

Improving the Performance of Your Root Cause Analysis (RCA) Program

By Chris Eckert PE, CMRP

President - Apollo Associated Services, LLC



prepared by Apollo Associated Services, LLC

authored by Chris Eckert

Enhancing Problem-Solving Capabilities™
ROOT CAUSE ANALYSIS

Improving the Performance of Your Root Cause Analysis (RCA) Program

Abstract

Today, most organizations utilize Root Cause Analysis (RCA) to solve problems, however the results often disappoint. Routinely, RCA's rely on overly simplistic approaches, which lead to categorical solutions such as "Re-train", or "Create new procedure". While common, these solutions are rarely effective at eliminating problems because they fail to address the underlying causes of the problem. An effective RCA method must identify the cause and effect relationships present within the organization's human, physical and technical assets before effective solutions can be found. A well-organized RCA Program is also needed to support and sustain the use of RCA within the organization. An effective RCA Program must include a training strategy, definition of roles and responsibilities, written program goals, written threshold criteria, a consistent software tool for reporting, and an effectiveness feedback loop (metrics).

This paper shall review the elements of an effective RCA method and will describe the necessary attributes for an effective RCA program. Important questions such as: "How do I develop an effective RCA Program?", "Where do I apply RCA in my facility?", "How do I get my workforce engaged in RCA?" and "How do I measure and demonstrate the results of my RCA's?" will also be addressed.

Where to look for Improvements?

In order to improve the performance of your existing RCA program, there are two primary areas to examine: 1) The RCA method in use, and 2) The organization and structure of your RCA program.

In this paper, I will share some commonly observed problems with RCA as applied today, provide an overview of the important elements needed for a sound RCA method, and I will briefly describe the key elements required for a healthy RCA program.

Pitfalls of Problem Solving Today

There are several pitfalls commonly encountered that prevent individuals and organizations from finding effective solutions to their problems. It is essential to recognize and avoid these common problems in order to avoid repeat failures. These pitfalls include:

- Reliance on Rule-based solutions
- Ignoring Problem Definition
- Incomplete Analysis due to Ineffective Forms and Checklists
- Telling Stories

Heavy Reliance on Rule-Based Solutions

To ensure a thorough and accurate analysis of a problem, everyone participating in or facilitating an incident should understand that most problems are the result of event-based scenarios. For these situations, rule-based solutions are rarely effective, even though they continue to be popular choices.

Event-based problems are better defined and ultimately solved when the principle

of cause and effect is understood. Examples of event-based problems include: "Which route should I take to work in the mornings?", "How do we improve the reliability of this system?", or "How do we reduce safety incidents?" For these questions/problems, we find that there are no single "right" answers, but many possible solutions--some better than others. The best solution depends upon multiple factors but at a minimum, the solution must control and eliminate one or more causes.

Rule-based solutions are normally developed after a failure and are intended to govern the actions of all people on that task in the future. While rules are needed and valuable, and some rule-based solutions are quite effective, many are ill conceived and ineffective. Commonly, the rule-based solutions do not attack or eliminate any causes of the problem; instead, they unknowingly establish new restrictions that will generally create an entirely new set of problems.

Rule-based solutions, although common, fail to address conditional causes and normally attempt only to control the actions of people. Because the individual creating the rule normally only considers the actions they perceive as the cause, while failing to anticipate the other outside influences that are always coming into play, their solution may work for the problem that was just encountered, however it will normally impose undue barriers for all other situations, eventually leading to disregard for the rule.

Ignore Problem Definition

We are typically so focused on providing solutions that we ignore an important step – properly defining the problem.

When you have been called into an emergency problem-solving meeting, what is the first thing the group typically talks about? Normally, it is solutions. Typically, when trying to solve a problem, people jump to solutions before taking the time to fully understand the problem. They believe that the problems we are trying to solve are obvious and that everyone sees them just as we do, which is rarely the case. A clear problem definition is required if we are going to arrive at effective solutions. The first step of RCA, a clear problem definition, will be outlined later in this paper.

