PUBLIC UTILITIES COMMISSION
505 VAN NESS AVENUE
SAN FRANCISCO, CA 94102-3298

November 5, 2021 SA2021-922

Lise Jordan, Sr. Director
Regulatory Compliance and Quality Assurance
Pacific Gas and Electric Company (PG&E)
77 Beale Street
San Francisco, CA 94105

SUBJECT: Substation Audit of PG&E's Martin Substation Headquarters

Dear Ms. Jordan:

On behalf of the Electric Safety and Reliability Branch (ESRB) of the California Public Utilities Commission (CPUC), Raymond Cho, Chris Lee, and Emiliano Solorio, of my staff conducted a substation audit of PG&E's Martin Substation Headquarters (HQ) from July 19 through July 23, 2021. The audit included a review of PG&E's substation procedures and maintenance records, in addition to field inspections of PG&E Martin HQ substations.

As a result of the audit, my staff identified violations of General Order 174. A copy of the audit findings itemizing the violations is enclosed. Please provide a response no later than December 3, 2021, via electronic transmittal of all corrective actions and preventive measures taken by PG&E to correct the identified violations and prevent the recurrence of such violations.

If you have any questions concerning this audit, please contact Raymond Cho at (415) 703-2236 or raymond.cho@cpuc.ca.gov.

Sincerely,

Banu Acimis, P.E.
Program and Project Supervisor
Electric Safety and Reliability Branch
Safety and Enforcement Division
California Public Utilities Commission

Enclosure: CPUC Audit Findings

Cc: Lee Palmer, Director, Safety and Enforcement Division, CPUC
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Emiliano Solorio, Utilities Engineer, ESRB, SED, CPUC

CPUC SUBSTATION AUDIT FINDINGS
PG&E MARTIN HEADQUARTERS
July 19 - 23, 2021

I. Records Review

During the substation audit, Electric Safety and Reliability Branch (ESRB) reviewed the following standards, procedures, and records for PG&E's Martin Headquarters (HQ):

- List of all assigned PG&E substations
- Map showing all assigned PG&E substations
- Single-line diagrams of ESRB selected substations
- Equipment lists for ESRB selected substations
- List of the previous 5 years substation inspections
- PG&E Substation Maintenance and Construction (SM&C) Manual: TD-3322M, Revision 10
- PG&E Substation Equipment Maintenance Requirements, Utility Standard: TD-3322S, Revision 7, with attachments 1 through 12
- PG&E Condition Based Management Transition Process, TD-3322B-012, Revision 2
- PG&E Substation Inspections, TD-3322B-024, Revision 0
- PG&E Substation Inspection Implementation Plan, TD-3322B-026, Revision 1
- PG&E SM&C Manual - Infrared Inspections
- PG&E SM&C Manual - Insulating Oil
- PG&E SM&C Manual – Substation Batteries
- PG&E Substation Fire Protection Systems and Equipment – Inspection, Test and Maintenance: TD-3320P-07, Revision 3
- List of all open/pending, completed, cancelled, and late work orders or what PG&E refers to as, Line Corrective (LC) Notifications, in the previous 24 months
- Last two visual inspection checklists for ESRB selected substations
- Infrared Testing records for ESRB selected substations in the last 24 months
- Most recent oil sample test results for ESRB selected substations
- Last electric test results for ESRB selected substations
- List of job specific trainings completed by the Martin HQ Qualified Electrical Workers (QEW)
- PG&E's inspector training policy

II. Records Violations

ESRB observed the following violations during the records review portion of the audit:

General Order (GO) 174, Rule 12, General states in part:

> *"Design, construction and maintenance should be performed in accordance with accepted good practices for the given local conditions known at the time by those responsible."*

1. PG&E Substation Equipment Maintenance Requirements, Utility Standard: TD-3322S[1], establishes PG&E's Basic Finish Date and Past Due dates as follows:

Table 1. Due Dates Per Priority Code

Priority Code	Basic Finish Date	Past Due Date
A	Within 30 days	1st day of the month following the month in which the basic finish date occurs
B	Within 90 days	1st day of the 2nd month following the month in which the basic finish date occurs
E	Within 365 days	1st day of the year following the year in which the basic finish date occurs
F	Greater than 365 days	None*

*Schedule Priority F when it is operationally efficient to perform the work

Based on Table 1 above, ESRB noted six notifications that were closed after their past due dates and one that has not been completed yet. Therefore, PG&E did not perform maintenance in accordance with accepted good practices described in Utility Standard TD-3322S. See Table 2 below for the past-due LC notifications.

