

PUBLIC UTILITIES COMMISSION

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May 5, 2023

SA2023-1068

Vincent Tanguay, Senior Director
Electric Compliance, Electric Engineering
Pacific Gas & Electric Company (PG&E)
300 Lakeside Dr., Oakland, CA 94612

SUBJECT: Substation Audit of PG&E's Oakport Headquarters (HQ)

Dear Mr. Tanguay:

On behalf of the Electric Safety and Reliability Branch (ESRB) of the California Public Utilities Commission (CPUC), Brandon Vazquez and Joseph Murphy of my staff conducted a substation audit of PG&E's Oakport HQ from March 13-17, 2023. The audit included a review of PG&E's substation procedures and maintenance records, in addition to field inspections of PG&E substations.

As a result of the audit, my staff identified violations of General Order (GO) 174. A copy of the audit findings itemizing the violations is enclosed. Please provide a response no later than June 2, 2023, 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. The response should indicate the date of each remedial action and preventive measure completed. For any outstanding items not addressed, please provide the projected completion dates of all corrective actions for the violations outlined in Sections II & IV of the enclosed Audit Findings.

If you have any questions concerning this audit, please contact Brandon Vazquez at (628) 249-2867 or brandon.vazquez@cpuc.ca.gov.

Sincerely,

A handwritten signature in blue ink, appearing to read "Banu Acimis".

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

Enclosure: CPUC Substation Audit Findings

Cc: Lee Palmer, Director, Safety and Enforcement Division, CPUC
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Nathan Sarina, Senior Utilities Engineer- Supervisor, ESRB, SED, CPUC
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**CPUC AUDIT FINDINGS OF PG&E OAKPORT
SUBSTATION HEADQUARTERS
March 13 - 17, 2023**

I. Records Review

During the audit, ESRB reviewed the following standards, procedures, and records for the Oakport Headquarters (HQ):

- List and locations of all assigned PG&E substations in the Oakport HQ
- Map showing all assigned PG&E substations in the Oakport HQ
- Equipment lists and single-line diagrams of substations in the Oakport HQ
- PG&E Substation Equipment Maintenance Requirements, Utility Standard: TD-3322S with Attachments 1 through 12
- PG&E Condition Based Management Transition Process, TD-3322B-012
- PG&E Substation Inspections, TD-3322B-024
- PG&E Substation Inspection Implementation Plan, TD-3322B-026
- PG&E Substation Maintenance and Construction (SM&C) Manual
- PG&E Infrared Inspection Procedures
- PG&E Insulating Oil Testing Manual
- PG&E Circuit Breakers Booklet
- PG&E Accumulated Critical Current (ACC) Process, TD-3320P-12
- PG&E Substation Fire Protection Systems and Equipment – Inspection, Test and Maintenance of Fire Protection Systems and Equipment at Substations: TD-3320P-07
- PG&E Substation General Work Procedures, TD-3320S
- List of inspections performed over the last five years
- Maintenance records for selected substations; Line Corrective (LC) Notifications in the last five years
- Last two routine substation inspection checklists for selected substations
- List of overloaded transformer banks for selected substations in the last five years
- Infrared testing records for selected substations in the last two years
- Last four oil test results for selected substations
- Last four electric test results for selected substations
- Training records for substation personnel in the last five years
- PG&E internal audits conducted in the last five years

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:

“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.”

1. PG&E Substation Equipment Maintenance Requirements, Utility Standard: TD-3322S¹, establishes PG&E’s Required End Date and Out-of-Compliance Date as follows:

Table 1: Due Dates Per Priority Code

Priority Code	Required End Date	Out-of-Compliance Date
A	N/A	Must close within 30 days.
B	Within 90 days	1 st day of the 2 nd month following the month in which the required end date occurs.
E	Within 365 days	1 st day of the year following the year in which the required end date occurs.