Incomplete Analysis with Forms and Checklists

Filling out report forms can be useful for capturing important information, but it is not an analysis. A thorough analysis requires a clear understanding of the cause and effect relationships. By checking boxes on a report form, we make overly simplistic generalizations, or categorizations, of the problem.

Categorization is a very common approach to classifying root causes, however it is of limited value because of the difficulty in identifying a specific solution to remedy the problem. Examples of categorization include: “Human Error”, “Training not followed” or “Less than Adequate Communications”. It is common that solutions such as “Re-train”, or “Re-communicate” are outcomes of these categorized reports. As we have all seen, these types of solutions are rarely

effective because they do not address specific causes.

Only by identifying the causes can we develop specific solutions that will break the causal chain. While we don’t want to eliminate report forms, we must ensure that we perform an analysis of the problem.

Telling Stories

Today most incidents are documented as a narrative or story. This characteristic is so pervasive that it is initially difficult to recognize as a pitfall. A story or narrative is a sequence of events that is meant to convey what happened in an incident or event. The story can be an important first step in gathering information, but it must be followed by an analysis that identifies the cause and effect relationships. While stories can reveal some causes of the problem, typically only the action causes are discussed and the conditional causes are ignored. As we have seen over the years, conditional causes represent approximately 75% of the causes found in a thorough analysis. By ignoring the majority of the causes, we limit our solution set to things that attempt to control people’s actions, which can be difficult. Again, the solutions “Re-train” and “Re-communicate” are common in RCA’s laden with storytelling because if all that is being shared are action causes, it follows that the solutions will need to be action based.

The RCA Process

We can avoid these pitfalls by adhering to a consistent and disciplined approach to RCA. Root Cause Analysis (RCA) is a systematic approach to identifying the cause and effect relationships of a

problem and acting upon these causes to prevent that problem from recurring. Understanding the cause and effect relationships in a problem is the essence of the Apollo RCA process.

The Apollo RCA process consists of four basic steps (A summary of the Apollo RCA process is provided in **Appendix 2** of this document.)

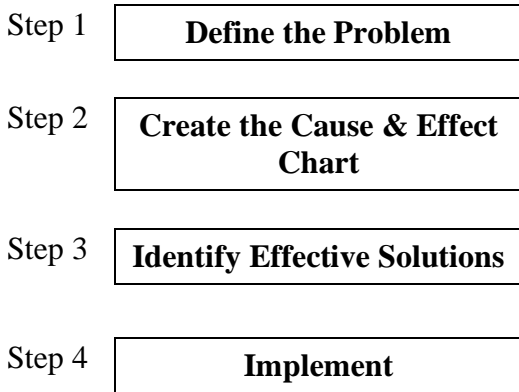


Figure #1 Apollo RCA Steps

Step 1. Define the Problem

A clear problem definition is extremely important for capturing the specifics of an incident within the context of the goals and objectives. People have different points of view about a problem and all perspectives should be incorporated.

Any problem, incident or undesirable event is defined as the gap between the goal (desired) and the actual condition. Problems should always be defined within the context of the organization's overall goals and objectives. Production people tend to see a problem differently than the maintenance people or the sales people. It is really not an issue of one group being "right" and the other groups being "wrong," though this perception sometimes exists. Everyone has a

different way of looking at the problem and we must accommodate those differences to take advantage of the expertise represented by each function. It is important to have specialists within an organization possessing different points of view. Incorporating different perspectives in the problem definition step establishes a more comprehensive problem statement. The group must reach a common understanding of the problem before they can begin the analysis.

Capturing the timing and location of a problem is also very important. We need to know not only the date and time of an incident, but the status or relative timing with respect to the other things occurring at the time. It's important to know that a particular incident occurred during start-up, during rate increases or 5 days after a new carrier was assigned.

