

ROOT CAUSE EXPERT

FOR PRACTITIONERS AND THE MANAGERS WHO DEPEND ON THEM

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Root Cause Vocab – Evidence

John Adams, the 2nd U.S. President, was a 34 year old lawyer in 1770 Boston when he defended a British officer and eight soldiers on trial for the shootings of civilians known as the Boston Massacre.

Separate trials ensued for Captain Thomas Preston and the eight men. During his closing arguments at the soldiers' defense John Adams said, "I will enlarge no more on the evidence, but submit it to you – facts are stubborn things; and whatever may be our wishes, our inclinations, or the dictates of our passions, they cannot alter the state of facts and evidence..."

Anti-British sentiment ran high in Colonial Boston, but one man - a fair-minded lawyer and future President – stuck to the facts, presented them in evidence, and won acquittals for all but two of the soldiers.

TAKE CHARGE OF YOUR AUDIENCE

"If it bleeds, it leads." No, this is not about tabloid journalism; we're referring to root cause analysis reports and oral briefings.

I once investigated an industrial accident where a contractor fell from a ladder and shattered his elbow. The plant's lost time accident record was bleak, and it was even worse for supplemental personnel.

On the day of the corrective action review board meeting, I decided to try something:

"Gentlemen, we are here this morning to discuss the fatality that took place on March 10th," I began.

The station manager's eyes became wide and he started to interrupt.

"I'm sorry," I said, "I needed to start that way to get everyone's attention. The gentle-

man only broke his elbow. But he fell from 10 feet up onto a hard concrete floor. If he had landed on his head, it would have been a fatality. The root causes were the same one way or the other." Everyone at the table listened carefully.

Your root cause investigation, analysis, report, and corrective actions – no matter how accurate, no matter how virtuous – **must compete for attention, approval, and action** with a dozen other matters on management's calendar.

Never misrepresent the facts or draw unsupported conclusions, but you have every right to make your hard work shine and move to the top of other people's agendas:

Here are some tips that work:

- Lead with direct causes (failure mechanisms).

These bridge from what the audience already knows to the new conclusions you will make. **Evidence** (see box at left) is likely to be well-linked.

- Show clear cause-and-effect relationships. You must be able to put the phrase "as a result" between your root cause conclusions and the consequences everyone recognizes.
- Use summary tables, visual aids, and color! They take a little more time, but they "sell" and they may flag logic flaws before your audience does.
- Acknowledge refuting evidence. It does not mean that you are wrong. Root cause analysis produces a preponderance of evidence, not perfect proof.

THE CASE OF THE CHINA SHACKLES



It is the eighth day of the refueling outage. A condition report appears describing 18 "China shackles" discovered

in a contractor's gang box. Pre-outage discussions had included shackle failures experienced by others, and the station toolroom had gathered and disposed of its inventory of "China shackles." Now the toolroom is saying they were just being proactive in response to a worker who expressed a concern. There is no proof that the shackles

ever were defective; they even came with vendor certification sheets.

You have received the condition report with instructions to perform an apparent cause evaluation. What is the **problem statement** you will use as a starting point? What is the likely **extent of condition**?

See Page 4 for our advice.

HUMAN PERFORMANCE – IT'S

Control room operators and maintenance technicians are tired of hearing about self-checking and "STAR" (stop-think-act-review). Don't get me wrong. They understand the value of self-checking during critical steps. They know that STAR can prevent significant events.

The thing that troubles front line workers is the feeling that they are out there all alone, contending with process problems and error traps that aren't getting better, even after they identify

them. Sooner or later, the best worker tumbles into one and gets branded with the diagnosis "failure to self-check." In an atmosphere of increased accountability, the consequences of just one lapse can be severe.

To many workers, there is no "up" side to human performance any more.

Remember that when you perform a root cause analysis on a human performance problem.

If there has been a failure to

self-check, pull the thread. Was there a clear success path, or was the person trying to figure out the method while doing the work? STAR works best for well-defined, practiced tasks that can go wrong when someone skips a step or manipulates the wrong component. Wondering "What should I do now?" is beyond the scope of STAR.

Sorting through competing priorities is also an unfair expectation for people required to perform error-free. Most nuclear plant workers

"When 'OR' logic is involved, more than one individual failure can cause trouble. Until each possibility is resolved, the results may not change."

"OR" LOGIC – POWERFUL BUT TRICKY!

Fault trees are handy root cause analysis tools because they show all the possible individual failures that could have caused the so-called "top event." User beware!

An emergency diesel generator had failed its surveillance, requiring several extra seconds to start and load. Troubleshooting narrowed the failure mechanism to the air start motor **OR** the electrical field flash circuit.

The air start motor was laboring audibly, and disassembly showed it to be bone dry of lubricant. But, after three changeouts, the overall EDG start time had improved only a second or two. The mood was grim.

Out came the system engineer's **fault tree**, which he had set aside in the excitement of rounding up every spare air motor in the fleet.

Sure enough, a few simple tests proved that an essential generator field flash relay was not closing, delaying excitation a few critical seconds. Undetected installation errors months earlier had set the stage for failure.

The point: When "OR" logic is involved, more than one individual failure can cause trouble. Until each possibility is resolved, the results may not change.

WHEN THE PROBLEM IS A TREND



An **adverse trend** can be a significant condition adverse to quality, just the same as a one-time event. So, how do you

perform a **root cause analysis** on something that happened again and again, and perhaps is still happening?

The key is in writing the problem statement. Your adverse condition is not any one of the input events, but the existence of many, frequent, or increasingly severe events. The condition to be prevented is that magnitude or direction, not the next event.