Table 2. Overdue LC Notifications

Notification No.	Priority	Basic finish date	Completed On	Past Due Date	Days Late
114277578	E	2/6/2019	7/26/2020	1/1/2020	207
114612728	E	5/14/2019	12/13/2020	1/1/2020	347
114777909	E	7/12/2019	4/23/2020	1/1/2020	113
115277140	E	11/4/2019	11/13/2020	1/1/2020	317
115421584	E	11/27/2019	1/29/2020	1/1/2020	28
117054572	E	12/31/2019	2/26/2020	1/1/2020	56
114605919	E	5/5/2019	N/A	1/1/2020	656+

[1] PG&E Utility Standard TD-3322S, October 2, 2020, Revision 7.

2. Based on PG&E's Substation Equipment Maintenance Requirements (TD-3322S Attachment 5)[2], infrared inspections are conducted yearly. Also, PG&E's SM&C Manual, which includes an Infrared Inspections section states in part:

"Infrared inspections are conducted in electric substations, as triggered in Utility Standard TD-3322S, Attachment 5, 'Station and Headquarters Maintenance Template,' or by condition or trouble."[3]

Based on ESRB's review of completed infrared inspection forms (TD-3322M-F80), PG&E did not perform infrared re-inspections or maintenance activities as required by the results of each completed form. ESRB identified the following five missed re-inspections for the substations listed in Table 3 below.

Table 3. Missed Substation Infrared Re-inspections

Substation	2019 Result	2020 Result	ESRB Finding
SF Airport	NA	Re-inspect in 90 days	Missed 2020 Re-inspect
East Grand	Re-inspect in 90 days	Re-inspect in 90 days	Missed 2019 and 2020 Re-inspect
Taraval	Re-inspect in 90 days	Re-inspect in 90 days	Missed 2019 and 2020 Re-inspect

3. One of the tests required on PG&E's Circuit Breaker Maintenance Form TD-3322M-F14 is the 2,500 V megger test. For the San Fran H substation, PG&E did not perform the megger test on Circuit Breaker 32 during a mechanism service on September 20, 2020. In a PG&E data request response, it stated that it did not have a reason as to why this test was not conducted.[4]

4. During ESRB's review, staff identified the following incomplete records:
    a. During ESRB's records review, staff noticed on notification #119051281 that the "Completed By" and "Reviewed By" fields on the form were incomplete.
    b. For Notification #113829657, the "Completed By" and "Reviewed By" lines on the form were not populated. A mechanism service was completed on the same day when the 15% was exceeded but staff did not mark an action item.
    c. For Randolph Substation, a Functional Performance Test (FPT) was performed for Circuit Breaker 401/2 on April 8, 2021. PG&E noted the variance in close coil duration was 27.2%. PG&E stated in its response to Post-audit Data Request #2, that a mechanism service was performed the same day, however staff did not mark an action item on the FPT form.
    d. For Portola Substation, an FPT was performed for Circuit Breaker 402/2 however, the "pass/fail" option was not circled on the form. PG&E staff also did not

[2] PG&E Utility Standard TD-3322S, Attachment 5, Published 04/22/2020, Revision 6, p.5.
[3] PG&E SM&C Manual, Infrared Inspections, Revision 10, p.1.
[4] PG&E's Response to Post-audit Data Request 2, dated 9/14/21, Question 28.

complete the calculation for largest percent variance for the trip coil duration time.

e. For Taraval Substation, an FPT was performed for Circuit Breaker 403 however, the "pass/fail" option was not circled on the form. Also, PG&E staff did not mark an action item to address the issues identified.

III. Field Inspection

During the field inspection, ESRB inspected the following substations:

Substation	City
San Fran H (Martin)	Daly City
Yosemite	San Francisco
San Fran P	San Francisco
East Grand	So. San Francisco
Lawndale	So. San Francisco
Sullivan	Daly City
Westlake	Daly City
Daly City	Daly City
Plymouth	San Francisco
Randolph	San Francisco
Ocean	San Francisco
21st Ave.	San Francisco
Taraval	San Francisco
San Fran J	San Francisco
San Fran X (Mission)	San Francisco
Castro	San Francisco
Portola	San Francisco
San Fran Airport	San Bruno
San Bruno	San Bruno
Sneath	San Bruno
Serramonte	Daly City
Pacifica	Pacifica

IV. Field Inspection – Violations List

ESRB observed the following violations during the field inspection:

GO 174, Rule 12, General states in part:

> *"…Substations shall be designed, constructed and maintained for their intended use, regard being given to the conditions under which they are to be operated, to promote the safety of workers and the public and enable adequacy of service.*
>
> *Design, construction, and maintenance should be performed in accordance with accepted good practices for the given local conditions known at the time by those responsible."*

Martin HQ Substation

1. PG&E's SM&C manual (TD-3322M) [5] Subsection V.F.1.b. states in part:

   "In bushings with glass oil reservoirs, visually check the oil to ensure it is not abnormally discolored. Also, watch the oil for erratic movement. This could be an indication of undesirable corona activity caused by a vacuum in the reservoir."

