

# Staff Proposal for Corrective Actions Stemming from the Root Cause Analysis of the 2017 and 2018 Wildfires Associated with PG&E Equipment.

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California Public Utilities Commission

Safety Policy Division

Pursuant to OII 1.19.06.015

July 2023



# 1. Background

The California Public Utilities Commission (CPUC or Commission) opened Investigation (I.)19-06-015 to determine whether Pacific Gas and Electric Company (PG&E) violated any rules, orders, or directives with respect to wildfires ignited in its service territory in 2017 and 2018. Decision (D.)20-05-019 in this proceeding ordered several enforcement actions, including approximately \$2 billion in penalties to be paid by PG&E for its role in the fires. The decision also ordered that a Root Cause Analysis (RCA) be conducted by an independent contractor (funded solely by PG&E shareholders) for each of the subject fires. Envista Forensics (Envista) was selected as the contractor to conduct this RCA.

D.20-05-019 states, "The purpose of the RCA will be to analyze the factors that contributed to the ignition of the fires and make recommendations as appropriate so that the learnings can be implemented on a go-forward basis to mitigate the risk of similarly caused fires in the future. Analyzing all of these fires will maximize lessons learned not only for PG&E, but also for the Commission. The information revealed may show that areas of GO 95 should be modified. The RCA shall consider all potential root causes and shall not be restricted to violations of GO 95. The RCA may identify systemic, programmatic, management, and structural matters that may need to be addressed to reduce such incidents in the future."<sup>1</sup>

In July 2021, Envista produced its RCA report that included a description of the causes of the fires and recommendations on mitigation of risks that led to the ignitions.<sup>2</sup> PG&E subsequently was directed to expend approximately \$63 million dollars of shareholder funds to implement corrective actions and recommendations identified in the RCA report.<sup>3</sup> Below is a summary of subsequent activities by the Commission and of the RCA report.

## Commission Workshop

On Dec. 5, 2022, the Commission hosted a workshop to discuss the RCA findings and possible corrective actions. The workshop consisted of presentations from Envista, PG&E, and the Commission's Safety Policy Division (SPD) staff.<sup>4</sup> These presentations are summarized below.

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<sup>1</sup> Decision Approving Proposed Settlement Agreement with Modifications. D.20-05-019

<sup>2</sup> The Envista Report can be found at [https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/safety-policy-division/reports/root-cause-analyses-of-the-2017-18-wildfires\\_070622.pdf](https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/safety-policy-division/reports/root-cause-analyses-of-the-2017-18-wildfires_070622.pdf).

<sup>3</sup> In D.20-05-019, the total amount is specified as \$50M plus any remaining funds from the RCA consultant budget of \$17M. Approximately \$63 is available for corrective actions.

<sup>4</sup> All the workshop presentations can be found at <https://www.cpuc.ca.gov/about-cpuc/divisions/safety-policy-division/safety-culture-and-governance/root-cause-analysis-i-19-06-015>

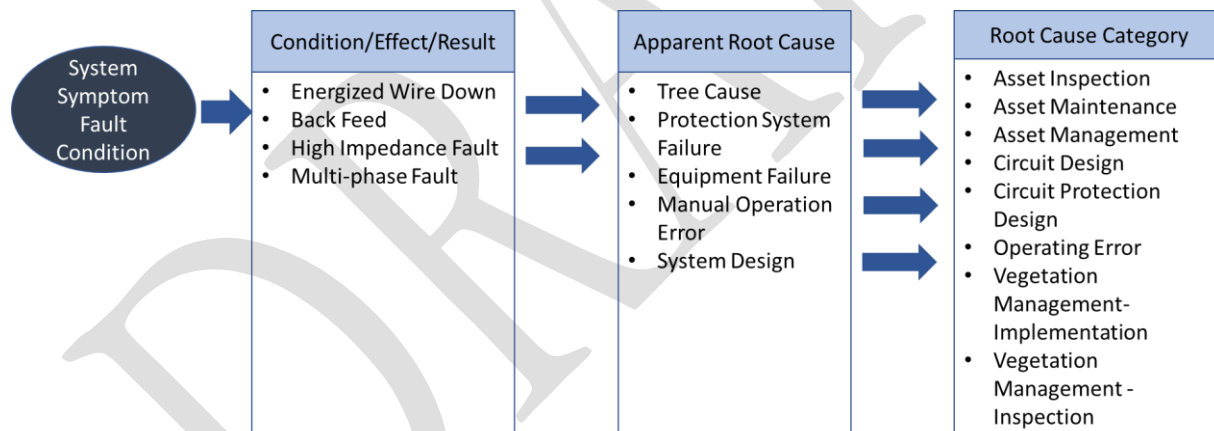
## Envista Presentation and Report:

The focus of the RCA project was to investigate the Root Causes of 16 wildfires that occurred in 2017 and the 2018 Camp fire (17 wildfires in total). The apparent cause of these ignitions were typically adverse events such as a tree limb falling on an energized wire or a component failing on a distribution or transmission line. The Envista Report describes the root causes as "the basic or contributing causal factors that underlie variation in performance associated with adverse events. These are the most basic causes that can reasonably be identified that management has control to fix, and when fixed, will prevent (or significantly reduce the likelihood of) the problem's recurrence"<sup>5</sup>

## Methods and Findings

To identify the root causes of the 17 wildfires, Envista used a Failure Decision Analysis methodology. The Failure Decision Analysis methodology identifies the Conditions/Effects/Results that were present at the time of the event, the Apparent Root Causes based on the physical failure evidence, and the Root Cause Categories defined as "programmatic or process-related activities, such as inspection, maintenance, management, implementation, design, and human performance."<sup>6</sup> Figure 1 illustrates the elements of the Failure Decision Analysis for this RCA investigation.

Figure 1 Failure Decision Analysis Methodology

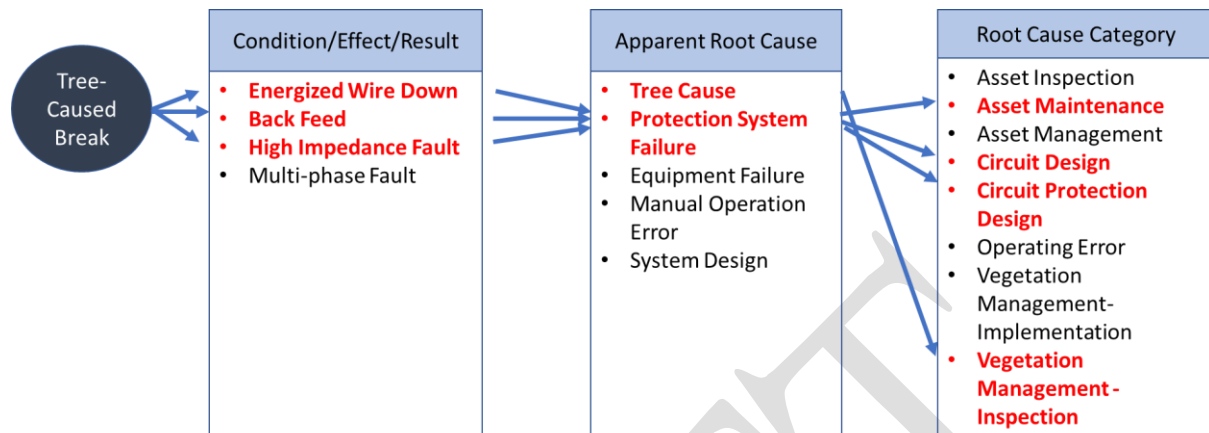


The Failure Decision Analysis does not attempt to identify a single Condition/Effect/Result, Apparent Root Cause or Root Cause Category for each wildfire event. Rather, the Failure Decision Analysis identifies all conditions and causes that are applicable to the event. Therefore, there can be multiple root causes for ignition. For example, in the Adobe fire the Envista Failure Decision Analysis identified (three) Conditions/Effects/Results, (two) Apparent Root Causes and (four) Root Cause Categories. (See red text in Figure 2).

