SeaState Group, Inc.

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Number 3

ROOT CAUSE EXPERT

FOR PRACTITIONERS AND THE MANAGERS WHO DEPEND ON THEM

INSIDE

RCE Vocabulary

"Expert"

Can you become a root cause "expert?" Absolutely!

According to Dr. James Voss of the University of Pittsburgh, the mark of an "expert" is the amount of time he or she devotes to **structuring the inquiry** *into a problem.*

"Novices" memorize rules and use them to jump to conclusions. Dogged reliance on rules by novices can distort the nature of the original question, dangerously fogging the view.

However, Voss believes that "educated" novices generally fare better than uneducated problem solvers, even in areas where they lack specialized knowledge. Instead of experiencing sudden brilliant insights, they search for facts to back conclusions, they collect enough of them to be convincing, and they reconcile contrary information with their preliminary hypotheses.

So, **anyone** *who applies proven methods carefully can become a root cause "expert!"*

EQUIPMENT FAILURE DIAGNOSTICS

To understand how a piece of equipment failed, you need to determine three things:

1 – Failure Mode

How did the failure show up? Did a pump seize? Did a support loosen? Did a relay open unexpectedly? Describe it well. Failure mode is closely related to the problem statement; it's the reason for the trouble the failure produced.

2 – Failure Mechanism

Next, determine how the failure mode developed. In other words, did the pump seize because of impeller/casing contact, foreign material intrusion, fluid viscosity increase, bearing misalignment, excessive end play, or what? Did the support fracture or did bolts back off? Did the relay burn out, or are the contacts just corroded, dirty, or bent? The failure mechanism may have taken some time to develop, but its effects were sudden and unexpected (acute). Explain it, then proceed to the third item.

3 – Degradation Influences

Generally there was an earlier time when the pump, support, or relay worked fine. Since then, factors have been at work behind the scenes, weakening or altering desirable properties of the original materials.

Phenomena like humidity, sunlight, vibration, heat, bacteria, pH excursions, sediment, freezing temperatures, pressure, and foot traffic are just a few possible degradation influences. Some, like sunlight, are natural. Others, like corrosive acids, are essential to production processes.

Hardware doesn't care. Its materials respond according to chemical and physical laws.

Although you must determine failure mode, failure mechanism, and degradation influences, they are insufficient as root causes.

Root causes lie deeper. They involve asking "Why did we allow these interactions to develop until we suffered an unwanted, untimely, and costly failure?"

CAN YOU PREVENT OLD DESIGN ISSUES?

Not without a time machine.

However, that doesn't let you off the root cause hook.

You are in the business of preventing the uncertainties, aggravations, and safety concerns that undetected old design issues can produce.

Therefore, your root cause analysis needs to ask:

- Why did this issue wait to reveal itself when and where it did (instead of earlier, when our response might have been easier)?
- Who else experienced this issue, while we were unaware or ignored warning signs?
- What can we learn about the original design organization, technical reviews, and quality assurance processes? What legacy, if any, have those deficiencies left for us?

Certainly, corrective actions must remedy the old issue. Equally important is acting on the insights you gain about how your problem detection processes worked between those good old days and the challenging present.

Fix those, too.

"If your root cause evaluation involves an equipment failure, follow your old high school teacher's advice: Show your work!"

TRIBAL KNOWLEDGE

You've heard the expression "It's tribal knowledge around here." That's fine for learning which vending machine takes your money, or where to find the Xerox paper with holes.

Watch out if tribal knowledge and traditions seem to be resisting the orderly processes you've worked hard to benchmark and improve.

Some warning signs:

- You rely heavily on retirees hired back for outages and infrequent evolutions.
- You assign tricky jobs to a select group of experienced people.
- Planners cobble tests and other special tasks from steps selected from multiple procedures.
- Old-timers depart with no structured efforts to capture and assimilate their unique insights and approaches.
- Important jobs fall apart midway, requiring additional tools, parts, and field adaptations.

Tribal knowledge is at the heart of organizational culture. You can't live without it, but it must not jeopardize your success.

Suspect excessive reliance on tribal knowledge when your root cause evaluation finds

- Unhealthy workarounds that persist too long.
- Certain approvals that for some reason just cannot be delegated.
- Responsible persons who make decisions contrary to factual evidence.

Fixing a cause rooted in tribal practices requires making deliberate changes to the >

DOCUMENT THAT HARD-WON DIAGNOSIS

Although equipment failure diagnostic results are not root causes by themselves, they are important leads for tracking them down. Document them.

If your root cause evaluation starts with an equipment failure, follow your old high school teacher's advice: "Show your work!"

Next time, instead of a long narrative, produce a graphic summarizing the threads you pulled and how you discounted them, one-by-one, until you closed in on your answer.

