

California's Risk-Based Decision-Making Framework: How Predicating Ratesetting Approval on Energy Utility Risk Quantification Advances the State's Safety Goals

By Jeremy Battis, Senior Analyst

Safety Policy Division of the California Public Utilities Commission

A CPUC Staff White Paper for Presentation at the CRRRI 33rd Western Conference

Monterey, California | June 2022

Overview

This paper documents one of the more sweeping public-safety protection policy actions to be devised by the CPUC in the prior decade: *the integration of risk assessment into California energy utilities' regulated activities by establishing risk disclosure and quantification as Step 1 in the GRC process.*

Summary

California is about a decade into its effort to apply risk-management principles to better avert what has become a proliferation of energy-utility-caused catastrophes brought about by factors such as insufficient past regulatory oversight, inadequately maintained infrastructure, and extreme weather exacerbated by climate change. A cornerstone of this reform effort – the *Risk-Based Decision-Making Framework* – predicates any GRC approval on energy utilities first completing a rigorous process of identifying their top-ranked operational safety risks, quantifying those risks, and establishing costs for mitigation programs to control risk. Now, having completed several rulemakings by which to refine the process, California has transferable knowledge to share on how its Public Utilities Commission, jurisdictional utilities, and stakeholder community together derived new methodologies for the State, while growing their collective risk-assessment capacities. California's experience may hold implications as well as insight for ratemaking entities considering adding a risk component to their requirements governing utility revenue requests.

Origins

California's energy-utility risk-assessment origins lie in the disaster of September 9, 2010, when at approximately 6:11 p.m., a segment of PG&E's underground natural-gas transmission pipeline ruptured in a residential neighborhood of San Bruno, just south of San Francisco. The 30-inch-diameter steel pipeline failure's ensuing explosion and fire claimed eight lives and 38 private residences, with nearly 100 more homes sustaining various levels of damage.

The Commission responded in part by initiating an investigation¹ to be informed by an independent review panel² of experts tasked with fact finding and making recommendations for improving Pacific Gas and Electric Company's safe operation of its natural gas transmission lines.

The panel's 200-page Report, made available June 8, 2011, pointed to root causes ranging from PG&E's aging infrastructure and subject pipeline material integrity degradation to shortcomings within the utility's management ranks and corporate safety culture.

The Report offered multiple incisive findings and conclusions directed toward the Commission and laying bare the agency's deficient safety capacity and staff resources:

"There is no data collected on which to benchmark and identify risk management issues or alternatives. The CPUC does not have the personnel to do quality analysis of risk management choices or to appraise in depth the quality of any such analyses that might be offered by PG&E."

"The CPUC currently does not have personnel with the skills to substantially review any risk analysis of risk management decisions submitted by utilities with rate requests related to risk management decisions."

Commission Safety staff "traditionally has had little involvement in natural gas utility ratemaking proceedings," where increased interaction with ratemaking staff could improve their "understanding [of] utility maintenance requirements and expenditures in gas rate cases."

The limited role of Commission Safety staff "in utility ratemaking in California is not unusual when compared to other states."

"Given the wide-ranging initiatives under consideration in the [Commission Investigation], the CPUC will need significantly far more detailed [utility risk mitigation] plans and estimates before it can consider revenue requirement and ratemaking impacts."

The San Bruno disaster thus served to expose that the CPUC was acutely under resourced to take on the job of competently assessing risk assessment efforts by utilities.

¹ The Commission initiated Rulemaking R.11-02-019 on February 24, 2011, to examine whether new safety and reliability rules should be adopted for natural gas pipelines on a statewide basis. On October 7, 2011, a raft of gas safety bills were signed into law by the Governor.

² The panel was established by Commission Resolution No. L-403, September 23, 2010.

³ What had been a relatively small Commission division addressing both consumer protection and safety issues ultimately spun off no fewer than five successor safety divisions addressing everything from ride share and autonomous vehicles to wildfires to railroads.

The disaster precipitated relatively rapid change in the structure, staffing,³ and priorities of the Commission, with alarmed elected leaders in Sacramento arming the CPUC with new funding, new mandates, and new regulatory statutory authority necessary for delivering enhanced safety oversight.

Probably most vital among the new laws enacted to address the San Bruno disaster was Senate Bill SB 705,⁴ requiring each gas corporation to “develop a plan for the safe and reliable operation of its commission-regulated gas pipeline facility that implements” the Commission’s safety goals.⁵

The Rate Case Plan: Regulatory Reform by Which to Derive a Risk-Based Decision-Making Framework

The CPUC’s administrative requirements for how large investor-owned utilities -- PG&E, SDG&E, SoCal Gas, and SCE -- are expected to submit and navigate regulatory approval of their General Rate Case (GRC)⁶ applications are referred to as “the Rate Case Plan” (RCP).⁷

Leveraging opportunity brought about by the new SB 705 statutory mandate, the Commission in 2013, embarked on its first major overhaul of GRC requirements⁸ for energy utilities in well over two decades, declaring in 2014, in the first Decision⁹ yielded from the subject rulemaking,¹⁰ “we modify the existing RCP to incorporate a risk-based decision-making framework into the GRCs for the large energy utilities.”¹¹

In revising the Rate Case Plan when it did, the Commission’s fundamental objective was to swiftly promote public safety by establishing a new regulatory mechanism to introduce an

³ What had been a relatively small Commission division addressing both consumer protection and safety issues ultimately spun off no fewer than five successor safety divisions addressing everything from ride share and autonomous vehicles to wildfires to railroads. Safety Policy Division, where the Commission’s Risk Assessment Section resides, today collaborates on GRC issues with the Energy Division, which is responsible of oversight of utility revenue requirements.

⁴ SB 705, 2011, establishes the policy of the State of California to place safety of the public and gas corporation employees as the top priority and requires that the distribution rate of a gas corporation include sufficient revenues and employee staffing to provide for prompt provision of service to the public consistent with this policy. The law requires the commission to take all reasonable and appropriate actions to carry out the policy.

⁵ Public Utilities Code Section 963(b)(3) in particular illuminates these safety goals: It is the policy of the state that the commission and each gas corporation place safety of the public and gas corporation employees as the top priority. The commission shall take all reasonable and appropriate actions necessary to carry out the safety priority policy of this paragraph consistent with the principle of just and reasonable cost-based rates.

⁶ The GRC is the proceeding wherein each of the energy utilities files an application requesting the Commission to authorize and adopt a revenue requirement for its operations and services.

⁷ Broadly speaking, the RCP exists to guide regulated utilities on the type of information that is to be presented and the procedural schedule that is to be followed for addressing revenue requirement requests within their GRCs.