<sup>5</sup> Envista Report, Pg. 3

<sup>6</sup> Envista Report, Pg. 63

Figure 2 Categories identified by the Failure Decision Analysis for the Adobe fire



Of the 17 wildfires studied, the Nuns, Redwood, and Camp fire had two ignition sources, so there were a total of 20 ignitions that were investigated using the Failure Decision Analysis methodology.<sup>7</sup> Table 1 in the Appendix summarizes the top four root causes identified by Failure Decision Analysis methodology and the frequency of their occurrence in the 20 ignitions. These root causes, in order of their frequency, are: (1) asset maintenance, (2) circuit design, (3) circuit protection design, and (4) vegetation management inspections.

Table 2 in the Appendix summarizes the conditions that Envista identified for each of the 20 ignitions.

In the review of the conditions and root causes of the wildfires -- Envista made several observations and findings regarding the elements common to the wildfires. They identified several system-wide failures as the root causes of the ignitions:<sup>8</sup> This included:

- "The failure of the circuit protection systems to de-energize the fallen lines when severed."
- "Key PG&E Distribution Systems functional groups failed to identify the increasing risk associated with downed energized conductors."
- "Circuit Configuration: "3 Wire" System"
- "High Impedance Fault Conditions"
- "Long Duration Energized Downed Conductors"
- "Electrical Back Feed Conditions"

Recommendations for corrective actions

<sup>7</sup> Envista Report, Pg. 9

<sup>8</sup> Derived from Envista workshop presentation Slide 8 and slide 24

Envista organized its recommendations into five themes. Four of the themes contain processes within the control of PG&E management, where corrective actions can be taken. The themes are Institutionalized Learning, Vegetation Management, Circuitry, Emergency and Crisis Management, and CPUC General Orders. The Envista Report makes a total of 19 recommendations.<sup>9</sup> Table 3 in the Appendix summarizes the findings for each theme.

#### PG&E Presentation:

During the workshop, PG&E summarized its response to the RCA report. This included highlighting the policies and mitigations that have been implemented in the years since the 2017 and 2018 wildfires and recommendations for corrective actions. Table 4 in the Appendix shows each Envista recommendation that applies to PG&E and PG&E's response.<sup>10</sup> PG&E posits these responses constitute the corrective actions recommended by Envista.

PG&E agrees with Envista's findings in nine of the 13 recommendations.<sup>11</sup> PG&E also states that many of the recommendations are ostensibly complete, implying that no further corrective actions are required.<sup>12</sup> As examples of their progress toward completion, PG&E cites several efforts that demonstrate progress in these areas (e.g., WMP, RAMP, PAS-55, and ISO 55001 certifications). The one exception is to the Circuitry theme where PG&E states that:

"Based on the Envista recommendations and findings we believe we have an opportunity to implement additional corrective actions in this area. For example, accelerate remediation of overdue maintenance tags in HFTD (High Fire Threat District) areas."<sup>13</sup>

The primary areas of disagreement between PG&E and Envista are listed in Table 4 in the Appendix and include: the qualifications for PG&E senior management overseeing vegetation management work (#6), specifics of Envista's vegetation management QA/QC recommendations (#9), Envista's recommendations on conversion of contracting strategies (#10), and Emergency Response/Incident Command System operations (#13).

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<sup>9</sup> Envista Report., See Section VII Finding and Recommendations for details of each finding.

<sup>10</sup> This table was compiled from the PG&E Dec 2020 workshop presentation, Slides 3-6.  
<https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/safety-policy-division/meeting-documents/pge-rca-report-cpuc-workshop120522.pdf>

<sup>11</sup> See PG&E presentation for their summary and recommendations.  
<https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/safety-policy-division/meeting-documents/pge-rca-report-cpuc-workshop120522.pdf>

<sup>12</sup> See slides 3 - 7 of PG&E workshop presentation.

<sup>13</sup> Ibid Slide 5

PG&E also recommended implementation of three additional corrective actions and these are summarized below:<sup>14</sup>

- System Hardening in HFTD areas
  - Undergrounding overhead conductors and other facilities
- Expulsion Fuse Replacement in HFTD areas
  - Replace expulsion fuses with non-expulsion fuses or FuseSavers
- Maintenance tag remediation in HFTD areas
  - Complete overdue Maintenance tags

#### SPD Staff Presentation:

SPD staff presented its initial recommendations on how shareholder funds should be expended. SPD generally agreed with PG&E's proposed recommendations for a portion of the shareholder funds, but also proposed additional corrective actions in response to Envista's findings. These additional proposed corrective actions included:

- Increase funding of the System Enhancement Initiative No. 20 (SEI-20) project, which requires PG&E and the CPUC to engage an independent engineering firm to study the grounding methods and circuit and transformer configuration in PG&E's distribution system and transmission system, to assure that the full scope of work can be completed.
- Independent evaluation of PG&E's risk modeling and prioritization.
- Independent review of PG&E records management process.

#### Post Workshop Comments

##### PG&E Comments:

Following the Workshop, PG&E proposed additional areas of expenditures, modifying its earlier proposal and combining these with modified versions of SPD's proposals. PG&E summarized its revised proposal in table 5 in the Appendix, reproduced below.<sup>15</sup>

##### Public Advocate Comments

The Public Advocate's Office provided numerous recommendations for corrective actions reflecting

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<sup>14</sup> Ibid slide 10.

<sup>15</sup> The PG&E Reply comments in full can be accessed at <https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/safety-policy-division/meeting-documents/pge-comments-on-rca-workshop.pdf>

SPD's recommendations, as well as follow-up on Envista's findings. These recommendations are listed below.<sup>16</sup>

- A. The Commission should require PG&E to accelerate and expand upon SEI 20.
- B. The Commission should require PG&E to fully implement Envista's recommendations.
  - 1. PG&E should utilize its Corrective Action process for all incidents and events, and trend issues across lines of business.
  - 2. PG&E should overhaul its maintenance program to balance preventative, predictive, and corrective maintenance.
  - 3. PG&E should perform QA/QC on 100% of vegetation management in the High Fire Threat Districts (HFTD).
- C. The Staff Proposal should be revised to implement additional recommendations from the RCA report
  - 1. Envista recommends that the Commission revise CPUC General Order (GO) 95 to better align transmission and distribution maintenance standards with those for power generation in GO 167
  - 2. The Staff Proposal should specify that the Commission shall conduct audits to follow-up and assess utility implementation with each of Envista's recommendations and Corrective Actions adopted by the Commission.
- D. The Commission should require PG&E to retain Envista to independently assess implementation of its recommendations.
- E. The Commission should streamline the RCA firm selection process.
- F. The Commission should serve notice of future RCA report availability to multiple proceeding service lists.
- G. The Commission should provide at least 20 days for comment on future workshops associated with the 2017 and 2018 wildfire RCA.

