

OpsPilot

RCA Module — User Manual

Root Cause Analysis · AI Engineering Co-Pilot



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What this guide covers — what root cause analysis is and why it matters, how the OpsPilot RCA module works, the questions it will ask, the methods it applies, and exactly what report you receive. A real worked example (Boiler Feedwater Pump P-101) runs through the document.

1. What is Root Cause Analysis?

Root Cause Analysis (RCA) is a structured investigation that gets past the obvious immediate cause of a failure to the underlying systemic reason it was allowed to happen — so the fix prevents recurrence rather than treating a symptom. Done well, RCA stops a problem coming back; done badly, it blames an operator and the failure returns months later.

OpsPilot applies recognised investigation methods — *the Ishikawa (fishbone) cause categories, 5-Why drill-down, and Pareto ranking* — with ISO 14224 equipment taxonomy and a disciplined evidence standard, so the conclusion is defensible.

Crucially, every finding is tagged for confidence: **CONFIRMED** (backed by physical evidence or records), **ASSUMED** (stated by one source, not yet verified), or **INFERRED** (a logical deduction). Evidence is also classed DIRECT or INDIRECT. This keeps fact and opinion separate.

2. What the OpsPilot RCA module does

RCA usually stalls in two places: the team jumps to a favourite cause and stops, or it settles on “human error” and never asks why the system allowed the error. OpsPilot runs the investigation as a guided conversation that does neither.

Role	Responsibility
AI Coach (OpsPilot)	Guides a structured RCA, brainstorms every credible cause, challenges shallow answers, pushes past human error to the systemic root, and suggests an owner and due date for every action.
Investigation Lead (you)	Provides the ground truth — the site, the people, the history. You validate the fishbone brainstorm, confirm the causes that have evidence, and accept or adjust the action plan.

3. How it works — the guided process

The module moves through nine stages, one question at a time. You can pause with “continue”, or type “generate the report” to stop early.

#	Stage	What happens
1	Problem statement	Defines the problem specifically and measurably — what failed, when, and the measurable consequence.
2	Business impact	Quantifies downtime, lost production, cost, safety and any repeat-failure history.
3	Evidence & documents	Captures evidence — photos, trends, P&IDs, MOC records, interviews — each classed DIRECT or INDIRECT, with evidence gaps flagged.
4	Interactive fishbone	OpsPilot brainstorms all possible causes across the six categories; you select and rank the ones with evidence.
5	5-Why drill-down	Drills each selected cause down to its systemic origin.
6	Root cause confirmation	States the confirmed root cause(s), separated from contributing causes.
7	Root cause validation	Tests the logic — does removing this cause prevent the failure?
8	Action plan	Corrective actions, each with a suggested owner and target date; root-cause actions distinguished from interim fixes.
9	Report generation	Unlocks the professional RCA Word report.

4. What you will be asked — have this ready

- The event: what failed, when, and the outcome — in your own words.
- The impact: downtime hours, production lost, cost, any safety or environmental consequence, and whether it has happened before.
- Evidence: photos, DCS/SCADA trends, P&IDs, maintenance and MOC records, and witness accounts — anything you can attach or describe.
- Your validation of the brainstormed causes — which have evidence behind them, and which to discard.
- Acceptance or adjustment of the recommended actions, owners and dates.

Tip — be honest about repeat history and “the thing everyone knows but nobody wrote down.” That context is often where the real root cause lives.

5. The methods it applies

Method	What it does in the report
Ishikawa fishbone	Organises every possible cause into six categories — Equipment, People, Process/Method, Environment, Management System, Material — so nothing is overlooked.
5-Why	Drills a selected cause down through successive “why” layers until the systemic origin is reached.

Method	What it does in the report
Pareto ranking	Ranks the surviving causes and classifies each as Root or Contributing, so effort goes where it counts.
ISO 14224 taxonomy	Records equipment class, failure mode and mechanism in the standard reliability vocabulary, so the event feeds fleet-wide data.

6. What you receive — the output

A complete, audit-ready RCA Word report. Its sections are:

- Document control and an executive summary.
- Problem statement and quantified business impact.
- ISO 14224 asset taxonomy (class, sub-class, failure mode and mechanism).
- Evidence register (each item classed DIRECT/INDIRECT) plus an evidence-gaps table with how to close each gap.
- Fishbone analysis across all six categories.
- Pareto ranking of causes, classified Root vs Contributing.
- 5-Why drill-down, root-cause confirmation and validation.
- Action plan with owners and target dates.

7. Worked example — Boiler Feedwater Pump P-101

The website example. P-101's inboard mechanical seal failed catastrophically, releasing hot feedwater and forcing a 72-hour boiler outage — the **third seal failure in 14 months**, with a combined impact of about A\$340,000.

The immediate cause was the seal faces running dry during a low-flow transient. But OpsPilot pushed past that to the systemic root:

Rank	Cause	Category	Type
1	Minimum-flow protection removed via a 2024 MOC without a hazard review	Management System	ROOT
2	No low-flow trip and recirculation line out of service	Process/Method	ROOT
3	Low-flow condition not detected in time by the operator	People	Contributing
4	Seal flush marginal at low flow	Equipment	Contributing

The lesson the report makes plain: the operator who “missed it” was not the cause. The cause was a protective system removed through management of change without anyone reviewing the hazard that removal created. Two of the five corrective actions target that root directly — reinstating minimum-flow protection and fixing the MOC hazard-review gap.

8. Getting the best result

- **Resist the first answer.** If OpsPilot challenges a shallow cause, that is the method working — push through it.
- **Bring evidence, not opinion.** Causes backed by DIRECT evidence carry the report; the rest are flagged honestly.
- **Don't stop at human error.** Always ask why the system permitted the error — that is where the durable fix is.
- **Use the evidence-gaps table.** It tells you exactly what to instrument or capture so the next investigation is faster.

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