   H30 bushing that was half-filled with oil at Shunt Reactor Bank 3 while the other bushings of the shunt reactor were filled.

[5] PG&E SM&C Manual TD-3322M, Revision 10, p. 41.

2. PG&E's SM&C manual (TD-3322M) [6] Subsection V.H.2.c. states in part:

"Ensure that the auxiliary cooling equipment fans, pumps, and controls are in good condition..."

a. One of the cooling fans was not working at Bank 2.

b. The oil filtration pump was not working at Bank 2.

c. Oil filtration pump at Bank 2 was leaking inside cabinet.

[6] PG&E SM&C Manual TD-3322M, Revision 10, p. 44.

d. Oil leak was found at pump of Bank 1.

3. PG&E's SM&C manual (TD-3322M)[7] Subsection V.A.8. states in part:

"Clean the equipment and spot-paint any rust spots, as necessary. Report areas of excessive rust, as defined in SMCM…"

Corrosion at the base of Bank 1.

[7] PG&E SM&C Manual TD-3322M, Revision 10, p. 23.

Yosemite Substation

4. PG&E's SM&C manual (TD-3322M) [8] Subsection V.H.2.a. states in part:

   "Check the radiators for rust, damage, or other abnormal conditions. Clean the rust spots and damaged areas and spot paint or repair the equipment as necessary."

   Oil was leaking from the radiator of Bank 2.

San Fran P Substation

5. PG&E's SM&C manual (TD-3322M) [9] Subsection V.A.7. states:

   "Visually check the condition and continuity of all equipment case ground connections. The connections should be tight and uncorroded. Do not touch substation equipment if the ground connection is either suspect or missing entirely. Equipment should be grounded as described in Numbered Document 067910."

   Detached ground wire under the radiator of Bank 6.

[8] PG&E SM&C Manual TD-3322M, Revision 10, p. 44.
[9] PG&E SM&C Manual TD-3322M, Revision 10, p. 23.

East Grand Substation

6. PG&E's SM&C manual (TD-3322M) [10] Subsection V.F.5. states:

   "Ensure that any animal guards are in good condition. Animal guards should be installed where there is potential for animal activity, where there is high circuit density, or where critical customers could be affected."

   a. Animal guard was coming off at Circuit Breaker (CB) 1106/2.

[10] PG&E SM&C Manual TD-3322M, Revision 10, p. 42.

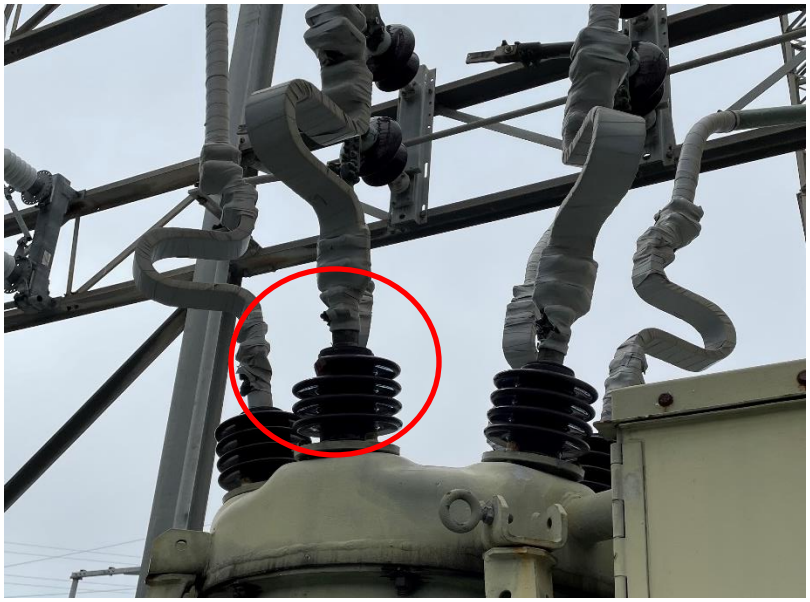
b. Animal guard was coming off at CB 1108/2.

c. Animal guard was coming off at CB 1400/2.