Based on the Out-of-Compliance Dates per Table 1, ESRB found 81 LC notifications that were not completed by their Out-of-Compliance Dates. Of the 81 past due LC notifications, 32 were past due-closed and 49 were past due-open. Past due-closed notifications are closed notifications completed after their Out-of-Compliance Dates. Past due-open notifications are open notifications that are past their Out-of-Compliance Dates. See Table 2 below for the most overdue notifications for each priority.

Table 2: Most Overdue Notifications

Substation	Description	Notification #	Priority	Notification Date	Completion Date	Out of Compliance Date	Days Late	Status
RICHMOND R	UMI-RICHMOND R BATTERY ALARM TROUBLE	117310361	A	5/23/2019	8/3/2019	6/22/2019	42	Closed
OAKLAND C	BK 3-PRTR_BROK_REPA - PIN 305163	120236123	B	12/28/2020	9/21/2022	5/1/2021	508	Closed
BARRETT	LTCR-BARRETT 402 LTC CONTROL	118546625	E	2/18/2020		1/1/2022	396	Open
WALDO	LTCR-WALDO 402 LTC CONTROL	118546626	E	2/18/2020		1/1/2022	396	Open

¹ PG&E Utility Standard TD-3322S, 4/7/2022, Rev. 8.

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

*“Infrared inspections are conducted in electric substations, as triggered in Utility Standard TD-3322S Attachment 5 maintenance template or by condition or trouble.”*³

Based on ESRB’s review of completed IR inspection forms (TD-3322M-F80), PG&E did not perform IR re-inspections as required. ESRB identified six missed/late re-inspections for the substations listed in Table 3 below.

Table 3: Substations with Missing/Late Re-inspections

Substation	2022 Infrared Inspection Date and Result	Missed/Late
Oakland X	3/5/2022: Reinspect 1105 A Phase in 90 days	Missed
Oakland X	3/5/2022: Reinspect 1106 B Phase in 90 days	Late ⁴
Bancroft	3/9/22: Reinspect Banks 401 and 402 in 90 days	Late
Barrett	3/12/22: Reinspect Bank 402 LTC in 90 days	Late
El Cerrito G	3/24/2022: Reinspect Bus Bank 2 B Phase in 90 days	Late
Oakland J	3/21/2022: Reinspect J 1116/3 ABC hinges, Bank 2/15 and Bank 2/13 C phase Bus, IJ 3/3 and IJ 3/5 A phase connections in 90 days	Late
Oakland D	3/24/22: Reinspect Bank 6 LTC in 90 days	Missed

- According to PG&E’s IR inspection form TD-3322M-F80, anomalies have to be assigned a priority code of either A or B, and corrective action must indicate either immediate repair, repair in 30 days, repair in 90 days, or re-inspect in 90 days.

Temperature Rise (AT)						
SAP Repair Priority Codes	Action	Direct View Targets Percent of Rated Load			Indirect View Targets	Main Tank compared to LTC
		0-40%	41-80%	81-100%		
A	Immediate Repair	> 100° C		> 125° C	> 10° C	> -5° C
A	Repair 30-days	80°-100° C		100°-125° C	NA	
B	Repair 90-days	60°-79° C	NA	80°-99° C	5°-9° C	-4° to -5° C
B	Re-inspect 90-days	15°-59° C	15°-79° C		2°-4° C	-2° to -3° C
NA	No Action	< 15° C			< 2° C	≤ -1° C

Figure 1: Temperature Rise Chart per Priority Code

However, ESRB found in the list of LC notifications PG&E provided that 10 hot spot-related notifications were assigned an “E” priority code and would have been past due as a Priority “B” notification (See Table 4). Per form TD-3322M-F80, hot spot repair

² PG&E Utility Standard TD-3322S, Attachment 5, Published 5/28/2021, Revision 7, p.5.

³ PG&E SM&C Manual, Infrared Inspection, Revision 9, p.1.

⁴ Repaired on 12/14/2022 per LC notification 123085787.

notifications must be assigned a priority code of A or B, not E. Using the maximum timeframe per Table 1, Priority B notifications must be completed by the 1st day of the fifth month after the Notification Date. Therefore, ESRB determined the 10 hot spot-related notifications were past-due using the Priority B Out-of-Compliance Date.