#### The Utility Reform Network Comments

The Utility Reform Network (TURN) provided comments that generally support SPD's preliminary proposals described in the Workshop. TURN offered specific recommendations in the following four areas (as quoted from its written comments):

- A. Technical Review of Three and Four Wire Distribution Systems:
  - "The Commission should accelerate the completion of this study and devote additional budget to the study to ensure that the final report is comprehensive and a helpful guide for future utility decision-making. Given PG&E's aggressive proposal to underground its distribution lines beginning in 2023, this study should be

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<sup>16</sup> "Public Advocates Office Comments on December 5, 2022, RCA Workshop" Dec 16<sup>th</sup>, 2022. Pg 1. This document can be found at [Root Cause Analysis of the wildfires of 2017 and the Camp fire of 2018 \(I.19-06-015\)](#)

completed as soon as possible to inform the Commission's consideration of PG&E's undergrounding proposal."<sup>17</sup>

B. Risk Based Decision-Making Framework Review:

"TURN supports an independent verification of PG&E's models and a more in-depth analysis of how different changes impact the outcomes of the models. PG&E, and the other California utilities, benefit to the extent the models have a "black box" quality and, accordingly, the utilities are not incentivized to bring sunshine to this process. The SPD proposed corrective action can shine a light on the models and how well they serve the public interest. A comprehensive examination of the models will test the limits of what RDF can do and identify weakness of PG&E's models."<sup>18</sup>

C. Data Collection

"TURN recommends a complete audit and development of proposed improvements for PG&E's data collection and data management practices."<sup>19</sup>

D. Additional Time for Stakeholder Feedback:

"Finally, TURN respectfully requests additional time for comment on future workshops and proposals. Given constrained resources and competing Commission proceedings, at least 20 business days is required to be able to provide thoughtful feedback on the proposals."<sup>20</sup>

## 2. Corrective Actions

Detailed in this section are the corrective actions proposed by SPD staff for allocation of the \$63M to address findings from Envista's RCA report. A primary objective of this Staff Proposal is to focus on proposed corrective actions that:

1. Address the Envista findings that have not already been addressed by PG&E since 2018.
2. Are feasibly attainable given the available total budget of \$63M.
3. Will enhance wildfire safety most effectively and expeditiously.
4. Are not unnecessarily duplicative of efforts being made in other proceedings or by other state agencies.

As shown in Table 3 of the Appendix, Envista provided a total of 19 findings and recommendations

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<sup>17</sup> "TURN Comments on RCA Workshop" Dec 16<sup>th</sup>, 2022. Pg 1. This document can be found at [Root Cause Analysis of the wildfires of 2017 and the Camp fire of 2018 \(I.19-06-015\)](#)

<sup>18</sup> Ibid Pg. 2

<sup>19</sup> Ibid Pg. 3

<sup>20</sup> Ibid Pg. 3



stemming from its RCA. Four (4) of Envista's findings and recommendations (i.e., findings 16-19) relate to potential General Order changes. This Staff Proposal does not include corrective actions related to these findings and recommendations, as there are several ongoing efforts to evaluate and address such modifications as needed.<sup>21</sup>

In addition, under the theme of "Institutional Learning," for two (2) findings (Finding 3: De-energization Protocol and Finding 5: Safety Culture), Envista did not make any recommendations for corrective action. As such, these findings are also not addressed in the proposed corrective actions within this Staff Proposal.

Finally, for several Envista findings and recommendations, PG&E has indicated that it has implemented corrective actions since 2018 that have addressed such findings and recommendations.<sup>22</sup> For these findings, SPD finds that PG&E's stated claims of corrective actions already taken reasonably address the issues raised by Envista, pending verification. Accordingly, this Staff Proposal requires PG&E, within 60 days following the approval of this Staff Proposal by the Commission through a vote on a related resolution at one of its voting meetings, to:

1. Provide all necessary documentation that corroborates PG&E's claims of corrective actions taken, with the pertinent information responsive to the Envista finding or recommendation highlighted or otherwise identified therein, for all findings in Table 6 of the Appendix where the value in the column titled, "SPD Recommendations for Corrective Action" is "PG&E to provide documentation validating stated corrective actions taken since 2018."
2. Submit this documentation to the Director of SPD and the service list for I.19-06-015.

## Corrective Action 1: Assess In-service Condition of Bare Conductors & Replace Deteriorated Bare Conductors

### RCA Findings addressed by this CA1

Finding 4: Risks identified but not acted on.

Finding 12: Asset management.

### Recommendation:

Staff proposes that PG&E conduct a pilot study to determine the data and information required to empirically assess the "in-service" (i.e., post-construction) condition of its bare overhead conductors, perform such assessment on a sampling of its overhead bare conductors where such data and information exists or can be reasonably approximated, determine the "in-service" condition of the assessed bare overhead conductors as a function of the conductor's initial material strength (i.e., as a percentage of its initial strength value utilized in the design), identify the threshold value(s) (or range of values) of material strength reduction in bare overhead conductors that constitute a level of deterioration which requires replacement, provide the rationale and justification for the identified

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<sup>21</sup> See ongoing efforts in R.18-04-019 and by the GO 95 Rules Committee.

<sup>22</sup> See Table 4 in the appendix.

threshold value(s) for bare conductor deterioration, utilize the results of the pilot study to propose and justify the replacement of identified deteriorated bare conductors, and take the following actions to reduce the wildfire risk of its 3-wire distribution network.

A corollary for this is the process used to calculate the remaining strength of wood poles following intrusive pole testing results. The intrusive pole testing results are used to calculate the remaining strength of "in-service" wood poles, as a percentage of its strength value utilized in design. This derated strength value is then used to calculate these assets' "in-service" (i.e., derated) safety factor values. In turn, the "in-service" safety factor values are used to determine wood pole replacement schedules to ensure compliance with General Order 95, Rule 44 requirements.

This corrective action will be completed in two phases. As described below, Phase 1 will consist of two steps (A and B). Step A will cover the completion of the pilot study, and submission of a report detailing the process, methodology, rationale, and results of the study. Step B will build on the pilot study completed in Step A, apply current risk models to risk-rank deteriorated bare conductors in High Fire-Threat District (HFTD) areas, and propose a plan to replace such conductors within the timeline and budget detailed in this corrective action. Following the completion of Phase 1, and the approval of PG&E's deteriorated bare conductor replacement proposal, Phase 2 will consist of regular progress and status reporting through the completion of this corrective action.

#### Phase 1:

- A. Develop a pilot study where PG&E identifies the data required and establishes a process and methodology to calculate and assess the "in-service" condition of its bare conductors to determine the level of material strength loss (i.e., deterioration) from annealing due to heating effects. This could be accomplished through application of empirical formulas or methods for determining the heating effects of operating conditions that exceed the rated ampacity of bare conductors (e.g., fault events, peak load events, etc.) on the material strength of conductors, given specific conductor parameters (e.g., type, age, tension, etc.) and duration of said operating conditions. This study should result in a report that: (1) clearly articulates the methodology used and data required to conduct such assessments, (2) describes the scope of and assumptions made in the pilot study, (3) establishes the threshold value(s) of material strength reduction that predicates a level of bare conductor deterioration requiring replacement, (4) explains PG&E's justification and rationale for the selected threshold value(s) of bare conductor deterioration, and (5) provides the results of the pilot study for all in-service bare conductors within scope, including identification of all bare conductors meeting or exceeding the threshold value(s) for replacement.
- B. Using the pilot study as a test case, PG&E will apply the same approach and methodology to assess the "in-service" condition of all bare conductors within HFTD areas of its service territory to identify all bare conductors exceeding the deterioration threshold value(s) determined in the pilot study. PG&E must then use its most current and accepted risk modeling methodologies to risk rank the identified bare conductors requiring replacement for wildfire risk. After risk ranking the deteriorated bare conductors, PG&E must develop and submit a proposal to replace the risk ranked deteriorated bare conductors with the

remaining funds and timeline allocated to this corrective action.<sup>23</sup> PG&E's proposal should balance considerations for the imminence of potential conductor failure, the expediency of deployment, risk mitigation benefits, and resource availability when determining the type of asset(s) to use in replacement (e.g., higher strength bare conductors, covered conductors, etc.). At a minimum, for the selected portfolio of deteriorated bare conductors to be replaced, PG&E's proposal must include the following information:

- a. The name and voltage classification of all circuits included.
- b. The targeted miles of bare conductor selected for replacement within each identified circuit.
- c. Its selected replacement asset type for each identified circuit (e.g., higher strength conductor, covered conductor, etc.).
- d. Unit costs for each replacement asset type identified above.
- e. The timeline to complete the planned replacements for each identified circuit, including quarterly and annual breakdowns for planned replacement work.
- f. The total expected cost to complete the planned bare conductor replacements.
- g. A description of how PG&E will:
  - i. Differentiate the replacement of bare conductors identified from execution of this corrective action with the replacement of bare conductors or any other authorized action in or from its most recently approved general rate case.
  - ii. Ensure that costs associated with execution of this corrective action are not comingled with costs for bare conductor replacement or any other authorized action in or from its most recently approved general rate case.

