White Paper Describing Alternative Tranching Method of Southern California Gas Company and San Diego Gas & Electric Company

November 1, 2024

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I. Introduction and Purpose

This paper describes Southern California Gas Company (SoCalGas) and San Diego Gas & Electric Company's (SDG&E) (together, the Companies) approach to tranching risk for their respective Risk Assessment and Mitigation Phase (RAMP) application and report to be filed with the California Public Utilities Commission (CPUC or Commission) in May 2025.[1]

By initiating Rulemaking (R.) 20-07-013 the Commission set in motion an iterative and collaborative process of risk-based evaluation and prioritization of safety-based utility activity and risk mitigation. Through the phased approach of the Safety Model Assessment Proceeding (S-MAP) and the resultant Risk-Based Decision-Making Framework (RDF), the utilities, intervenors, and the Commission continue to participate in shaping an evolving construct that informs the Commission regarding safety related forecasted and risk mitigation spending through the RAMP and related assessment reports.[2] Decision (D.) 24-05-064 (the Phase 3 Decision) provides the most current guidance and revisions to the RDF while affording flexibility such that the utilities can consider the most appropriate method of evaluating and presenting certain of their data.[3] Specifically, as being presented here, the RDF's Cost Benefit Approach[4] offers the utilities the option to use an approach adopted by the Commission in the Phase 3 Decision, or to develop and adopt an alternative approach to the tranching of its risk portfolio, and explain the alternative approach through a white paper provided a minimum of 45 days prior to the date of its pre-RAMP workshop. Staff and parties have 21 days from submittal to provide input on the White Paper, and the alternative approach will be discussed in the Companies' RAMP Risk workshop. SoCalGas and SDG&E appreciate the opportunity to present an alternative tranching methodology to support the thoughtful consideration and transparent assessment by the Commission and intervenors of the broad portfolio of risks and mitigation activities to be presented in their respective RAMP reports.

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1 A "tranche" is a "[a] logical disaggregation of a group of assets (physical or human) or systems into subgroups with like characteristics for purposes of risk assessment." D.21-11-009, Appx. D. For purposes of this whitepaper, "tranching" refers to the act of dividing assets into tranches to be used in RAMP analysis.

2 Risk Spend Accountability Report (RSAR), Safety Performance Metric Report (SPMR), and the Risk Mitigation Accountability Report (RMAR).

3 Another example of options afforded in the Cost Benefit Approach is the alternative to the Department of Transportation Value of a Statistical Life (VSL) and dollar value of electric and gas reliability (Phase 2 Decision); and tail risk consequence modeling (Phase 3 Decision).

4 D.24-05-064, Appendix A "Risk-Based Decision Framework".

As described herein, the Companies' tranching approach is designed to promote the following goals to advance the Commission's overall RDF objectives:

- Achieve data-driven results;
- Promote increased transparency and granularity;
- Establish measurable LoRE and/or CoRE distinction between tranches;
- Align with and inform risk mitigation efforts compatible with the Companies' existing and prospective operating procedures; and
- Result in homogenous risk profiles (to the extent possible based on available data).

The Companies tested the development of tranches in accordance with the Commission's Risk-Based Decision-Making Framework RDF Cost Benefit Approach, Step 3, Row 14, as recently revised via the Phase 3 Decision (Phase 3 Tranching Approach). The results of this testing, discussed further below, indicate the methodology may not best enable achievement of the Commission's RDF objectives.

Following testing of the Phase 3 Tranching Approach (PTTA), the Companies developed and describe herein an alternative Homogenous Tranching Method (or HTM) that they believe is better suited to the achievement of Commission's RDF objectives. This methodology, to be used to develop their 2025 RAMP reports, builds upon the PTTA and provides greater flexibility such that it can be applied to all of the Companies' diverse RAMP risks.[5] The HTM is designed to prevent potential information loss observed in PTTA testing, by identifying the specific Risk Profiles (Classes) targeted by the Risk-Treatment,[6] the particular risk levels within Classes that the Risk Treatment predominantly reduces, and the specific LoRE/CoRE regions within those risk levels that are most affected.[7] Importantly, the HTM enhances the ability of the Commission to identify the "riskiest portions of [a utility's]

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[5] The Companies met with the Commission's Safety Policy Division (SPD) staff on September 10, 2024 and October 14, 2024 to discuss their observations and HTM approach.

[6] According to the International Organization for Standardization (ISO) 31000:2018, risk treatment involves the process of selecting and implementing measures to modify risk. This can include avoiding the risk, taking or increasing the risk to pursue an opportunity, removing the risk source, changing the likelihood, changing the consequences, sharing the risk, or retaining the risk by informed decision. For purposes of this whitepaper, the Companies use the term "risk treatment" to refer to a risk control or mitigation in the RAMP context.

[7] LoRE is the likelihood of a risk event. D.21-11-009, Appx. D at 2. CoRE refers to the consequences of a risk event. *Id*. at 1. A LoRE/CoRE pairing is a likelihood and resulting consequence of a risk event that can be combined in an ordered pair and plotted on an x-y plane, and a LoRE/CoRE region is a collection of LoRE/CoRE pairs that are in relatively close proximity to one another on an x-y plane.

infrastructure and/or management system," consistent with the Phase 3 Decision's stated objectives.[8]

Section II of this paper describes the PTTA testing, results, and observations leading to the development of the HTM and this whitepaper.