The last and most important part of a properly defined problem is its significance. The significance section helps define priorities within an organization by quantifying the impact of the event on the goals of the organization. Areas to consider in significance are: safety and environmental impact (expressed in chemical types, amounts and where it went), lost revenue (expressed in \$\$), downtime (expressed in lost pounds/kg of production), customer service lapses, regulatory failures (which rag was violated), out-of-pocket costs (\$\$), and so on. The significance section should be divided into sub-categories that reflect the overall goals and objectives of the organization.

Besides clarifying the magnitude of the event, the significance will determine: 1) The appropriate solution spending, and

2) The amount of time to be allocated to the analysis. If the quantified losses are not significant, an analysis may not even be warranted. By defining the problem and quantifying the significance, you understand the appropriate resources to dedicate towards solving the problem as well as establish the starting point for the cause and effect chart.

Step 2. Create Cause and Effect Chart

The Apollo Cause and Effect Chart is where a problem is broken into its individual causes by asking "why". The cause and effect chart is a powerful communication tool and provides a "visual dialogue" of the problem. The chart simplifies complex issues by breaking them into individual cause and effect relationships while still illustrating the connectivity. The cause and effect chart forces participants to abandon story telling by focusing them on the causes of a problem.

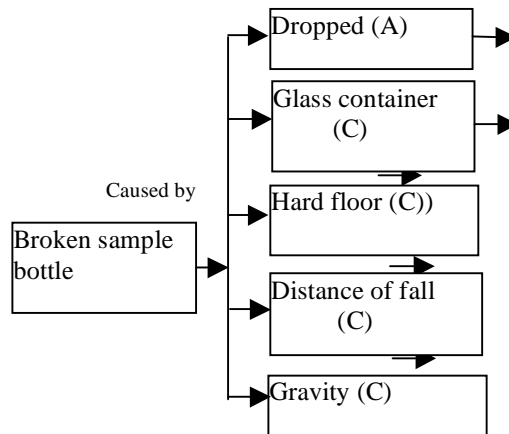
Causes take the form actions or conditions. Typically, there are at least two causes for each effect--one action and one or more conditions. People are very good at identifying action causes but often need help seeing the conditional causes.

Let's consider at a simple example. Say your operator is carrying a glass sample bottle, which falls from their hand and breaks. You would like to solve the problem of the broken sample bottle. When I present this example to people and then ask "What caused the bottle to break?", over 90% of the answers are "dropped". While this is correct, there are a total of 5 causes at a very basic level and "dropped" happens to be the only action cause. All 5 causes must exist for the bottle to break. The

remaining causes are all conditional causes, yet rarely does anyone speak of a condition. When I then ask the same people, "What would your solution be to this problem?", most answer "Tell the operator to be more careful", or "Stress the importance of handling glass containers carefully." In the many years previously spent in the chemical industry, I had never encountered any operators who were knowingly careless with glass sample bottles, or who weren't aware of the fragile nature of glass. Yet, we continue to commonly see these types of solutions even though we know that they are of little value.

Did you determine the other four causes? Most people have to think harder to identify the conditional causes because our brains are programmed to see action causes while we tend to ignore conditions.

The basic causal set is:



Now, let's explore another interesting facet. Except for the action cause of "dropped", pick any one of the other 4 conditional causes and think of a solution that will eliminate that cause. What happens? If you eliminate any one of the 4 conditional causes, you will

see that this has exactly the same end result as eliminating the action cause of “dropped”---the effect of “Broken Sample bottle” will not occur.

In the same example, while we can't do much about “gravity”, we can eliminate or control the other conditional causes. Many chemical companies have solved the conditional cause of “Hard Surface” by installing FRP grating under the sample point, which is the highest probability location for the bottle to be dropped. They also solve on “Glass container”. While glass is an ideal sample container for most chemicals and they desire to stick with it, they utilize thick rubber casings that protect the bottle from breakage if it falls. Other solutions include utilizing non-breakable sample containers, or completely eliminating the glass container and switching to on-line analyzers. (Of course, this isn't economically feasible for all situations, but you can see that focusing on conditional causes opens up many new and different possibilities for solutions that may not have been as apparent before.)