Within 90 days after approval of this Staff Proposal by the Commission, PG&E will submit a report to the Director of SPD and the service list for I.19-06-015. The report will address the five (5) elements described in Phase 1 Section A above and include an appendix that contains the deteriorated bare conductor replacement proposal specified in Phase 1 Section B above. Phase 1 of this corrective action will be completed, and Phase 2 initiated, upon approval of PG&E's report and deteriorated bare conductor replacement proposal by the Director of SPD.

#### Phase 2:

Upon approval of PG&E's report and deteriorated bare conductor replacement proposal by the Director of SPD, PG&E shall:

- A. Execute the deteriorated bare conductor replacement proposal approved in Phase 1.
- B. Submit a progress report to the Director of SPD and the service list for I.19-06-015 every six (6) months, throughout the duration of the corrective action, detailing its progress towards completion of the approved proposal during the previous six months (i.e., reporting period). At a minimum, the progress reports shall include:
  - a. The miles of deteriorated bare conductors replaced and associated costs, compared to targeted miles and projected unit costs in the approved proposal, and

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<sup>23</sup> Any remaining budget, as specified in this Staff Proposal for this corrective action, following the completion of Phase 1 must be allocated towards the completion of Phase 2 for this corrective action.

broken out by circuit name and voltage classification.

- i. Reported quantities must be broken out by reporting period and cumulatively.
- b. An explanation for any discrepancies in reported progress, unit costs, or timelines, as compared to the targeted miles, timelines, and unit costs specified in the approved proposal.
- c. For any discrepancies identified above, a "makeup plan" for how PG&E plans to align its completion of the replacements with the targets, unit costs, and timelines in the approved proposal.
- d. A description of potential project risks that may affect:
  - i. Targeted work completion
  - ii. Timelines
  - iii. Budget
  - iv. Location of conductor replacements

#### Project duration:

- Phase 1: To be completed within 90 days from approval of this Staff Proposal by the Commission.
- Phase 2: To be completed by December 31, 2025.

#### Budget:

- Phase 1: \$2M
- Phase 2: \$30M
- Total: \$32M

## Corrective Action 2: Install Gang Operated Protective Devices - Upgrade PG&E Distribution Hardware.

#### RCA Findings addressed by this CA2

Finding 4: Risks not acted on.

Finding 11: 3-wire system.

#### Recommendation:

Staff proposes that PG&E install gang operated protective devices in place of existing fuses on circuits traversing HFTD areas of its service territory, where installation of such devices would reduce wildfire risks associated with potential back-feed and high impedance fault conditions. This would allow all phases of a circuit or circuit segment to be simultaneously de-energized upon detection of a fault on any individual phase. PG&E shall take the following actions to reduce the wildfire risks associated with its 3-wire distribution network.

This corrective action will be completed in two phases. Phase 1 will include the production of a report detailing PG&E's analysis and a proposal for which fuses it plans to replace with gang operated protective devices to mitigate wildfire risks. The report and proposal produced in Phase 1 will then be submitted to the Director of SPD for approval. Following approval, Phase 2 will commence with the execution of the approved proposal for the replacement of fuses with gang operated protective devices in HFTD areas and require regular progress and status reporting through the completion of this corrective action.

Phase 1:

- A. Produce a report that details PG&E's process, criteria, and rationale for identifying which fuses to replace with gang operated protective devices on circuits traversing HFTD areas in PG&E's territory to reduce wildfire risks associated with potential back-feed and high impedance fault conditions. For each circuit or circuit segment under consideration, PG&E shall detail:
  - a. The name and voltage classification of all circuits considered.
  - b. The number of fuses considered for replacement with gang operated protection devices.
  - c. The types of operating conditions or events considered that can lead to electric back-feed or high impedance faults.
  - d. The probability of (1) undetected fault and (2) back-feed conditions of each circuit or circuit segment under the various operating conditions identified above for the:
    - i. Existing in-service protective device configuration.
    - ii. Proposed gang operated protective device configuration.
  - e. Other risk factors that contributed to the analysis.
  - f. The unit cost for the replacement of all identified fuses with gang operated protection devices.
- B. PG&E must then use the most current and accepted risk modeling methodologies used in RAMP (or as potentially modified by the Risk-Based Decision-Making Framework (RDF) rulemaking) to determine the wildfire risk mitigation benefits of replacing the identified fuses with gang operated protection devices as compared to the current design and configuration. After completion of this assessment, PG&E must risk rank the identified fuses requiring replacement for wildfire risk. After risk ranking the fuses, PG&E must develop and submit a proposal to replace the risk ranked fuses with the remaining funds and timeline allocated to this corrective action.<sup>24</sup> At a minimum, for the selected portfolio of fuses to be replaced, PG&E's proposal must include the following information:
  - a. The name and voltage classification of all circuits or circuit segments included.
  - b. The targeted number of fuses selected for replacement within each identified circuit.
  - c. Unit costs for each fuse replacement identified above.
  - d. The timeline to complete the planned replacements for each identified circuit or circuit segment, including quarterly and annual breakdowns for planned

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<sup>24</sup> Any remaining budget, as specified in this Staff Proposal for this corrective action, following the completion of Phase 1 must be allocated towards the completion of Phase 2 for this corrective action.

- replacement work.
- e. The total expected cost to complete the planned fuse replacements.
  - f. A description of how PG&E will:
    - i. Differentiate the replacement of fuses identified from execution of this corrective action with the replacement of fuses or any other authorized action in or from its most recently approved general rate case.
    - ii. Ensure that costs associated with execution of this corrective action are not comingled with costs for fuse replacement or any other authorized action in or from its most recently approved general rate case.

Within 90 days after approval of this Staff Proposal, PG&E will submit a report to the Director of SPD and the service list for I.19-06-015. The report will address the elements described in Phase 1 Section A above and include an appendix that contains the fuse replacement proposal specified in Phase 1 Section B above. Phase 1 of this corrective action will be completed, and Phase 2 initiated, upon approval of PG&E's report and fuse replacement proposal by the Director of SPD.

#### Phase 2:

Upon approval of PG&E's report and proposal for the replacement of fuses with gang operated protection devices on circuits or circuit segments traversing HFTD areas, PG&E shall:

- A. Execute the fuse replacement proposal approved in Phase 1.
- B. Submit a progress report to the Director of SPD and the service list for I.19-06-015 every six (6) months, throughout the duration of the corrective action, detailing its progress towards completion of the approved proposal during the previous six months (i.e., reporting period). At a minimum, the progress reports shall include:
  - a. The number of fuses replaced and associated costs, compared to targeted fuse replacements and projected unit costs in the approved proposal, and broken out by circuit/circuit segment name and voltage classification.
    - i. Reported quantities must be broken out by reporting period and cumulatively.
  - b. An explanation for any discrepancies in reported progress, unit costs, or timelines, as compared to the targeted miles, timelines, and unit costs specified in the approved proposal.
  - c. For any discrepancies identified above, a "makeup plan" for how PG&E plans to align its completion of the replacements with the targets, unit costs, and timelines in the approved proposal.
  - d. A description of potential project risks that may affect:
    - i. Targeted work completion
    - ii. Timelines
    - iii. Budget
    - iv. Location of fuse replacements

#### Project duration:

- Phase 1: To be completed within 90 days from approval of this Staff Proposal.

- Phase 2: To be completed by December 31, 2025.

#### Budget:

- Phase 1: \$1M
- Phase 2: \$18M
- Total: \$19M

## Corrective Action 3: Deploy Early Fault Detection on 60 - 70 kV Transmission Lines

### RCA Findings addressed by this CA3

Finding 4: Risks not acted on.

Finding 11: 3-wire system.

