PACIFIC GAS AND ELECTRIC COMPANY
10 Year Electrical Undergrounding Plan (EUP)
Data Response

PG&E Data Request No.:	OEIS_004-Q001
PG&E File Name:	EUP-PhI_DR_OEIS_004-Q001
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Requester DR No.:	Energy Safety-DR-EUP-26-09
Requesting Party:	Office of Energy Infrastructure Safety
Requester:	Adam Berlinerman
Date Sent:	October 29, 2026
Responsible Person(s):	Andrea Brown

SUBJECT: CPUC DATA TEMPLATE, PRESENT VALUE CALCULATION, SCREEN 2 BCR INPUTS, RISK MODELING

QUESTION 001

EPSS/PSPS Modeling

a. Explain the identical expected outage durations for EPSS-enabled and EPSS disabled events as outlined in WP016A – EPSS Toy Problem. In this explanation, list all assumptions and assumption justifications, address physical differences between the outage types (e.g., increased circuit segment length impacted by EPSS-enabled outages), and list any expected model updates.

b. What are PG&E's working definitions of failures, events, outages, momentary outages, sustained outages, and Raw WDRM Probability of Failure (PoF)? What are the main differences between them?

c. What if any adjustments to account for EPSS are applied to the Raw WDRM PoF in WP016A – EPSS Toy Problem? List and explain.

d. Does EPSS enablement affect the PoF? Please explain.

e. Why does PG&E use Raw WDRM PoF rather than p(e)Observed[1] as the starting point of EPSS Outage Program Risk calculations?

f. In response to DR No. Energy Safety-DR-EUP-26-04, PG&E stated that "for events where both distribution and transmission facilities are de-energized, the model attributes the associated PSPS outage risk to the distribution system. This treatment is consistent with the modeling assumption that, if the distribution facilities were undergrounded, temporary generation at the substation would be available to serve customers and avoid the outage. Therefore, the modeled risk is evaluated as addressable through the distribution mitigation."

   i. When does PG&E provide temporary generation at the substation to avoid outage?

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1 Pacific Gas and Electric Company Electrical Undergrounding Plan Attachment B WP015 Distribution Event Probability Models Version 4 (DEPM V4), at pg. 610.

ii. Has temporary generation been installed at substations for PSPS that affect only transmission lines or undergrounded distribution lines?

iii. How long does it take to set up temporary generation at a substation?

iv. Is this applicable to all substations/circuits or limited by generation capacity?

i. Forest Kaser, Director WP020 PSPS V1 Risk Model Documentation describes noncore fallback when an upstream ancestor exceeds 11 generations.

i. What is the average number of circuit segments on a circuit? How often are there more than 11 sequential circuit segments?

ii. How many events or circuit segments utilize the noncore fallback?

iii. Why is core spreading limited to 11 upstream generations?

j. Provide separate EPSS and PSPS Table 8 Outage Program Likelihood/Consequence/Risk values for each "circuit segment."

k. WP018 states that "EPSS risk is defined as the incremental risk of outages that exceed the standard outage risk when EPSS is not enabled. This includes outages that were mitigated due to EPSS being active, by considering the likelihood of those outages occurring if EPSS had not been enabled during the same time. In contrast, the EPSS likelihood reported for the EUP reflects the full likelihood of an EPSS outage, encompassing all outages that would have occurred during that time regardless of EPSS activation. This approach ensures a comprehensive representation of outage likelihood, though it introduces a potential mismatch in risk and likelihood reporting."

i. Is the risk calculated using the incremental likelihood but then reported in Table 8 as the full outage likelihood value?

ii. Is the consequence reported back calculated using the full outage likelihood value?

iii. How does the full likelihood of an EPSS outage ensure a comprehensive representation of outage likelihood? In particular, why not report the incremental likelihood of outages to match the EPSS outage risk methodology?

ANSWER 001

a. The model uses the same expected duration for sustained equipment outages, regardless of EPSS operating status. The duration is derived from historical sustained distribution equipment outages, grouped by asset type and upstream protective device type.

In the future, PG&E plans to evaluate the effect of EPSS on outage duration but has not done so yet. If that analysis demonstrates meaningful differences in outage duration between EPSS outages and Non-EPSS sustained outages, PG&E will create a separate estimate for each condition.

b. Failures: In the WDRM, a failure is an occurrence associated with an actual or potential electrical fault. Failures include outages, faults that result in an ignition without producing an outage, and conditions identified for emergency repair that

could otherwise lead to a fault. In the context of the probability of failure, “event” is synonymous with “failure.”

Outages: An outage is a loss of electric service resulting from operation of a grid protection device or another condition requiring de-energization. Outages are a subset of failures because some failures, such as faults that cause an ignition without operating a protection device, do not result in an outage.