7. PG&E's SM&C manual (TD-3322M) [11] Subsection V.F.2. states:

   "Visually inspect all the bushings for the following:
   - *Chipped or broken insulation…"*

   Insulator chipped at CB 1108/2.



8. PG&E's SM&C manual (TD-3322M) [12] Subsection V.H.2.c. states in part:

   "Ensure that the auxiliary cooling equipment fans, pumps, and controls are in good condition..."

   Stage 2 cooling switch was not working at Bank 5.

9. PG&E's SM&C manual (TD-3322M) [13] Subsection V.H.2.a. states:

   "Check the radiators for rust, damage, or other abnormal conditions. Clean the rust spots and damaged areas and spot paint or repair the equipment as necessary."

   Radiator fins showed atmospheric corrosion and need painting at Bank 5.

[11] PG&E SM&C Manual TD-3322M, Revision 10, p. 41.
[12] PG&E SM&C Manual TD-3322M, Revision 10, p. 44.
[13] PG&E SM&C Manual TD-3322M, Revision 10, p. 44.

Taraval Substation

10. PG&E's SM&C manual (TD-3322M) [14] Subsection IV.C.6 states in part:

> *"Proper nitrogen gas pressure must be maintained to ensure that moisture and oxygen do not oxidize and degrade the windings paper insulation. To maintain low moisture levels in the oil, nitrogen leaks must be repaired as soon as possible…"*

Low nitrogen pressure at Bank 2.

[14] PG&E SM&C Manual TD-3322M, Revision 10, p. 15.

San Fran J Substation

11. PG&E's SM&C manual (TD-3322M) [15] Subsection V.U.4.a. states:

"Check all of the oil-filled equipment for oil leaks, weeps, or spills. If any leaks are found, document the equipment's designation, the location of the leaks, the PCB content, and the extent of the leaks."

a. Oil leak at the oil filtration system of Bank 2.

b. Oil leak on the radiator flange of Bank 2.

[15] PG&E SM&C Manual TD-3322M, Revision 10, p. 69.

Mission Substation

12. PG&E's SM&C manual (TD-3322M) [16] Subsection V.B.6.e. states:

"Check for signs of relay failure, which may include:

- *Abnormal indicating lights*
- *Text displays on digital relays*
- *Glass covers with signs of smoke*
- *Burning doors*
- *Annunciator alarms"*

a. Module failure reading at Breaker Failure Relay Device 1109/12.

b. Module failure reading at Breaker Failure Relay Device 1127/12.

[16] PG&E SM&C Manual TD-3322M, Revision 10, p. 31.

c. Latching out error at Relay KX3/22.

Castro Substation

13. PG&E's SM&C manual (TD-3322M) [17] Subsection V.U.4.a. states:

"Check all of the oil-filled equipment for oil leaks, weeps, or spills. If any leaks are found, document the equipment's designation, the location of the leaks, the PCB content, and the extent of the leaks."

Oil leak at Bank 2.

14. LTC has been out of service since 2017 on Bank 1.

[17] PG&E SM&C Manual TD-3322M, Revision 10, p. 69.

15. PG&E's SM&C manual (TD-3322M) [18] Subsection V.U.3.g. states:

"Ensure that "Check valve closed prior to leaving station" signs are posted on pond."

The sign to close drain valve at the pond was missing on the inside of the fence.