### Recommendation:

Staff proposes that PG&E deploy early fault detection on 60-70 kV transmission lines traversing HFTD areas in its service territory. Installation of early fault detection reduces the duration of potential fault events, which increases wildfire safety by reducing the probability of ignitions.

This corrective action will be completed in two phases. Phase 1 will include the production of a report detailing PG&E's analysis and a proposal for which 60-70 kV transmission lines it plans to install early fault detection capabilities on to mitigate wildfire risks. The report and proposal produced in Phase 1 will then be submitted to the Director of SPD for approval. Following approval, Phase 2 will commence with the execution of the approved proposal for installation of early fault detection capabilities in HFTD areas and require regular progress and status reporting through the completion of this corrective action.

### Phase 1:

- A. Produce a report that details PG&E's process, criteria, and rationale for identifying which 60-70 kV transmission lines traversing HFTD areas to upgrade with early fault detection capabilities to reduce wildfire risks associated with potential back-feed and high impedance fault conditions. For each circuit or circuit segment under consideration, PG&E shall detail:
  - a. The name and voltage classification of all circuits considered.
  - b. The number of early fault detection devices considered for installation.
  - c. The number of circuit miles covered by installation of the early fault detection devices.
  - d. The types of operating conditions or events considered that can lead to electric back-feed or high impedance faults.
  - e. The probability of (1) undetected fault and (2) back-feed conditions of each circuit or circuit segment under the various operating conditions identified above for the:
    - i. Existing in-service protective device configuration.
    - ii. Proposed early fault detection protective device configuration.

- f. Other risk factors that contributed to the analysis.
  - g. The unit cost for the installation of all early fault detection devices.
- B. PG&E must then use the most current and accepted risk modeling methodologies used in RAMP (or as potentially modified by the RDF rulemaking) to determine the wildfire risk mitigation benefits of installing early fault detection capabilities on the identified 60-70 kV transmission lines as compared to the current design and configuration. After completion of this assessment, PG&E must risk rank the identified 60-70 kV transmission lines for wildfire risk. After risk ranking the 60-70 kV transmission lines, PG&E must develop and submit a proposal to install early fault detection capabilities on the risk ranked 60-70 kV transmission lines with the remaining funds and timeline allocated to this corrective action.<sup>25</sup> At a minimum, for the selected 60-70 kV transmission lines to be outfitted with early fault detection capabilities, PG&E's proposal must include the following information:
- a. The name and voltage classification of all circuits included.
  - b. The targeted number of early fault detection devices to install on each identified circuit.
  - c. Unit costs for each early fault detection device installation identified above.
  - d. The timeline to complete the planned installation for each identified circuit, including quarterly and annual breakdowns for planned installations.
  - e. The total expected cost to complete the planned early fault detection device installations.
  - f. A description of how PG&E will:
    - i. Differentiate the installation of early fault detection devices identified from execution of this corrective action with the installation of early fault detection devices or any other authorized action in or from its most recently approved general rate case.
    - ii. Ensure that costs associated with execution of this corrective action are not comingled with costs for installation of early fault detection devices or any other authorized action in or from its most recently approved general rate case.

Within 90 days after approval of this staff proposal, PG&E will submit a report to the Director of SPD and the service list for I.19-06-015. The report will address the elements described in Phase 1 Section A above and include an appendix that contains the early fault detection installation proposal specified in Phase 1 Section B above. Phase 1 of this corrective action will be completed, and Phase 2 initiated, upon approval of PG&E's report and early fault detection installation proposal by the Director of SPD.

Phase 2:

Upon approval of PG&E's report and proposal for the installation of early fault detection devices on 60-70 kV transmission lines traversing HFTD areas, PG&E shall:

- A. Execute the early fault detection installation proposal approved in Phase 1.

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<sup>25</sup> Any remaining budget, as specified in this Staff Proposal for this corrective action, following the completion of Phase 1 must be allocated towards the completion of Phase 2 for this corrective action.



- B. Submit a progress report to the Director of SPD and the service list for I.19-06-015 every six (6) months, throughout the duration of the corrective action, detailing its progress towards completion of the approved proposal during the previous six months (i.e., reporting period). At a minimum, the progress reports shall include:
- a. The number of early fault detection devices installed, circuit miles covered through such installations, and associated costs, compared to targeted early fault detection device installations, circuit miles covered, and projected unit costs in the approved proposal, broken out by circuit name and voltage classification.
    - i. Reported quantities must be broken out by reporting period and cumulatively.
  - b. An explanation for any discrepancies in reported progress, unit costs, or timelines, as compared to the targeted early fault detection devices installed, miles covered by such installations, timelines, and unit costs specified in the approved proposal.
  - c. For any discrepancies identified above, a "makeup plan" for how PG&E plans to align its completion of the installations with the targets, unit costs, and timelines in the approved proposal.
  - d. A description of potential project risks that may affect:
    - i. Targeted work completion
    - ii. Timelines
    - iii. Budget
    - iv. Location of early fault detection device installations

#### Project duration:

- Phase 1: To be completed within 90 days from approval of this Staff Proposal.
- Phase 2: To be completed by December 31, 2025.

#### Budget:

- Phase 1: \$750K
- Phase 2: \$10M
- Total: \$10.75M

## Corrective Action 4: Supplement SEI-20 Project

### RCA Findings addressed by this CA4

Finding 11: 3-wire system.

#### Recommendation:

Staff proposes that some RCA funds be directed to supplement the existing SEI-20 budget. Currently, there is \$750,000 allocated for SEI-20 to conduct an independent study of the grounding methods and circuit and transformer configuration. During the initial solicitation process, proposals for the SEI-20 scope of work were higher than the budgeted amount. Thus, to adequately perform the scope of SEI-20 the budget needs to be increased. Any remaining funds not used for SEI-20

project shall be reallocated to Corrective actions 1 through 3 in equal amounts.

Project duration:

- NA

Budget:

- Additional \$1.25M allocated to SEI-20 (\$2 million total budget for SEI-20)

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### 3. Appendix: Tables and Summary of RCA Corrective Actions

Table 1 below lists the top four root cause categories identified by the Envista Failure Decision Analysis.

*Table 1 Root Cause Categories and the frequency of their occurrence in the 20 ignitions studied*

Root Cause	Envista Definition <sup>26</sup>	Frequency	*% of all ignitions with this Root Cause
Asset Maintenance <sup>27</sup>	Electrical systems not adequately maintained for their intended use, with regard being given to the conditions under which they are to be operated, to enable the furnishing of safe, proper, and adequate service.	15	75%
Circuit Design	The design of the 3-wire overhead distribution systems creates a condition in which the circuit protective devices, comprising circuit breakers, reclosers, sectionalizers and fuses, frequently do not detect and interrupt a phase to ground fault (L-G fault) caused by one or more downed conductors.	14	70%
Circuit Protection Design	Inadequate circuit protection design to protect the electrical circuit from damage in the event of a fault such as high temperature, excessive current or a short circuit in a conductor.	13	65%
Vegetation Management Inspections	Vegetation management inspection activities performed were inadequate to identify dead, rotten, or diseased trees or dead, rotten, or diseased portions of otherwise healthy trees overhanging or leaning toward—and may fall into—a span of electrical lines.	11	55%

\* Percentage of all ignitions with this root cause is calculated as frequency divided by total ignitions (20 total ignitions).

<sup>26</sup> Envista Report, Pg. 64

<sup>27</sup> The Envista Report characterizes “fuse failure” as an “asset maintenance” related root cause. However, Staff are not convinced that, based on the information presented, there is a correlation between fuse operations and asset maintenance programs.

Table 2 below is a summary of conditions identified as part of Envista's Failure Decision Analysis.

