RCA-2024-011 Unit 3 stopped on a false thrust bearing temperature

Level 1 root cause analysis (spurious shutdown)

Document	RCA-2024-011
Revision	Final
Date	2024-09-06
Applies to	CCD-U3-BRG-THR, CH-FR-1989-0051, junction box JB-U3-01
Owner	Lead: Priya Nandakumar. Team: Dale Whitaker, Sofia Reyes, Tom Halvorsen
Approved	Ray Okafor, 2024-09-10
Status	Actions open (A4)

1 Problem statement

On 19 August 2024 at 21:40, Unit 3 was stopped by the shift supervisor on a thrust bearing temperature alarm. The bearing was healthy; the measurement was wrong.

2 Impact

Unit unavailable for 14.2 h; approx. 510 MWh lost generation (approx. USD 31k). No damage, no safety effect. Linked work order WO-2024-0649.

3 How it was detected

Control room indication of thrust bearing pad 1 (the only thrust pad visible in the control room at that time) jumped between 66 and 84 °C. The 80 °C alarm was raised twice.

4 Timeline

Date / time	Event	Source
19 Aug 21:05	Thrust pad 1 temperature jumps 66 → 84 → 67 → 83 °C within 20 min; oil bath local thermometer steady at 52 °C	SCADA trend, rounds
21:22, 21:31	Bearing temperature alarm (80 °C) raised and cleared twice	Alarm log
21:40	Shift supervisor stops Unit 3 as a precaution (no procedure for validating the alarm; trip level not reached)	Shift log, interview
22:30	I&C on call: indication still jumping with the unit stopped and cooling	Shift log
20 Aug 08:10	I&C finds the pad 1 RTD terminal in JB-U3-01 loose with green corrosion; re-terminated; loop resistance correct	WO-2024-0649
20 Aug 11:50	Unit 3 back in service; temperature normal at 66 °C	Shift log

5 Evidence collected

Parts: corroded terminal (kept). Position: JB-U3-01 in the upper bracket, condensation marks inside the box. People: shift supervisor B, I&C on call. Paper: SCADA trend, alarm log, local oil thermometer on rounds sheet, 2017 overhaul wiring records. Paradigms: "if a bearing alarm comes, stop first, ask later".

6 Hypotheses and verification

#	Hypothesis	Evidence	Result
H1	Real thrust bearing overheating	Oil bath steady; temperature kept jumping after stop; bearing inspection normal	Ruled out
H2	Cooling water problem	Total flow 80 L/s; other bearings normal	Ruled out

#	Hypothesis	Evidence	Result
H3	Measurement fault (RTD, cable, terminal)	Step changes too fast for a bearing (thermal time constant minutes); fault persisted with the unit stopped; loose corroded terminal found	**Verified**

A bearing pad cannot change temperature by 18 K within a minute and back. Fast steps with a steady oil bath point to the measurement.

7 Root causes

Type	Root cause	Evidence
Physical	Loose, corroded terminal in JB-U3-01 gave intermittent contact resistance on the pad 1 RTD	Terminal condition, loop resistance before/after
Human	Unit stopped without validating the alarm against other indications	Shift log, interview
Latent	No procedure for validating a bearing temperature alarm; operators had only one sensor per bearing	Procedures, design
Latent	No periodic inspection of junction boxes; condensation in the upper bracket box	PM plan, JB condition

8 Actions

#	Action	Root	Owner	Due	Status
A1	Issue OP-07 Bearing temperature alarm response (validate before stopping unless at trip level) (MOC-2024-015)	Human, Latent 1	Priya Nandakumar	2024-10-31	Closed 2024-10-02
A2	Check and re-torque all bearing RTD terminals, all units	Physical	Dale Whitaker	2024-11-30	Closed 2024-11-14
A3	Specify dual-element RTDs and all-pad monitoring in the planned monitoring retrofit	Latent 1	Priya Nandakumar	2025-06-30	Closed 2026-09 (CH retrofit)
A4	Add periodic inspection of bearing junction boxes in wet or humid areas to the PM plan	Latent 2	Gina Alvarez	2025-03-31	**Open** (PM-JB proposed 2026-10-12, not scheduled)

9 Effectiveness check

No spurious bearing-temperature stops since OP-07 (checked 2025-09-01). A4 still open.

10 Lessons and FMECA / PM updates

FMECA FM-06 added (bearing temperature measurement fault). Lesson: one channel moving fast and alone, with the oil bath steady, is a measurement problem until proven otherwise. Stopping a healthy unit is a failure too.