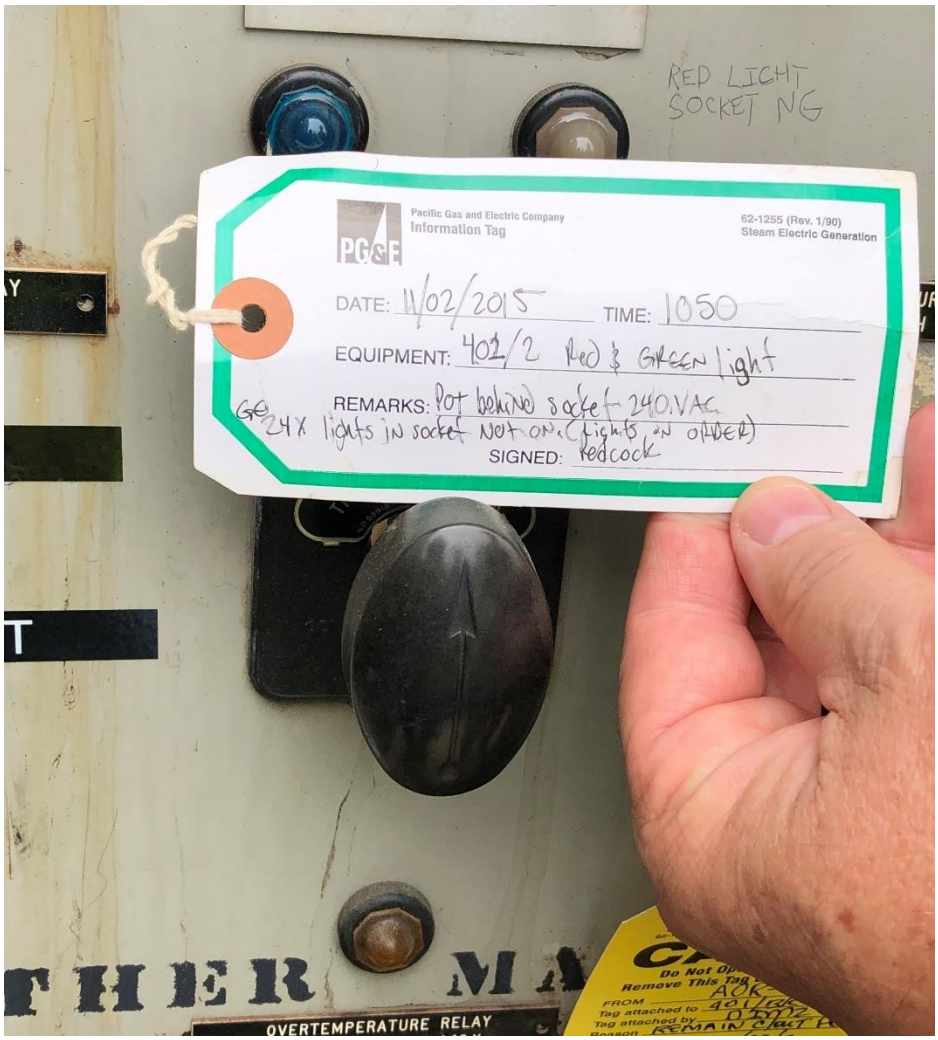
Portola Substation

16. PG&E's SM&C manual (TD-3322M) [19] Subsection V.J.5.b. states:

"Replace any burned-out bulbs."

The status indicator light was out at 402/2. Service tag is dated 11/2/2015.

[18] PG&E SM&C Manual TD-3322M, Revision 10, p. 69.
[19] PG&E SM&C Manual TD-3322M, Revision 10, p. 56.



San Francisco Airport Substation

17. PG&E's SM&C manual (TD-3322M) [20] Subsection V.B.6.e. states:

"Check for signs of relay failure, which may include:

- *Abnormal indicating lights*
- *Text displays on digital relays*
- *Glass covers with signs of smoke*
- *Burning doors*
- *Annunciator alarms"*

There was a "Maintenance Alert" on RAS system A and B.

[20] PG&E SM&C Manual TD-3322M, Revision 10, p. 31.

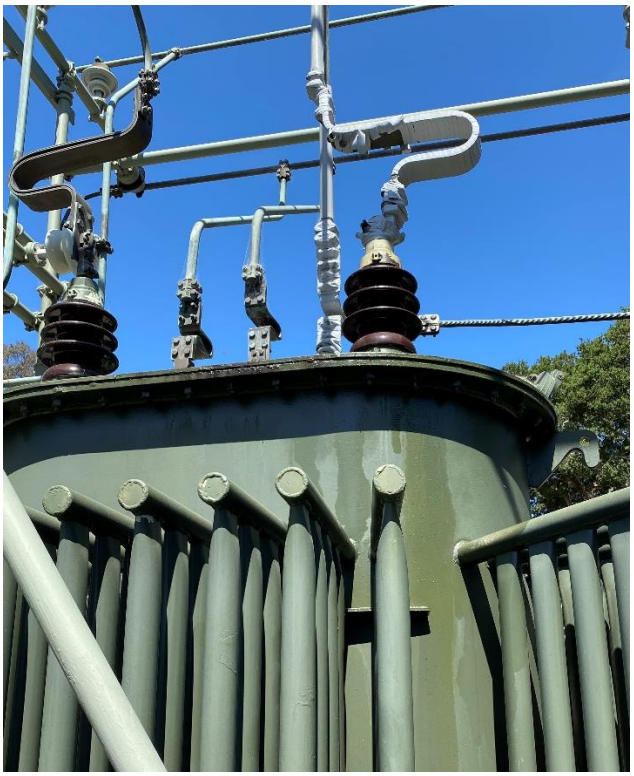
San Bruno Substation

18. PG&E's SM&C manual (TD-3322M)[21] Subsection V.U.4.a. states:

"Check all of the oil-filled equipment for oil leaks, weeps, or spills. If any leaks are found, document the equipment's designation, the location of the leaks, the PCB content, and the extent of the leaks."

a. Oil leak from bushing on Bank 2C.