Table 2 Conditions present in the 20 ignitions<sup>28</sup>

Wildfire	Circuit	Circuit Type	Cause	Likely Protection System Failure	Possible Downed Energized Conductor (Mins)	Possible High Impedance Conditions	Possible Back-feed
Camp #1	Caribou-Palermo 115kV	Trans	Equipment	No	UNKN	No	No
Camp #2	Wyandotte 1105	3-Wire	Tree	No	UNKN	No	No
Norrbom	Sonoma 1103	3-Wire	Tree	Yes	1440	Yes	Yes
Point	West Point 1102	3-Wire	Tree	Yes	378	Yes	Yes
Adobe	Dunbar 1101	3-Wire	Tree	Yes	193	Yes	Yes
Pocket	Cloverdale 1102	3-Wire	Tree	Yes	186	No	No
Oakmont	Rincon 1101	3-Wire	Error	Yes	164	Yes	Yes
Cherokee	Clark Rd 1102	3-Wire	Tree	Yes	144	Yes	Yes
McCourtney	Grass Valley 1103	3-Wire	Tree	Yes	109	Yes	Yes
Nuns #1	Dunbar 1101	3-Wire	Tree	No	103	No	No
Nuns #2	Dunbar 1101	3-Wire	Tree	No	103	Yes	Yes
Atlas 1 & 2	Pueblo 1104	3-Wire	Tree	Yes	87	Yes	Yes
Sulphur	Redbud 1101	3-Wire	Pole Failure	No	62	Yes	No
Redwood #1	Potter Valley 1105	3-Wire	Tree	No	61	Yes	Yes
LaPorte	Bangor 1101	3-Wire	Tree	Yes	38	Yes	Yes
Young	Fulton 1102	3-Wire	Tree	Yes	38	No	No
Patrick	Pueblo 2103	4-Wire	Tree	No	4	Yes	No
Cascade	Bangor 1101	3-Wire	Sag	Yes	0	No	No
Lobo	Narrows 2102	4-Wire	Tree	Yes	0	No	No
Redwood #2	Mendocino 60kV	Trans	Tree	No	0	No	No

Table 3 below is a summary Envista's Findings and Recommendations.

Table 3 Envista's Findings and Recommendations

Theme	ID	Finding	Issues	Recommendation
Institutional Learning	1	Corrective Action – Compliance Management	The lack of an effective Corrective Action Program (CAP) at PG&E resulted in the absence of a mechanism to trend all identified deficiencies.	Implement an enterprise-wide CAP that requires its use for all incidents and events, as well as trends issues across all LOBs.

<sup>28</sup> Table 2 is derived from Envista's workshop presentation slides 22 and 23.

Theme	ID	Finding	Issues	Recommendation
Institutional Learning	2	After-Action Review	After-Action Reports (AARs) are not produced in a timely manner and repeat findings indicate that corrective action processes need to be improved.	Incorporate the After-Action Reports (AARs) into the enterprise-wide CAP that requires timely AARs for emergency and wildfire exercises and events across all LOBs.
Institutional Learning	3	De-Energization Protocol	PG&E did not have a de-energization protocol prior to the 2017 wildfire siege.	None
Institutional Learning	4	Risks Identified but not Acted Upon	The threat of wildfires was identified as a significant risk but organized planning and preparation efforts for such a threat were limited.	Given the proven costs of not taking quick action when new major risks are identified, PG&E could institute a process to ensure that relevant plans, operational programs, and procedures are aligned with actions to address such threats.
Institutional Learning	5	Safety Culture	The RCA Team has reviewed NorthStar Consulting's and Dekra's safety culture findings to-date and has no basis for challenging such.	Based on documents reviewed and interviews conducted for this RCA report, the RCA Team has no additional findings or recommendations beyond related subjects discussed in this report.
Vegetation Management	6	Leadership Qualifications	PG&E places key management individuals into Vegetation Management who do not have the required qualifications and competence.	PG&E should immediately take steps to ensure that a Vice President and other senior program leaders have the necessary professional VM education, experience, training, certifications, and competence to adequately administer and manage Vegetation Management functions.
Vegetation Management	7	Contractor Qualifications	Many of the consulting utility foresters (CUFs) lacked the education, training, skill, and experience to perform pre-inspections. PG&E didn't verify that the CUFs met the minimum qualifications.	Personnel performing tree risk assessments shall have the demonstrated competence to effectively conduct required tasks including a minimum defined level of education, training, skills, and experience to identify and mitigate at-risk trees. This includes, but should not be limited to, education, training, and demonstrated competence in basic tree biology and major species identification. A basic understanding of electricity and the utility structure and operations is necessary.

Theme	ID	Finding	Issues	Recommendation
Vegetation Management	8	Vegetation Management Programs	PG&E has too many unnecessarily disjointed programs that should be combined to improve efficiencies in vegetation management. This will reduce costs over time, increase the cycle length, and be less confusing to PG&E's contractors and customers without losing any safety or electric service reliability.	Combine these programs, resulting in a more efficient, streamlined program. The inspectors and tree crews can identify and clear the ROW and off-ROW hazard trees, maintaining regulatory clearance requirements at lower costs without any reduction in safety or reliability, as has been demonstrated by utilities across the country.
Vegetation Management	9	QA/QC Program	The PG&E Quality Assurance/Quality Control Program wasn't designed for auditing tree populations but instead for line miles. In addition, the focus of these audits was to only identify trees not in compliance with the radial clearance requirements of General Order (GO) 95, Rule 35, and PRC-4293. Hazard trees were sometimes identified by the auditors, but this didn't affect the audit scorecard for contractors to be in compliance with PG&E's own procedures.	The QA/QC programs should be performed at the same time with the priority of identifying hazard trees. The QA/QC programs should consider auditing 100% of all circuits in high fire-risk areas and ensure 100% auditing of circuits with unsatisfactory performance. In other areas, the sample formula should be based on tree populations.
Vegetation Management	10	Pre-Inspection Contract Strategy	PG&E uses a lump sum pre-inspection contract strategy. A time and materials (T&M) contract will allow the pre-inspector the time to thoroughly inspect and identify hazard trees.	PG&E should consider converting from lump sum contracts to time and materials contracts.
Circuitry	11	3-Wire System	The fundamental design of the overall PG&E electric 3-wire system permits undetected ground-faulted overhead conductors to remain electrically energized in contrast to industry best practice.	PG&E should expeditiously proceed with System Enhancement Initiative No. 20, which requires PG&E and the CPUC to engage an independent engineering firm to study the grounding methods and circuit and transformer configuration in PG&E's distribution system and transmission system.
Circuitry	12	Asset Management	The corrective maintenance (tag) backlog was significant in both duration and number, which contributed to degraded system conditions.	PG&E should implement a comprehensive program that includes the proper balance of the various approaches to maintenance, including preventive, predictive, and corrective, and not replace on failure.

Theme	ID	Finding	Issues	Recommendation
Emergency & Crisis Management	13	Incident Command System Not Fully Implemented	PG&E had taken steps before the 2017 wildfires to implement ICS but review of documents and interviews with PG&E emergency management officials identifies that the company had not fully implemented ICS before the fires in 2017.	PG&E should consider full implementation of the ICS, including for daily operations, as has been done at other major utilities, including ConEd in New York and Consumers Energy in Michigan.
Emergency & Crisis Management	14	Crisis Management Plan	A crisis management plan which fully utilizes the executive management team for oversight during planning and response activities did not exist during the 2017 and 2018 timeframe.	Redefine the role of the executive management team during an event to that of a Crisis Management Team (CMT).
Emergency & Crisis Management	15	Emergency Preparedness – Officer-in-Charge (OIC)	OIC was created ad hoc during the 2018 Wildfire event to address the unspecified role of the executive. OIC responsibilities overlap those of the Incident Commander (IC) and operates outside of the IC Chain-of-Command which effectively usurps the IC's authority.	PG&E should realign the OIC responsibilities to be centralized under the IC.
General Orders	16	General Order 95 Maintenance Program	General Order 95 does not provide guidance on preventive and predictive maintenance minimum standards.	The CPUC should modify General Order (GO) 95 to require California utilities to implement a comprehensive maintenance program that includes the proper balance of the various approaches to maintenance, e.g., preventive, predictive, or corrective. This action would align GO 95 with GO 167 – Enforcement of Maintenance and Operation Standards for Electric Generating Facilities
General Orders	17	General Order 166 – Mutual Agreement Resource Typing	PG&E did not maintain a list of available resources (amount, type of personnel, capability, equipment, materials, and supplies) to meet mutual agreements with EEI, FPL, Yolo County and Western Regional and to comply with the intent of GO 166 Mutual Assistance Agreement(s) Standard.	The CPUC should modify GO 166 – Mutual Assistance Agreement(s) Standard 2 to explicitly require California utilities to include available resource by amount, capability, and type (personnel, equipment, materials, and supplies) in their mutual assistance agreements.
General Orders	18	Support PG&E Vegetation Management Effort on Private Property	PG&E's Vegetation Management Department encounters resistance from property owners to prune or remove trees that pose a risk to reliability and public safety.	The CPUC could make changes to Rule 35 which allows utility companies the ability to maintain vegetation that poses a risk to reliability and public safety.