Section III describes the HTM approach the Companies have developed to tranche their risks, which include preliminary RAMP Risks, including Medium Pressure Gas, High Pressure Gas, Gas Excavation Damage, Gas Storage (SoCalGas only), Wildfire & PSPS (SDG&E only), Electric Infrastructure Integrity (EII) (SDG&E only), Employee Safety, Contractor Safety, and Cybersecurity.

The Companies note that analysis of risks and preparation for their respective RAMP filings are ongoing. Thus, the results used for purposes of testing the PTTA and for developing and testing the HTM are preliminary and subject to further adjustment and assessment.

II. The Phase 3 Decision's Tranching Methodology (PTTA): Testing, Observations, and Challenges

A. The PTTA: Definition and Objectives

The Phase 3 Decision adopted the PTTA for tranching (segmenting) risks and "requir[es utilities] to use this approach to determine tranches in most cases," while allowing for flexibility.[9] The PTTA is described in the Phase 3 Decision as follows:

> The best practice for determining the homogeneity of risk profiles in reporting Tranches is the use of quintiles of LoRE and quintiles of CoRE, resulting in 25 reporting tranches. The utility can and should submit more granular data in workbooks included with RAMP and GRC filings if it is available, but that more granular data shall be aggregated into at least 25 reporting tranches with homogeneous risk profiles. If the assets or system associated with a given risk are less than 25 in number, the utility may use an alternative means of determining homogeneity of risk profiles, including quartiles or other smaller divisions of LoRE and CoRE, but this alternative means must be described in detail in the RAMP filing.
>
> If an IOU prefers to determine tranches not based on homogeneous risk profiles using LoRE and CoRE quintiles, or they wish to use a percentile ranking approach that would result in more than 25 reporting tranches, the IOU must submit a White Paper describing its preferred method for

[8] D.24-05-064 at 28.

[9] D.24-05-064 at 26-27.

> determining tranches along with relevant workpapers to SPD no later than 45 days before their first pre-RAMP workshop and must serve the White Paper to the service list of R.20-07-013 on the same timeframe. Staff and Parties may provide input on the IOU's White Paper on an alternative approach to creating tranches within 21 days of the submittal. This alternative approach to creating tranches shall be discussed in the pre-RAMP workshop, a requirement that reflects the first of the IOUs' two proposed approaches. The IOU must also include the White Paper in its RAMP filing, clearly indicating any changes to the previously served version.[10]

The PTTA articulates, among other things, two core objectives for tranching:

1) The number of tranches for each risk should be the result of pairing each of five equal Likelihood of Risk Event subdivisions (LoRE quintiles) with each of five equal Consequence of Risk Event subdivisions (CoRE quintiles), or a total of twenty-five tranches,[11] and

2) Each resultant tranche should feature "homogeneity of risk profiles;" that is, all of the events within a tranche should be similarly "risky" and have the same LoRE and CoRE.

Further, the Risk OIR Phase 3 Decision concludes that the approach should provide benefits to "understand[ing] if a utility is requesting funding for mitigations in the riskiest portions of their infrastructure and/or management system," as follows:[12]

> Filing of RAMP analyses using LoRE/CoRE quintile tranches will aid the Commission and [help] parties understand if a utility is requesting funding for mitigations in the riskiest portions of their infrastructure and/or management system. This is essential if the Commission is to ensure strategic targeting of mitigations such that the greatest risk reduction benefits are achieved at the lowest cost, while taking into account the need to minimize risks as quickly as possible. Ensuring the greatest risk reduction benefits are achieved at the lowest cost is essential to ensuring just, reasonable, and affordable rates.

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[10] D.24-05-064 at 26-27.

[11] Quintiles are achieved when a grouping is divided into five (5) equal subgroups. Alternatively, the Companies understand from their meetings with SPD that SPD considers other "quantile" subdivisions - such as quartiles (four equal subgroups) or terciles (three equal subgroups) – to be consistent with the PTTA.

[12] D.24-05-064 at 28.

B. Testing the PTTA

With the intent of understanding, empirically, the implications of fitting real data into the PTTA, the Companies tested the PTTA on preliminary unscaled model results for SoCalGas medium-pressure gas pipeline system (MP Gas) and SDG&E Wildfire without PSPS, as well as for a randomly generated risk example from a uniform distribution.

Specifically, the Companies divided the LoREs and CoREs into "quintiles" consistent with the above-described methodology. A quintile is defined as a quantile for the special case of five equal proportions.[13] Although the quintile concept inherently reflects equal divisions, the Phase 3 Decision did not provide clear guidance on how to accomplish proportional "equality."