The interesting fact about this situation is that when we fail to identify the conditional causes, we miss out on some of the most creative and effective solutions.

Evidence

All causes should be supported with evidence. If there is no evidence to support a cause, it must be identified with a question mark (?). Question marks in an investigation are valuable because they point out missing information. A question mark on a cause and effect chart is an action item to collect more information and it is also

a warning flag for solutions. Normally, solutions should not be attached to questionable causes because if the cause turns out to be invalid, any solution that was designed to eliminate the cause will have no impact on eliminating the overall problem.

While common, overly simplistic approaches to cause and effect charts, such as the “5-why's”, limit the exploration of cause and accordingly limit the availability of the creative and low cost solutions. A properly developed cause and effect chart frequently reveals solutions that cost little to no money out of pocket. So the additional time spent developing 30 or more causes will pay off many times over in most situations.

The exercise of formulating the cause and effect chart is typically best completed by a group of 3-6 people representing the disciplines involved in the incident. A group may need from ½ hour to 4 hours to develop the cause and effect chart; 1 to 2 hours is common. As the significance of the problem increases, so should the time allocated to building the cause and effect chart.

Step 3. Identify Effective Solutions

An accurate cause and effect chart must be developed before we can identify effective solutions. The cause and effect chart is the structure from which we develop solutions. Solutions solve problems because they control specific causes and break the causal chain, thus preventing the problem from recurring. For this reason, the chart is our starting point for identifying possible solutions.

Effective solutions are the result of two distinct steps. First we identify possible

solutions for each individual cause on the chart. The second step is to evaluate all of the possible solutions against the three solution criteria:

1. Does this solution prevent recurrence of the problem, while not creating new problems?
2. Is this solution within our control?
3. Does this solution meet our goals and objectives? In other words provide positive payback while not compromising other goals.

We often eliminate good ideas too early by disqualifying possible solutions as impractical or impossible. We must resist the temptation to judge solutions until they are fully explored. First, brainstorm all possible solutions and then eliminate the solutions that fail to meet the solutions criteria. The evaluation should include consideration of life cycle costs and ease of implementation versus benefit analysis

Step 4. Implementation

The first three steps of an RCA are wasted if the implementation is not completed. Following up on the specific solutions to ensure that they have been completed is only one part of the implementation. There should also be validation of the solutions. If a solution is found to be ineffective, the RCA should be re-opened and updated to incorporate the new learning that may have been previously unknown. New, or modified solutions may be needed to eliminate the new causes.

Implementation also includes the write-up of the incident and archival for future reference. Communicating successes, lessons learned and areas for improvement is an important and valued

activity within any successful organization, department or facility.

After you begin utilizing RCA, you will begin to uncover the systemic causes deeper in your chart. Because these systemic causes drive many of the decisions made in your organization, elimination of just one systemic cause will make a major contribution to proactively eliminating problems yet to be encountered.

The four steps of Apollo RCA are a time and industry proven problem-solving tool. RCA is an integral element of today's organizational discipline because the defect intolerance mindset it fosters will drive the culture change that is needed. By attacking and analyzing problems when they occur, we inevitably uncover and eliminate the same systemic and common causes that will be present in major incidents, thus facilitating a transition into prevention.

The RCA Program

Effective approaches for starting and sustaining an RCA program

In its most basic form, an effective RCA program consists of:

- 1) RCA policy
- 2) A training strategy
- 3) Software for consistent reporting
- 4) An action tracking system,
- 5) Metrics tracking

A Clearly Defined RCA Policy

An RCA policy is a written document that clearly defines the intentions of your RCA program and should contain:

- o The goals of the RCA program
- o Threshold criteria
- o Roles and responsibilities

Once completed, the RCA policy should be communicated throughout the organization at the beginning of the program rollout.

