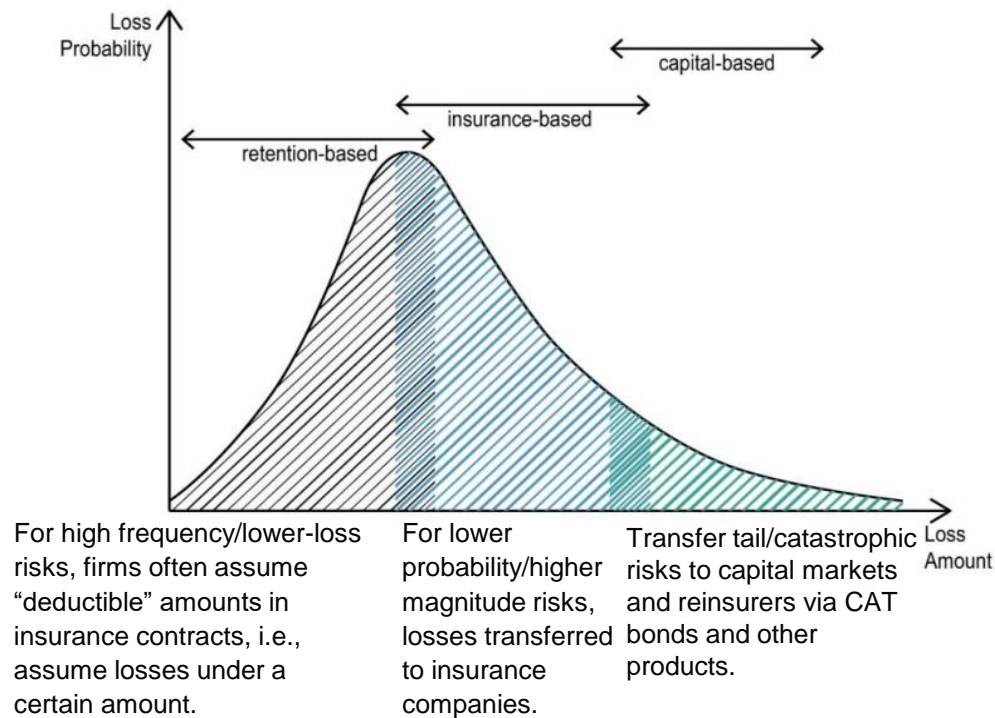


Risk Attitude Function

PG&E used a risk-averse Risk Attitude Function in converting Monetized Levels of an Attribute to Risk-Adjusted Levels as allowed in D.22-12-027

Per D.22-12-027, the **Risk Attitude Function**¹ is a function or formula applied to Monetized Levels of an Attribute to express the attitude towards uncertainty, i.e., risk aversion, neutrality or seeking.

The shape of PG&E’s Risk Attitude Function was informed by common Risk Financing Strategy² and Market Information.



Slope 1 set to reflect preference to “in-house” the risk, slope 2 and 3 set based on observed multipliers in insurance and Cat-Bond pricing. PG&E continues to review risk attitude function ahead of the 2024 RAMP.

(1) The ‘Risk Attitude Function’ is alternatively discussed in proceedings as ‘Risk Scaling’ or ‘Risk Scaling Function’. Both terms should be considered equivalent.

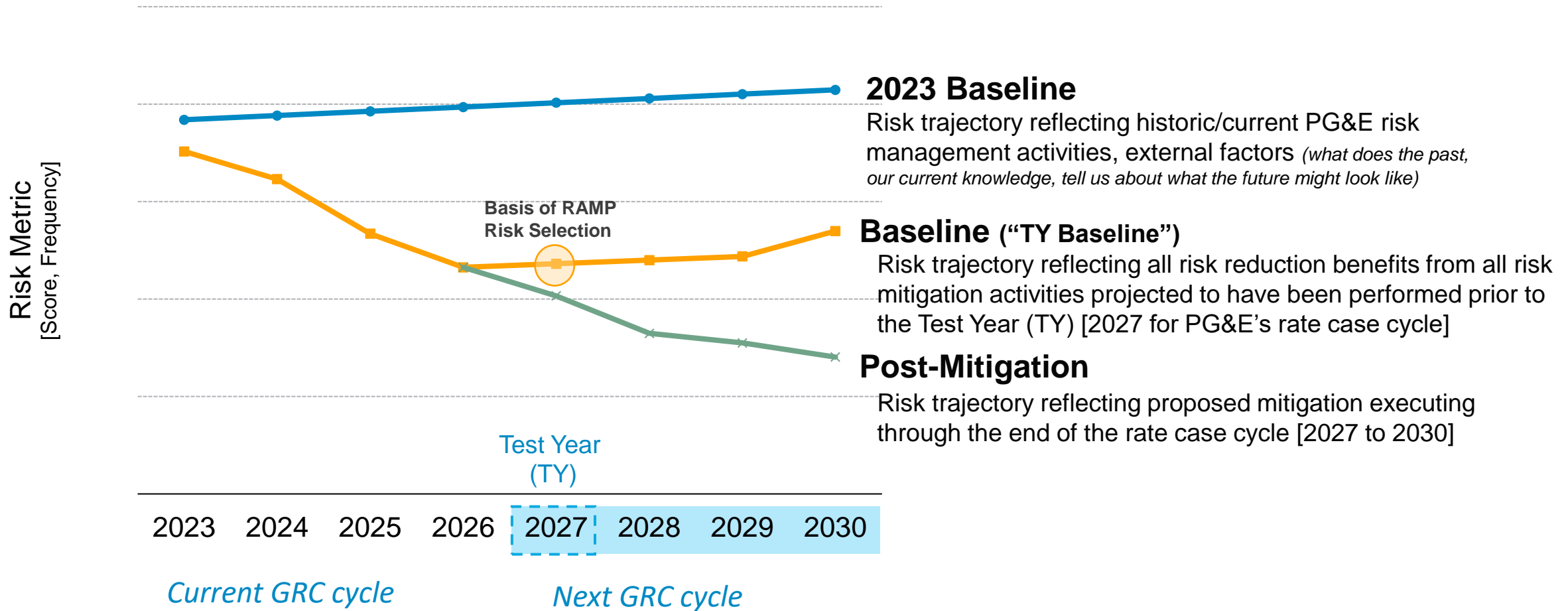
(2) C. Kousky, Greig, K., Lingle, B., “Financing Third Party Wildfire Damages: Options for California’s Electric Utilities”, *Wharton Risk Management and Decision Processes Center* (Feb 2019)

(3) For more information, see PG&E’s “Risk Scaling – A Market-based Approach” whitepaper, submitted for Workshop #4 in R.20-07-013, Phase III. [Link Internal](#)



Baseline Risk Values Used for RAMP Risk Selection

Consistent with D.21-11-009's guidance on establishing Baselines, the Risk Values used for RAMP Risk Selection are the TY 2027 Baseline values



Preliminary RAMP Risk Presentations



Employee Safety Incident





Employee Safety Incident: Overview

Risk Name	Employee Safety Incident
Risk Definition	Any PG&E employee incident resulting in a serious injury or fatality to a PG&E employee, PG&E contractor, or a member of the public, excluding incidents resulting from asset failure or equipment malfunction
Scope	<p>In Scope</p> <ul style="list-style-type: none">PG&E employee Cal/OSHA DART cases and SIFs* that are not the result of an asset failurePublic serious injuries or fatalities (Public SIF Actuals**) resulting from an Employee Safety incidentPG&E contractor serious injuries or fatalities resulting from an Employee Safety incident <p>Out of scope</p> <ul style="list-style-type: none">PG&E employee recordable injuries and fatalities resulting from the failure of an asset not due to employee errorPG&E employee SIF incidents that are the result of a preventable MVI
Tranche development	PG&E SIF incident data review for functional area potential and actual serious injuries and fatality incidents
Tranches	<ul style="list-style-type: none">PG&E office-based employees.PG&E field employees (Electric Operations, Gas Operations, Generation, Other)
Date range	2018 through June 2023

*As defined in SAFE-1100S Serious Injury and Fatality (SIF) Standard

**Public SIF Actual as defined by the CPUC. A serious injury that results in in-patient medical treatment



Employee Safety Incident: Evolution

2017 RAMP

- **Risk drivers:** PG&E Cal/OSHA recordable injury data divided into seven categories
- **No tranches**
- Separate risk for evaluating Occupational Health programs:
 - **Lack of Fitness for Duty Program Awareness** (FFD Program Awareness)
 - Some overlap with Employee Safety

2020 RAMP

- **Risk drivers:** PG&E Cal/OSHA recordable injury data divided into 35 claim cause categories
- **Two tranches:** office-based and field employees
- Combined FFD Program Awareness with Employee Safety Incident risk for comprehensive analysis
- **Safety Consequence:** Cal/OSHA serious injury definition

2024 RAMP

- **Risk drivers:** Keys to Life focus areas. SIF Incident Investigation cause information sub-drivers. DART case claim cause categories
- **Five tranches:** office-based and field employees (EO, GO, Gen, Other)
- **Safety Consequence:** PG&E SIF definition (aligned with PG&E SIF metrics) and CPUC defined Public SIF Actuals. DART cases included as “Minor” injuries (NTSB AIS classification)

2017 RAMP risk safety rank: 1

2020 RAMP risk safety rank: 5

2024 RAMP risk safety rank: 7



Employee Safety Incident: Bowtie

DART Subdrivers (Claim Cause Categories)	% Total
Strains	39%
Falls, slips, and trips	13%
Repetitive-typing/mousing/keying	11%
Repetitive-placing/grasping/moving objects/except tools	6%
Contact with or exposure to harmful substances or environments	5%
Repetitive-use of tools	5%
Contact with equipment or object	4%
Transportation non-preventable Motor Vehicle Incident	4%
Struck by equipment or object	4%
Other	4%
Caught in or by equipment or object	3%
Assault or attack and other injuries by persons or animal	1%

Drivers	Freq (Events/Yr)	% Freq	% Risk
DART driver	365.4	93.4%	63.7%
KTL4 - Failure to follow electrical safety testing and grounding rules	3.1	0.8%	12.9%
KTL10 - Failure to follow hazardous environment procedures	5.6	1.4%	7.4%
KTL5 - Failure to follow clearance and energy lockout/tagout rules	1.5	0.4%	7.2%
KTL8 - Failure to follow safety at heights rules	2.5	0.7%	2.8%
KTL1 - Failure to conduct pre-job safety briefings prior to performing work activities	1.5	0.4%	2.7%
KTL2 - Failure to follow safe driving principles and equipment operating procedures	1.3	0.3%	2.6%
CC - RIM	6.3	1.6%	0.4%
CC - Physical Attack	2.0	0.5%	0.1%
KTL7 - Failure to follow suspended load rules	1.1	0.3%	0.1%
KTL9 - Failure to follow excavation procedures	0.2	0.05%	0.0%
KTL3 - Failure to use personal protective equipment (PPE) for the task being performed.	0.5	0.12%	0.0%
KTL6 - Failure to follow confined space rules	0.2	0.05%	0.0%
Aggregated	391	100%	100%

Outcomes	CoRE (risk-adj. 2023 \$M)	%Freq	%Risk
Exposure	24,737		
Employees			
Days Away, Restricted, or Transferred - Non-SIF	0.07	96%	65%
Serious Injury or Fatality (SIF)	7.10	0.5%	35%
All Other	-	3.8%	0%
Aggregated	0.1	100%	100%

Employee Safety Incident

TY Baseline Risk Score for 2027
\$39M
(2023 \$, risk-adjusted)

PG&E's Keys to Life (KTLs) represent the highest-risk safety commitments that must be followed to prevent serious injury or loss of life.