The Companies interpret the term "equal" such that the modelled LoREs and expected value CoREs would each be divided into five groups of near-equal size.[14] This is accomplished using percentiles, *i.e.*, by sorting the LoREs from smallest to largest and then defining group boundaries at the 20%, 40%, 60%, and 80% LoRE quantiles. This process can be repeated using the CoREs to obtain the CoRE quintiles. Each LoRE and corresponding CoRE can be expressed as an ordered pair (*i.e.,* ($LoRE_i$, $CoRE_i$)) and plotted on an x-y axis, with a 5x5 grid to demarcate the boundaries for the LoRE and CoRE quintiles. In this graphical representation, there would be a near equal number of LoRE/CoRE pairs in each column (the quintiles of LoRE) and a near equal number of LoRE/CoRE pairs in each row (the quintiles of CoRE) (*see* Figure 1, 2 and 3 below). This maximizes the likelihood of having an equal number of pairs within each LoRE/CoRE tranche, thereby reducing the likelihood of having empty tranches[15] or tranches with a disproportionately high number of pairs.

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[13] *See, e.g.,* Cambridge Dictionary, *available at* https://dictionary.cambridge.org/us/dictionary/english/quintile (defining quintile as "one of five equal measurements that a set of things can be divided into").

[14] The term "near-equal" alludes to the fact that dividing into five equal groups may not be possible. For example, in the case where the number of points is not evenly divisible by 5, it is not possible that all 5 groups will have the exact same number of points.

[15] An empty tranche results from developing 25 tranches in accordance with the PTTA approach and determining that certain of the tranches have no actual risk associated with them. An empty tranche is essentially no tranche at all – *i.e.,* it is a dummy tranche that is created solely for the purpose of adhering to the PTTA. For this reason, the Companies have adopted an approach that avoids empty tranches.

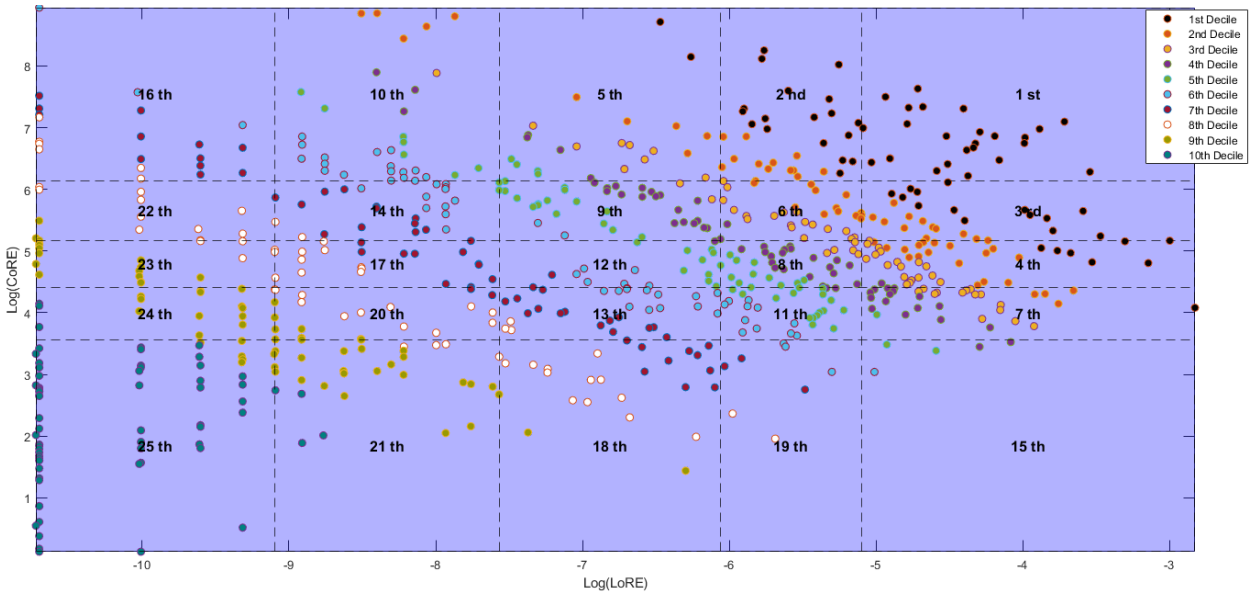

Figure 1. Preliminary Unscaled Wildfire without PSPS Log-Log plot of LoRE/Expected CoRE Quintile Approach. For added information, the pairs are identified by color to which risk decile they belong to. The numbers within the tranche regions define the order of the tranches from the highest resulting risk to the lowest.