Table 4: Past-Due Hot Spot-Related Notifications assigned Priority Code E

Substation	Description	Notification #	Priority	Notification Date	Completion Date	Past Due Date	Status
BANCROFT	TXFR-BANCROFT UNIT 401 REPAIR HOT SPOT	121553717	E	6/16/2021		11/1/2021	Open
BANCROFT	TXFR-BANCROFT 402 HOT SPOT REPAIR	121553711	E	6/16/2021		11/1/2021	Open
BERKELEY T	FACR-STA.T STA-BK HOT SPOT REPAIR	123085660	E	3/10/2022	2/9/2023	8/1/2022	Closed
BERKELEY T	BRKR-STA.T 1101 (FT1) HOT SPOT REPAIR	121553811	E	6/16/2021	12/8/2021	11/1/2021	Closed
OAKLAND D	LTCR-STA.D BK6 HOT SPOT REPAIR	120686372	E	3/23/2021	9/26/2021	8/1/2021	Closed
OAKLAND D	BRKR-OCB # 122 BUSHING HOT	114282651	E	2/7/2018	7/5/2018	7/1/2018	Closed
OAKLAND D	STAN-D SERVICE BANK-4 B PH HOT SPOT	123187997	E	3/25/2022		8/1/2022	Open
OAKLAND X	BRKR-STA.X 1105A HOT SPOT REPAIR	123085828	E	3/10/2022		8/1/2022	Open
OAKLAND X	BRKR-STA.X 1106A CABLE HOT SPOT	123085787 ⁵	E	3/10/2022		8/1/2022	Open
PALO SECO	TXFR-PALO SECO BK401 HOT SPOT	123085668	E ⁶	3/10/2022		8/1/2022	Open

4. ESRB found that PG&E failed to take corrective actions as prescribed during the 2021 and 2022 IR inspections listed below. A description of each violation is provided in the list below.

- i. Barrett Substation: The 3/12/22 IR inspection found that the battery cabinet heater blows cold air thus recommended immediate repair. PG&E created LC notification 123098319 to repair the battery cabinet heater. However, PG&E miscategorized the notification as a Priority E instead of a Priority B. LC notification 123098319 is open and past due as a result.
- ii. Berkeley F Substation: The 5/14/21 90-day IR reinspection found the same hot spot at the ground clamp near the F12 pothead as the annual inspection. However, PG&E failed to create a repair or reinspection notification for the repeated finding at the ground clamp. While the 3/7/2022 annual IR inspection found no hot spots or thermal anomalies, ESRB still believes PG&E was negligent in failing to take corrective action for the hot spot at the ground clamp.

⁵ Repaired on 12/14/2022, LC 123085787

⁶ Palo Seco Substation Infrared Inspection 3/6/2022 Report pg.3 notes: “Bk-1 radiator has cold target. It could be clogged. Repair priority High.”

- iii. Fairmount Substation: The 3/14/22 annual IR inspection found the CB 401/2 cell cabinet heater was not working and battery cabinet heater was not working, thus recommended repairs. PG&E created LC notification 123149549 to repair the CB 401/2 cell cabinet heater and LC notification 123149176 to repair the battery cabinet heater. However, PG&E miscategorized notifications 123149549 and 123149176 as Priority E instead of B. These two notifications are open and past due as a result.
- iv. Oakland D Substation: The 3/24/22 annual IR inspection found that the Bank 3 cooling fan was not working, Bank 4 cooling fan was not working, and Bank 5 cooling fan was not working. Repairs were recommended with High Priority for all findings. PG&E created LC notifications 125230195 and 123188755, respectively, to repair the cooling fans at Banks 3 and 4. However, PG&E miscategorized notifications 125230195 and 123188755 as Priority E instead of B. These two notifications are open and past due as a result. In addition, PG&E failed to create an LC notification to repair the cooling fan at Bank 5.
- v. Oakland I Substation: The 3/11/22 annual IR inspection found that the Bank 402 control cabinet heater was not working thus recommended repair. However, PG&E failed to create an LC notification to repair the control cabinet heater.