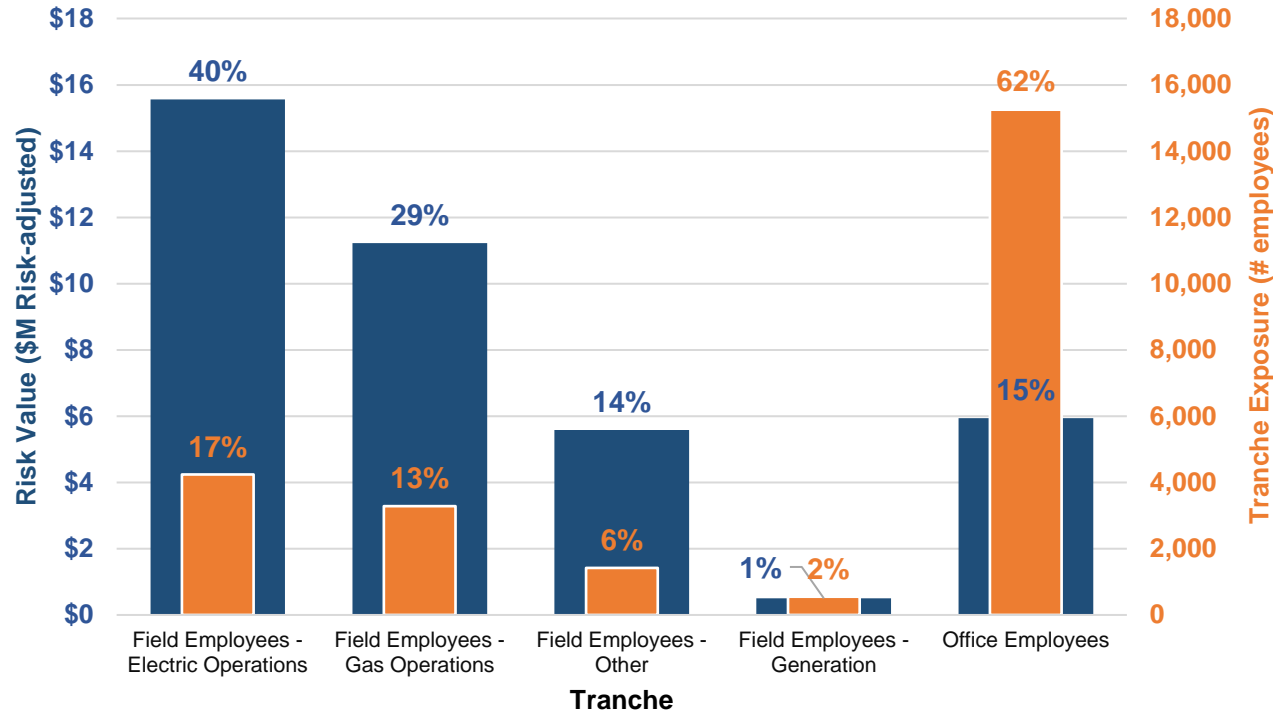
CC Drivers denotes cross-cutting factor (CCF) drivers. A CCF is a driver or control that impacts multiple risks.

RIM: Record and Information Management

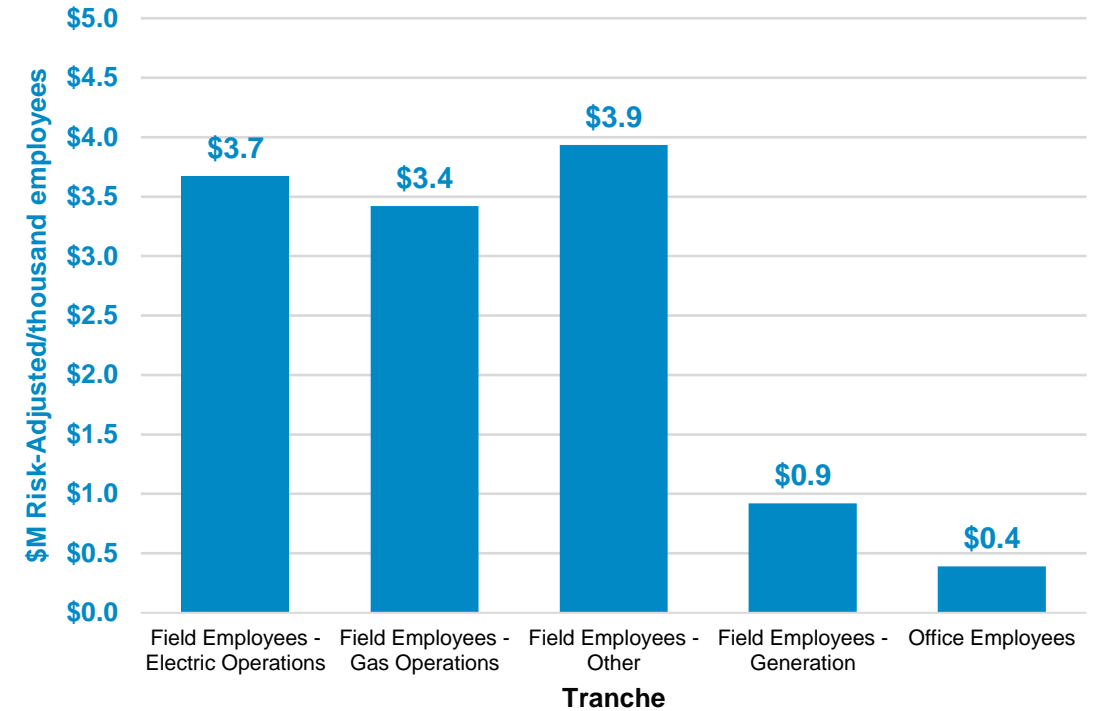


Employee Safety Incident: Tranches

**Risk (\$M Risk-adjusted) and Exposure (# employees)
Comparison by Tranche**



**Risk per Unit Exposure by Tranche
(\$M Risk-adjusted/thousand employees)**



Tranche	Tranche Exposure (number of employees)	% Exposure	Safety Risk (\$M)	Financial Risk (\$M)	Total Risk (\$M)	% Risk	Risk (\$M) / Unit Exposure
Field Employees - Electric Operations	4,235	17%	\$13.1	\$2.5	\$15.6	40%	\$3.7
Field Employees - Gas Operations	3,281	13%	\$8.5	\$2.7	\$11.2	29%	\$3.4
Field Employees - Other	1,419	6%	\$4.7	\$0.9	\$5.6	14%	\$3.9
Field Employees - Generation	549	2%	\$0.3	\$0.2	\$0.5	1%	\$0.9
Office Employees	15,254	62%	\$4.0	\$1.9	\$5.9	15%	\$0.4
Aggregated	24,737	100%	\$30.7	\$8.1	\$38.8	100%	\$1.6



Employee Safety Incident: Data Sources

Model Element	PG&E	Industry	SME
Exposure	PG&E Human Resources personnel information		
Drivers	Drivers based on the PG&E Keys to Life and Cal/OSHA Days Away from work, Transferred, or Restricted (DART) case information		
Sub-drivers	Sub-drivers based on SIF Investigation cause data and DART categorized case claim cause data		
Outcomes	PG&E SIF Actuals, DART cases		
Financial Consequence	Average cost per workers compensation claim (2016 through October 2022)		
Safety Consequence	A serious injury or fatality to a PG&E contractor, a PG&E employee, or a member of the public resulting from an employee incident. Employee DART cases aligned with the NTSB Abbreviated Injury Scale (AIS) classification for Minor injuries		
Reliability Consequence	NA		

Data Source	Description
PG&E SEMS database	Cal/OSHA Days Away, Restricted or Transferred (DART) Cases including claim cause data
PG&E Serious Injury and Fatality (SIF) Incident Investigations	SIF Potential and Actual Investigations including cause data
PG&E Public SIF Actual data	CPUC Safety and Operational Metrics data (no incidents in data range)
PG&E Human Resources report (GN 801 – Internal Classification)	Personnel information for number of field and office employees (tranches)
Data derived from the Actuarial Review of Self-Insured Workers' Compensation Program Report, dated January 4, 2023	Average cost per workers compensation claim (2016 through 2022 [October] claim year)

Cybersecurity Incident





Cybersecurity Incident: Overview

Risk Name

Cybersecurity Incident

Risk Definition

A cybersecurity incident that impacts PG&E's core business functions, resulting in a loss of control of company data or systems used for gas, electric, and business operations.

Scope

In Scope

- Cybersecurity incidents are classified level 1 through level 5, corresponding to bow tie Outcomes:
 - Level 1: Single - limited number of localized users/systems - no impact at all to UDN/ODN
 - Level 2: Single - limited number of localized users/systems - minor impact to UDN - no impact to ODN
 - Level 3: 15-25% of users/systems impacted - moderate UDN impact/loss of UDN services - ODN compromise, limited loss of services
 - Level 4: 25-50% of users/systems impacted - significant impact to UDN and UDN services - moderate ODN service impact
 - Level 5: More than 50% users/systems impacted - severe overall network degradation
- Cybersecurity incidents caused by attacks via Malware/Ransomware, Social Engineering, Supply Chain Breach, Vulnerable Devices and Infrastructure, Software Application Defects and/or Insider acts (malicious, non-malicious)

Tranche Development

PG&E Cybersecurity reviewed possible vectors for a threat actor to exploit via one of the drivers and cause a cybersecurity incident.

Tranches

- UDN – Utility Data Network
- ODN – Operational Data Network
- People – Employees and Contractors
- Third Parties – Vendors
- Systems and Software

Date range

2018 through December 2023



Cybersecurity Incident: Evolution

2017 RAMP

- **Risk Bowtie:** Cyber Attack and Insider Threat were two separate risks. Cyber Attack included Data Loss Events.
- **Exposure:** Undifferentiated by units or systems.
- **Risk Drivers:** Governance, Business Process, Systems and Infrastructure, People and Culture
- **Risk:** Little available data to quantify.

2017 RAMP risk safety rank: 21

2020 RAMP

- **Cross-cutting Factor:** Cybersecurity was a cross-cutting factor and not a stand-alone risk event.
- **Mapping:** Cybersecurity mapped to Loss of Containment on Gas Transmission Pipeline, Large Overpressure Event Downstream of Gas M&C Facility, and Large Uncontrolled Water Release (Dam Failure)