⁸ Prior, the most recent major set of revisions to the RCP resulted from 1989’s Decision D.89-01-040. Minor changes to the RCP were adopted in D.92-08-033, D.93-07-030, and D.07-07-004.

⁹ D.14-12-025. Decision D.14-12-025 (2014), aka “the Rate Case Plan Decision.”

¹⁰ R.13-11-006. Rulemaking R.13-11-006 (2013-2020).

¹¹ The same decision concluded that the GRC served as the prime regulatory checkpoint from which to base any and all actions necessary to carry out the Commission’s existing and expanded safety oversight obligations.

enhanced level of outside scrutiny into utility operations by tying evidence of utility risk-management progress to utility revenue-request approval. To enable such an ambitious goal, the Commission first needed to put in place new regulatory requirements; specifically, a risk-informed decision-making process that would be, “rational, well-informed and comparable to best industry practices.”¹²

The *risk-based decision-making framework*, or “**RDF**,” accounting for the better part of the content forming the 2014 Rate Case Plan Decision, greatly expanded the scope of the Rate Case Plan to one well beyond simply GRC nuts and bolts such that it would underpin California’s strategy for safeguarding against future energy-utility-spawned catastrophe.¹³

The RDF introduced three new component risk-related compliance tracks, which had corresponding utility-assigned work products by which to inform future GRC applications:

- **S-MAP** an ongoing rulemaking process to serve as a regulatory vehicle for having utilities propose and refine their approach to risk assessment (aka the *Safety Model Assessment Proceeding*¹⁴ ());
- **RAMP** a cyclical review track for utilities to submit **risk disclosure reports** -- aka *Risk Assessment Mitigation Phase* (RAMP) or “**RAMP reports**” -- quantifying things like expected consequences and mitigation spending; and
- a verification mechanism whereby there is ongoing utility submittal of **compliance progress reports** describing items like risk mitigation spending and how forecasted expenditure levels across proposed categories measured up against recorded spending.

The descending order of the three primary RDF components listed above is indicative of the effort and resources required to address each of each one. The ordering also conveys how a particular RDF component would precede and inform another, with the S-MAP setting parameters for determining the adequacy of RAMP reports. And in turn, compliance progress reports providing annual dashboard reads of how well utility-forecasted spending levels, promised mitigation projects, and reduced levels of risk are materializing.

A utility’s GRC application is generally greenlighted to commence upon conclusion of the RAMP report component.¹⁵ Accordingly, the various utility-risk-related disclosures, data, and

¹² [R.13-11-006](#). Rulemaking R.13-11-006 (2013-2020).

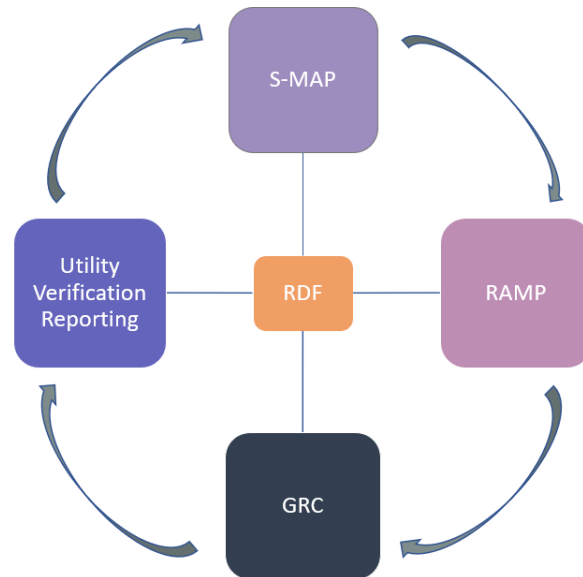
¹³ Leaving little room for doubt where lawmakers stood on the position of GRC reform at the Commission, the Legislature in 2014, added [Section 750](#) to the P.U. Code, requiring that the Commission develop formal procedures to consider safety in a rate case application by an electrical corporation or gas corporation.

¹⁴ [Application A.15-05-002](#), the *Safety Model Assessment Proceeding* (first S-MAP 2015-2019),

¹⁵ To ensure that a utility RAMP report may timely inform the GRC application, the filing dates for the two are set apart by one year, and Commission Safety staff is allotted 110 days to complete its review of a RAMP report.

assurances that the RAMP exercise yield serve as GRC inputs, informing a utility's revenue requirement request. With this in mind, components 1, 2, and 3, above also represent sequential steps in an ongoing compliance repetition, where the action of a utility filing its GRC-application would follow, as presented below in Figure 1.

Figure 1. GRC APPLICATION AS A STEP WITHIN THE RDF PROCESS



More on the particulars and regulatory stages of development that shape the S-MAP and RAMP presented in the sections that follow.

Safety Model Assessment Proceeding (S-MAP)

The S-MAP regulatory track serves as the Commission's rulemaking engine for generating applicable RDF policies and for studying existing gaps in rules and utility risk models to promote continual improvement. The S-MAP describes how utility RAMP reports are to be composed, submitted, assessed, and approved.¹⁶ Specifically, the purpose of the S-MAP, as articulated in the 2014 Rate Case Plan Decision establishing its initial parameters, is to "allow the Commission and parties to examine, understand, and comment on the models that the energy utilities plan to use to prioritize risks and to mitigate risks. . . [and to] establish the guidelines and standards for these models."

¹⁶ In time, the Commission would employ a position of not formally approving a utility's RAMP report, but rather requiring issuance of a single-draft Staff Report response appraising the adequacy of a utility's effort, and generally leaving urgent and necessary RAMP modifications to be addressed within the GRC application.

Additional general requirements and parameters covered by an S-MAP rulemaking include:

- Each utility should present, within a RAMP report, its top risks for which the utility expects to seek recovery within its GRC.
- The S-MAP filings¹⁷ of each large energy utility should explain:
 - how each utility proposes to assess safety risks associated with its assets and operations; and
 - the tools or activities proposed to manage, mitigate, and minimize such risks.
- The S-MAP proceeding should be consolidated and allow for development of uniform and common standards for the four subject electric and gas utilities.
- The end-product of an S-MAP proceeding is to be a Commission Decision¹⁸ determining the appropriateness of a particular risk assessment approach or model for a utility to employ as the basis for a subsequent RAMP report.¹⁹

The first S-MAP proceeding, initiated in 2015, had the four subject utilities file applications consolidated under proceeding Application A.15-05-002. Concluding in 2019, the proceeding generally transpired concurrently with RDF proceeding R.13-11-006.²⁰ The S-MAP proceeding advanced utility risk model and RAMP rigor over the course of three resulting Commission Decisions, as detailed within *Attachment A, Chronology of Applicable Commission Rulemakings and Decisions*, to this white paper.