Program Goals

It is important that everyone in the organization understand why the RCA program is being implemented. A single paragraph is normally sufficient to express the goals.

For example,

The ACME Tool Company RCA Program goals are:

- o **Reduce costs by \$550M/yr**
- o **Increase capacity by 30% by 2007**
- o **Reduce emissions by 400K lbs/yr**
- o **Improve Asset Utilization by 10%**
- o **<5 Customer Service failures/yr**
- o **Reduce OSHA recordable rate from 3.5 to 2.0 in 2 years.**

Threshold Criteria

The threshold criteria are sometimes referred to as the “hurdles” or “triggers.” Threshold criteria define when an incident should be investigated. As you can imagine, the threshold criteria align closely with the goals and objectives of the organization. As you begin to reduce the number of incidents exceeding your threshold criteria through effective use of RCA, you can continue to lower the threshold values until you reach the point of diminishing returns.

By having and communicating the threshold criteria to the organization, the trained facilitators in your organization will know when they are expected to organize and lead an RCA without having to be told.

The threshold criteria need to be specific and quantified. Considerations should be given to:

- Safety
- Environmental releases/reportables
- Revenue Impacts including production and sales losses
- Excessive out of pocket costs including maintenance, cleanup and disposal, repair, overtime, insurance, fines, etc.
- Supply chain deviations such as missed shipments
- Product Quality problems
- Failures of Critical Equipment
- Failures of equipment/devices on the “bad actor” list
- Regulatory violations

The leadership team should be actively involved in establishing the threshold criteria for the area. (Refer to **Appendix 3** for an example of Threshold Criteria.)

Defining Roles and Responsibilities

An effective RCA program must have defined roles and responsibilities established for those involved. In the absence of well-defined roles, employees assume that when an RCA is to be conducted, even after they have been trained, the boss will come tell me to do it. The boss on the other hand assumes that it is obvious that an RCA needs to be completed and expects one of the employees to lead it. In this common scenario, normally nothing gets done and problems continue.

It will be important for the RCA program to have a champion. The champion should be well versed in the RCA process and will interface with the business units and/or functional groups to develop the implementation plans, threshold criteria, etc. The program champion will normally lead the development and deployment of the entire RCA program and will have oversight for all aspects of the program. The program champion will normally establish the initial communication to the organization regarding: 1) The goals of the RCA program, 2) Threshold criteria that will be followed, 3) Roles and responsibilities and 4) Reporting and action tracking.

Because most RCA's are completed by small, multi-disciplined teams with participants who possess information, expertise, or experience in one or more aspects of the problem, a team facilitator is needed. Typically, there is one facilitator/team (excepting in significant failures whereby two facilitators are common) and multiple participants. The facilitators need to clearly understand who they are and the threshold events they need to be watching for.

The RCA facilitator is responsible for assuring that the RCA report is completed and is communicated to the appropriate personnel, including local management, sister plants and the business team. The facilitator should also assure that all parties have completed their actions as planned.

The participants in the RCA team are responsible for bringing the data, facts and evidence needed to develop a sound analysis.

The role of the area leadership is to provide support for the program champion as well as provide the resources needed to conduct the analysis and implement the solutions. Having managers request cause and effect charts for unplanned failures, production losses or incidents is a great way to begin institutionalization of RCA.

The RCA team should be staffed with the personnel who have direct knowledge of the incident, but at no time should the team consist of greater than 10 members. In the case of significant events where greater than 10 participants are appropriate, the use of a "core-team" and "sub-teams" is recommended.

Training Strategy

Before you begin your RCA program, you will need a targeted training plan. Typically, managers who will not be involved in the process, except for providing resources or support, should receive overview training on the deliverables of the process, what they should expect to see and the support they will need to provide. This overview can typically be accomplished in 4 hours or less.

Participants in the RCA process need a deeper level of understanding in the process than do the managers. They need to fully understand problem definition, the principles of cause and effect, and solution identification. This can typically be accomplished with 1 day of training.