2020 RAMP risk safety rank: N/A

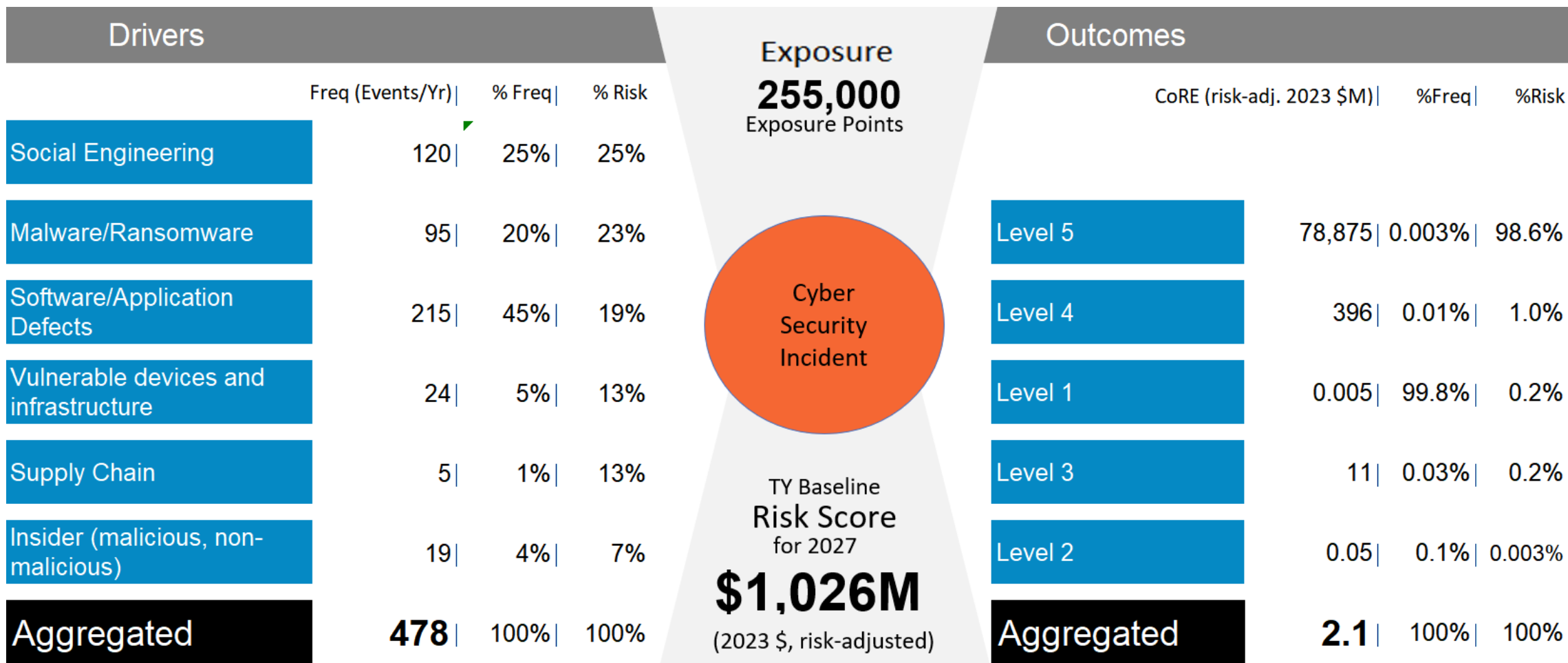
2024 RAMP

- **Risk:** Cyber Incident is now a stand-alone risk event and a cross-cutting factor, excluding Data Loss Events (separate risk).
- **Tranches:** UDN, ODN, People, Third Parties, Systems/SW
- **Risk Drivers:** Social Engineering, Malware/Ransomware, Vulnerable Devices and Infrastructure, Software/Application Defects, Supply Chain, Insider (Malicious, Non-malicious)
- **Safety:** A Cyber Incident is linked to indirect safety via Electric Reliability and to direct safety consequences.
- **Reliability:** A Cyber Incident is linked to direct reliability consequences.

2024 RAMP risk safety rank: 8



Cybersecurity Incident: Bowtie

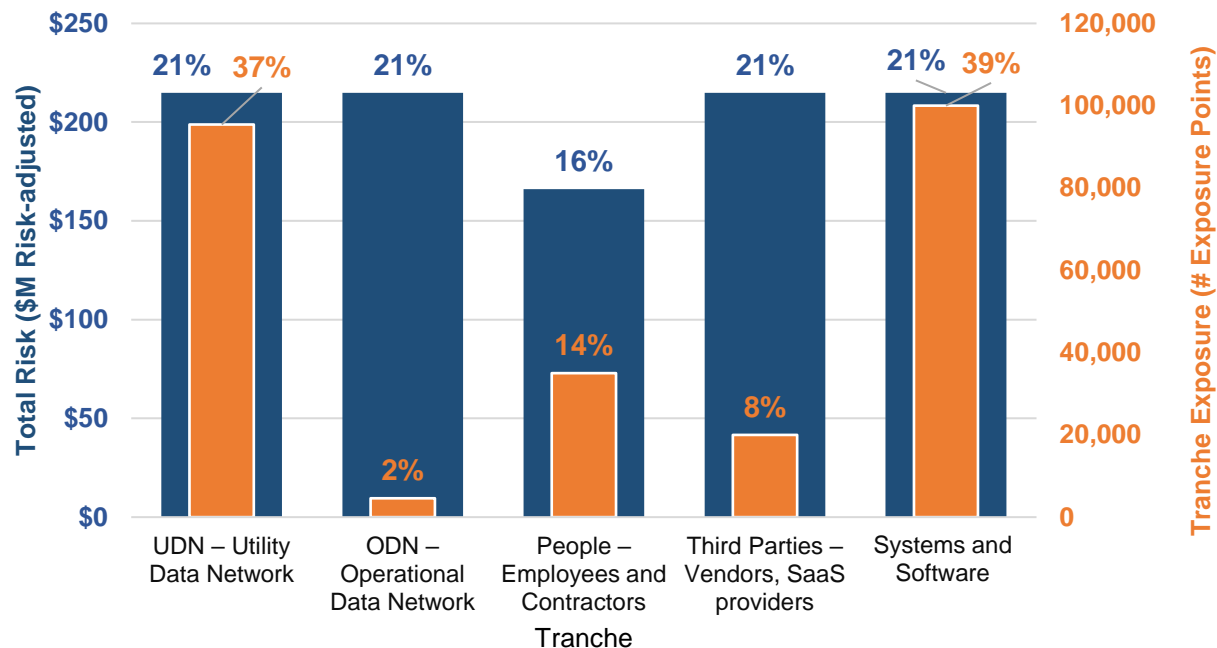


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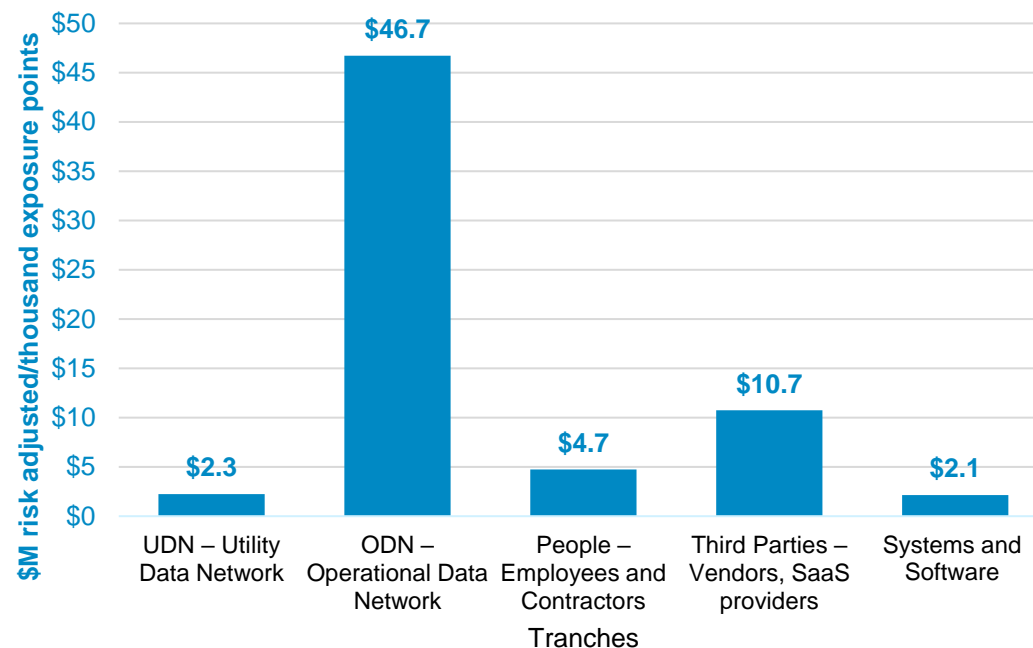


Cybersecurity Incident: Tranches

Risk (\$M Risk-adjusted) and Exposure (# Exposure Points) Comparison by Tranche



Risk Score per Exposure by Tranche (\$M risk adjusted/thousand exposure points)



Tranche	Exposure (# Exposure Points)	% Exposure	Safety Risk (\$M)	Electric Reliability Risk (\$M)	Gas Reliability Risk (\$M)	Financial Risk (\$M)	Total Risk (\$M)	% Risk	Risk (\$M) / Unit Exposure
UDN – Utility Data Network	95,400	37%	\$5.24	\$195.54	\$5.19	\$9.00	\$214.90	21%	\$2.25
ODN – Operational Data Network	4,600	2%	\$5.24	\$195.54	\$5.19	\$9.00	\$214.90	21%	\$46.72
People – Employees and Contractors	35,000	14%	\$4.05	\$151.18	\$4.01	\$6.70	\$166.00	16%	\$4.74
Third Parties – Vendors, SaaS providers	20,000	8%	\$5.24	\$195.54	\$5.19	\$9.00	\$214.90	21%	\$10.75
Systems and Software	100,000	39%	\$5.24	\$195.54	\$5.19	\$9.00	\$214.90	21%	\$2.15
Aggregated	255,000	100%	\$25.00	\$933.34	\$24.75	\$42.67	\$1,025.76	100%	\$4.02

Totals may not sum precisely due to rounding.

Preliminary



Cybersecurity Incident: Data Sources

Model Element	PG&E	Industry	SME
Exposure	Internal estimate for UDN, ODN, People, Third-Parties, Systems/SW		
Drivers	Social Engineering, Malware/Ransomware, Software/Application Defects, Vulnerable Devices and Infrastructure, Supply Chain, Insider (Malicious, Non-malicious)	Internal & external data sources	
Sub-drivers	Not defined		
Outcomes	A cybersecurity incident that impacts PG&E's core business functions, resulting in a loss of control of company data or systems used for gas, electric, and business operations	Internal & external data sources	
Financial Consequence	The financial impact to PG&E, PG&E Customers, PG&E Suppliers and Resellers	Internal & external data sources	
Safety Consequence	A serious injury or fatality to a PG&E contractor, a PG&E employee, or a member of the public resulting from a targeted or indirect cyber incident	Internal & external data sources	
Reliability Consequence	An impact to PG&E's electric and/or gas reliability resulting from a cyber incident	Internal & external data sources	

Data Source	Description
SIOC Incident Data – Internal PG&E Data	Internal incident/event/log data gathered by the Security Intelligence Operations Center (SIOC)
Marsh Insurance Data	Actual claims data for the North American Utility and Power Generation Sectors
Mandiant/Fireye, IBM, Siemens-cybersecurity (Global Utility Sector)	Paid third-party reports and surveys and publicly available intelligence reports.
Cybersecurity & Infrastructure Security Agency (CISA), Department of Homeland Security (DHS) and other government partners	Includes Federal and State agencies
Assembled case studies of large-scale, known cyber attacks	Case studies of known incidents mapped to PG&E impacts

Loss of Containment on Gas Transmission Pipeline





LOC on Gas Transmission Pipeline: Overview

Risk Name

Loss of Containment on Gas Transmission Pipeline

Risk Definition

Failure of a gas transmission pipeline resulting in a loss of containment, with or without ignition, that could lead to significant impact on public safety, employee or contractor safety, property damage, financial loss, and the inability to deliver natural gas to customers. Failure of a gas transmission pipeline includes both pipeline leak and pipeline rupture.

Scope

In Scope

- Failure of a transmission pipeline that leads to a loss of containment with or without ignition

Out of scope

- A loss of containment driven by Large Over-pressurization (OP) Events (included in the “Large OP Event” risk model)

Tranche development

The gas transmission tranches were increased from 4 to 24 since the 2023 GRC filing to include a more granular categorization of assets. This development allows for more targeted review by tranche to assess risk across a wider range of likelihood of failure (LOF) and consequence of failure (COF) categories. The 24 tranches are defined by likelihood of failure (LOF) and consequence of failure (COF) categories. These LOF and COF categories are drawn from threat-specific likelihood and consequence area data used in the Transmission Integrity Management (TIMP) operational risk model.

Tranches

Six LOF and four COF categories lead to 24 tranches. The LOF categories are built from TIMP Threat Identification models. The COF categories are built from TIMP Consequence Areas, Dept. of Transportation Class locations, and TIMP Leak/Rupture Boundary analysis.