A 2016 CPUC Safety staff report,²¹ largely adopted in the first Commission S-MAP Decision that year, served to identify priority areas where initial RAMP requirements could be extended to further advance the rigor of the utilities' risk assessment efforts:

¹⁷ The exercise of requiring utility S-MAP submittals was undertaken just once in 2015, as part of proceeding Application A.15-05-002, the Safety Model Assessment Proceeding (first S-MAP), which established specific RAMP guidelines.

¹⁸ Notably, the Rate Case Plan Decision determined that each utility's iterative RAMP process would not conclude with or yield a Commission Decision. Justification for this somewhat atypical approach included considerations of improved RAMP integration within the GRC approval process by deferring to its Decision and the pursuit of economizing scarce Commission, utility, and intervenor resources.

¹⁹ The 2014 Rate Case Plan Decision contemplated whether a utility application was the appropriate regulatory vehicle for filing a RAMP report and initiating a Commission proceeding. This consideration was closely tied to the broader consideration of whether and how to integrate the RAMP fully into the GRC process or to have it exist independently. Ultimately, the Commission landed on a hybrid approach whereby a utility RAMP report would precede a utility GRC application, with Commission Safety Staff conclusions and recommendations on a given utility RAMP report serving as the starting point for Commission review of a utility GRC application for adequacy and appropriateness. Although the 2014 Rate Case Plan Decision declined to direct utilities to submit their RAMP reports via application, a RAMP application has been the required pathway since 2020 by Decision D.20-01-002.

²⁰ The RDF proceeding begot the S-MAP, developed the RDF processes, and transitioned GRCs and RAMPs to four-year cycles. Accordingly, the RDF proceeding could be thought as higher level than the S-MAP while also having had a hand in shaping the RAMP.

²¹ Report made available via ALJ Ruling, March 22, 2016, informing Decision D.16-08-018 of rulemaking A.15-05-002.

“The utilities should explain their approaches to risk assessment in RAMP filings. For their RAMP filings, the utilities will make choices about how many risks to include and how to select those risks. The utilities should explain, in narrative form and with charts, how and why they made the choices that they did” and the utilities should explain why their risk methodology is justified and how an end result is optimized and the best available.

“The utilities should include risk-spend efficiency calculations in their RAMP filings, even if those calculations are imperfect.”

“The RAMP filing is an opportunity for the utilities to improve their methods for assessing and mitigating risk. It is also a way for the utilities to demonstrate new methods to better calculate and identify risk — and to mitigate risk more effectively. The utilities should use the RAMP filings as opportunities to clearly identify the most effective ways to achieve these goals and should communicate that understanding to all parties so that others can adopt the best practices that result.”

Two years after the 2016 Commission S-MAP Decision, another expansive set of RAMP requirements -- higher standards for risk quantification with still more rigor and complexity expected of a utility’s risk methodology – took effect by way of a 2018 Commission S-MAP Decision.²² Resulting additional required RAMP elements included:

- a Multi-Attribute Value Function²³
- an enterprise risk register identifying a utility’s primary risks
- risk assessment and risk ranking
- identification of enterprise risks; and
- mitigation analysis of risks including a proposed mitigation plan consisting of one or more mitigation measures for each identified risk, as well as two plan alternatives

The 2018 Commission S-MAP Decision adopted two additional essential: a *Risk Lexicon*, defining and standardizing commonly used risk assessment terms; and *Ten Major Components of a RAMP*, both detailed within *Attachments B and C*, to this white paper.

A third RAMP tool also introduced at the time sought to employ a visual schematic representing component risk inputs and outputs to facilitate better understanding of how

²² Decision D.18-12-014, 2018 Commission S-MAP Decision.

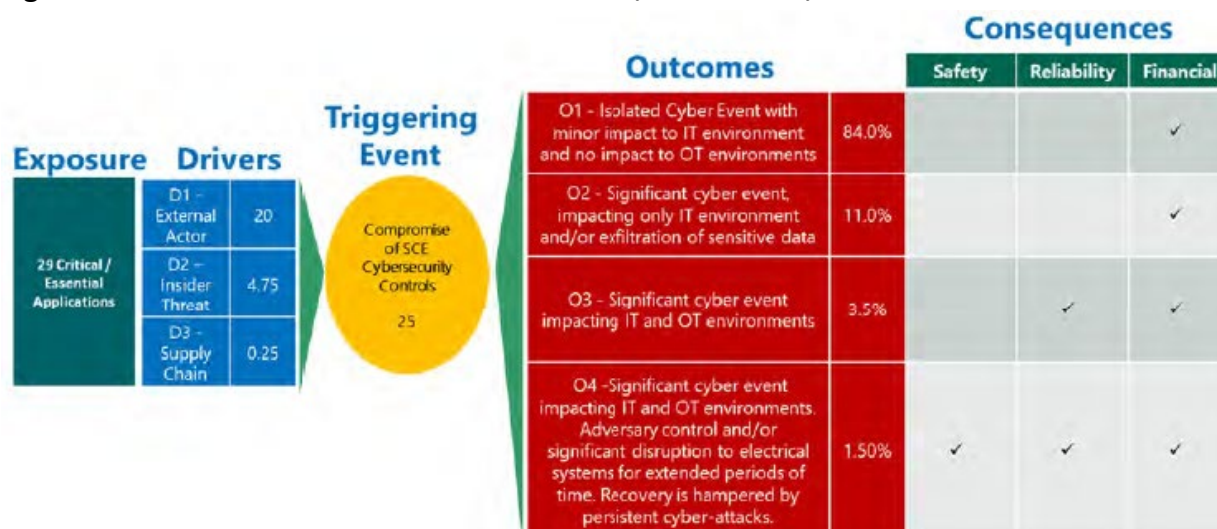
²³ The Attachment B Risk Lexicon defines a Multi-Attribute Value Function as a tool for combining all potential consequences of the occurrence of a risk event and that creates a single measurement of value.

utilities perceived their safety threats, causes, and resulting harm by way of a risk *Bow Tie*²⁴ diagram. Example Bow Tie diagrams are offered below in Figures 2 and 3.