Facilitators of an RCA need a full understanding of the RCA method, in addition to facilitation experience. This skill level requires a minimum of 2 days of training so that practical examples can be completed and hands-on facilitation practice can be obtained.

The program champion should obtain the facilitator training and 1 to 2 additional days training/mentoring on the assembly, roll out and continual improvement of the RCA program.

Software

Software can be a valuable tool for assuring the consistency and quality of the RCA's, not to mention aid in expediting the development of the final report. There are many packaged software solutions available, such as Apollo's *RealityCharting*[™], or you may opt to utilize something more basic such as a Microsoft® product. There are limitless options.

Some things to keep in mind when selecting RCA software:

1. Ability of the software to support the users by reinforcing the rules of the RCA method being applied. People tend to revert to bad habits—don't let them backslide because your software doesn't include a methodological safety net. A program that incorporates wizards

and rules that reinforce the RCA method will normally pay for itself the first time used through a more thorough analysis with more effective solutions.

2. Simplicity. Choose a package that minimizes the time spent on drawing boxes and lines and maximizes the time spent on entering causes and evidence. Also look for a package that develops the final report in real time as the RCA is being input—another time saving element.
3. Choose a package with an open architecture, especially if you plan to utilize a site, or enterprise server-based application. As frequently as IT operating environments change these days, you will need a flexible package that can interface with a variety of enterprise resource planning modules, action tracking systems and other plug-ins. The best RCA software solutions available today are web-browser based. Browser-based applications can run from any location around the world as long as internet access is available. Browser-based applications require less work and programming from your IT department and are generally their preference as compared to conventional server versions. This means quicker implementation and less red tape for you.

Corrective Actions (Solutions) Tracking

In order to assure that the necessary actions intended to prevent the recurrence of a failure are completed, an action tracking system is necessary. The facilitator is responsible for assuring all corrective actions have been completed on time. Ideally, the CA tracking system should have the capability to store the

completed RCA as well as provide automated e-mail notices of actions that are due.

Performance and Pay-back metrics

Besides following up to assure all actions and solutions are implemented, a check of the effectiveness of the solutions should be made 6 months to one year after the solutions have been implemented. If the follow-up data does not show the desired improvement, the RCA should be re-opened and the deviations analyzed. A follow-up report should be issued to explain the deviations and describe the new actions that will prevent recurrence. Since the report includes a cause and effect diagram, it is very easy to re-familiarize ourselves with the details of the event even though a year or more may have passed.

An important activity within the RCA program is monitoring and reporting the payback of the RCA's. Simplicity is the key to this activity. If you make the payback calculation too cumbersome, it won't be completed.

We recommend this simple approach:

$$ROI = \frac{\text{Savings}}{(\text{Cost of solutions} + \text{RCA})}$$

where:

Savings = (Cost of problem before RCA – Cost of problem after RCA solutions were implemented)

Typically, this activity simply looks at the magnitude of the losses (lost value/incident multiplied by the frequency of the incidents.) before the implementation of the solutions versus after the implementation of the solutions.

All the loss data should come directly from the Problem Definition Significance section that has already been completed.

The follow-up data for the implemented solutions should be taken approximately 6 months to one year after the last solution has been implemented in order to allow enough "soak time". This is necessary to assure that the solutions are effective after the problem leaves the radar screen. It is routine to see ROI numbers in the range of 500%, or greater within one year after the solutions were implemented when an effective RCA method is used.

Based on data from approximately 100 Apollo RCA's in industry, the average value (net) returned from each RCA was \$17,000/year per RCA. In a typical manufacturing environment, it is common that one facilitator applying RCA on multiple problems can easily achieve \$250,000/year of added value by permanently eliminating problems. (Refer to **Appendix 2** for actual study data from Apollo clients regarding payback of their RCA's.)

How do I get my RCA Program started?