Date range

Pipeline and Hazardous Materials Safety Administration (PHMSA) data: 1984-2023

Gas Quarterly Incident data: 2010- 2022

Working Assessment Plan (WAP) data from TIMP operational risk model based on the 2022 risk run result



LOC on Gas Transmission Pipeline: Evolution

2017 RAMP

- **Scope:** *rupture* of a gas transmission pipeline *with ignition* which may result in loss of containment and/or severe consequences.
- **Risk drivers:** 9 drivers and 3 cross cutting risks. Each cross-cutting risk has a model.
- **No tranches**
- **No outcomes**
- **Consequence attributes:** safety-injuries, safety-fatalities, environmental, reliability, compliance, trust, financial
- **Data usage:** primarily PHMSA

2017 RAMP risk safety rank: 15

2020 RAMP

- **Scope:** failure of gas transmission pipe resulting in a loss of containment *with or without ignition*. Failure can be *a leak or rupture*.
- **Risk drivers:** 9 drivers. Cross cutter is not considered as a risk. 4 cross-cutting factors.
- **4 tranches:** based on impacted occupancy count and %SMYS
- **Outcomes:** 8 outcomes
- **Consequence attributes:** safety, reliability, financial
- **Data usage:** PHMSA, TIMP model output, industry ratios, SME input

2020 RAMP risk safety rank: 3

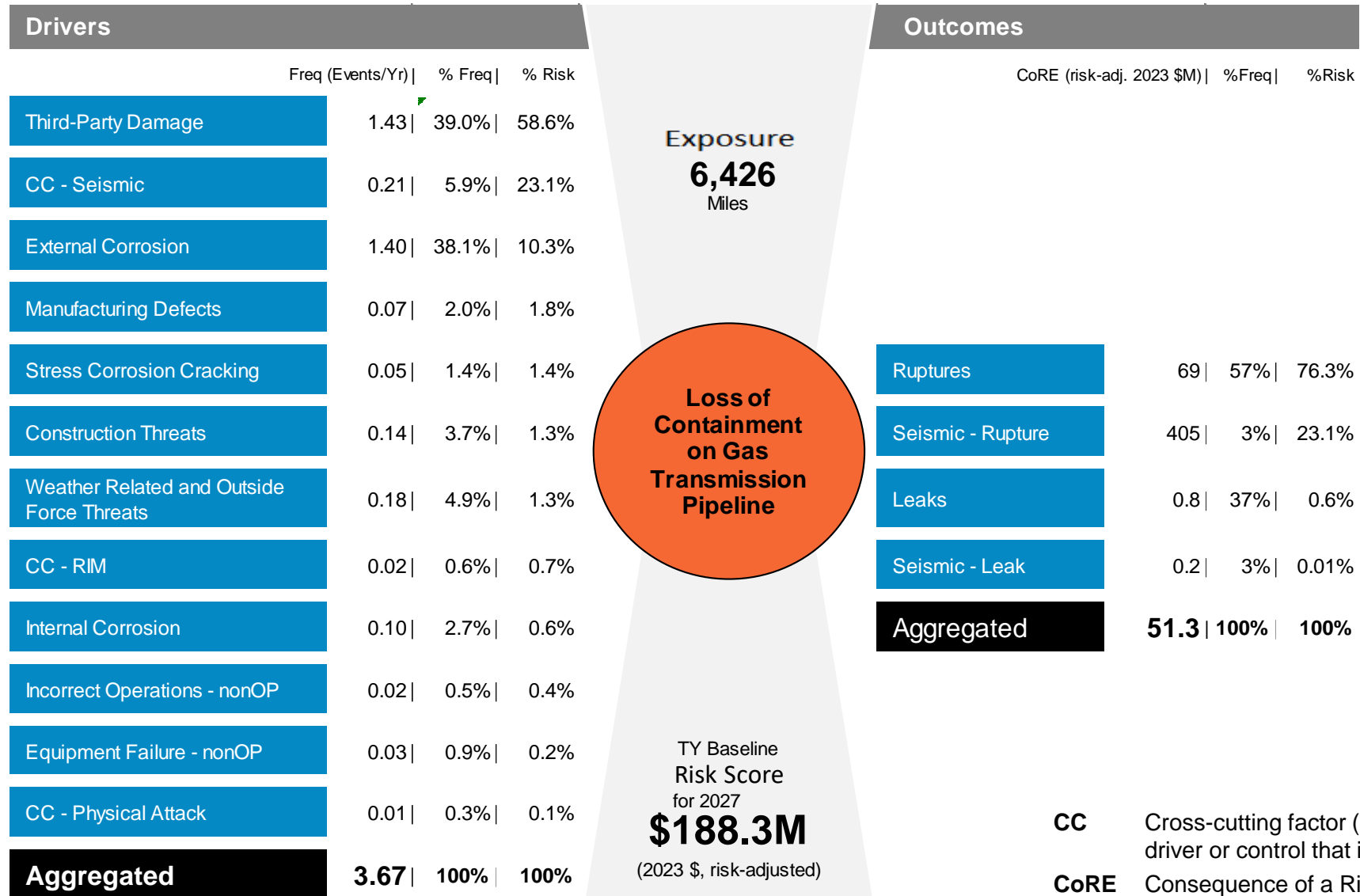
2024 RAMP

- **Scope:** failure of gas transmission pipe resulting in a loss of containment *with or without ignition*. Failure can be *a leak or rupture*.
- **Risk drivers:** 9 drivers. 3 cross-cutting factors.
- **24 tranches:** increased number of tranches to group assets with more in-depth profiling of risk using COF and LOF categories.
- **Outcomes:** 4 outcomes
- **Consequence attributes:** safety, reliability, financial
- **Data usage:** same source of data as 2020 RAMP but data output from TIMP becomes the primary data source to use.

2024 RAMP risk safety rank: 2



LOC on Gas Transmission Pipeline: Bowtie



CC Cross-cutting factor (CCF) drivers. A CCF is a driver or control that impacts multiple risks

CoRE Consequence of a Risk Event



LOC on Gas Transmission Pipeline: Tranches

1. Exposure [Miles] by Tranche

Tranche Exposure (Miles)		COF Categories			
		HCA	MCA	IOC > 0 & rupture mode on Non-HCA/MCA	IOC = 0 or leak mode on Non-HCA/MCA
LOF Categories	Shallow/Exposed Pipe	160.4	92.9	17.3	399.8
	Geohazard Pipe	365.6	132.4	28.2	853.6
	Potential SCC/SSWC Pipe	51.3	32.4	13.6	331.5
	Potential IC Pipe	201.8	144.4	27.0	555.8
	Potential Manufacturing Defect Pipe	195.2	154.2	33.8	900.8
	All Other Pipe	603.1	239.0	47.1	845.1

2. Risk Score [\$M] by Tranche

2027 TY Baseline Proposed Risk Score (\$M)		COF Categories			
		HCA	MCA	IOC > 0 & rupture mode on Non-HCA/MCA	IOC = 0 or leak mode on Non-HCA/MCA
LOF Categories	Shallow/Exposed Pipe	21.80	1.36	0.05	1.35
	Geohazard Pipe	80.62	1.95	0.40	10.55
	Potential SCC/SSWC Pipe	3.29	0.46	0.14	3.50
	Potential IC Pipe	10.35	1.92	0.23	1.78
	Potential Manufacturing Defect Pipe	11.14	1.18	0.11	2.96
	All Other Pipe	30.51	1.35	0.10	1.23

3. Risk Score per Exposure by Tranche [\$M/Mile]

Risk Score per Exposure (\$M/Mile)		COF Categories			
		HCA	MCA	IOC > 0 & rupture mode on Non-HCA/MCA	IOC = 0 or leak mode on Non-HCA/MCA
LOF Categories	Shallow/Exposed Pipe	0.136	0.015	0.003	0.003
	Geohazard Pipe	0.221	0.015	0.014	0.012
	Potential SCC/SSWC Pipe	0.064	0.014	0.010	0.011
	Potential IC Pipe	0.051	0.013	0.008	0.003
	Potential Manufacturing Defect Pipe	0.057	0.008	0.003	0.003
	All Other Pipe	0.051	0.006	0.002	0.001

Key Takeaways

- More tranche miles fall under IOC=0 or leak mode in non-HCA/MCA areas, but the total risk of these tranches is relatively low.
- More risk lies in High Consequence Area (HCA), especially for pipes exposed to geohazard threat (correlated with more population living near earthquake faults), and shallow/exposed pipes that have higher third-party damage risk.

Note: "All Other Pipe" category primarily includes external corrosion and third-party damage threat.

HCA High consequence area
MCA Moderate consequence area
IOC Impacted occupancy count

SCC Stress corrosion cracking
SSWC Selective seam weld corrosion
IC Internal corrosion



LOC on Gas Transmission Pipeline: Data Sources

Model Element	PG&E	Industry	SME
Exposure	Data output from TIMP risk model		
Drivers/Sub-drivers	Data output from TIMP risk model	American Society of Mechanical Engineers (ASME) B31.8S Standard PHMSA data	SME input to support frequency calculation (event frequency, modeling parameters etc.)
Outcomes	Data output from TIMP risk model Output from System Earthquake Risk Assessment (SERA) model (seismic)	PHMSA data	
Financial Consequence		Financial loss data from PHMSA	
Safety Consequence	Data output from TIMP risk model	PHMSA data	SME input to support data fitting, parameter selection (p50/p99, truncated bound, etc.)
Reliability Consequence	Data output from TIMP risk model Gas Quarterly Incident report		SME input to support validity check, parameter selection (p50/p99, truncated bound, etc.)

Data Source	Description
Working Assessment Plan (WAP)	Output from the TIMP operational risk model containing total risk, likelihood, and consequence values per threat and per failure type for each pipe segment covered by the TIMP program.
Pipeline and Hazardous Materials Safety Administration (PHMSA)	PHMSA data that tracks failure incidents, their causes, consequences and asset characteristics from natural gas pipeline and facility operators nationwide.
Gas Quarterly Incident report	PG&E gas quarterly incident report containing leak and outage data.
COF Risk Scores Table	Output from TIMP operational risk model. Used to support more detailed breakdown of COF (Consequence of Failure) for safety and reliability in units of IOC (Impacted Occupancy Count).
Output from models of other PG&E functional areas	For example, output from SERA model for seismic modeling

Wildfire with PSPS and EPSS





Wildfire with PSPS and EPSS: Overview

Risk Name	Wildfire with PSPS and EPSS
Risk Definition	Wildfire that may endanger the public, private property, sensitive lands or environment originating from PG&E assets or activities. It also encompasses the benefits and consequences of operational mitigations such as Public Safety Power Shutoff (PSPS) and Enhanced Powerline Safety Settings (EPSS).
Scope	<p>In Scope</p> <ul style="list-style-type: none">PG&E recorded ignition record (CPUC reportable and non-reportable)Other PG&E failure events (e.g. equipment failure without ignition, outage, etc.) <p>Out of scope</p> <ul style="list-style-type: none">PG&E spark that did not result in a recorded ignition record
Tranche development	PG&E Wildfire Distribution Risk Model and Transmission Asset Classifications
Tranches	<ul style="list-style-type: none">Union of HFTD¹ + HFRA² (HFTD/HFRA) and non-HFTD/HFRAAsset Class – Transmission, Substation, Distribution Primary (Overhead and Underground), Secondaries and ServicesDistribution - Deciles of Risk based on WDRMv3Transmission Voltage Class
Date range	2015 through 2022

1. HFTD: High Fire Threat District
2. HFRA: High Fire Risk Area



Wildfire: Evolution

2017 RAMP

- **Scope:** CPUC reportable ignitions
- **Risk drivers:** Based on (8) drivers: vegetation, equipment failure – conductor, equipment failure – connector/hardware, equipment failure – other, third-party contact, animal, fuse operation, and unknown
- **No tranches:** Transmission and Distribution circuit miles in Fire Index Areas
- **Safety Consequence:** Wildfire Operational Risk model estimates safety impact, based on CAL FIRE and NFIRS data.