Figure 2. BOW TIE DIAGRAM AS CONCEPTUAL SCHEMATIC



Figure 3. BOW TIE DIAGRAM AS APPLIED BY SCE, 2022 RAMP, CYBER ATTACK RISK CHAPTER



The 2018 Commission S-MAP Decision was informed significantly by recommendations from parties -- utilities and intervenors -- to the rulemaking whose disparate positions were unified according to a Settlement Agreement incorporated into the Decision and adopted with modifications.²⁵

Among other contributions, the parties' Settlement Agreement recommendations resulted in the establishment of new provisions that:

- required mathematically-correct and logically-sound methodologies

²⁴ The Attachment B Risk Lexicon defines a Bow Tie diagram as a tool that consists of the risk event in the center, a listing of the drivers on the left side that potentially lead to the risk event occurring, and a listing of consequences on the right side that show the potential outcomes if the risk event occurs.

²⁵ Namely, the Decision modified the agreement to provide a utility risk model minimum safety weight of 40 percent so as to ensure that the Safety attribute would be weighted most heavily; other required risk model attributes are Financial and Reliability. The Settlement Agreement, which offers extensive technical guidance, is available as an attachment to the 2018 Commission S-MAP Decision.

- required transparency and sufficient data for third parties to assess utility judgments; and
- provided for dynamic analysis when certain utility risk model assumptions are expected to change significantly over time

Finally, the Settlement Agreement led to the 2018 Commission S-MAP Decision adopting new minimum standards for utilities when crafting their risk models and RAMP reports, as detailed within *Attachment D, Minimum Required Steps for Risk Analysis and Mitigation Planning by Large Utilities*, to this white paper. The new minimum standards language offered still more risk definitions and introduced several vital risk concepts to the risk methodology.

Risk Assessment and Mitigation Phase (RAMP)

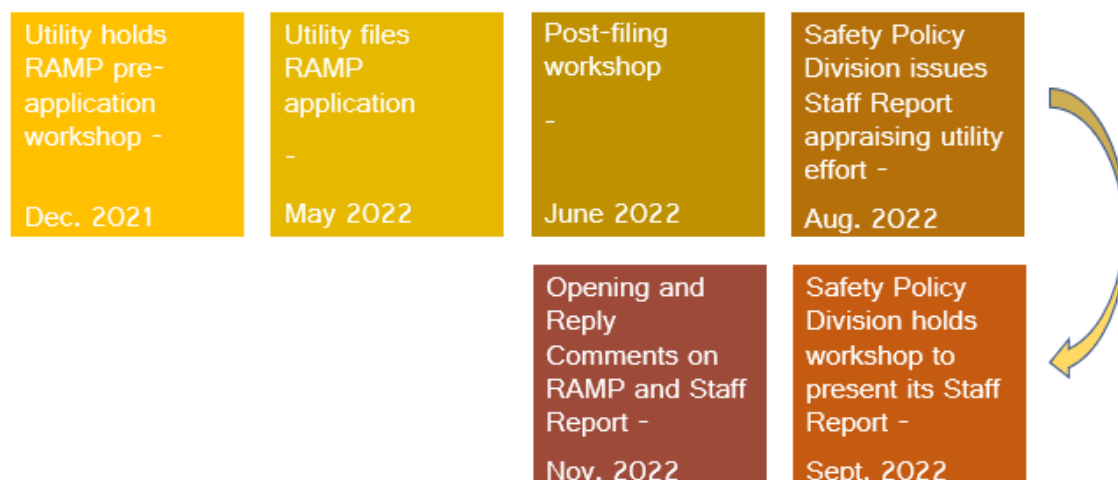
A RAMP report represents a major once-every-four-years regulatory compliance undertaking required of electric and gas utilities. The document, submitted within a RAMP application, serves to verify that the applicable entity has adhered to RDF and S-MAP expectations. The RAMP report has a utility present perhaps a dozen of its most-significant operational safety risks and defend its approach to mitigation measures and proposed spending levels.

RAMP proceedings allow intervenors to question a utility’s proposed approach and to suggest alternatives reducing safety risk prior to a project spending request being formally submitted for funding authorization as part of a GRC application.

The result is an ability for the Commission to reasonably determine whether the utility has appropriately programmed risk-control spending within its revenue requirement and that spending levels are reasonable and optimized to the extent possible.

Figure 4 below identifies the primary steps that comprise a typical RAMP process, employing the 2022 iteration as an example.

Figure 4. PRIMARY STEPS WITHIN A UTILITY RAMP ITERATION



The RAMP process commenced with the first utility RAMP report submission in 2016. The rotating process generally has one of the four subject utilities submit a RAMP application in a given year. To date, there have been five²⁶ completed RAMP iterations with a sixth in progress, resulting in each utility having gained the experience of two RAMP iterations. Activities to date are captured below in Figure 5.

Figure 5. TABLE OF CALIFORNIA UTILITY RAMP ITERATIONS

	2022	2021	2020	2018	2017	2016
SCE	X			X		
SoCal Gas		X				X
SDG&E		X				X
PG&E			X		X	

Upon a utility completing the primary RAMP steps shown in Figure 4, the subject RAMP proceeding, whose focus is the vetting of a utility RAMP report, retreats to the background as the subject utility makes final revisions to its draft GRC application, including any necessary modifications to address deficiencies identified within the RAMP report so that it may be integrated into the GRC. This transition entails a passing of the baton among Commission divisions as Safety Policy Division pivots to a support role for any further risk-related issues within the approaching GRC, deferring to Energy Division as lead for the GRC phase.²⁷ All the while, SPD staff turn their primary focus to receiving the next incoming utility RAMP application.

The placement of a utility RAMP proceeding as the starting point for eventual approval of a four-year GRC funding cycle is shown below within Figure 6.

Figure 6. 2022 RAMP PROCEEDING PLACEMENT IN ONE UTILITY'S GRC CYCLE

TY 2021 GRC	2022 RAMP	2023	2024	TY 2025 GRC	2026 RAMP
Authorization of funding for new 4-year cycle	Application submitted and vetted	TY 2025 GRC application submitted	TY 2025 GRC application approved	Authorization of funding for new 4-year cycle	Application submitted and vetted
Attrition years 2022-2024	Informing TY 2025 GRC	Submittal expected May 2023	Approval expected May 2024	Attrition years 2026-2028	Informing TY 2029 GRC
<ul style="list-style-type: none"> + Test Year 2021 GRC begins, originating with 2018 RAMP + 2019, GRC application filed + 2020, GRC approved with effective date of 2021, ending 2024 	<ul style="list-style-type: none"> + Significant analysis and stakeholder vetting + To inform utility risk spending for years 2025 thru 2028 within TY 2025 GRC application 	<ul style="list-style-type: none"> + 2022 RAMP closed out + Any flagged areas of concern within proposed utility risk spending or risk model addressed here, within TY 2025 GRC application 	<ul style="list-style-type: none"> + 2024, GRC approved with effective date of 2025 + Revised risk model, remedying any deficiencies, adopted as part of GRC 	<ul style="list-style-type: none"> + Test Year 2025 GRC begins, originating with 2021 RAMP + 2023, GRC application filed + 2024, GRC approved with effective date of 2025, ending 2028 	<ul style="list-style-type: none"> + Significant analysis and stakeholder vetting + To inform utility risk spending for years 2029 thru 2032 within TY 2029 GRC application

²⁶ The Sempra utilities, SoCal Gas and SDG&E, have a RAMP application process that is largely integrated, with RAMP filings made the same year and contemporaneous CPUC review. The work products resulting from the five RAMP iterations are available on the Commission's [RAMP webpage](#).