Tabulate the causes of the individual events, but step back and ask, "What gradually changed or broke down to let them accumulate or become as serious as we now realize they are? What opportunities did we lose to recognize and avoid the situation we are now in?"

Fixing those weaknesses will prevent recurrence – of the trend.

MORE THAN STAR

balance several assignments at once, including projects for long-term plant betterment.

A system engineer, for example, who must oversee troubleshooting on a moment's notice will eventually fail without a chance to study assigned systems and build reserves of personal knowledge on how they work.

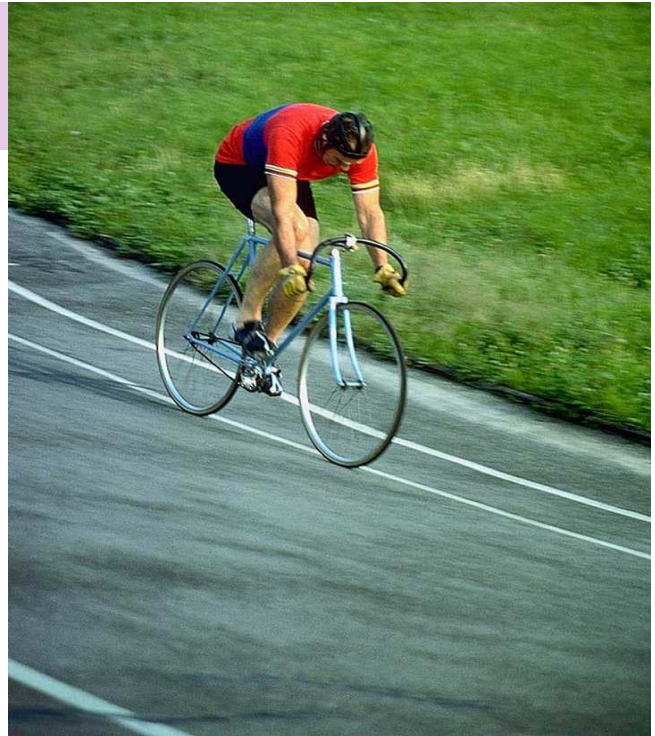
Excellent performance also requires desire. Nearly every time I ask a worker "What motivates you?" he or she rarely says anything about money or advancement.

Instead, three answers stand out:

- Self-satisfaction
- Loyalty to peers
- Family and community

If a workplace erodes the potential for pride, forces groups to take sides on controversial issues, or drains people's energies to the point where they cannot live balanced lives, the organization has started breeding poor human performance.

The organization has become the root cause.



SEASTATE GROUP PUBLISHES MID-CYCLE CROSS-CUTTING ISSUE SUMMARY

NRC sends semi-annual ROP assessment letters to each power reactor licensee. Our clients have a big stake in the cross cutting issue areas: human performance, safety conscious work environment, and problem identification and resolution. Unfortunately, there is no easy way to

scan the NRC website for cross cutting issues. So we do the research and summarize it. Our fourth compilation is now available.

On August 30, 2005, Arkansas Nuclear One picked up the only new PI&R cross cutter, based on six issues related to prioritization and cor-

rection. Three stations (Byron, Duane Arnold, and Watts Bar) received new human performance citations, many stemming from procedure adherence issues across multiple cornerstones. For your **personal free copy**, log on to www.fix-it-once.com and click on "Contact Us."

HOW DEEP TO DIG?

Your root cause procedure may advise investigators to probe until they ask a certain number of "why" questions or reach causes that satisfy a well-crafted definition of "root" cause. A filled-out chart or tree testifies to their efforts.

The real answer, and the reason for strong management involvement in every investigation is this: Dig until you

fully understand the system in which this intolerable problem emerged. **Dig until the risk of going forward is acceptable**, knowing what you know and appreciating what is still uncertain.

In practical terms, this means that a full root cause investigation is incomplete until it determines why human beings strayed so far from healthy processes. Why

monitoring systems failed. Why predictions of trouble fell on deaf ears. Why events began setting priorities instead of the organization's own plans. External stakeholders have become increasingly vocal about shallow root cause investigations. Tuck the latest three or four reports in your bag for quiet study this weekend. Forget the rules. Did they evaluate the system?

If not, the critics may be right.

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CHINA SHACKLES – SOME ANSWERS

Continued from Page 1...

Your best choice for a problem statement is one like this: "On April 10, 200X, station maintenance noted 18 shackles stamped "China," ready for use in a Contracto, LLC gangbox. Two weeks earlier, in response to a worker concern, Utilico had removed similar shackles from its own inventory."

Such a starting point allows you to pursue several **parallel paths** without prejudging any one of them:

- Whether the shackles really are unsafe to use.
- How Contracto failed to get the word about the China shackles.
- How the toolroom made judgments about equipment safety without specialized expertise.
- How Purchasing acquired questionable shackles in the first place.
- How Utilico controls tools brought onsite and used by outage contractors.

- How a "worker concern" never made it into the corrective action system for everyone to see, screen, evaluate, and act upon.

Extent of condition should consider these areas:

- Assuming the tool room's decision to get rid of the shackles was sound, what other gangboxes, cribs, unissued warehouse stock, and private stashes need to be inspected and resupplied with acceptable shackles?
- Even if the China shackles prove OK, should the station sample its lifting slings, hooks, come-alongs, cable, chain, safety harnesses, etc., for conformance to current U.S. requirements, especially if no one but the tool room is looking out for this risk?
- How effective is the communication process between Utilico and sources of supplemental help like Contracto? What other factors threaten effective sharing or enforcement of new work standards?



*"Time is a great teacher,
but unfortunately it kills all its pupils."*

Hector Berlioz – Composer

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