If priority code B requirements are applied to the violations above, then the above violations are also overdue as shown in Table 5 below.

Table 5: Findings Overdue as Priority B

Substation	Equipment	Priority	Identification Date	Out of Compliance Date
Barrett	Battery Heater	B	3/12/22	8/1/22
Berkeley F	Ground Clamp	B	5/14/21	10/1/21
Fairmount	CB 401/2 Heater	B	3/14/22	8/1/22
Fairmount	Battery Heater	B	3/14/22	8/1/22
Oakland D	Bank 3 cooling fan	B	3/24/22	8/1/22
Oakland D	Bank 4 cooling fan	B	3/24/22	8/1/22
Oakland D	Bank 5 cooling fan	B	3/24/22	8/1/22
Oakland I	Bank 402 control heater	B	3/11/22	8/1/22

- 5. ESRB found that PG&E failed to conduct oil retests at the recommended interval per the oil analysis report and take corrective action when deficiencies were found. A description of each violation is provided in the list below.
 - i. Stuart Substation: Transformer Bank 2 oil was tested on 11/17/2022 with findings that the oil was acidic and in poor condition. A retest in 90 days was noted. No

retest was conducted within 90 days. Per PG&E's Post-Audit Data Request Response on 4/25/2023, PG&E has since created a notification (#125875565) to perform the oil retest.

- ii. Russell Substation: Transformer oil was tested on 11/28/2022 with findings that the oil was acidic and in poor condition. A retest in 90 days was noted. No retest was conducted within 90 days. Per PG&E's Post-Audit Data Request Response on 4/25/2023, PG&E has since created a notification (#125875576) to perform the oil retest.
- iii. Berkeley F Substation: F-1102 3 Phase Regulator last 4 oil analyses (3/2010, 2/2016, 1/2019, and 1/2023) yielded an FQ of 4 indicating the oil is in poor condition and may be forming sludge. PG&E failed to take corrective action to determine the cause of these results and improve the oil quality. Per PG&E's Post-Audit Data Request Response on 4/25/2023, PG&E has since created a notification (#125805979) for a clearance to inspect Regulator F-1102 and determine the cause of the poor oil quality.

III. Field Inspection

During the field inspection, ESRB inspected the following substations:

Substation	City
Edes	Oakland
Bancroft	Oakland
Oakland X	Oakland
Point Pinole	Richmond
San Pablo	Richmond
Richmond R	Richmond
El Cerrito G	El Cerrito
Waldo	El Cerrito
Fairmount	El Cerrito
Berkeley F	Berkeley
Stuart	Berkeley
Russell	Berkeley
Oakland D	Oakland
Oakland L	Oakland
Oakland C	Oakland
Oakland K	Oakland
Florence	Oakland
Palo Seco	Oakland

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.”

1. Edes Substation

1.1. The fuse inventory list needs to be updated.



1.2. The “Entry Procedure Required” sign is faded/damaged at Transformer Bank 2.



1.3. The “Entry Procedure Required” sign is faded/damaged at Transformer Bank 3.



1.4. There is a bird nest in between insulators on Switch 185.



1.5. The nitrogen tank pressure was high at Transformer Bank 2. PG&E corrected the issue during the audit.



1.6. There is a digital temperature monitor malfunction indicating high liquid and winding temperatures at Transformer Bank 2. PG&E has a preexisting LC notification (#121481756) to correct this issue.



1.7. Circuit Breaker (CB) 2/2 is slow to close. PG&E has a preexisting LC notification (#125584792) to correct this issue.



2. Bancroft Substation

The Load Tap Changer (LTC) fluid level gauge is broken at Transformer Bank 401.



3. Oakland X Substation

3.1. The nitrogen tank pressure is low on both 12/4 kV Transformers. PG&E has a preexisting LC notification (#125633620) to correct this issue.



3.2. The nitrogen tank pressure is low at Transformer Bank 5. PG&E has a preexisting LC notification (#125633620) to correct this issue.