[21] PG&E SM&C Manual TD-3322M, Revision 10, p. 69.



b. Oil leak at the temperature probe of Bank 1C.

19. PG&E's SM&C manual (TD-3322M) [22] Subsection V.F.5 states:

"Ensure that any animal guards are in good condition. Animal guards should be installed where there is potential for animal activity, where there is high circuit density, or where critical customers could be affected."

a. Animal guard was missing on Bank 2A.

b. Animal guard was degrading on Bank 2C.

[22] PG&E SM&C Manual TD-3322M, Revision 10, p. 42.

20. PG&E's SM&C manual (TD-3322M) [23] Subsection V.U.3.c. states:

"Check for damage to containment structures, berms (curbing), or swales (ditches).

Oil containment berm was broken due to erosion next to control room behind Bank 2.

21. PG&E's SM&C manual (TD-3322M) [24] Subsection II.B.2. states in part:

"Carefully perform the visual condition assessment to find indications of abnormal conditions before the equipment fails."

The B phase at Bank 1 indicated a temperature of 50°C. This was about 20 degrees higher than the other two phases on Bank 1.

22. PG&E's SM&C manual (TD-3322M) [25] Subsection IV.C.6 states in part:

"Proper nitrogen gas pressure must be maintained to ensure that moisture and oxygen do not oxidize and degrade the windings paper insulation. To maintain low moisture levels in the oil, nitrogen leaks must be repaired as soon as possible…"

The nitrogen pressure gauge had a reading of zero on Bank 1.

[23] PG&E SM&C Manual TD-3322M, Revision 10, p. 68.
[24] PG&E SM&C Manual TD-3322M, Revision 10, p. 2.
[25] PG&E SM&C Manual TD-3322M, Revision 10, p. 15.

Sneath Substation

23. PG&E's SM&C manual (TD-3322M) [26] Subsection V.U.4.a. states:

> *"Check all of the oil-filled equipment for oil leaks, weeps, or spills. If any leaks are found, document the equipment's designation, the location of the leaks, the PCB content, and the extent of the leaks."*

Oil weep at the temperature probe of Bank 1A.

[26] PG&E SM&C Manual TD-3322M, Revision 10, p. 69.

24. PG&E's SM&C manual (TD-3322M) [27] Subsection V.F.5 states:

> *"Ensure that any animal guards are in good condition. Animal guards should be installed where there is potential for animal activity, where there is high circuit density, or where critical customers could be affected."*

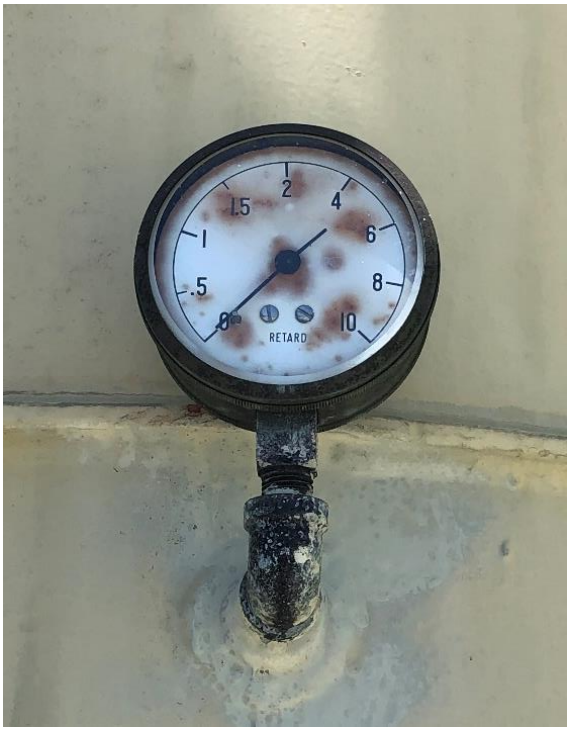
The animal guard was degrading at CB 1101/2.

