

**PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023
Data Response**

PG&E Data Request No.:	SPD_001-Q001		
PG&E File Name:	WMP-Discovery2023_DR_SPD_001-Q001		
Request Date:	February 23, 2023	Requester DR No.:	Email Transmittal DR-01
Date Sent:	March 9, 2023	Requesting Party:	Safety Policy Division
DRU Index #:		Requester:	Wendy al-Mukdad

SUBJECT: PG&E 2023 WMP – INQUIRIES (MAINLY REFCL & EPSS & SUPPORTING TECHNOLOGIES)

QUESTION 001

REFCL Inquiries:

- a. REFCL Pilot at Calistoga Circuit Segment ID 1102131531:
 - i. Describe various active settings profiles.
 - ii. Describe how staged fault testing is planned to be conducted.
 - iii. Explain how REFCL rides through momentary faults & when REFCL deenergizes line for permanent faults.
- b. Substation Configuration – Describe any substation and/or circuit configuration issues to deploy REFCL.
- c. Availability of REFCL – Describe any known barriers to increasing deployment in CA.
- d. Explain which risk drivers per Table PG&E-7.1.4-1 REFCL mitigates.
- e. Explain why REFCL is not preferred mitigation for broader deployment and confirm PG&E no longer plans to install REFCL at 2 substations per year per GRC filing.

ANSWER 001

- a.
 - i. The REFCL equipment installed in the substation protects all the primary lines on both Calistoga circuits. Three settings profiles allow for changing fault sensitivity and tripping behavior on the fly based on field conditions/risk. Setting 1 is for low risk with a three second delay before switching the neutral to solid grounding for line protection to clear the fault. Setting 2 is for medium risk with a three second fault ride through before directly tripping the faulted feeder circuit breaker for a sustained fault. Setting 3 is for high risk with no time delay and greatest fault sensitivity and tripping the faulted feeder circuit breaker.
 - ii. Staged fault testing was performed in 2022 with preliminary data collected. A mobile high voltage resistor bank is momentarily connected to stage a fault on the circuit. Normally the system rides through the neutral shift with no service

outage from the test. Due to greater line to ground voltages during the testing, the possibility of unplanned outage of line equipment failing is slightly increased.

- iii. All service transformers on REFCL circuits are connected line to line, so service voltage is maintained during the ground fault. If setting 1 or 2 is active, once a ground fault is detected, a three second time delay elapses before the fault confirmation is performed. If the fault confirmation determines that the fault vanished (momentary fault), then the neutral voltage is returned to normal with no service interruption. If the fault confirmation determines that it is a sustained fault, then the tripping is handled based on the active setting group described in 1ai.
- b. Due to equipment failures in the substation and on the line in the REFCL demonstration project, PG&E is still evaluating the technology and gaining operational experience with it. In order to deploy REFCL, the primary considerations for deployment are:
 - Substation voltage regulators: Replace wye-ground connected regulators with line-line connected regulators
 - Substation feeder breakers: High accuracy current transformers retrofitted
 - Substation secondary neutral: clearance of substation transformer bank and installation of grounding switch and cable connections to arc suppression coil
 - Substation physical space: Enough room within the substation for an 16 ft x 28 ft footprint per Ground Fault Neutralizer (GFN). Some substations may require 2 GFNs right away for deploying REFCL
 - Distribution circuits: 3-wire uni-grounded neutral only
 - Distribution circuits: Maximum of approximately 50 circuit miles of underground cable per transformer bank
 - Distribution circuits: Primary connected customers – requires large isolation transformer depending on complexity of customer-owned equipment
 - Distribution circuits: Long single phase underground cable causes increased neutral current and requires capacitive balancing units (CBUs)
- c. Each distribution circuit in California is unique. REFCL deployment needs to be evaluated on a circuit-by-circuit basis. Present lead time for certain types of substation equipment to support REFCL deployment exceeds 60 weeks.
- d. REFCL mitigates the following risk drivers from the table:
 - Vegetation contact, Equipment/Facility failure
 - Contact from object
 - Unknown
 - Other
 - Vandalism/Theft
 - Contamination

- CC – seismic scenario
- e. Staged fault testing is planned in first half of 2023 and if testing is successful the REFCL technology will be put into normal operation to gain experience and quantify the benefits of the technology on PG&E's distribution system. Potential REFCL deployments will be explored after evaluation of the demonstration site. No additional REFCL deployments are planned under the GRC filing at this time.