4. Point Pinole Substation

4.1. The position indicator is faded on CB 1101/2. PG&E has a preexisting LC notification (#125552589) to correct this issue.

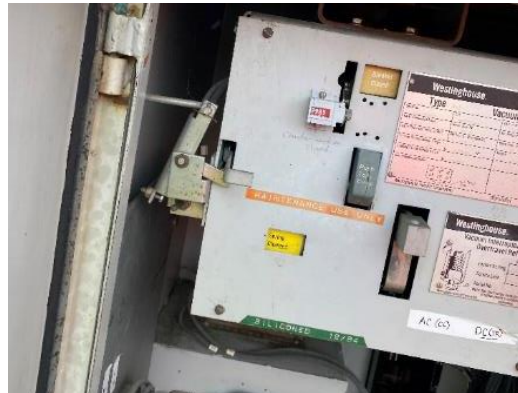


4.2. CB 1103/2 requires replacement. PG&E has a preexisting LC notification (#125338092) to correct this issue.

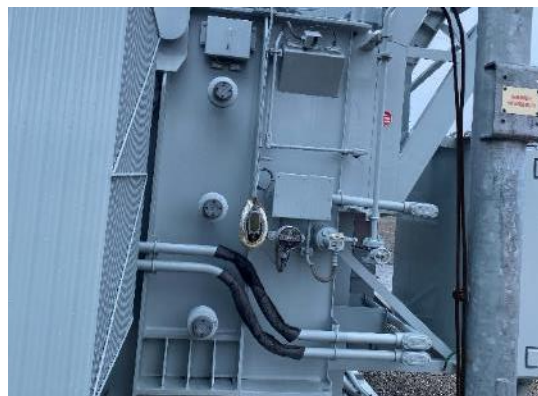


5. San Pablo Substation

5.1. The counter is illegible at CB 1106/2.



5.2. There is an oil leak at the gas sampling port on Transformer Bank 1. PG&E has a preexisting LC notification (#125567750) to correct this issue.



6. Richmond R Substation

- 6.1. There is a communications issue on Phase A to SCADA. PG&E has a preexisting LC notification (#125230318) to correct this issue.
- 6.2. Transformer Bank 2 distribution cables not marked for phase and voltage per PG&E Standard 033582. PG&E created CAP (#125807386) to track installation of the voltage tags during the next routine maintenance.



7. El Cerrito G Substation

- 7.1. The nitrogen tank pressure is low at Transformer Bank 5 and the gauge is difficult to read at low pressures.



7.2. There is rust/corrosion on the PG&E owned and maintained BART 34.5 kV supply PTs/CTs.



7.3. The Closed/Open indicator is faded on CB 192. PG&E has a preexisting LC notification (#125635193) to correct this issue.



7.4. The electrolyte level is low on cells 22, 23, 24, and 39 in the main building battery room. PG&E has a preexisting LC notification (#125507373) to correct this issue.



8. Fairmount Substation

The single line diagram is missing the LTCs for both Transformer Banks. PG&E has a preexisting LC notification (#125573305) to correct this issue.

9. Berkeley F Substation

9.1. The “Entry Procedure Required” sign was missing at Regulator F-1103. PG&E corrected this issue during the audit.



9.2. The Oil Level gauge on Regulator F-1103 is not calibrated to the gauge readings. Inspection records do not alert inspectors that the gauge readings do not reflect actual oil level. PG&E created an LC notification (#125573321) to correct this issue.



10. Stuart Substation

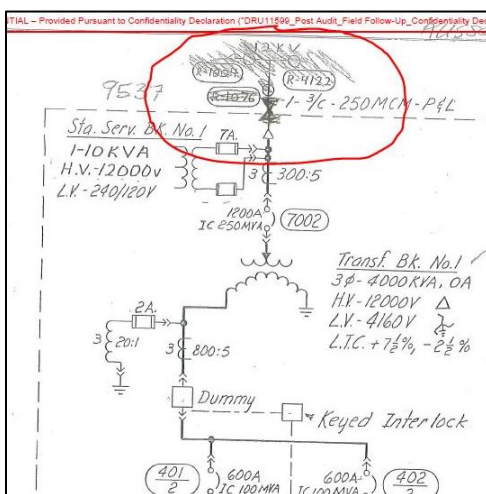
The cabinet heater at Switch 7334 is not working. PG&E has a preexisting LC notification (#123086791) to correct this issue.