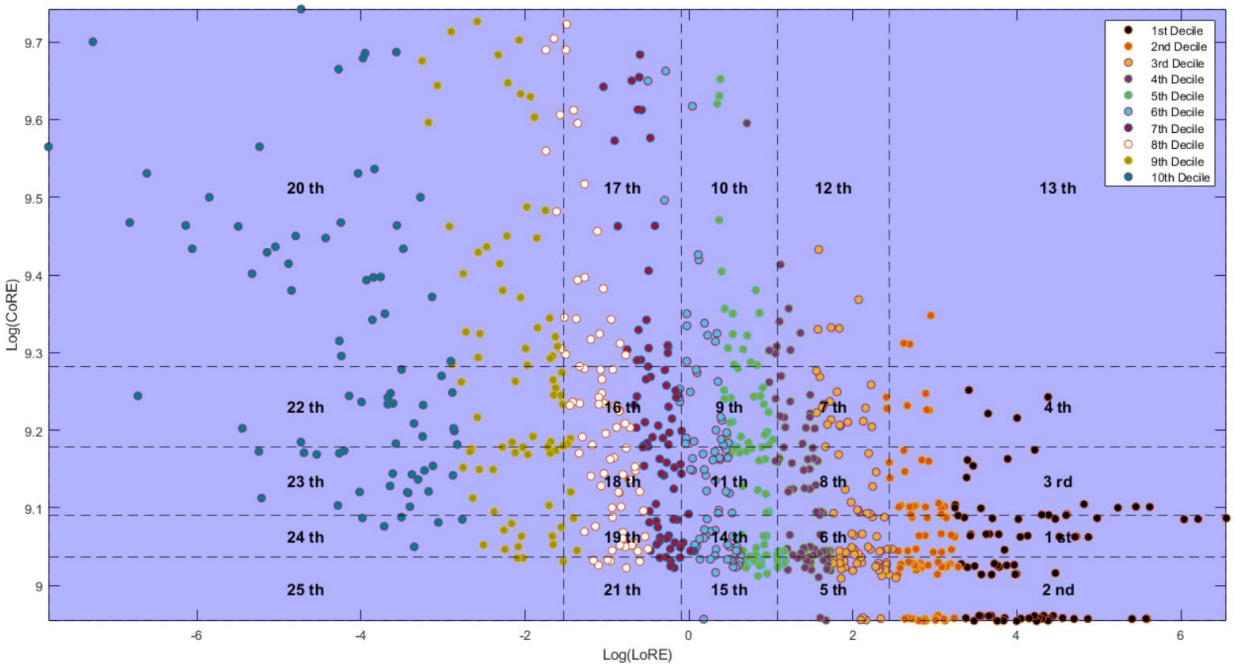

Figure 2. Preliminary Unscaled SoCalGas Medium Pressure Pipe Mains and Services Log-Log plot of LoRE/Expected CoRE Quintile Approach. For added information, the pairs are identified by color to which risk decile they belong to. The numbers within the tranche regions define the order of the tranches from the highest resulting risk to the lowest.

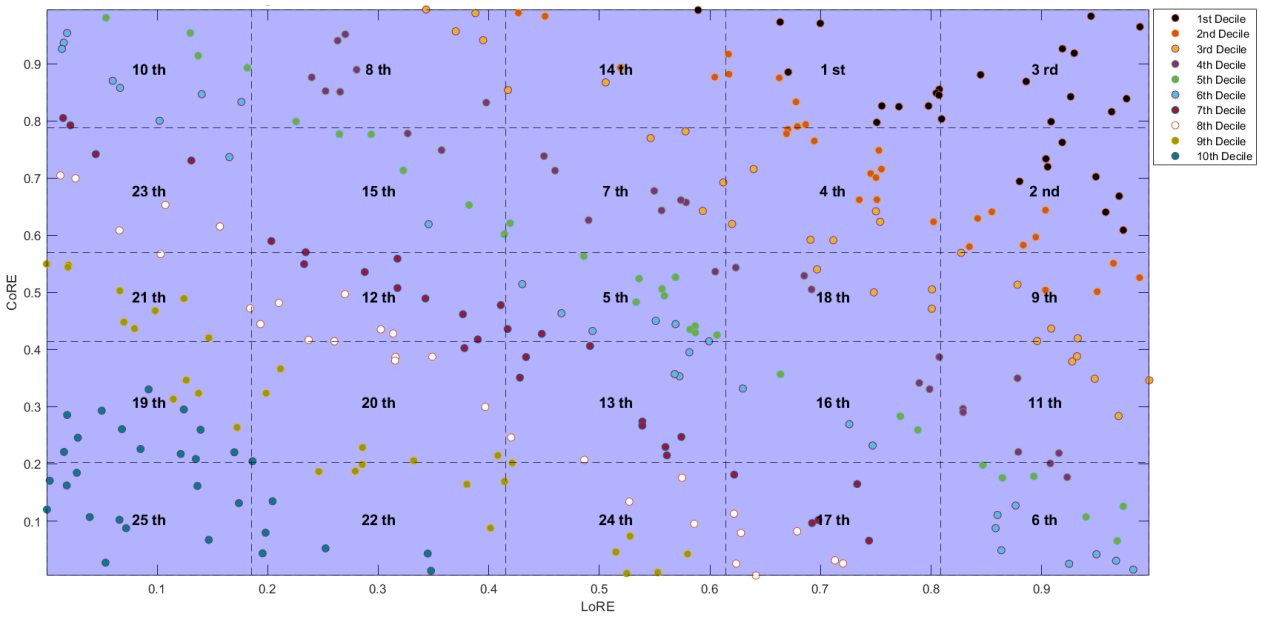

Figure 3. Randomly Generated LoRE/ CoRE pairs from a uniform distribution. For added information, the pairs are identified by color to which risk decile they belong to. The numbers within the tranche regions define the order of the tranches from the highest resulting risk to the lowest.