25. PG&E's SM&C manual (TD-3322M) [28] Subsection IV.C.6 states in part:

> *"Proper nitrogen gas pressure must be maintained to ensure that moisture and oxygen do not oxidize and degrade the windings paper insulation. To maintain low moisture levels in the oil, nitrogen leaks must be repaired as soon as possible…"*

Low nitrogen pressure on Banks 1A, 1B, and 1C.

[27] PG&E SM&C Manual TD-3322M, Revision 10, p. 42.
[28] PG&E SM&C Manual TD-3322M, Revision 10, p. 15.



26. PG&E's SM&C manual (TD-3322M) [29] Subsection II.B.2. states in part:

"To help determine if any problems are developing, also analyze the meter readings, recording charts, and gauges."

Illegible amp meter at CB 1101/2.

[29] PG&E SM&C Manual TD-3322M, Revision 10, p. 2.

Serramonte Substation

27. PG&E's SM&C manual (TD-3322M) [30] Subsection V.A.3.c. states in part:

"Ensure that the barbed wire at the top of the fence is intact…"

Damaged or bent barbed wired in some areas of the perimeter fence.

28. PG&E's SM&C manual (TD-3322M) [31] Subsection V.B.6.e. states:

"Check for signs of relay failure, which may include:
- *Abnormal indicating lights*
- *Text displays on digital relays*
- *Glass covers with signs of smoke*
- *Burning doors*
- *Annunciator alarms"*

Battery failure code shown on display of Set A Multifunction Relay.

29. PG&E's SM&C manual (TD-3322M) [32] Subsection V.F.5 states:

"Ensure that any animal guards are in good condition. Animal guards should be installed where there is potential for animal activity, where there is high circuit density, or where critical customers could be affected."

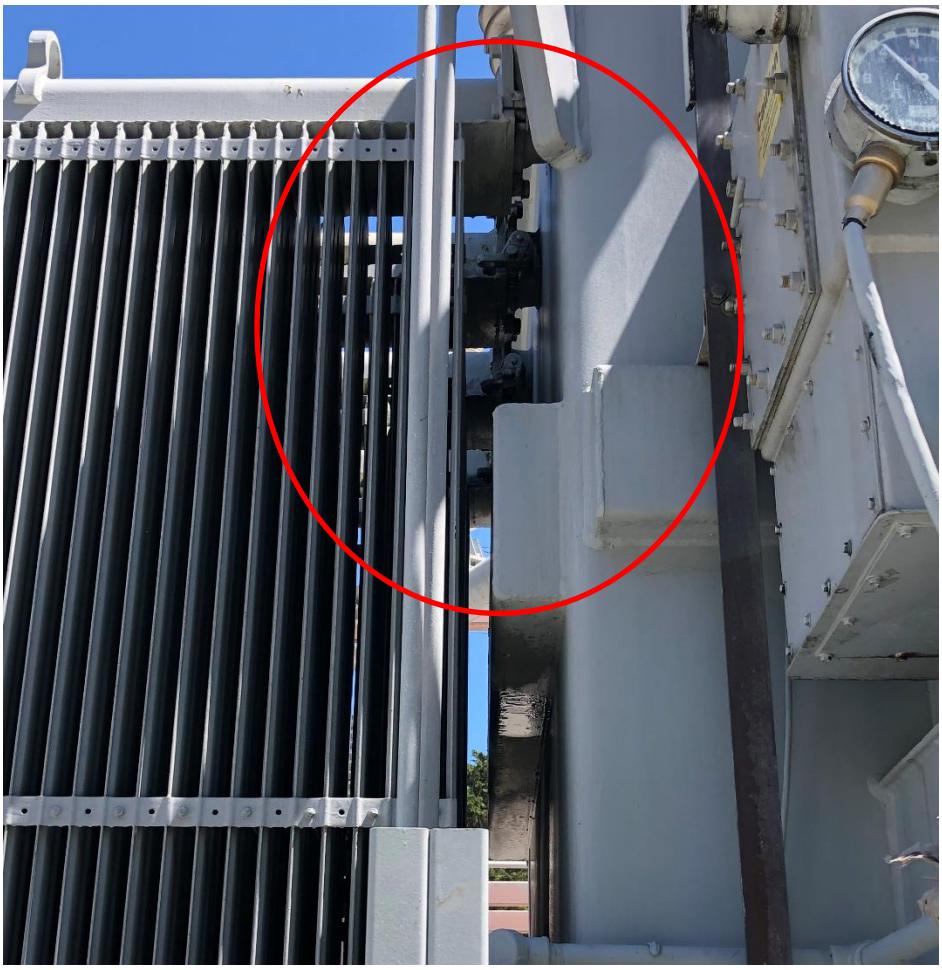
Animal guard degrading on CB 1103/2.