²⁷ Safety Policy Division, where the Commission's Risk Assessment capacity resides, collaborates with the Energy Division, the assigned lead for utility revenue requirements.

WHAT'S TOPICAL IN 2022 FOR RISK ASSESSMENT IN CALIFORNIA

Today's utility RAMP applications typically address a dozen gas and/or electric safety risks and run to thousands of pages when accounting for appendices, regulatory legalese, and assorted work papers where utilities show their calculations. Newly critical energy safety risks -- Wildfire and Climate Change impacts -- have rapidly gained prominence and urgency in the decade since the 2014 Rate Case Plan Decision instituted the RDF. And as such, have required the Commission and California utilities to respond with initial assumptions to enable to address these risk and deploy mitigation measures.

Wildfire and Climate Change risks have accelerated in importance as accumulated loss and increased incidence year by year in the past half-decade evince evermore destructive and severe events with the specter of more to come. The Commission and utilities have responded in part with more emphasis on risk granularity, allowing for a more surgical approach to identifying and controlling risk.

Often, granularity is helpful to attain a read on categories of utility infrastructure including pole or pipeline vintage, and pole or pipeline composition. Similarly, replacement of legacy utility hardware at end-of-useful life can be made easier when important layers of information -- asset class, condition, and location -- are ranked and recorded.

Such grouped subcategories of utility operational assets having generally uniform risk characteristics are, for RDF purposes, termed "tranches." Increasingly, the subject risks themselves are being segmented into component parts to allow for a more custom approach to the problem. One example would be Wildfire risk. Statewide, Wildfire risk consists of three tiers of wildland geographic areas assigned according to likelihood and severity of consequence, which serve to aid the prioritization of resources to reduce risk of ignition by utility infrastructure.

California electric utilities are newly required²⁸ to further segment their existing Wildfire risk category to create a new risk category centered on planned power shutoffs, a rationed-deployment safety tool that de-energizes powerlines to preclude ignition. The change posits that California utilities can more precisely account for costs and benefits when weighing whether to deactivate a powerline to prevent fire, an action having its own subset of societal costs and consequences.

IN HINDSIGHT: GAPS IN INITIAL RULES AND WEAKNESSES IN UTILITY MODELS

- Utility risk models hamstrung by weak transparency and questionable replicability of results

²⁸ "We require the IOUs to treat PSPS events as a risk within the RDF framework, not just as a mitigation, just as they would for any other risk to safety, reliability, and finances. Similar to other risks, the IOUs shall address the likelihood and consequences of PSPS events in the RDF and in future RAMP filings," D.21-11-009. Decision D.21-11-009 (2021, the "Phase I Decision").

- Initial utility risks models considered only one risk driver, a gross over-simplification of real world occurrences
- Many key risk model assumptions derived on the basis of subject matter expert discretion and judgment
- Utility risk scores not comparable across utilities
- Utility risk models not able to generate absolute risk scores
- Utility risk models subject to employing questionable weighting approaches and categories
- Challenging to judge proposed risk-mitigation program cost effectiveness on the basis of risk reduction per dollar spent with utility reliance on non-linear scales

RDF OUTLOOK AND WHAT'S AHEAD FOR CALIFORNIA

The RDF, as it informs the RAMP process today, has entered an intermediate phase of maturity. In addition to having the hindsight of three or so generations of rules applied and tested, the utilities – among other advances -- have generally coalesced around a set²⁹ of identified common primary risks, while having assembled much of the past incidence frequency data linked to their risks needed to establish baseline assumptions.

Still, the Commission and the California energy-regulatory risk community that informs it, recognize that much work remains to improve the efficacy of the RDF such that spending is contained, and energy utilities are able to avert a more sizable quantity of major risk events associated with their operations.

RDF rule omissions and glitches that remain include:

- Risk tolerance inadequately incorporated into utility risk calculation models and methodology
- Absence of upper and lower risk tolerability limits at the utility enterprise, line of business, and threat levels
- Persistent subjectivity and variability within a utility's chosen weighting and categories of risk consequences
- Utilities over reliant on risk portfolio prioritization where more optimization would be preferred

²⁹ For examples of California gas and electric utility RAMP risks see Attachments E and F to this white paper.

- Utilities appear to lack sufficient capacity at present to optimize their risk portfolio in a mathematically rigorous sense
- Utility risk models inadequately account for interacting and compounding risk drivers and synergy in mitigation across multiple risks
- Insufficient refinement of the procedure for utilities to provide supplemental analysis and revised assumptions when integrating a RAMP report into the GRC application, including accounting for project constraints and feasibility (collectively, the “GRC backstop” considerations)
- Inconsistent dollar assignments to value of statistical life
- Very limited application, at present, of requirements extending to Small and Multijurisdictional Utilities

The responding RDF rulemaking, the second S-MAP³⁰ proceeding, now underway, is expected to consider, if not address, each point listed above.

KEY TAKEAWAYS

- There is a need to improve standards for utility RAMP filings. The assumptions and quantification of risk probabilities, associated consequences, and risk-reduction value of mitigations vary in quality from risk to risk and from utility to utility. The Commission recognizes the need for continuous improvement and constant refinement and has responded accordingly.
- The RDF’s decade in existence notwithstanding, a substantial amount of work remains to be done to seamlessly integrate the risk-based decision-making framework into utility General Rate Cases. At present, the rapid clip at which utility safety-related risk mitigation expenditures are growing points to an unsustainable trend.
- The RAMP process has served to elevate and prioritize safety, but its envisaged end-goal remains unattained and elusive: a substantive cost-benefit analysis able to adequately inform utility risk-mitigation goals vis a vis other Commission priorities tied to significant investments such as attaining California’s decarbonization and clean energy goals; and the overriding consideration to maintain just and reasonable rates.
- The RDF and RAMP process having been well tested, have been demonstrated to be transferrable and replicable problem-solving approaches for application by other

³⁰ Rulemaking R.20-07-013.

agencies. California's newest safety agency, the Office of Energy Infrastructure Safety,³¹ now employs the Commission-derived framework in carrying out its functions.