2017 RAMP risk safety rank: 8

2020 RAMP

- **Scope:** CPUC reportable ignitions
- **Risk drivers:** Based on (6) drivers: equipment failure, vegetation, third-party contact, animal, unknown or other, and seismic scenario
- **Tranches:** (8) tranches based on HFTD/non-HFTD and across distribution, transmission, and substation facilities.
- **Safety Consequence:** Estimated based on fire incidents from CAL FIRE database

2020 RAMP risk safety rank: 1

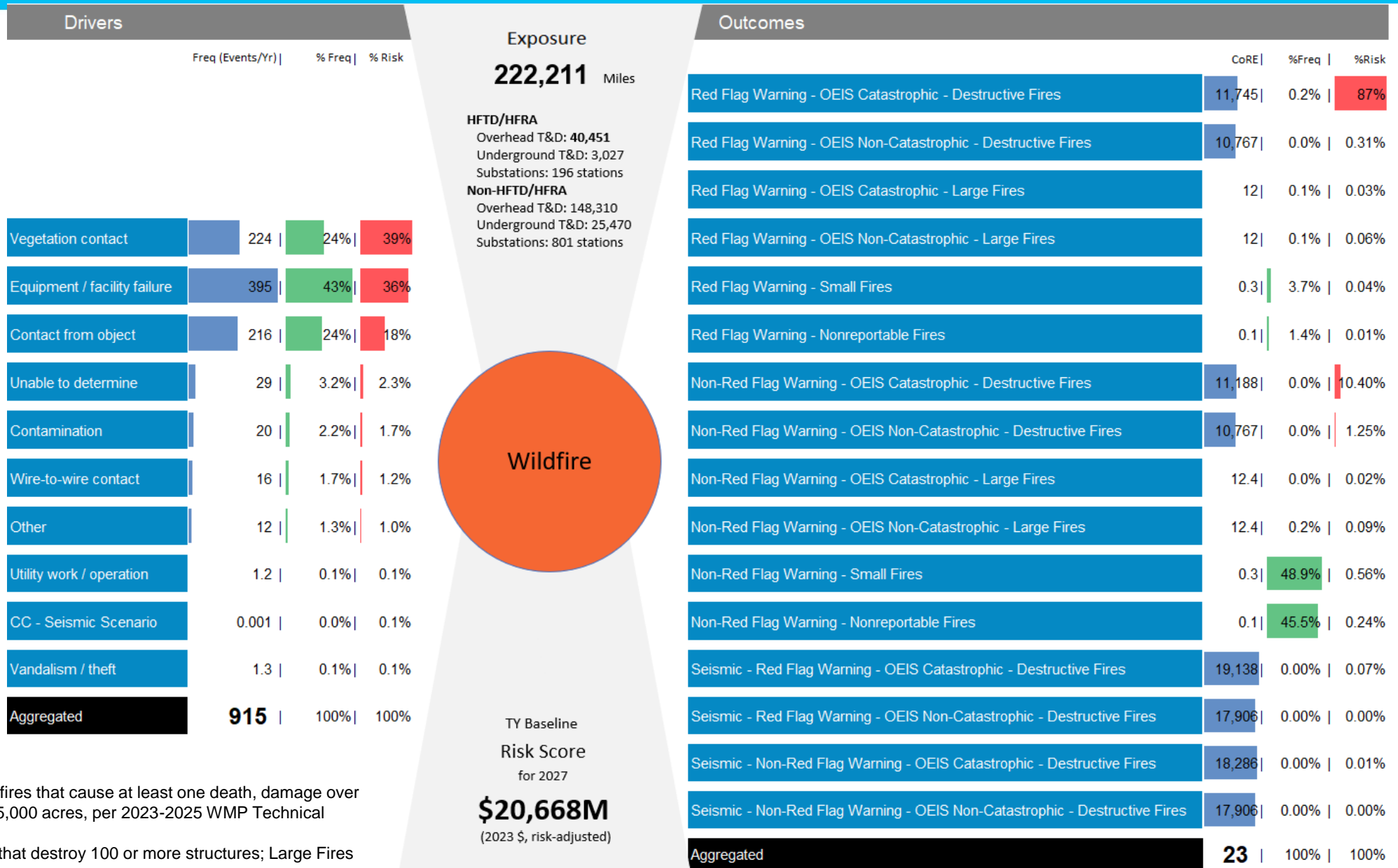
2024 RAMP

- **Scope:** CPUC reportable and non-reportable ignitions
- **Risk drivers:** Based on (10) drivers: including twenty-eight sub-drivers based on ignition cause
- **Tranches:** (32) tranches based on HFTD/HFRA & non-HFTD/HFRA, Asset Class, WDRM v3 deciles, and Transmission Voltage Classed
- **Safety Consequence:** Safety impacts from CALFIRE and PG&E historical fires

2024 RAMP risk safety rank: 1



Wildfire: Bowtie (PG&E Service Territory)



*OEIS Catastrophic fires are fires that cause at least one death, damage over 500 structures, or burn over 5,000 acres, per 2023-2025 WMP Technical Guidelines

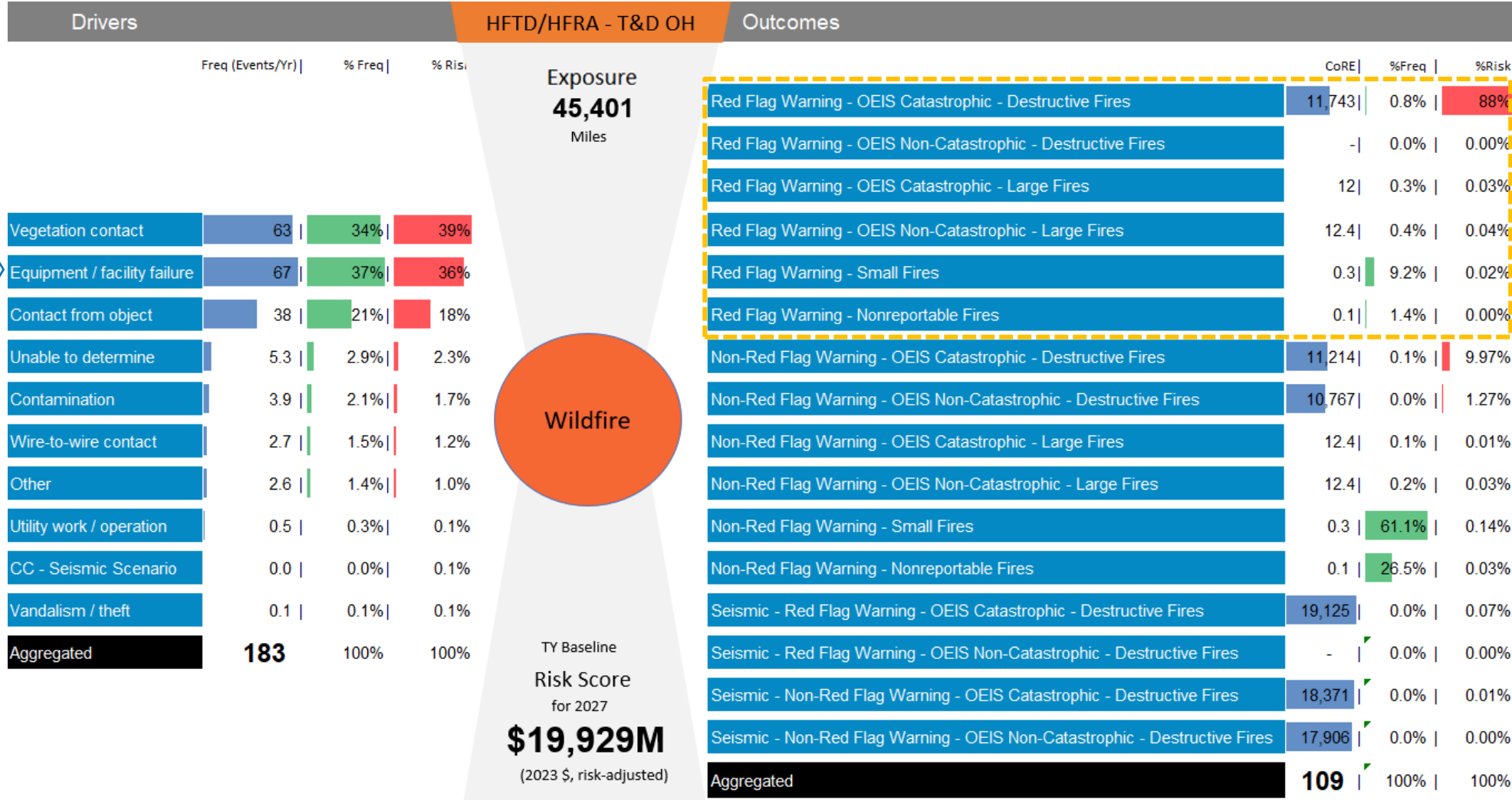
** Destructive Fires are fires that destroy 100 or more structures; Large Fires are fires that burn over 300 acres.



Wildfire: Bowtie (HFTD/HFRA Overhead)

Equipment Subdriver	Frequency
Conductor	23.0
Connection device	10.7
Pole	7.8
Capacitor bank	4.3
Crossarm	3.4
Transformer	3.2
Fuse	3.1
Insulator and brushing	2.8
Other equipment / facility	2.2
Recloser	1.9
Switch	1.9
Lightning arrester	1.3
Voltage regulator / booster	1.0
Anchor / guy	0.2
Sectionalizer	0.1