[30] PG&E SM&C Manual TD-3322M, Revision 10, p. 21.
[31] PG&E SM&C Manual TD-3322M, Revision 10, p. 31.
[32] PG&E SM&C Manual TD-3322M, Revision 10, p. 42.

30. PG&E's SM&C manual (TD-3322M) [33] Subsection V.U.4.a. states:

> *"Check all of the oil-filled equipment for oil leaks, weeps, or spills. If any leaks are found, document the equipment's designation, the location of the leaks, the PCB content, and the extent of the leaks."*

Oil leaking from the flange near tank and position indicator probe at Bank 1.



Pacifica Substation

31. PG&E's SM&C manual (TD-3322M) [34] Subsection V.H.2.a. states:

> *"Check the radiators for rust, damage, or other abnormal conditions. Clean the rust spots and damaged areas and spot paint or repair the equipment as necessary."*

[33] PG&E SM&C Manual TD-3322M, Revision 10, p. 69.
[34] PG&E SM&C Manual TD-3322M, Revision 10, p. 44.

a. Severe corrosion found on radiator fin of Bank 1.

b. Oil leak and corrosion found on radiator of Bank 2.

V. Record Review Follow up Requests and Concern(s):

ESRB staff have the following additional requests regarding records reviewed:

1. ESRB found that PG&E has not provided an auditable substation inspection record for the 2019 calendar year. PG&E's response to the Martin HQ Pre-audit Data Request, Question 12, did not include corresponding dates for inspected line items. In addition, PG&E's response to Post-audit Data Request #2, Question 3, only included inspection records for January, February, and March. Provide a complete inspection record for the 2019 calendar year, including corresponding dates for inspected line item.

2. Did PG&E complete work for Notification #120938043 at San Fran H Substation? If so, please provide records.

3. At East Grand Substation, CB 172 exhibited severe corrosion. PG&E mentioned in its response to Post-audit Data Request #2 that CB 172 was scheduled to be removed from service on 9/20/21. What is the current status of the removal of CB 172? Please provide records.

4. What is the status of LC #121838168 regarding oil leak mitigation of Transformer Bank 1 at Serramonte Substation? Please provide records.

5. What is the status of LC #120745354 for adding oil to Bank 1 LTC at Serramonte Substation? Please provide records.

6. After reviewing the additional 2021 infrared inspection data, ESRB noted that PG&E identified the following issues below:

   - East Grand Substation SW 183 issue found. Repair priority B.
   - San Fran J Substation issue found for Cap 1 & Cap 2. Repair priority N/A.
   - Mission Substation issue found for BK #1 and X-1101 Cable at reactor B. Repair priority B.
   - Serramonte Substation issue found for 1103/3B Air Switch. Repair Priority B.

   a. Provide the work orders for the issues identified above and records of completion if finished.
   b. Regarding the issue found at San Fran J Substation for Cap 1 & Cap 2, provide an explanation for a priority code of N/A?

7. For Circuit Breaker 1104 at the Pacifica Substation, the lubrication assessment was marked "N/A" on the Functional Performance Test (FPT). PG&E explained in its response to Post-audit Data Request #2, that it is marked as N/A since one cannot view the mechanism or perform the lubrication check, due to the large front cover in place. When something obstructs the view of a PG&E inspector performing their lubrication assessment, how does PG&E ensure that mechanism linkages and associated components are assessed for adequate lubrication?

8. Provide a copy of PG&E document #TD-3322B-60. Regarding TD-3322B-60, how frequently does a circuit breaker need to be exercised and how does it differ from the previous directive?

   ESRB identified a concern while performing this audit:

   ESRB observed multiple oil leak/weep issues at the following substations:

   a. Yosemite Substation
   b. Castro Substation
   c. Westlake Substation
   d. Sullivan Substation
   e. Lawndale Substation
   f. Plymouth Substation
   g. Portola Substation
   h. Randolph Substation
   i. Taraval Substation

   Regarding the PG&E process outlined in TD-3350P-06, ESRB recommends that PG&E's maintenance department provide its nominations for transferring substation assets to distribution assets to PG&E's Substation Asset Management team.