Conversely, an alternative interpretation of "equal" could involve dividing the LoREs and CoREs into five groups with equidistant boundaries (*e.g.*, if the dataset ranges from 0 to 50, the groups would be defined by values between 0-10, 10-20, etc.) Unless the data is perfectly uniformly distributed, however, this method would not result in an equal number of LoREs or CoREs in each quintile, making it impossible to have an equal number of pairs within each tranche. For instance, if one LoRE quintile has 20 values and another has 10, graphically, one column would have 20 pairs and another would have 10 pairs. Consequently, it would be impossible for the 10 tranches resulting from dividing these two columns by the CoRE quintile boundaries to have an equal number of pairs.

Even with a near-equal number of LoRE/CoRE pairs along a single dimension, SoCalGas and SDG&E still observed that, unless these pairs are scattered in a precisely uniform manner in both dimensions, the groups necessarily will have an unequal number of pairs in each quintile tranche and may result in empty tranches. For example, the 5x1 tranche (*i.e.*, the 5th LoRE column from left and 1st CoRE row from the bottom) in Figure 1 holds only five pairs, while the 5x2 tranche holds over 30 pairs. Even in the case of a uniformly distributed example, as seen in Figure 3, the number of pairs vary from one quintile tranche to the next, which demonstrates that a precise uniform distribution of the LoRE/CoRE pairs is an extreme case. This effect can lead to both clustering and sparsity in the data. For example, a tranche might exhibit a relatively high total risk score compared to other tranches due to a dense concentration of LoRE/CoRE pairs. However, these pairs may not necessarily correspond to the highest risk segments within that risk chapter.

C. Observations: Information Loss

The analysis reveals inconsistencies between the PTTA objective to develop tranches with "homogeneity of risk profiles" and the guidance to produce twenty-five tranches reflective of each possible pairing of LoRE and CoRE quintiles.[16]

SoCalGas and SDG&E observed that the risk (LoRE x CoRE) of similar levels will scatter across many quintile tranches. As a result, a quintile tranche can aggregate the highest risk pairs with some of the lowest risk pairs. In Figure 1, the Companies see that the first decile risks are mixed with the fifth decile risks. By "decile of risk," the Companies mean that the risks computed from the LoRE/CoRE pairs are divided into 10 risk quantiles. This is done by ordering the risks from highest to lowest and then grouping them into 10 nearly equal groups. The first decile represents the top 10% of risk, the second decile represents the next top 10% of risk, and so on. This type of aggregation can lead to potentially minimizing the presence of risk with respect to specific assets.

The Companies also observe that broadly applying the PTTA to an entire risk chapter could mix unlike risk profiles in a way that does not best represent the differences in risk profiles of the assets within the risk. For example, SoCalGas's Medium Pressure system includes a variety of above and below ground assets such as pipeline mains and services, regulator stations, risers, and meter set assemblies (MSAs). Applying a tranching algorithm to the entire system could result in gas mains, regulators, and risers being grouped together into a single tranche. This approach does not best represent risk profiles, as these assets require different risk treatments and largely are not physically connected. Therefore, while these assets may be regarded under the same RAMP risk chapter (*i.e.,* Medium Pressure Gas System), it makes sense to view the assets separately. This is consistent with the Phase 3 Decision's intended benefit of the PTTA, in part, to identify "the riskiest portions of [a utility's] infrastructure and/or management system. . . ."[17]

Overall, the Companies observed that many of the resultant tranches include a heterogeneous mix of risk events, often related to multiple asset types with uncorrelated risk treatments. Consequently, the resulting PTTA tranches are not homogenous. This ultimately limits the ability of this methodology to support the Commission's risk-informed decision-making objectives.

D. The Challenge: Preventing Information Loss and Meeting RDF Objectives

In light of the findings of their PTTA analysis, the Companies developed an alternative

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[16] *See* D.24-05-064 at 26-27.

[17] D.24-05-064 at 28.

HTM.[18] The Companies will apply the HTM to all their RAMP risks to provide greater transparency and better inform the Commission and interested stakeholders. To prevent the information loss and lack of risk homogeneity identified during testing of the PTTA and ultimately better-inform the Commission's decision-making process, the HTM strives to achieve three objectives:

1. Promote homogeneity of risk profiles within tranches;
2. Establish tranches on the basis of LoRE x CoRE pairings; and
3. Better align the tranches with risk treatments.

The HTM allows for a risk to be broken down into Classes, or groups of assets with similar risk profiles. The method further disaggregates the risk within a Class into different risk levels, and then divides the risk levels into similar LoRE/CoRE regions. This offers the advantage of identifying the specific Risk Profiles (Classes) targeted by the Risk-Treatment, the particular risk levels within these Classes that the treatment predominantly reduces, and the specific LoRE/CoRE regions within those risk levels that are most affected.

III. The Homogenous Tranche Method (HTM)

A. The HTM Delivers Homogenous Risk Profiles and Other RDF Objectives

The HTM alternative provides a rigorously defined algorithm that addresses unfavorable PTTA observations while delivering, where possible, "homogenous risk profiles," meaning all of the elements within the tranche should be of the same risk profile, at the same risk quantile, and divided into similar LoRE/CoRE regions. The HTM aims to meet this objective while preserving the critically distinct characteristics within the risk. As a result, when a risk-treatment is analyzed, it is clear what risk profile (*e.g.*, gas regulators), what level of risk (*e.g.*, the top 20%), and of which LoRE/CoRE nature (*e.g.*, lower LoRE/upper CoRE) are most affected. This provides a clearer picture of risk treatment that enhances the Commission's ability to identify the "riskiest portions of [a utility's] infrastructure and/or management system," consistent with the Phase 3 Decision's stated objectives.[19]

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[18] D.24-05-064, Appendix A, Step 3 provides that utilities "may use an alternative modeling method to the truncated power law and submit to SPD and serve to the service list of R.20-07-013, or a successor proceeding, and the utility's most recent RAMP application proceeding a Whitepaper and related workpapers clearly justifying its approach no later than 45 days before its first pre-RAMP workshop."