Disclaimer

This Report was prepared by California Public Utilities Commission (CPUC) staff. It does not necessarily represent the views of the CPUC, its Commissioners, or the State of California.

The CPUC, the State of California, its employees, contractors, and subcontractors make no warrants, expressed or implied, and assume no legal liability for the information in this Report.

This Report has not been approved or disapproved by the CPUC.

³¹ Formerly the Wildfire Safety Division of the CPUC, the entity's new status as agency became effective July 1, 2021.

Attachment A

RISK-BASED DECISION-MAKING FRAMEWORK

CHRONOLOGY OF APPLICABLE COMMISSION RULEMAKINGS AND DECISIONS

R.13-11-006. Rulemaking R.13-11-006 (2013-2020, “the RDF proceeding”), designated disclosure of utility safety risk factors as a precursor to and major factor informing utility spending and budgets, and prioritized establishment of a new regulatory *Risk-Based Decision-Making Framework* to determine appropriate rules and expectations for how enhanced utility risk-management practices would lead to a safer California at a cost deemed reasonable.

D.14-12-025. Decision D.14-12-025 (2014, “the Rate Case Plan Decision”), was the first set of new Commission Orders resulting from R.13-11-006, and codified an initial set of RAMP requirements to incorporate a Risk-Based Decision-Making Framework into the process for approving energy utility operating and capital budgets -- a major regulatory-compliance undertaking initiated upon a utility’s filing of a General Rate Case (GRC) application.

D.15-11-005. Decision D.15-11-005 (2015, “the Cycl-10 Decision”) was the second set of new Commission Orders resulting from R.13-11-006, and addressed additional safety and risk-management issues, including several recommendations put forward by Commission consultant experts.

D.16-08-018. Decision D.16-08-018 (2016, “the Interim Decision”), within Application A.15-05-002, *the Safety Model Assessment Proceeding* (“first S-MAP,” 2016-2019) established guidelines for what utility RAMP submissions should include, as well as an assessment methodology by which to review the RAMP submissions. Requirements included new safety model and risk assessment standards. Improved utility risk frameworks that are quantitative, probabilistic, transparent, and more consistent from one utility to another were issues identified as requiring further analysis.

D.18-12-014. Decision D.18-12-014 (2018, “the Settlement Agreement Decision”), within Application A.15-05-002, further brought to bear the *Risk-Based Decision-Making Framework* vision articulated in R.13-11-006, and adopted recommendations put forward by the parties to codify RAMP descriptors, factors, and requirements such as a risk lexicon; ten component parts of all utility risk compliance filings; risk- and mitigation-tranches, and guidance for quantifying and ranking utility risks that account for assigning standard-unit values across disparate risk-model inputs and outputs.

D.19-04-020. Decision D.19-04-020, (2019, “the Reporting and Verification Decision”), within Application A.15-05-002, adopted 26 safety performance metrics and further refined utility risk and safety assessment and reporting requirements.

Attachment A (cont.)

RISK-BASED DECISION-MAKING FRAMEWORK

CHRONOLOGY OF APPLICABLE COMMISSION RULEMAKINGS AND DECISIONS

D.20-01-002. Decision D.20-01-002 (2020, “the Four-Year Cycle Decision”), was the third and final set of Commission Orders resulting from Rulemaking R.13-11-006 (now closed), which set forth a four-year cycle for Commission review of utility RAMP risk reports. The Decision also established that a utility RAMP risk report shall be filed as an application prior to an energy utility submitting a request for approval of any GRC application to fund its proposed system-wide utility operating and capital expenses.

R.20-07-013. Rulemaking R.20-07-013 (2020 -), now in progress, this proceeding (“second S-MAP”) has the broad objective to improve energy utility prioritization of safety consistent with P.U. Code Sec. 451. This multi-phase, multi-track rulemaking is addressing, among other things, the identification of critical lessons learned from the risk assessment and risk modeling regulatory efforts completed thus far; benefit of new rules for utility safety reporting and performance metrics; potential for advancing the Commission’s GRC, Climate, and Wildfire safety goals, and the appropriateness of revised risk model weightings, tolerance, and loss value assignments.

D.21-11-009. Decision D.21-11-009 (2021, the “Phase I Decision”), addressed safety metrics related to utility reporting operations related to accountability and reliability, and required that utilities’ treat planned power shutoffs as a discreet primary risk rather than simply a wildfire mitigation.

Attachment B
2021 REVISED RISK LEXICON | DECISION D.21-11-009

New terms are highlighted in *italics*. Revised terms are asterisked, with additions underlined.

2021 S-MAP Revised Lexicon	
Term	Definition
Alternative Analysis	Evaluation of different alternatives available to mitigate risk.
Attribute	An observable aspect of a risky situation that has value or reflects a utility objective, such as safety or reliability. Changes in the levels of attributes are used to determine the consequences of a Risk Event. The attributes in an MAVF should cover the reasons that a utility would undertake risk mitigation activities.
<i>Baseline</i>	<i>A reference point in time at the start of the new General Rate Case (GRC) cycle.</i>
<i>Baseline Risk</i>	<i>The amount of residual risk evaluated at the baseline (i.e. at the start of the new GRC cycle) after taking into account all risk reduction benefits from all risk mitigation activities projected to have been performed by the start of the new GRC cycle. The projected risk mitigation activities include those that are classified by the IOUs as controls, as well as all mitigation activities for which the IOUs are seeking approval and/or funding in the current or upcoming RAMP and GRC applications.</i>
Bow Tie	A tool that consists of the Risk Event in the center, a listing of drivers on the left side that potentially lead to the Risk Event occurring, and a listing of Consequences on the right side that show the potential outcomes if the Risk Event occurs.
Consequence (or Impact)	The effect of the occurrence of a Risk Event. Consequences affect Attributes of a Multi Attribute Value Function (MAVF).
Control	Currently established measure that is modifying risk.
CoRE	Consequences of a Risk Event.
CPUC	California Public Utilities Commission
Driver	A factor that could influence the likelihood of occurrence of a Risk Event. A driver may include external events or characteristics inherent to the asset or system.
Enterprise Risk Register (also referred to as “risk registry” or “ERR”)	An inventory of enterprise risks at a snapshot in time that summarizes (for a utility’s management and/or stakeholders such as the CPUC) risks that a utility may face. The ERR must be refreshed on a regular basis and can reflect the changing nature of a risk; for example, risks that were consolidated together may be

Attachment B (cont.)