Here are some popular tools:

- Fault Tree
- Supporting/Refuting Evidence Matrix
- Analysis of Differences (Change Analysis)
- Kepner-Tregoe® style "Is/Is Not" table
- Failure Modes and Effects Analysis (FMEA)

Keep your chart simple enough for non-experts. Talk it through with a skeptical peer. Your visual will help convince others, but more importantly it will keep you honest and help you avoid leaving anything out.

MANAGE YOUR MANAGER

Responsible managers come in all styles, from hands-on to call-me-when-it's-done. Root cause investigators deserve the best possible support. If the backing you need is not automatic, then you must create opportunities for your manager to deliver it. (That's a nice way of saying you must manage your manager!)

Make sure you have a scope and charter document, even if you have to write it. Revise it along the way, especially as extent of condition emerges .

Propose lines of inquiry and depths to dig, then listen and document the boss's response.

Use the manager to drum up reluctant resources and schedule manager visits to keep team members psyched.

Review your methods and the quality of the evidence. Test drive your conclusions with the manager aboard. Don't wait for the formal approval signature.

Never seek agreement or action from others without your manager in your corner. If he or she must present the results, you must coach and rehearse.

Root cause evaluations are projects where your boss needs <u>your</u> leadership. Provide it!

Asset or Liability?

culture's value system.

That may need to start with senior leaders: the things they expect and the things they reward. Get one or two of them on board with you.

Build an action plan that uses solid change management principles, including visible executive sponsorship. Start with promising areas where the stakes are modest ("low hanging fruit."). Publish milestones and celebrate successes.

Amazonian Kaiapos Native Americans. Photo: Valter Campanato, Agencia Brasil

New tribal knowledge will begin replacing the old. New advocates will appear, this time urging others to follow process and to be intolerant of second-class performance. The tribal stories will change from tales of midnight heroics to parables about safe practices, efficient outages, and reliable runs.

The tribe will always be there, but it will be on your side.

"Fixing a cause rooted in tribal knowledge requires making deliberate changes to the culture's value system."

Apparent Cause Evaluator Training

Many plants have reduced root cause evaluation numbers to the "teens" per year. A small core of seasoned preparers deliver high quality RCEs on demand.

Today the real payoff is in the 50 to 150 additional people you rely on for apparent cause evaluations.

The stakes have risen; external stakeholders expect bold ACE reports and sharp reductions in problem recurrence.

Here's a success formula:

- Formally train and qualify ACE evaluators – don't rely entirely on natural talent.
- Integrate hardware failures, human performance, and organizational effectiveness in your training. ACEs come from all directions.
- Insist on a proficiency evaluation. This should include an exam and a practical demo.

Invest in solid ACE evaluators and reap big dividends.

Please (Don't) Hold The Door

At home, doors offer privacy and security. At nuclear stations, doors do much more. Some doors even are integral to defense-in-depth. An eastern BWR offers an important lesson:

A few years ago, during a summer heat wave, the 1B primary condensate pump was running hot. Until it could be secured, Engineering came up with ways to augment air flow to the room. In no time two new condition reports arrived:

August 2: Pump room door rolled up without fire protection compensatory measures.

August 3: Adjacent pit area fire door propped open with no impairment permit at all.

Apparent cause evaluators came up with a bucketful of explanations:

- Fire impairment coordinator communications with Maintenance and Engineering were weak.
- Planning did not follow Engineering's advice.
- Several document entries were unclear.
- The pit area fire door had a label only on one side.
- Maintenance extrapolated permit terms from one door to the other.

What common root cause would you say linked these ACE findings? (See page 4.)

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ROOT CAUSE EXPERT

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FIRE DOORS – A DEEPER CAUSE

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This station had a serious fundamental weakness, and it showed through in how they handled the two fairly simple fire protection impairments:

Station personnel did not value the condition of doors.

Despite the role of doors as mitigators of fire and flooding, despite their job to maintain ventilation balance and air quality, despite their ability to separate humans from radiological and chemical hazards, no one really cared about doors. Doors simply were things that got in the way of progress.

Defeating all kinds of doors had become a way of doing business. No one gave it conscious thought anymore. The station-wide mental model had become: "Analyze this door and find a way we can leave it open."

In our root cause experience at other stations, we have seen misguided and downright dangerous mental models like these at the bottom (or the end) of thorough root cause analyses:

- Security: Our job is letting good people in (vs. keeping bad people out).

- Engineering: Our job is analyzing off-normal situations and helping Ops declare systems operable.
- Rad Pro: Our job is delivering low person-rem exposures, not standing in the way of urgent work.
- Material Control: Our job is minimizing inventory and controlling costs.
- Maintenance: Our job is fixing things quickly and staying out of the limelight the rest of the time.

Happily, these stations eventually recognized and corrected their faulty mental models, but in some cases the transformation required new managers with fresh perspectives.