[19] D.24-05-064 at 28.

B. The Step-by-Step Methodology and Graphical Representations

The HTM approach differs from the PTTA at the outset by identifying each of the Classes that make up the risk.

The steps for the HTM are as follows:[20]

Step 1. Organize the granular level risk and associated LoRE/CoRE pairs, the starting LoRE/CoRE pairs, into groups, referred to as "Classes," based on similar risk profiles (*e.g.*, Mains, Regulators, Risers).

Step 2. Within each Class, rank the risk scores (LoRE x CoRE) into quantiles using the following algorithm. A K-quantile is defined here as a quantile of order K (*e.g.*, tercile (2-quantile), quartile (4-quantile)). And N is defined here as the number of starting LoRE/CoRE pairs within the Class.

1) If N is less than 8, then $K = 1$ and you can move to Step 3.

2) If *N* is not less than 8, find the whole number K such that the following inequality is satisfied:

$$\min\left(\frac{N}{8} - 1{,}9\right) < K \leq \min\left(\frac{N}{8}, 10\right),$$

then continue to Step 3.

Step 3. For each risk K-quantile from Step 2, create up to four homogenous LoRE/CoRE Tranches. These will be the final tranches of the HTM.

1) If no more than four unique LoRE/CoRE pairs for this Risk Quantile exist, then the Risk Quantile is the final Tranche and sub-Steps 2-3 do not apply. Note, if there are no more than four unique LoRE/CoRE pairs, then one can simply examine the values of those LoREs/CoREs and grouping them is no longer necessary.

2) Separate the Risk Quantile into regions using the median of the LoRE and the median of the CoRE. This will separate the LoREs into two groups of near-equal numbers where about half are less than the LoRE median, and the other is greater than the median.

[20] Any further developments or adjustments to the HTM steps that result from the Companies' continued development and preparation of their RAMP presentations will appear in their respective RAMP filings.

For values equal to the median, decide which group (lower LoRE or upper LoRE) will produce the greater balance of the starting pairs. Do the same for the CoREs. Since there are at least five unique LoRE/CoRE pairs, this will produce at least two LoRE/CoRE homogeneous regions.

3) Dissolve any region with a relatively low number of LoRE/CoRE pairs compared to other regions. One way this can be achieved is by computing the Euclidean distance to every LoRE/CoRE pair in the other regions. Then the closest point (nearest neighbor) will determine which tranche the pair should be recategorized into.

4) As a result, there will be two to four Tranches for each Risk Quantile. The homogenous profiles for each risk K-quantile will be from the following:

   1. Lower LoRE/Upper CoRE
   2. Upper LoRE/Lower CoRE
   3. Upper LoRE/Upper CoRE
   4. Lower LoRE/Lower CoRE

Step 4. For each final Tranche, T_i, define the LoRE(T_i) as the sum of the LoREs from the starting LoRE/CoRE pairs that make up T_i. Then define the CoRE(T_i) as the sum of all the Risks from the starting LoRE/CoRE divided by LoRE(T_i).

Figures 4-6 illustrate the HTM applied to two of the Company's unscaled preliminary risks: Wildfire without PSPS and Medium Pressure Mains and Services excluding Excavation (Medium Pressure Pipe). For Medium Pressure Pipe, two approaches are shown: 1) treating everything as one class, skipping step 1 of the HTM algorithm, and 2) defining four hypothetical classes for step 1. Wildfire without PSPS is treated as a single class, so only one HTM example is provided.