2021 REVISED RISK LEXICON | DECISION D.21-11-009

Enterprise Risk Register (cont.)	separated, new risks may be added, and the level of risks may change over time.
Exposure	The measure that indicates the scope of the risk, e.g., miles of transmission pipeline, number of employees, miles of overhead distribution lines, etc. Exposure defines the context of the risk, i.e., specifies whether the risk is associated with the entire system, or focused on a part of it.
<i>Foundational Activities, Elements, or Programs</i>	<i>Initiatives that support or enable two or more mitigation programs or two or more risks but do not directly reduce the consequences or reduce the likelihood of safety risk events.</i>
Frequency	The number of events generally defined per unit of time. (Frequency is not synonymous with probability or likelihood.)
General Rate Case (GRC)	A CPUC proceeding that is denominated a general rate case, as well as PG&E's Gas Transmission and Storage (GT&S) rate proceeding.
Inherent Risk	The level of risk that exists without risk controls or mitigations.
Likelihood or Probability	The relative possibility that an event will occur, 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 certain we are that the event will occur.
LoRE	Likelihood of a Risk Event.
Mitigation	Measure or activity proposed or in process designed to reduce the impact/consequences and/or likelihood/probability of an event.
Multi-Attribute Value Function (MAVF)	A tool for combining all potential consequences of the occurrence of a risk event, and creates a single measurement of value.
Natural Unit of an Attribute	The way the level of an attribute is measured or expressed. For example, the natural unit of a financial attribute may be dollars. Natural units are chosen for convenience and ease of communication and are distinct from scaled units.
Outcome	The final resolution or end result.
Planned or Forecasted Residual Risk	Risk remaining after implementation of proposed mitigations.
Range of the Natural Unit	Part of the specification of an Attribute. For an Attribute with a numerical natural unit, such as dollars, the smallest observable value of the Attribute is the low end of the range and the largest observable value is the high end of the range. Therefore, any Attribute level that results as a consequence of an event, or a risk mitigation action, or of doing nothing should be found within the range. For weighting purposes, the range of the natural units of an Attribute should be able to describe any mitigation action. For an Attribute with a categorical natural unit, such as corporate image, the range of the Attribute is from the least desirable level to the most desirable level.

Attachment B (cont.)

2021 REVISED RISK LEXICON | DECISION D.21-11-009

Residual Risk*	Risk remaining after current controls <u>application of mitigations, including mitigations classified as controls.</u>
Risk	The potential for the occurrence of an event that would be desirable to avoid, often expressed in terms of a combination of various outcomes of an adverse event and their associated probabilities. Different stakeholders may have varied perspectives on risk.
Risk Driver	Same as definition for Driver.
Risk Event	An occurrence or change of a particular set of circumstances that may have potentially adverse consequences and may require action to address. In particular, the occurrence of a Risk Event changes the levels of some or all of the Attributes of a risky situation.
Risk Score	Numerical representation of qualitative and/or quantitative risk assessment that is typically used to relatively rank risks and may change over time.
Risk Tolerance	Maximum amount of residual risk that an entity or its stakeholders are willing to accept after application of risk control or mitigation. Risk tolerance can be influenced by legal or regulatory requirements.
Scaled Unit of an Attribute: a value that varies from 0 to 100	The scaled unit is set to 0 for the most desirable level of natural unit in the range of natural units. The scaled unit is set to 100 for the least desirable level of natural unit in the range of natural units. For any level of attribute between the most desirable and the least desirable levels, the scale unit is between 0 and 100. The benefit achieved by changing the level of an Attribute in natural units is measured by the corresponding difference in scaled units. In the special case of moving from the least desirable level to the most desirable level, the benefit is equal to 100 scaled units.
Settlement Agreement	The entirety of the agreement between Pacific Gas & Electric Company, Southern California Edison Company, Southern California Gas Company, and San Diego Gas & Electric Company, The Utility Reform Network, Energy Producers and Users Coalition, Indicated Shippers, and the Public Advocate's Office of the Public Utilities Commission.
Settling Parties	Pacific Gas & Electric Company (PG&E), Southern California Edison Company (SCE), Southern California Gas Company (SoCalGas), and San Diego Gas & Electric Company (SDG&E), The Utility Reform Network, Energy Producers and Users Coalition, Indicated Shippers, and the Public Advocate's Office of the Public Utilities Commission.
Tranche	A logical disaggregation of a group of assets (physical or human) or systems into subgroups with like characteristics for purposes of risk assessment.

Attachment C

TEN MAJOR COMPONENTS OF A RAMP DECISIONS D.18-12-014 AND D.16-08-018

Overall, the utility should show how it will use its expertise and budget to improve its safety record. To do so, <u>each utility should:</u>
1. Identify its top risks
2. Describe the controls or mitigations currently in place
3. Present its plan for improving the mitigation of each risk
4. Present two alternative mitigation plans that it considered
5. Present an early stage “risk mitigated to cost ratio” or related optimization
6. Identify lessons learned in the current round to apply in future rounds
7. Move toward probabilistic calculations to the maximum extent possible
8. For those business areas with less data, improve the collection of data and provide a timeframe for improvement
9. Describe the company’s safety culture, executive engagement, and compensation policies
10. Respond to immediate or short-term crises outside of the RAMP and GRC process