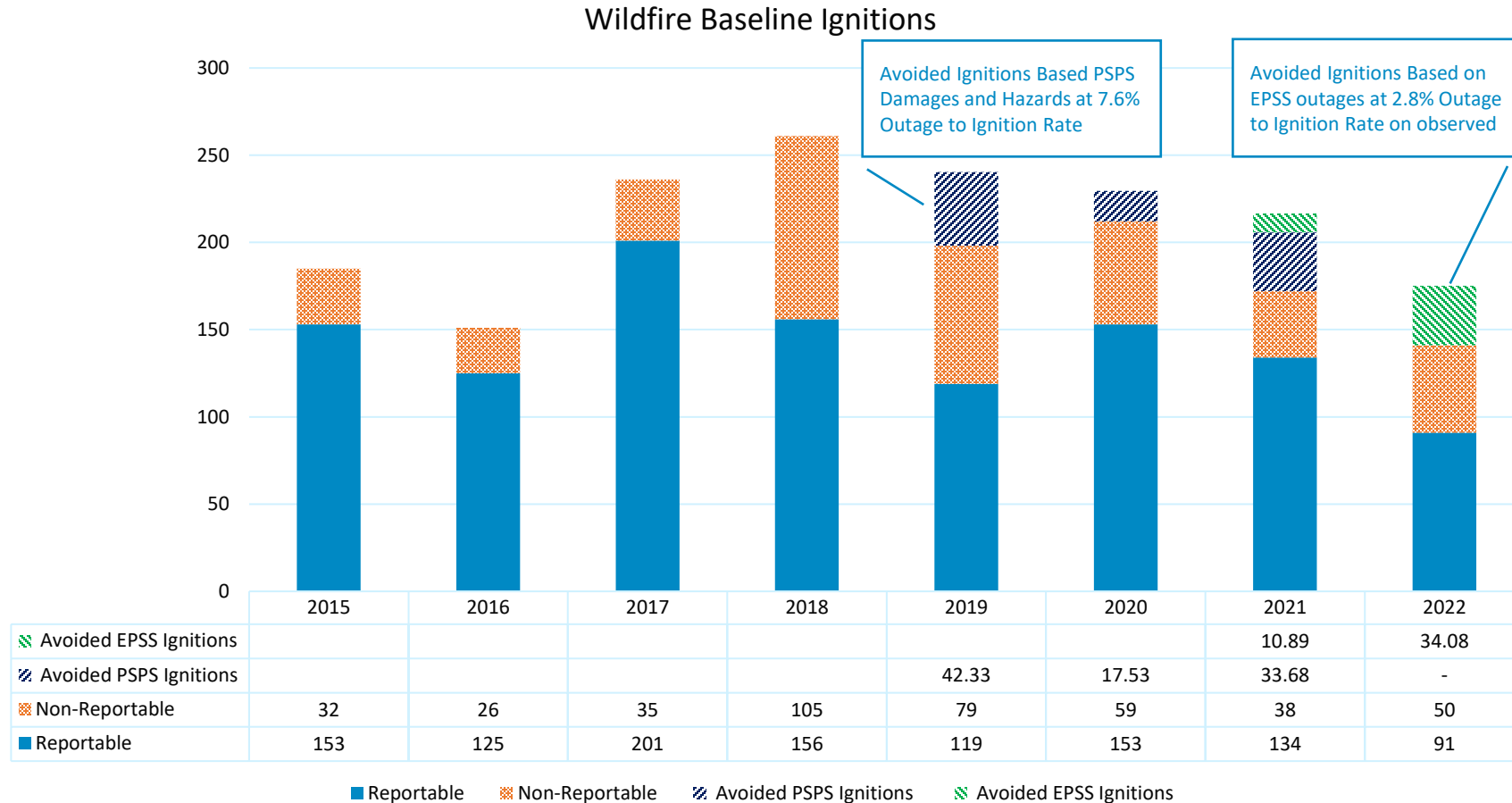
Tranche	Mileage
HFTD/HFRA - Transmission - 230/500 kV	2,111
HFTD/HFRA - Transmission - 115 kV	1,737
HFTD/HFRA - Transmission - 60/70 kV	1,812
HFTD/HFRA - Distribution - Primary	25,935
HFTD/HFRA - Distribution - Secondary	2,771
HFTD/HFRA - Distribution - Service	11,036





Wildfire: Baseline HFRA Ignitions

Baseline Wildfire Risk includes actual ignition events + avoided ignition events with the usage of operational mitigations like EPSS and PSPS over the 2017-2022 time period



Numbers in this chart are preliminary as of 1/24/24 and are subject to change as further data analysis is performed

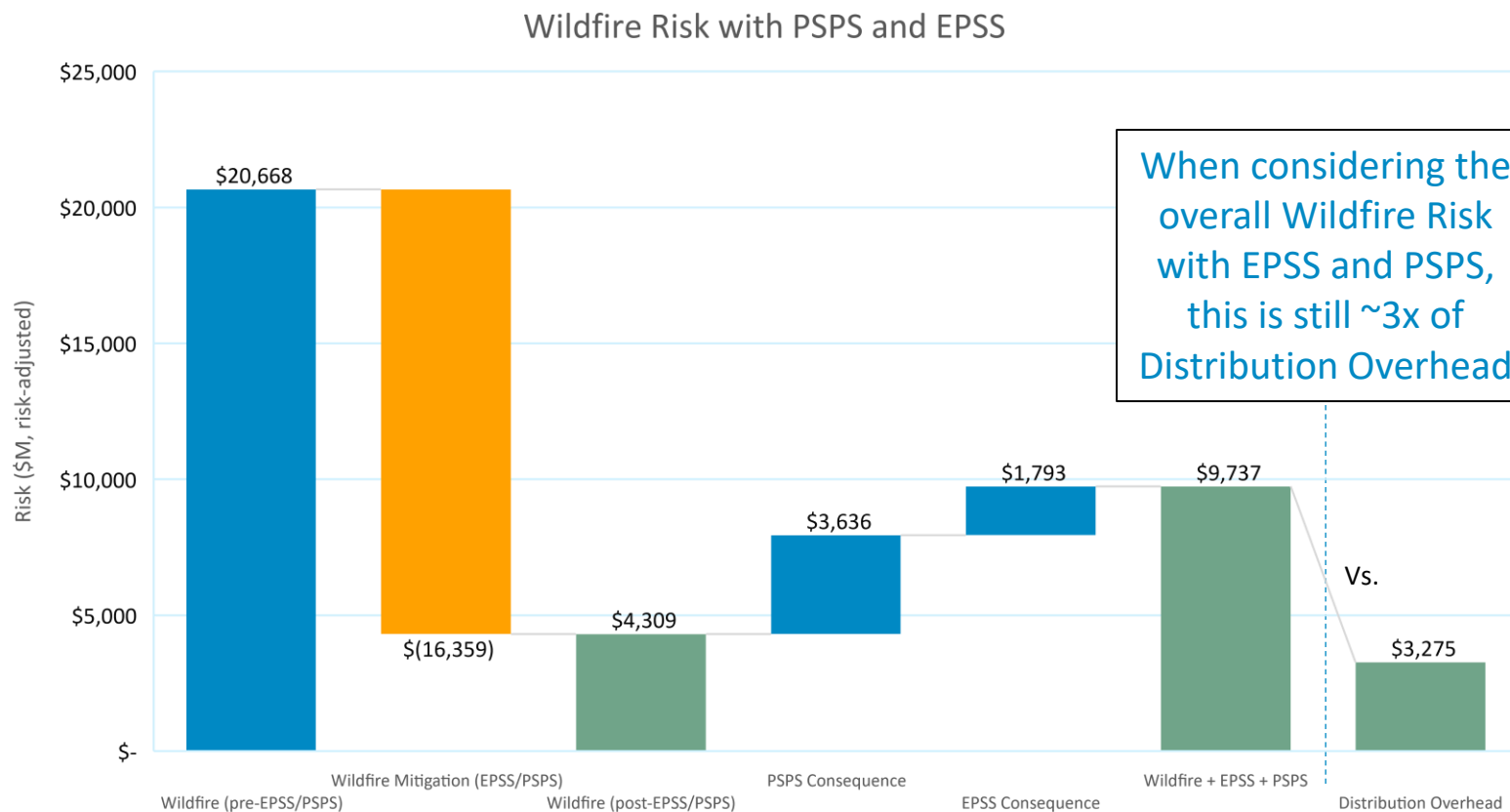
Preliminary



Wildfire with EPSS and PSPS: Waterfall

Overall Wildfire Risk is a combination of operationally unmitigated Wildfire Risk, net of Wildfire Risk Mitigation plus negative impacts from EPSS and PSPS

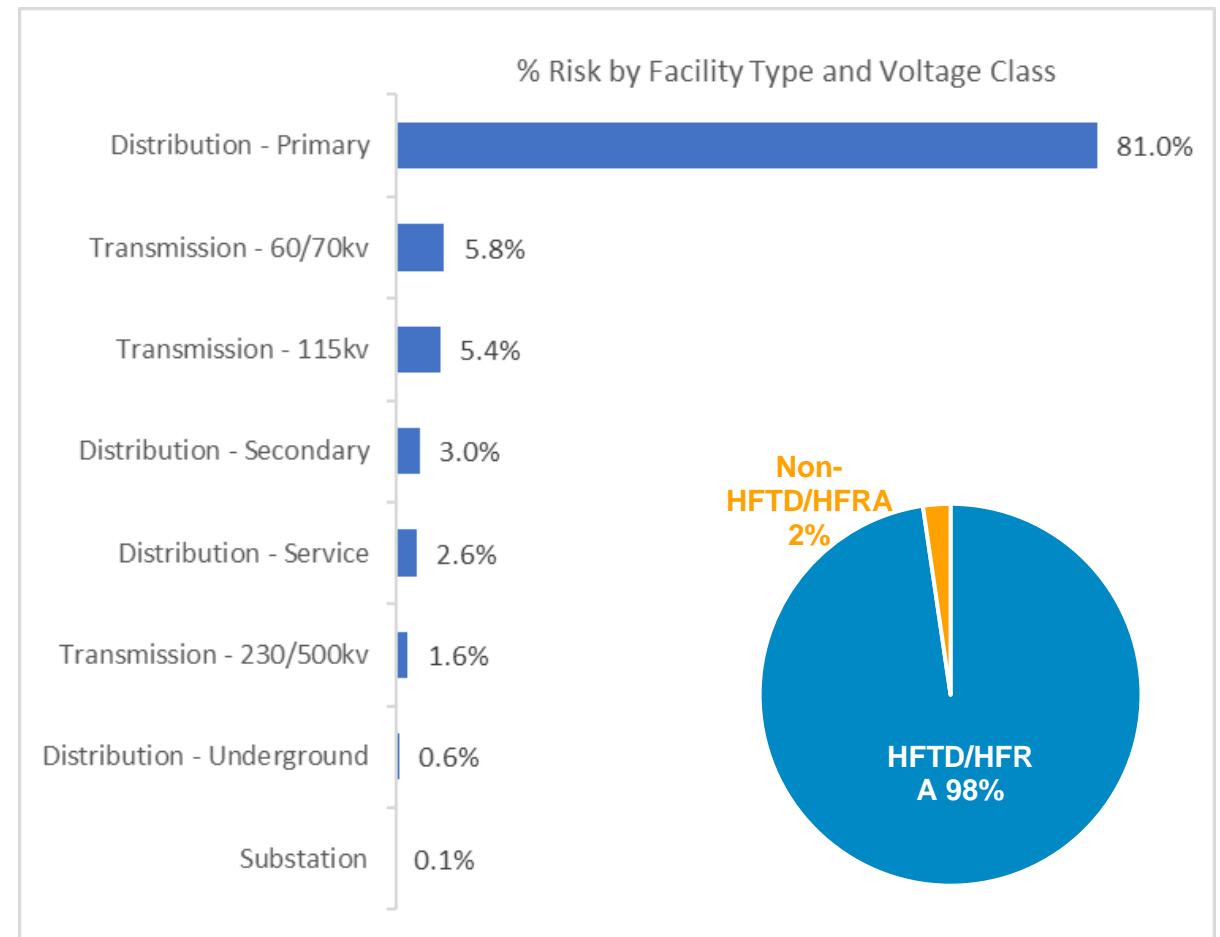
Risk Name	Risk (\$M, risk-adjusted)
Wildfire (pre-EPSS/PSPS)	\$20,668
Wildfire Mitigation (EPSS/PSPS)	\$(16,359)
Wildfire (post-EPSS/PSPS)	\$4,309
PSPS Consequence	\$3,636
EPSS Consequence	\$1,793
Wildfire + EPSS + PSPS	\$9,737
Compared to..	
Distribution Overhead	\$3,275