Theme	ID	Finding	Issues	Recommendation
General Orders	19	Modification of GO 95, Rule 35 to Emphasize Safety, Reliability, and Hazard Tree Assessment	Modification of GO 95, Rule 35 to emphasize safety, reliability and hazard tree assessment would direct and enable electric utilities to better focus on the root cause of tree-related fires. PG&E's focus was primarily on complying with the clearance requirement of 18 inches and not on identifying hazard trees. None of the vegetation-related fires were a result of clearance violations.	The California Public Utilities Commission (CPUC) could consider requiring the utilities to use the following standards and best management practices: 1)ANSI-A300 (Part 9) Tree Risk Assessment 2)the CPUC could consider requiring that the California utilities vegetation management managers develop a pocket field guide and a quantitative risk matrix

Table 4 below is a summary of PG&E's initial response to Envista's findings and recommendations.

Table 4 PG&E's Response to Envista's Findings and recommendations

Theme	Finding	Envista Recommendation	PG&E Response	PG&E Corrective Actions Completed since 2018
Institutional Learning	1: Corrective Action – Compliance Management	Implement an enterprise-wide CAP that requires its use for all incidents and events	Agree	<ul style="list-style-type: none"> <li>Implemented enterprise-wide CAP in 2017</li> </ul>
	2: After-Action Review	Incorporate After-Action Reports (AARs) into the enterprise-wide CAP	Agree	<ul style="list-style-type: none"> <li>Implemented a new CAP process that integrated the AARs</li> <li>Our AAR Process Standard specifically addresses how findings from AARs are incorporated in the CAP process</li> </ul>
	3: De-Energization Protocol	None	No Response	
	4: Risks Identified but not Acted Upon	Institute a process to ensure that plans, operational programs, and procedures are aligned with actions to address identified threats	Agree	<ul style="list-style-type: none"> <li>Process and risk models to address all-hazards, including wildfires</li> <li>Risk Spend Efficiency (RSE) and 2020 Risk Assessment Mitigation Phase (RAMP) Report and other risk focused initiatives were implemented</li> <li>Put a plan of reorganization in place for the Chief Risk Officer (CRO) and Chief Safety Officer (CSO) positions</li> </ul>



Theme	Finding	Envista Recommendation	PG&E Response	PG&E Corrective Actions Completed since 2018
				<ul style="list-style-type: none"> <li>Received PAS 55 and ISO 55 - 001 certifications for electric operations</li> </ul>
	5: Safety Culture	None	No Response	
Vegetation Management	6: Leadership Qualifications	Vice President and other senior program leaders should have professional VM education, experience, training, and certifications	Partially Disagree	<ul style="list-style-type: none"> <li>Senior Management are required to have broad managerial experience</li> <li>Leadership closest to work have arboreal certification and/or a forestry education</li> </ul>
	7: Contractor Qualifications	Personnel performing tree risk assessments shall have a minimum defined level of education, training, skills, and experience	Agree	<ul style="list-style-type: none"> <li>VM program now meets or exceeds the proposed training requirements</li> <li>Contractors are required to attend extensive company vegetation management training</li> </ul>
	8: Vegetation Management Programs	Combine various VM programs into a more efficient, streamlined program	Agree	<ul style="list-style-type: none"> <li>Began transitioning from three separate VM Program elements to a "One Veg" program</li> <li>Transition to be completed in 2023</li> </ul>
	9: QA/QC Program	The QA/QC programs should consider auditing 100% of all circuits in high fire-risk areas. Ensure 100% auditing of circuits with unsatisfactory performance	Partially Disagree	<ul style="list-style-type: none"> <li>Company performs 100% work verification of EVM work which is considered sufficient</li> <li>We do not agree with auditing 100% of all circuits in high fire-risk areas for all types of VM work</li> </ul>
	10: Pre-Inspection Contract Strategy	PG&E should consider converting from lump sum contracts to time and materials contracts	Partially Disagree	<ul style="list-style-type: none"> <li>Company uses a mix of contract strategies that are appropriate for the specific program and scope of work</li> </ul>
	11: 3-Wire System	Proceed with System Enhancement Initiative No. 20, which requires PG&E and the CPUC to engage an independent engineering firm to study grounding methods, circuits and transformer configuration	Agree	<ul style="list-style-type: none"> <li>This study is expected to be completed by the end of 2023</li> </ul>
Circuitry	12: Asset Management	PG&E should implement a comprehensive program that includes the proper balance of approaches to maintenance, including preventive,	Agree	<ul style="list-style-type: none"> <li>Provided a comprehensive description of our current asset management program in our 2022 Revised Wildfire Mitigation Plan (WMP)</li> </ul>

Theme	Finding	Envista Recommendation	PG&E Response	PG&E Corrective Actions Completed since 2018
		predictive, and corrective measures		<ul style="list-style-type: none"> <li>• Provided significant details about our strategy for reducing our tag backlog at the request of Energy Safety in our Revised WMP</li> <li>• It has been proposed to accelerate completion of overdue maintenance tags in HFTD areas</li> </ul>
Emergency and Crisis Management	13: Incident Command System Not Fully Implemented	PG&E should consider full implementation of the ICS, including for daily operations, as has been done at other major utilities, including ConEd in New York and Consumers Energy in Michigan	Disagree	<ul style="list-style-type: none"> <li>• We disagree with the recommendation. Our ICS is implemented for our all-hazards approach and is part of the company's daily operating procedure. All company emergency responders and those assigned Emergency Operations Center (EOC) positions must complete assigned training</li> <li>• Emergency preparedness exercises are conducted regularly and representatives from federal, state, and local agencies are invited to participate in or observe the annual CERP exercise</li> </ul>
	14: Crisis Management Plan	Redefine the role of the executive management team to a Crisis Management Team (CMT)	Agree	<ul style="list-style-type: none"> <li>• Implemented a CMT named the Corporate Incident Management Council (CIMC)</li> <li>• Roles and responsibilities for CIMC are in the Company Emergency Response Plan (CERP)</li> </ul>
	15: Emergency Preparedness – Officer-in-Charge (OIC)	PG&E should realign the OIC responsibilities to be centralized under the IC.	Agree	<ul style="list-style-type: none"> <li>• We have centralized the OIC responsibilities under the IC. The roles and responsibilities for these positions have been clarified in our CERP</li> </ul>

Table 5 below is a summary of PG&E's updated proposal for corrective actions.