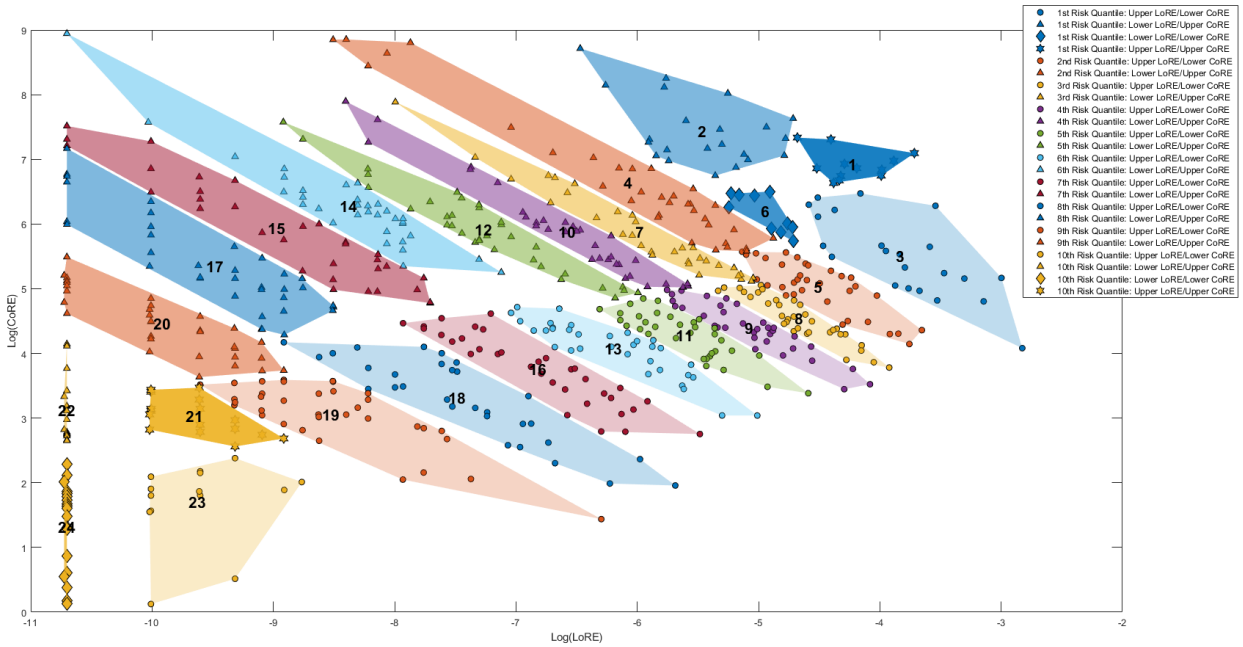

Figure 4. Preliminary Unscaled Wildfire without PSPS Log-Log plot of LoRE/Expected CoRE Alternative Homogenous Tranche Method. Here Wildfire without PSPS is a Class as defined in Step 1 of the HTM algorithm. The numbers within the tranche regions define the order of the tranches from the highest resulting risk to the lowest.

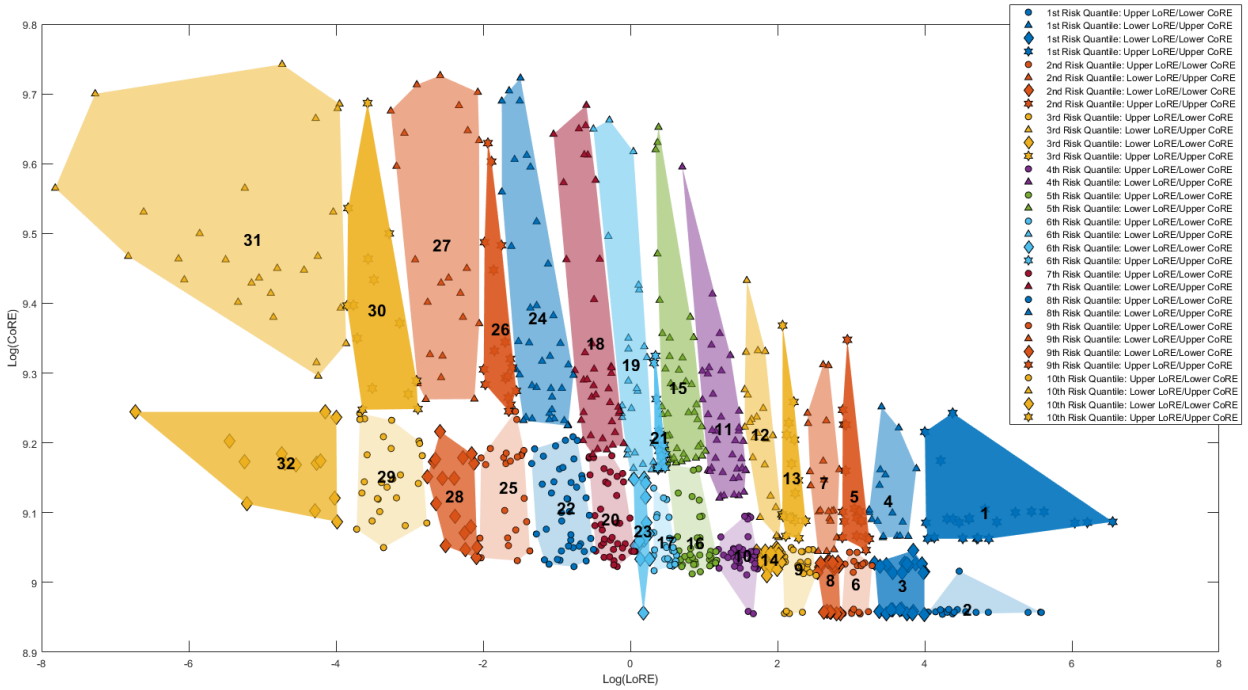

Figure 5. Preliminary Unscaled SoCalGas Medium Pressure Pipe Log-Log plot of LoRE/Expected CoRE Alternative Homogenous Tranche Method. Here for comparison reasons, Step 1 of the HTM algorithm is skipped and the entire dataset is treated as one Class. The numbers within the tranche regions define the order of the tranches from the highest resulting risk to the lowest.