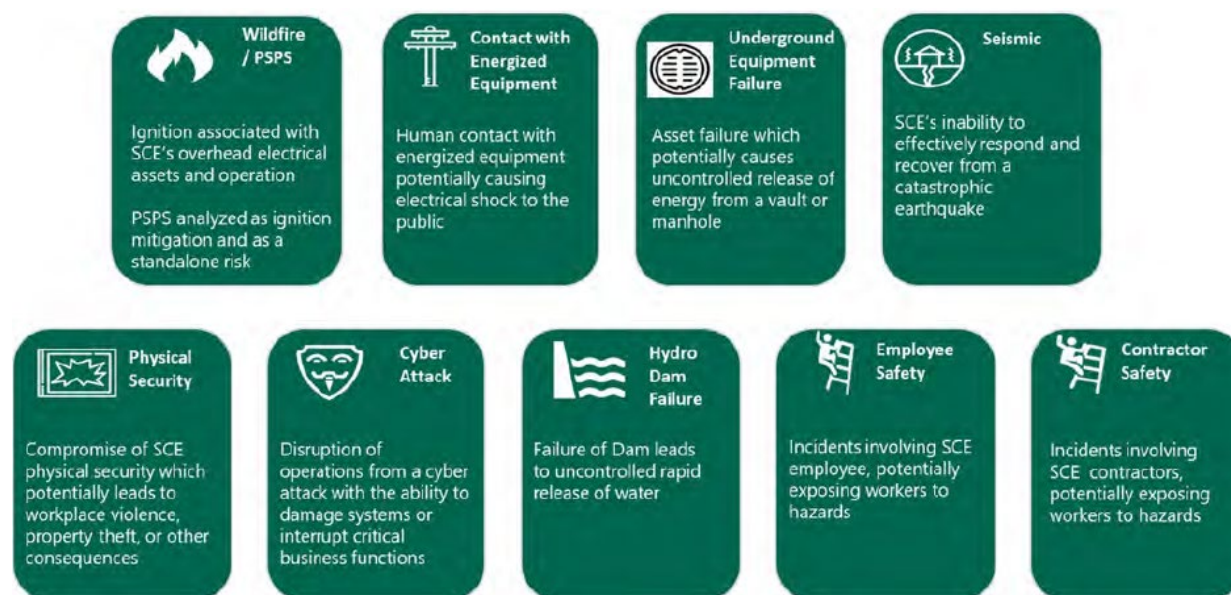
Attachment D

MINIMUM REQUIRED STEPS FOR RISK ANALYSIS AND MITIGATION PLANNING BY LARGE UTILITIES | DECISION D.18-12-014

- Step 1A- Building a Multi-Attribute Value Function (MAVF), a fundamental building block for the risk and mitigation analysis agreed to by parties.
- Step 1B- Identifying Risks for the Enterprise Risk Register (ERR) for purposes of determining which risks will be addressed in RAMP.
- Step 2A- Risk Assessment and Risk Ranking in Preparation for RAMP. Each utility will compute a Safety Risk Score for each ERR risk using the Safety Attribute of its MAVF. In this step, it is significant to note that for the risks with the top 40% Safety Risk Score, the utility will also then compute a Multi-Attribute Risk Score using at least the Safety, Reliability and Financial Attributes of its MAVF. These outputs will be used in the step below to identify the risks that RAMP will address.
- Step 2B- Selecting Enterprise Risks for the RAMP. In this step the utility assesses which risks are the top ones to be addressed in the RAMP. With input from the above steps, the utility will host a publicly noticed workshop with interested parties and Commission Safety staff to gain additional input regarding appropriate risks. Based on input, the utility will make a final determination of risks and submit a rationale to accept or disregard input received during the workshop.
- Step 3- Mitigation Analysis for Risks in RAMP. This step requires a detailed pre- and post-mitigation analysis to determine the risk reduction from mitigation. In order to provide a more detailed or granular view of how mitigations will reduce risk, this analysis will be broken down by “tranches,” defined as “subgroups of assets or systems with like characteristics, i.e., the same LoRE or CoRE [Likelihood or Consequence of Risk Event] values.” For each of the mitigations, the utility will calculate the associated Risk Spend Efficiency (RSE), by dividing the mitigation risk reduction benefit by the mitigation cost estimate. Present values will be used for the numerator and denominator, and should be based on the full set of risk reduction benefits estimated from the incurred costs. A utility has the option to also provide an alternative to an “expected value computation,” such as a “tail value,” and parties to the RAMP or GRC retain the right to challenge these alternative assumptions.
- Global Items- Supplemental GRC Analysis Trigger Requirements; outlines conditions under which utility-proposed programs requesting funding in a GRC but not included within a utility’s companion RAMP document shall require supplemental analysis.

Attachment E

EXAMPLE ELECTRIC UTILITY RAMP REPORT RISKS ADDRESSED, AS DEMONSTRATED BY SCE RAMP, FILED 2022 | APPLICATION A.22-05-013



Additional Identified RAMP Risk Considerations

- Battery Energy Storage Systems
- Climate Change
- Transmission and Substation Assets
- Nuclear Decommissioning (*i.e.*, SONGS)
- Widespread Outage

Attachment F

EXAMPLE GAS UTILITY RAMP REPORT RISKS ADDRESSED, AS DEMONSTRATED BY SOCAL GAS RAMP, FILED 2021 | APPLICATION A.21-05-014

Reported Primary RAMP Risks

Incident on the Distribution System (Excluding Dig-Ins)
Incident Involving an Employee
Dig-In on the Distribution System
Incident Involving a Contractor
Incident on the Transmission System (Excluding Dig-Ins)
Incident on the Storage System (Excluding Dig-Ins)
Dig-In on the Transmission System
Cybersecurity
Inability to Recover Critical Technology and Applications
Insufficient Supply to the Natural Gas System

Additional Reported ERR Risks

Capacity Restrictions or Disruptions to the Natural Gas System
Environmental Compliance
Consumer Privacy
Energy System Resilience

Additional Reported Cross-Functional Risks

Asset Management	Pandemic
Climate Change Adaption and Natural Forces	Records Management
Emergency Preparedness and Response	Safety Management Systems
Information Technology Resiliency	Workforce Planning / Qualified Workforce

Attachment G

TYPICAL RAMP REPORT ORDERING OF CONTENT CHAPTERS, AS DEMONSTRATED BY SEMPRA UTILITIES RAMP, FILED 2021 | APPLICATIONS A.21-05-011 AND A.21-05-014

IV. RAMP RISK CHAPTER ORGANIZATION AND OVERVIEW

In each individual risk chapter, the Companies describe the existing controls and new and/or incremental planned mitigations for each risk, presenting at least two alternative mitigation plans for each risk. The Companies present the following sections in each risk chapter:

1. Introduction.
2. Risk Assessment – In accordance with the Settlement Decision,²⁹ this section describes the risk bow tie, possible drivers/triggers, and potential consequences of each identified risk.
3. 2020 Controls – This section discusses how activities with recorded costs in or prior to 2020 (denoted with a control ID) help mitigate the risk.
4. 2022 – 2024 Controls and Mitigation Plan – This section discusses both planned significant changes to existing mitigations and/or planned new mitigations (denoted with a mitigation ID) that will address the risk, and includes a table informing which existing and new mitigations are planned to occur during the TY 2024 GRC's 2022 – 2024 forecast period.³⁰
5. Costs, Unit, and Quantitative Analysis Summary Tables – This section includes tables summarizing the costs, units, and RSEs for mitigations included in the risk control and mitigation plan.
6. Alternative Mitigation Plan Analysis – This section presents at least two alternative mitigation plans considered as part of the risk assessment process, including forecasted costs, units, and RSE values.
7. Appendices
 - a. Appendix A provides a summary of which elements of the bow tie are addressed by which mitigations.
 - b. Appendix B provides a summary of the source documents used in the quantitative analyses.

²⁹ D.18-12-014 at 33 and Attachment A, A-11 (Bow Tie).

³⁰ As discussed in some risk chapters, not all activities with a control ID or a mitigation ID are included in the risk control and mitigation plan for the 2022-2024 period.