Wildfire: Tranches

Tranche	Miles	Risk	Risk %	Risk / Mile
HFTD/HFRA - Distribution - Primary - Tranche 1	434	665	3.2%	1.53
HFTD/HFRA - Distribution - Primary - Tranche 2	596	673	3.3%	1.13
HFTD/HFRA - Distribution - Primary - Tranche 3	718	1,446	7.0%	2.01
HFTD/HFRA - Distribution - Primary - Tranche 4	869	1,842	8.9%	2.12
HFTD/HFRA - Distribution - Primary - Tranche 5	1,088	1,896	9.2%	1.74
HFTD/HFRA - Distribution - Primary - Tranche 6	1,340	1,776	8.6%	1.33
HFTD/HFRA - Distribution - Primary - Tranche 7	1,765	1,851	9.0%	1.05
HFTD/HFRA - Distribution - Primary - Tranche 8	2,535	1,874	9.1%	0.74
HFTD/HFRA - Distribution - Primary - Tranche 9	3,930	1,850	9.0%	0.47
HFTD/HFRA - Distribution - Primary - Tranche 10	12,660	1,621	7.8%	0.13
HFTD/HFRA - Distribution - Secondary	2,771	743	3.6%	0.27
HFTD/HFRA - Distribution - Service	11,036	828	4.0%	0.07
HFTD/HFRA - Substation	196	21	0.1%	0.11
HFTD/HFRA - Transmission - 115 kV	1,737	1,161	5.6%	0.67
HFTD/HFRA - Transmission - 230/500 kV	2,111	306	1.5%	0.14
HFTD/HFRA - Transmission - 60/70 kV	1,812	1,397	6.8%	0.77
HFTD/HFRA - Underground	3,027	137	0.7%	0.05
non-HFTD/HFRA - Distribution - Primary - Tranche 1	1	12	0.1%	8.98
non-HFTD/HFRA - Distribution - Primary - Tranche 2	8	21	0.1%	2.53
non-HFTD/HFRA - Distribution - Primary - Tranche 3	14	25	0.1%	1.77
non-HFTD/HFRA - Distribution - Primary - Tranche 4	19	26	0.1%	1.38
non-HFTD/HFRA - Distribution - Primary - Tranche 5	21	18	0.1%	0.86
non-HFTD/HFRA - Distribution - Primary - Tranche 6	71	36	0.2%	0.51
non-HFTD/HFRA - Distribution - Primary - Tranche 7	117	34	0.2%	0.29
non-HFTD/HFRA - Distribution - Primary - Tranche 8	169	32	0.2%	0.19
non-HFTD/HFRA - Distribution - Primary - Tranche 9	576	59	0.3%	0.10
non-HFTD/HFRA - Distribution - Primary - Tranche 10	53,884	247	1.2%	0.00
non-HFTD/HFRA - Distribution - Secondary	13,385	32	0.2%	0.00
non-HFTD/HFRA - Distribution - Service	67,718	3	0.0%	0.00
non-HFTD/HFRA - Substation	801	3	0.0%	0.00
non-HFTD/HFRA - Transmission	12,326	19	0.1%	0.00
non-HFTD/HFRA - Underground	25,470	12	0.1%	0.00
	222,211	20,668	100%	0.09



Preliminary



Wildfire with EPSS and PSPS: Data Sources

Model Element	PG&E	Industry	SME
Exposure	Circuit Miles in distribution and transmission system (PG&E GIS Information)		
Drivers	Ignitions Data (Ignition record basic cause)		
Sub-drivers	Ignition record supplemental cause		
Outcomes	CAL FIRE Wildfire data sets	CAL FIRE enhanced with PG&E data	
Financial Consequence	Historic financial damages associated to large wildfires (e.g., suppression cost per acre, cost of buildings destroyed)	CAL FIRE enhanced with PG&E data	
Safety Consequence	Historic safety impacts as identified by the CAL FIRE data set	CAL FIRE enhanced with PG&E data	
Reliability Consequence	Historic EPSS and PSPS impacts associated to wildfire and anticipated CMI from impacted lines		

Data Source	Description
CAL FIRE Wildfire data set	Historic information for all California wildfires, including acreage burned, safety impacts, and buildings impacted.
NLCD data set	National Land Cover Database set. Information surrounding ground cover used in modeling. Enhanced with PG&E datasets.

Failure of Electric Distribution Overhead Assets





Failure of Electric Distribution Overhead Assets: Overview

Risk Name	Failure of Electric Distribution Overhead Assets
Risk Definition	The failure of electric distribution overhead assets or lack of remote operational functionality that may result in public or workforce safety issues, property damage, environmental damage, or inability to deliver energy
Scope	<p>In Scope</p> <ul style="list-style-type: none">Failure of assets associated with PG&E's overhead electrical distribution system, including poles and support structures, primary and secondary conductor, voltage regulating equipment, protection equipment, switching equipment, transformers, and PG&E-owned streetlights. <p>Out of scope</p> <ul style="list-style-type: none">Consequences of any ignitions associated with the failure of electric distribution system assetsSafety consequence for PG&E employees and PG&E contractors resulting from failure of assets that are caused by human errorSafety consequence from third party contact with intact energized electrical equipment
Tranche development	Deciles based on circuit segment level risk
Tranches	<ul style="list-style-type: none">Union of HFTD¹ + HFRA² (HFTD/HFRA) and non-HFTD/HFRADeciles of risk
Date range	2017 through 2022

1. HFTD: High Fire Threat District
2. HFRA: High Fire Risk Area



Failure of Electric Distribution Overhead Assets: Evolution

2017 RAMP

Defined as Distribution Overhead Conductor Primary (DOCP).

- **Risk drivers:** Nine drivers based on contact with intact conductor and wire down events.
- **No tranches**
- **Safety Consequence:** Primarily attributed to contact with intact conductor event

2017 RAMP risk safety rank: 2

2020 RAMP

- **Risk drivers:** 11 drivers and 61 sub-drivers.
- **Tranches:** Five tranches based on circuits identified with increased risk of asset failure and circuit reliability performance
- **Safety Consequence:** Attributed to equipment failures related to conductor (employee, contractor, third-party managed separately)

2020 RAMP risk safety rank: 9

2024 RAMP

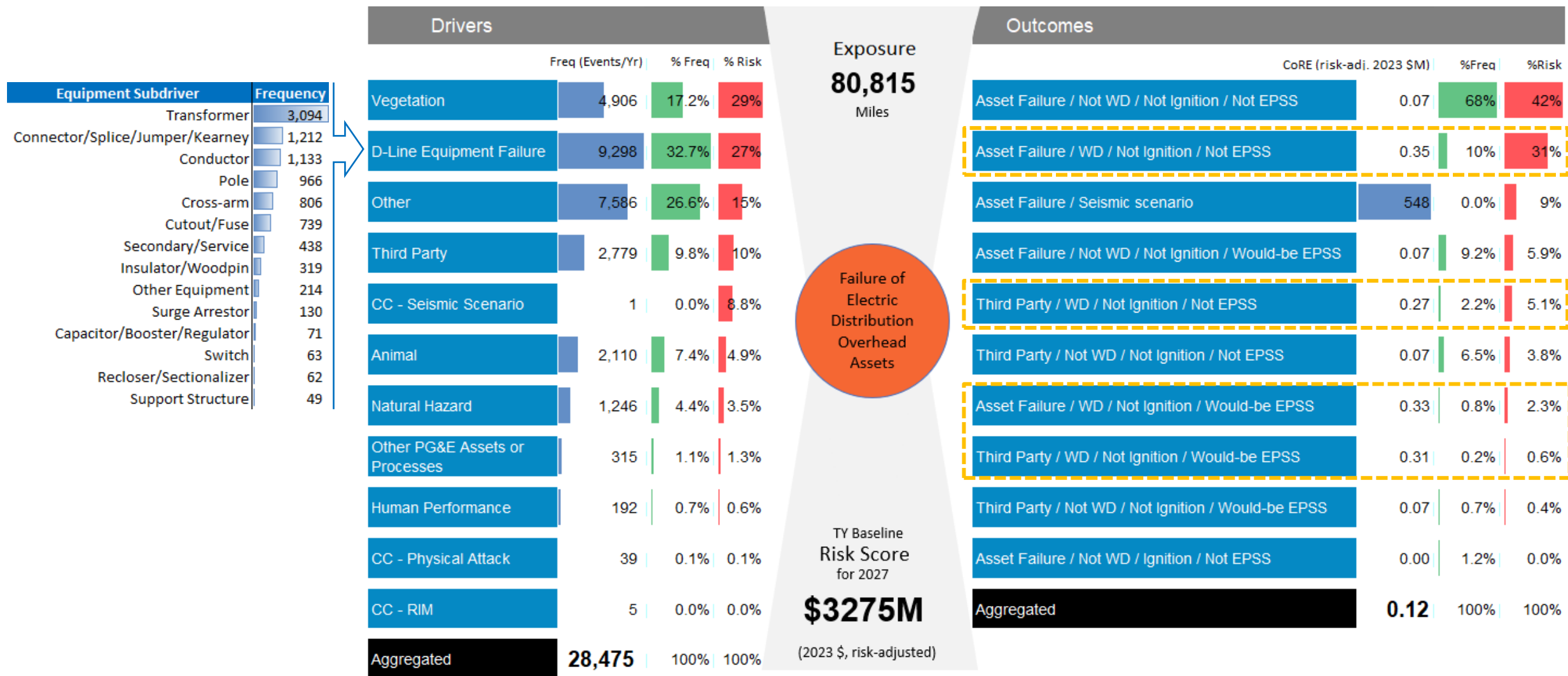
- **Risk drivers:** 11 drivers and 67 sub-drivers.
- **Tranches:** 20 tranches based on HFTD/HFRA and non-HFTD/HFRA and risk score deciles
- **Safety Consequence:** Added indirect safety impacts of reduced reliability

2024 RAMP risk safety rank: 5



Failure of Electric Distribution Overhead Assets: Bowtie

Wires Down (WD) represents about 13% of incidents, but 39% of Risk, with the Consequence of a Risk Event ~5x than of a non-WD.



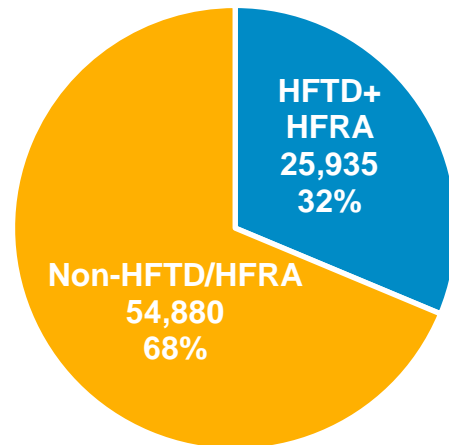


Failure of Electric Distribution Overhead Assets: Tranches

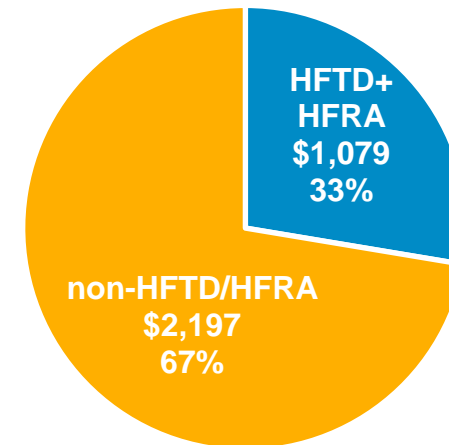
Tranches	Miles	Risk Score	% Risk Score	Risk / Miles
HFTD/HFRA	25,935	\$ 1,079	33%	\$ 0.04159
non-HFTD/HFRA	54,880	\$ 2,197	67%	\$ 0.04002

#	Tranches	Miles	Risk Score	#	Tranches	Miles	Risk Score	Total Risk Score	% Total Risk Score	Risk/ Miles
1	HFTD/HFRA_Tranche_01	77	\$ 122	11	Non-HFTD/HFRA_Tranche_01	94	\$ 120	\$ 242	7.4%	1.42
2	HFTD/HFRA_Tranche_02	219	\$ 159	12	Non-HFTD/HFRA_Tranche_02	387	\$ 219	\$ 378	11.6%	0.62
3	HFTD/HFRA_Tranche_03	385	\$ 135	13	Non-HFTD/HFRA_Tranche_03	691	\$ 222	\$ 358	10.9%	0.33
4	HFTD/HFRA_Tranche_04	724	\$ 99	14	Non-HFTD/HFRA_Tranche_04	863	\$ 194	\$ 293	9.0%	0.18
5	HFTD/HFRA_Tranche_05	873	\$ 83	15	Non-HFTD/HFRA_Tranche_05	1,324	\$ 207	\$ 290	8.9%	0.13
6	HFTD/HFRA_Tranche_06	1,274	\$ 93	16	Non-HFTD/HFRA_Tranche_06	1,863	\$ 221	\$ 314	9.6%	0.10
7	HFTD/HFRA_Tranche_07	1,941	\$ 109	17	Non-HFTD/HFRA_Tranche_07	2,524	\$ 212	\$ 321	9.8%	0.07
8	HFTD/HFRA_Tranche_08	2,943	\$ 81	18	Non-HFTD/HFRA_Tranche_08	3,608	\$ 223	\$ 303	9.3%	0.05
9	HFTD/HFRA_Tranche_09	4,848	\$ 80	19	Non-HFTD/HFRA_Tranche_09	6,958	\$ 224	\$ 304	9.3%	0.03
10	HFTD/HFRA_Tranche_10	12,651	\$ 116	20	Non-HFTD/HFRA_Tranche_10	36,569	\$ 355	\$ 471	14.4%	0.01