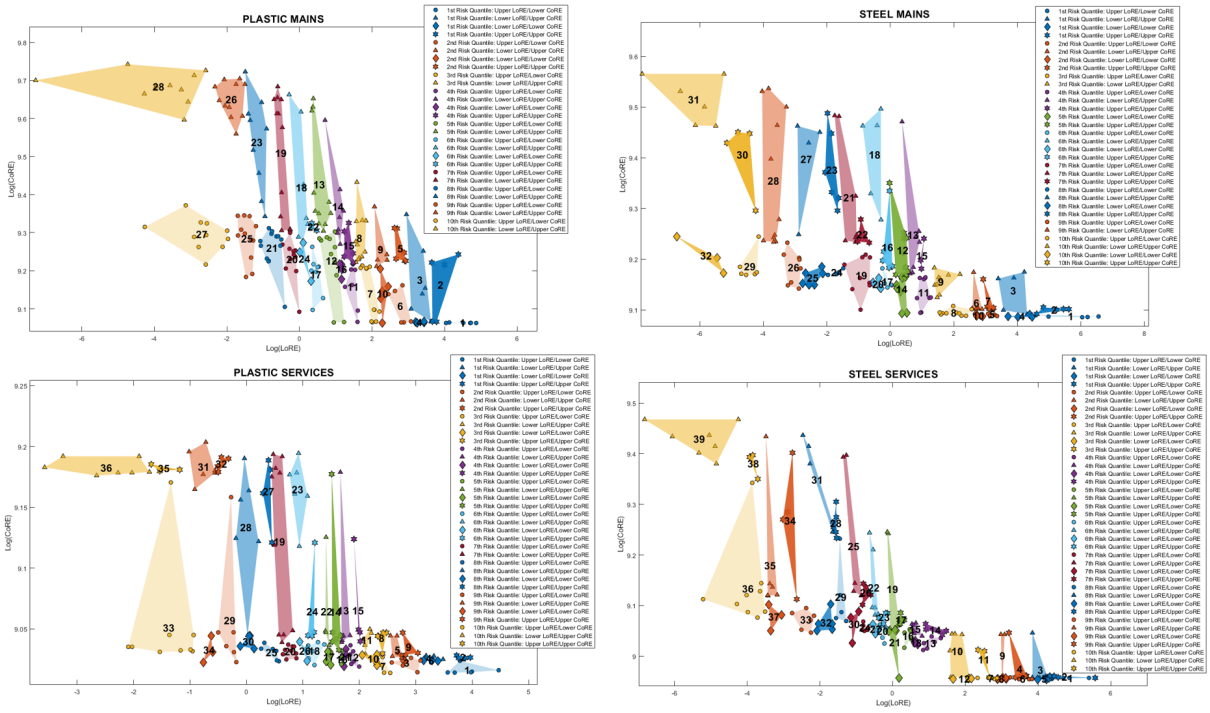

Figure 6. Preliminary Unscaled SoCalGas Medium Pressure Pipe Log-Log plot of LoRE/Expected CoRE Alternative Homogenous Tranche Method. Here for illustration of Step 1 of the HTM algorithm, four hypothetical classes are identified. The numbers within the tranche regions for each class define the order of the tranches from the highest resulting risk to the lowest within that Class.

C. Methodology Applicability

The HTM is intended for use with all RAMP risks, at varying levels. Specifically, as of the time of this White Paper's submission, the Companies anticipate that there is sufficient granularity of modeling for the five RAMP risks referenced below for the algorithm to be used to define the final tranches into 2-4 LoRE/CoRE regions as defined in sub-step 4 of step 3. The five preliminary RAMP risks are:

1. Wildfire & PSPS (SDG&E only)
2. Electric Infrastructure Integrity (SDG&E only)
3. Gas Excavation
4. High Pressure Gas
5. Medium Pressure Pipe

It is anticipated that certain RAMP risks, however, will lack the granularity of modeling to break down beyond Step 1 of the HTM algorithm. In other words, these risks feature a low number of starting LoRE/CoRE ordered pairs. After defining the similar risk profiles (Classes), for example Office personnel vs. Field personnel, if there are no more than four LoRE/CoRE pairs per Class, those pairs define the final tranches of those Classes within the risk. At the time of submitting this whitepaper, SoCalGas and SDG&E expect this to be the case for the following four preliminary RAMP risks:

1. Employee Safety
2. Contractor Safety
3. Cybersecurity
4. Gas Storage (SoCalGas only)

IV. Conclusion

Consistent with Commission guidance, the Companies submit this White Paper to present their alternative approach to tranching risks for their respective RAMP reports and additionally will be presenting this methodology at their December 2024 pre-RAMP workshop, where the Companies will also present their preliminary RAMP risks. As discussed in this paper, the Companies believe the HTM approach better achieves the Commission's RDF objectives in that it promotes data-driven results and increased transparency and granularity; establishes measurable LoRE and/or CoRE distinction between tranches; aligns with and informs risk mitigation efforts compatible with the Companies' existing and prospective operating procedures; and results in homogenous risk profiles (to the extent possible based on available data). The Companies are continuing to assess and analyze risks in preparation of their respective RAMP reports. Thus, results modeled here are preliminary and will be updated in the Company's respective RAMP reports.