Momentary Outage: outages lasting 5 minutes or less

Sustained Outage: outages lasting greater than 5 minutes

Raw WDRM Probability of Failure (PoF): Also called p(e)Corrected in WP015 Distribution Event Probability Models Version 4 (DEPM V4), Raw WDRM PoF is the estimated unmitigated failure probability. It is derived from p(e)Observed by adjusting observed outage and ignition counts to remove the effects of EPSS.

c. The following are downstream adjustments that are made to the raw WDRM PoF to calculate the EPSS Outage Likelihood:

    1) Exclude EPSS-independent failure modes. PoF is set to zero for switch_equipment_cause, transformer_equipment_cause, and transformer_equipment_leaking, because these failure modes are considered independent of EPSS.

    2) Apply EPSS enablement rate. For remaining failure modes, Raw WDRM PoF is multiplied by the circuit-level historical EPSS enablement rate to estimate the portion of failures expected to occur while EPSS is enabled.

    3) Apply the sustained outage fraction for the non-EPSS counterfactual. The EPSS-enabled failure frequency is multiplied by the failure-mode-specific sustained outage fraction to estimate how many of those failures would have resulted in sustained outages absent EPSS. This provides the counterfactual used to calculate incremental EPSS outage risk.

d. The WDRM failure probability, i.e., p(e)Corrected, estimates unmitigated failure probability and is therefore independent of EPSS.

e. The EPSS Outage Program Risk model estimates the incremental reliability impact of EPSS, which is primarily driven by outages that would have been momentary under standard protection settings becoming sustained outages when EPSS is enabled.

    PG&E uses p(e)Corrected rather than p(e)Observed because the EPSS Outage Program Risk calculation requires a baseline failure probability that excludes the effects of EPSS. p(e)Observed reflects actual operating conditions, including EPSS enablement, while p(e)Corrected adjusts for those effects. Starting from this corrected baseline allows the EPSS Outage Program Risk calculation to isolate the incremental outage risk attributable to EPSS enablement, rather than counting EPSS’s effects both in the baseline failure probability and again in the EPSS risk calculation.

f.

    i. PG&E may use temporary substation generation during a PSPS when a distribution substation is impacted by an upstream transmission line de-energization and the distribution facilities downstream of the substation are

safe to energize. Temporary generation is connected at the substation to energize circuits where downstream assets are not at weather risk and sufficient generation capacity is available. Where portions of the downstream system remain at risk, temporary generation may be combined with distribution sectionalization to energize only safe-to-energize areas.

ii. Yes. PG&E's temporary substation microgrid program is specifically designed to support customers when the substation serving them is affected by an upstream transmission-line de-energization while the downstream distribution facilities remain safe to energize. PG&E's PSPS materials characterize this as addressing transmission-level-only impacts.

iii. Typical temporary generation deployments at substations take approximately 48–72 hours, depending on the location, amount of generation required, and availability of field and control center resources.

iv. Temporary substation generation is not applicable to all substations or circuits. Its use depends on site- and event-specific conditions, including whether the substation and/or surrounding area has sufficient space to accommodate the necessary equipment, whether an adequate tie-in point is available, whether downstream distribution facilities are safe to energize, and whether sufficient generation capacity is available. Where portions of the downstream system remain at weather risk, PG&E may use distribution sectionalization in combination with temporary generation to energize only portions of the system that are safe to energize.

i. The noncore fallback is not applied when an upstream ancestor exceeds 11 generations. It is applied when a circuit segment/PSPS event pair appears in the customer-experienced dataset but is not represented in the upstream ancestor tree. In this case, the model assigns the event's circuit-segment-level risk to itself, without any upstream spreading.

    i. Average number of sequential circuit segments on a circuit: 2.38. For circuits within the PSPS event polygons for the PSPS event look back period (events used for the PSPS risk calculations), the maximum observed in-event ancestor path is 7 circuit segments, including the source segment.

    ii. 156 distinct circuit segments utilize the noncore fallback (out of 1709 distinct circuit segments with PSPS risk).

    iii. For the circuit segments in the PSPS event lookback period, none exceed 7 ancestor circuit segments (including themselves) within the same circuit.

j. Please see Columns N-S in the "PGE_EUPERR_2026-10-12_T8_R0" tab in "*EUP-PhI_DR_OEIS_004-Q001Atch01.xlsx*" for the PSPS and EPSS Risk, Consequence, and Likelihood values for each "circuit segment" presented in EUP Table 8.

k. **Documentation Clarification:** The cited language in WP018 stating that EUP reports the full likelihood of an EPSS outage is incorrect. EPSS likelihood is reported on an incremental basis. PG&E intends to submit an additional substantive erratum to remove this language from WP018. This correction is limited to documentation text and does not affect the underlying methodology, reported values, or EUP narrative.

i. EPSS Outage Program Risk in Table 8 is the incremental risk from EPSS enablement.

ii. The consequence reported in Table 8 is calculated by dividing the incremental risk by incremental likelihood.

iii. Incremental risk and incremental likelihood are reported in Table 8.