Exposure (Miles)



Risk Value (\$M Risk-adjusted)





Failure of Electric Distribution Overhead Assets: Data Sources

Model Element	PG&E	Industry	SME
Exposure	Circuit miles of primary electric lines		
Drivers	based on primary and secondary outage causes from ILIS		
Sub-drivers	based on primary and secondary outage causes from ILIS		
Outcomes	Outcomes are based on ILIS data, and incorporate control center data to identify if an outage occurred when EPSS was enabled		
Financial Consequence	Financial consequence is based on the cost of restoration of service		
Safety Consequence	Safety consequence is based on historical SIF values associated to distribution assets. Employee and contractor incidents are considered in the safety risks. 3 rd party contact with intact lines is considered in the Public Contact with Intact Energized Electrical Equipment (PCEEE) Risk.	Indirect Safety utilizes industry benchmark data	
Reliability Consequence	Reliability is based on outage records from the ILIS		

Data Source	Description
PG&E ILIS	Integrated Logging Information System
PG&E SIF Data	Internal serious injury and fatality tracker associated with distribution overhead asset failure
PG&E SAP	Financial cost associated with outages

Proposed RAMP Report Outline





Proposed RAMP Report Outline

D.22-10-002 adopted additional RSAR, RAMP, and GRC requirements that include greater consistency between regulatory filings: *“Where feasible, the IOUs should standardize chapters and headings in the RSARs, RAMPs and GRCs.”*

With this goal in mind, PG&E is proposing the following outline for the 2024 RAMP Report to align it with the exhibit structure and naming conventions that will be used in PG&E’s 2027 GRC Application.

RAMP Exhibit 01: Introduction

RAMP Exhibit 02: Risk Management, Safety, Business Planning and Related Influences

1. Risk Management Framework
2. Risk Modeling and Cost-Benefit Ratio
3. Cross-Cutting Factors
4. RAMP Risk Selection
5. Risk in Business Planning
6. Safety Culture, Policy, and Compensation
7. Climate Resilience
8. Environmental and Social Justice

RAMP Exhibit 03: Gas Operations

1. Risk Mitigation Plan: Loss of Containment on Gas Transmission Pipeline
2. Risk Mitigation Plan: Large Overpressure Event Downstream of Gas Measurement and Control Facility
3. Risk Mitigation Plan: Loss of Containment on Gas Distribution Main or Service

RAMP Exhibit 04: Electric Operations

1. Risk Mitigation Plan: Wildfire with PSPS and EPSS
2. Risk Mitigation Plan: Public Contact with Intact Energized Electrical Equipment
3. Risk Mitigation Plan: Electric Transmission System-Wide Blackout
4. Risk Mitigation Plan: Failure of Electric Distribution Overhead Assets
5. Risk Mitigation Plan: Failure of Electric Distribution Underground Assets

RAMP Exhibit 05: Energy Supply

1. Risk Mitigation Plan: Large Uncontrolled Water Release (Dam Failure)

RAMP Exhibit 07: Shared Services

1. Risk Mitigation Plan: Contractor Safety Incident
2. Risk Mitigation Plan: Employee Safety Incident
3. Risk Mitigation Plan: Cybersecurity Incident

RAMP Exhibit 08: Appendices

Closing Remarks



Appendix





Preliminary 2024 RAMP Risks and Attribute Risk Values

<i>Risk Values are Preliminary. Not for Any Use Other than this Workshop.</i>				TY Baseline (2027) Risk Values (\$M, Risk-Adjusted)				
Safety Rank	PG&E Enterprise Risk Register (ERR) Risk	Preliminary RAMP Risk	Safety	Electric Reliability	Gas Reliability	Financial	Total	
Top 40% of Safety Risks	1	Wildfire with PSPS and EPSS	✓	342	5,706	0	3,689	9,737
	2	Loss of Containment on Gas Transmission Pipeline	✓	140	0	22	26	188
	3	Public Contact with Intact Energized Electrical Equipment	✓	61	0	0	0	61
	4	Electric Transmission System-wide Blackout	✓	59	2,116	0	6	2,181
	5	Failure of Electric Distribution Overhead Assets	✓	52	3,118	0	105	3,275
	6	Contractor Safety Incident	✓	36	0	0	0	36
	7	Employee Safety Incident	✓	31	0	0	8	39
	8	Cybersecurity Incident	✓	25	933	25	43	1,026
	9	Large Uncontrolled Water Release (Dam Failure)	✓	21	0	0	417	438
	10	Large Overpressure Event Downstream of Gas Measurement and Control Facility	✓	20	0	<1	1	21
	11	Loss of Containment on Gas Distribution Main or Service	✓	19	0	9	81	109
	12	Failure of Electric Distribution Underground Assets	✓	14	712	0	19	745



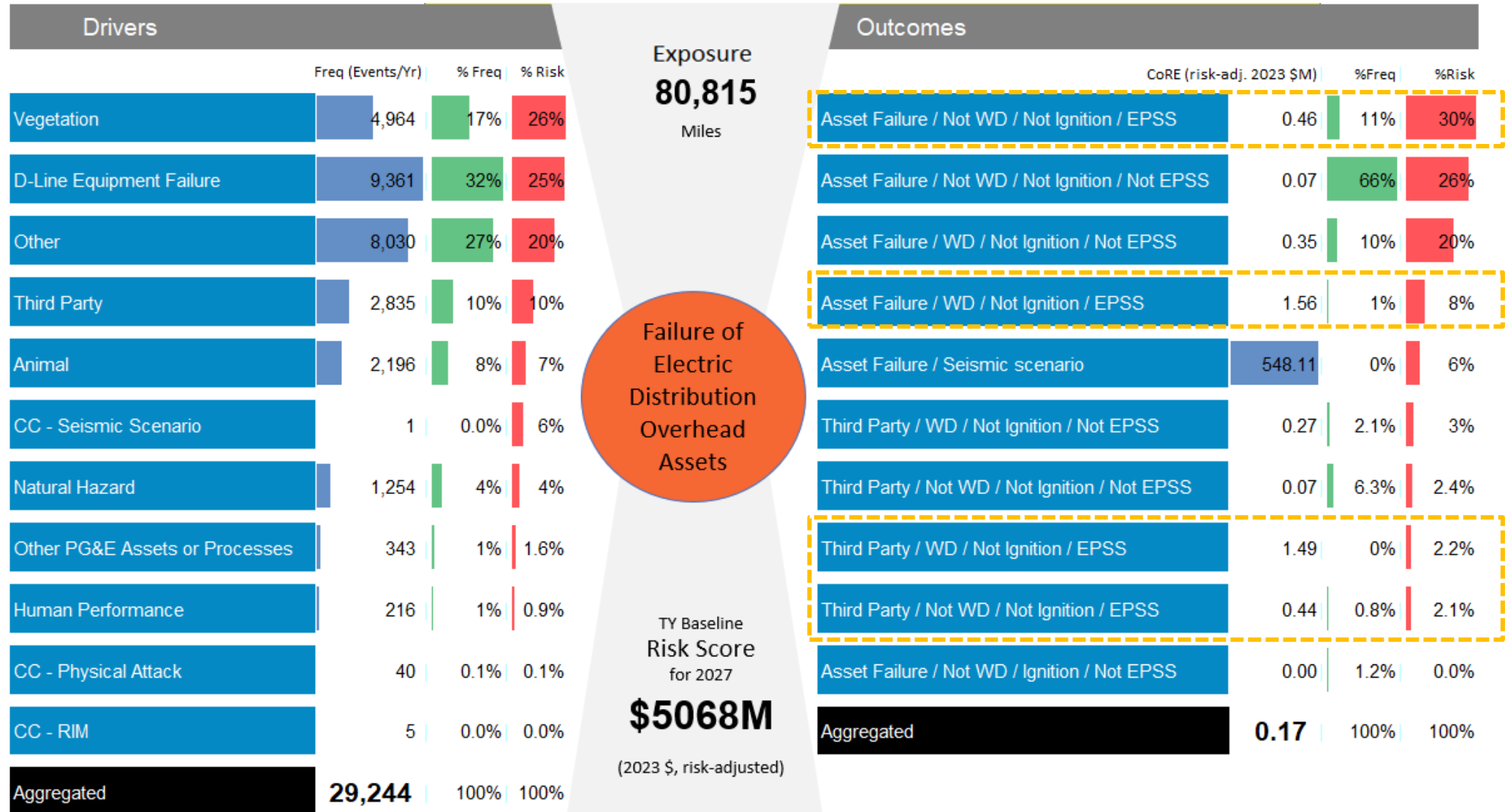
Preliminary 2024 RAMP Risks: Changes from 2020

Risk Name	Risk Definition or Scoping	Model Development	Indirect Safety	Commentary
Wildfire with PSPS and EPSS	X	X	X	PSPS and EPSS reflected in Baseline risk rather than Post-mitigation risk; reliability consequences from PSPS and EPSS included.
Loss of Containment on Gas Transmission Pipeline		X		Increased tranche granularity, increased alignment with operational risk model
Public Contact with Intact Energized Electrical Equipment	X	X		Third-party Safety Incident Risk was rescoped to include only contact with intact energized electric equipment rather than public contact with PG&E assets that may lead to SIF
Electric Transmission System-wide Blackout		X	X	Included indirect safety
Failure of Electric Distribution Overhead Assets	X	X	X	Included car pole incidences
Contractor Safety Incident	X	X		Included Contractor Motor Vehicle Incidents (MVs), Excludes Aviation incidents
Employee Safety Incident	X	X		Non-preventable MVSI events scoped in (small impact); inclusion of Safety impact from DART cases (using AIS incorporation)
Cybersecurity Incident	X	X	X	Created bow tie model. Focus quantification on Level 4+ outcomes, include significant reliability impacts and indirect safety.
Large Uncontrolled Water Release (Dam Failure)	X	X		Non-catastrophic outcomes included in the quantification
Large Overpressure Event Downstream of Gas M&C Facility		X		Mapping of LOC Transmission, LOC Distribution outcomes to Overpressure LOC improves representation of potentially catastrophic LOC
Loss of Containment on Gas Distribution Main or Service		X		Increased tranche granularity (incl. adding material vintage, candidacy for Pipeline Replacement), increased outcome granularity
Failure of Electric Distribution Underground Assets	X	X		Model now includes what were previously two separate models covering Electric Underground assets
Real Estate and Facilities Failure	X	X		Move of General Office from SF to Oakland; further planned consolidation of workforce from multi-story (i.e., higher risk) buildings; partially remote workforce
Failure of Electric Transmission Overhead Assets		X	X	Included indirect safety impacts, tranching informed by transmission composite model
Motor Vehicle Safety Incident	X			Non-preventable MVIs moved to Employee Safety



Failure of Electric Distribution Overhead Assets – with EPSS Impact

When EPSS Events were added, EPSS events represents about 14% of incidents, but 45% of Risk with the Consequence of a Risk Event ~5x than of a non-EPSS event



Preliminary