11. Russell Substation

11.1. The nitrogen tank pressure was zero at Transformer Bank 1. PG&E corrected this issue during the audit.



11.2. The single-line diagram Drawing # 050897 Rev. 3 has unapproved, handwritten changes.



12. Oakland D Substation

12.1. The LTC oil filtration gauge needle is missing at Transformer Bank 4.



12.2. The compressor power indicator light was not working at Transformer Bank 3. PG&E corrected this issue during the audit.



12.3. The battery cells were covered with coating making it difficult to read the electrolyte level and battery cells 22-30 were missing label markings. PG&E has a preexisting LC notification (#124137786) to correct this issue.



12.4. A temperature difference alarm is on at the Transformer Bank 6 LTC. PG&E could not clear the alarm. PG&E has a preexisting LC notification (#125496676) to correct this issue.



12.5. The LTC oil filtration gauge needle is missing at Transformer Bank 3. PG&E has a preexisting LC notification (#125640823) to correct this issue.



12.6. The animal abatement disk at the tertiary CT is broken. PG&E has a preexisting LC notification (#125640707) to correct this issue.



12.7. The 115 kV control room fire extinguisher is missing a February 2023 inspection. PG&E has a preexisting LC notification (#125636362) to correct this issue.



12.8. An annunciator alarm is on for the 12kV CB. PG&E has a preexisting LC notification (#125635765) to correct this issue.

13.3. The fuse inventory list needs to be updated. PG&E has a preexisting LC notification (#125611157) to correct this issue.



13.4. A temperature difference alarm is on at the Transformer Bank 3 LTC. PG&E could not clear the alarm. PG&E has a preexisting LC notification (#124539961) to correct this issue.



13.5. The temperature probe has an oil leak at Transformer Bank 1. PG&E has a preexisting LC notification (#125612186) to correct this issue.



13.6. The counter is illegible at CB 312. PG&E has a preexisting LC notification (#125611836) to correct this issue.



13.7. The “Entry Procedure Required” signs were faded at CB 412. PG&E corrected this issue during the audit. PG&E had a preexisting LC notification (#125611835) to correct this issue.



14. Oakland C Substation

14.1. The nitrogen tank pressure was low at Transformer Bank 6. PG&E corrected this issue during the audit.



14.2. The Transformer Bank 6 LTC counter is illegible.



14.3. The compressor power indicator light was not working at Transformer Bank 10. PG&E corrected this issue during the audit.



14.4. The compressor power indicator light was not working at Transformer Bank 1. PG&E corrected this issue during the audit.



14.5. A PT bushing is chipped at CX-2 Switch 173, C Phase.



14.6. The transmission fuse inventory list needs to be updated. PG&E has a preexisting LC notification (#125566866) to correct this issue.



14.7. The distribution fuse inventory list needs to be updated. PG&E has a preexisting LC notification (#125616403) to correct this issue.



14.8. The Transformer Bank 5 LTC has a “Run to whole” control issue. PG&E has a preexisting LC notification (#125255310) to correct this issue.



14.9. Transformer Bank 10 has an annunciator alarm on and the LTC has an “off step” alarm on. PG&E was unable to clear these alarms. PG&E has a preexisting LC notification (#125015431) to correct these issues.



15. Oakland K Substation

15.1. There is a bird nest at the B Phase insulator on Switch 173.



15.2. There is an oil leak at Transformer Bank 2 C Phase. PG&E has a preexisting LC notification (#125602290) to correct this issue.



15.3. There is corrosion on several battery cells at the transmission battery bank. PG&E has a preexisting LC notification (#125601812) to correct this issue.