Table 5 PG&E's Updated proposal for corrective actions

Responsible Party	Corrective Action	Considerations	Proposed Spend
CPUC	Increase funding and scope of System Enhancement Initiative 20 (SEI-20) to evaluate PG&E three-wire infrastructure	<ul style="list-style-type: none"> <li>• Include identification of best mitigation of downed conductor, dry lightning storms</li> <li>• Suggest recommendations include implementation recommendations and cost</li> </ul>	To be discussed in early 2023
CPUC	Require robust risk models of PG&E assets and operational portfolio – include an independent model validation process	<ul style="list-style-type: none"> <li>• Suggest establishment of a program at a University of California system school to develop assessment capabilities to be used statewide.</li> <li>• Group would be able to perform independent assessments of all. IOU risk models</li> </ul>	\$5M - \$10M
CPUC	Independent review of PG&E Records Management process.	<ul style="list-style-type: none"> <li>• In lieu of an independent review, focus on tangible improvements to PG&amp;E records</li> <li>• Collection and processing of LiDAR data to improve the spatial location and inventory of electric transmission, substation, and distribution towers, poles, and equipment</li> <li>• Correction of critical asset data gaps through historical records research and field inventory (e.g., missing/erroneous pole install dates)</li> </ul>	\$15M - \$20M
PG&E	Conductor replacement	<ul style="list-style-type: none"> <li>• Replacement of deteriorated bare conductors with covered conductors in HFTD.</li> <li>• Also, this incrementally addresses ignitions (conductors and splices are the highest driver), public safety, and reliability risk in HFTD areas</li> </ul>	\$20M - \$25M

Responsible Party	Corrective Action	Considerations	Proposed Spend
002043 PG&E	Installation of ganged operated protective devices in place of existing fuses allow all phases to be de-energized upon detection of a fault on any individual phase	<p>Ganged protective device operation reduces the possibility for energized back feed conditions by de-energizing all phases where line to line transformers may contribute to back feed high-impedance fault conditions</p> <ul style="list-style-type: none"> <li>• While fuse removal accomplishes the goal of reducing back feed potential, the replacement of fuses with a new protective device has additional primary benefits: <ul style="list-style-type: none"> <li>○ Replacing the fuse with a ganged protective device allows for coordination with upstream protective devices such that outages continue to be localized with the fewest customers impacted</li> </ul> </li> <li>• During non-EPSS conditions reclosing for the protective zone is available to mitigate transient faults</li> </ul>	\$10M – \$15M
PG&E	Deploy early fault detection on 60 - 70 kV transmission lines	<ul style="list-style-type: none"> <li>• Reduces / eliminate fault duration (eliminate back-feed potential)</li> <li>• Additionally addresses Commission concern with reliability</li> </ul>	\$5M - \$10M
		Total	\$63M

Table 6 below is a summary of Envista's findings, the current activities being undertaken by PG&E, and SPD recommendations for corrective actions.

*Table 6 Summary of current activities and recommended Corrective Actions*

Theme	Finding	PG&E Corrective actions taken since 2018 <sup>29</sup>	SPD Recommendations for Corrective Action
Institutional Learning	1: Corrective Action - Compliance Management	PG&E Implemented Enterprise-wide CAP in 2017	PG&E to provide documentation validating stated corrective actions taken since 2018.

<sup>29</sup> See the PG&E December 2020 Workshop Presentation, Slides 3 - 6

Theme	Finding	PG&E Corrective actions taken since 2018 <sup>29</sup>	SPD Recommendations for Corrective Action
	2: After-Action Review	<p>Implemented a new CAP process that integrated the AARs.</p> <p>Our AAR Process Standard specifically addresses how findings from AARs are incorporated in the CAP process.</p>	PG&E to provide documentation validating stated corrective actions taken since 2018.
	3: De-Energization Protocol not in place in 2017	PSPS and EPSS are now in place	No additional action is recommended.
	4: Risks Identified but not acted Upon	<p>Process and risk models to address all-hazards, including wildfires.</p> <p>Risk Spend Efficiency (RSE) and 2020 Risk Assessment Mitigation Phase (RAMP) Report and other risk focused initiatives were implemented.</p> <p>Put a plan of reorganization in place for the Chief Risk Officer (CRO) and Chief Safety Officer (CSO) positions.</p> <p>Received PAS 55 and ISO 55 - 001 certifications for electric operations.</p>	<p>PG&amp;E to provide documentation validating stated corrective actions taken since 2018.</p> <p>Correct Action 1: Assess &amp; Replace Deteriorated In-service Bare Conductors</p> <p>Correct Action 2: Install Gang Operated Protective Devices</p> <p>Correct Action 3: Deploy Early Fault Detection</p>
	5: Safety Culture	No Response	No additional action is recommended.
Vegetation Management	6: Leadership Qualifications	<p>Senior Management are required to have broad managerial experience.</p> <p>Leadership closest to work have arboreal certification and/or a forestry education.</p>	PG&E to provide documentation validating stated corrective actions taken since 2018.

Theme	Finding	PG&E Corrective actions taken since 2018 <sup>29</sup>	SPD Recommendations for Corrective Action
	7: Contractor Qualifications	<p>PG&amp;E VM program now meets or exceeds the proposed training requirements.</p> <p>Contractors are required to attend extensive company vegetation management training.</p>	PG&E to provide documentation validating stated corrective actions taken since 2018.
	8: Vegetation Management Programs: Combine VM programs, resulting in a more efficient, streamlined program.	<p>Began transitioning from three separate VM Program elements to a "One Veg" program.</p> <p>Transition to be completed in 2023</p>	PG&E to provide documentation validating stated corrective actions taken since 2018.
	9: Vegetation management QA/QC programs	<p>Company performs 100% work verification of EVM work which is considered sufficient.</p> <p>We do not agree with auditing 100% of all circuits in high fire-risk areas for all types of VM work.</p>	PG&E to provide documentation validating stated corrective actions taken since 2018.
	10: Pre-Inspection Contract Strategy PG&E should consider converting from lump sum contracts to time and materials contracts.	Company uses a mix of contract strategies that are appropriate for the specific program and scope of work.	No additional action is recommended.
Circuitry	11: 3-Wire System PG&E should expeditiously proceed with System Enhancement Initiative No. 2054,	<p>This study is expected to be completed by the end of 2023.</p> <p><i>(SEI-20 Update) No bidder within the 750K budget has responded to the SEI-20 RFP.</i></p>	<p>Correct Action 2: Install Gang Operated Protective Devices</p> <p>Correct Action 3: Deploy Early Fault Detection</p> <p>Correct Action 4: Supplement Funding for SEI-20 Project</p>

Theme	Finding	PG&E Corrective actions taken since 2018 <sup>29</sup>	SPD Recommendations for Corrective Action
	12: Asset Management	<p>Provided a comprehensive description of our current asset management program in our 2022 Revised Wildfire Mitigation Plan (WMP).</p> <p>Provided significant details about our strategy for reducing our tag backlog at the request of Energy Safety in our Revised WMP.</p> <p>It has been proposed to accelerate completion of overdue maintenance tags in HFTD areas.</p>	<p>Maintenance backlogs are being addressed in WMPs.</p> <p>Correct Action 1: Assess &amp; Replace Deteriorated In-service Bare Conductors</p>
Emergency & Crisis Management	13: Incident Command System Not Fully Implemented	<p>We disagree with the recommendation. Our ICS is implemented for our all-hazards approach and is part of the company's daily operating procedure. All company emergency responders and those assigned Emergency Operations Center (EOC) positions must complete assigned training.</p> <p>Emergency preparedness exercises are conducted regularly and representatives from federal, state, and local agencies are invited to participate in or observe the annual CERP exercise.</p>	PG&E to provide documentation validating stated corrective actions taken since 2018.
	14: Crisis Management Plan	<p>Implemented a CMT named the Corporate Incident Management Council (CIMC).</p> <p>Roles and responsibilities for CIMC are in the Company Emergency Response Plan (CERP) .</p>	PG&E to provide documentation validating stated corrective actions taken since 2018.

Theme	Finding	PG&E Corrective actions taken since 2018 <sup>29</sup>	SPD Recommendations for Corrective Action
	15: Emergency Preparedness Officer-in-Charge (OIC)	We have centralized the OIC responsibilities under the IC. The roles and responsibilities for these positions have been clarified in our CERP.	PG&E to provide documentation validating stated corrective actions taken since 2018.

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