The hardest part of any journey is the first step. Implementing an RCA program is no different. However, with a little training and support, an RCA program can be implemented within weeks or months of the decision.

Successful programs typically follow these initial steps:

- 1) Establish leadership support
- 2) Identify a champion facilitator

- 3) Develop written RCA Program Plan, which includes: A) Program goals, B) Threshold Criteria, C) Roles and Responsibilities, and D) Rollout and training plan
- 4) Communicate the RCA Program Plan
- 5) Begin initial training with priority on the managers, facilitators and program champion.
- 6) Identify an incident that exceeds the RCA Policy trigger
- 7) Begin conducting RCA's with the facilitator leading the RCA according to the RCA process
- 8) The facilitator documents and distributes the report.
- 9) Develop more facilitators to handle the workload.
- 10) Monitor payback metrics—adjust threshold criteria if needed.

In your early planning, remember that it usually takes 3-4 RCA's before the facilitator becomes comfortable and confident. This is the phase where management support is most needed. A few encouraging words from the manager on the facilitator's first few RCA's can provide valuable and needed reinforcement that will result in a facilitator who is willing to take on larger problems. Once a facilitator develops the confidence in both themselves and the process, little management support is needed beyond this.

It may be necessary for the Program Champion to provide mentoring to the new facilitators until they develop the skills needed. As the results of the RCA's become visible, the program champion will be able to determine what, if any, additional coaching and mentoring is needed.

Over the long term, the facilitators should be expected to monitor for threshold events in their area and act independently to pull their RCA team together to analyze the event, implement the solutions and communicate the findings via the RCA report.

What are the RCA priorities in my facility?

No matter what business we are in, finding problems that cause excessive expenditures, production delays or customer service failures is not difficult. The problem is finding the time to tackle them. In order to determine the right time to apply RCA, you need to have a general idea of the significance of the incident. Once you understand the significance, whether it is \$500,000 lost profit, or a broken leg, you should compare that to your "RCA threshold criteria policy" that clarifies when an RCA should be conducted.

How do I engage my workforce in my RCA program?

A common barrier for RCA program deployment is overcoming the general lack of trust existing in the workforce. Without the trust of the workforce, people will not provide the causes needed to develop effective solutions; rather they will withhold critical information in order to protect themselves or their co-workers.

There are several ways, among many, to overcome this lack of trust. The most effective way is to demonstrate your unwavering commitment to finding effective solutions and not punishing. One way this can be accomplished is by

attacking a problem laden with human causes and assuring the final solutions target causes, even if those causes are human causes while not assigning blame. It may take several months of repetition at this before people are willing to open their minds and accept that *things are different, someone is going to listen to me and I'm not going to get blamed.*

One thing to remember is that if your solutions are going to tackling human issues, you must address the underlying causes that are driving the human issues if you are to be effective. Because humans can be extremely variable, frequently the most effective solutions attack conditional causes. When a conditional cause, necessary for the problem to exist, is eliminated, the problem is solved regardless of what the people do from then on.

Other suggestions for over-coming the trust barrier include: 1) Demonstrate your commitment to your employees by investing in their capabilities through training. Effective RCA training will reveal that blame and punishment are not effective solutions. (Note: there are times when discipline is appropriate as in cases of willful violation and malicious intent, however as much as we would like to believe, these situations do not occur that frequently.), 2) Initially, if you are getting resistance, rather than tackling problems that exceed your threshold criteria, begin by analyzing problems that are "hot button" issues or otherwise important to the untrusting workers. By doing so they will be engaged in the process, will have a vested interest in contributing and will buy into the solutions. Within 2 or 3 RCA's, you will see their trust increase.

3) Establish the "What's in it for me?" A key to engaging any employee in the RCA program is making a business connection between their job and the bottom line. This is revealed in the "significance" section of Problem Definition. Employees see how their efforts can work to reduce or eliminate the losses and they also gain a new appreciation for the total impact that problems have in the organization. Further, they can see "What's in it for me" by being able to quantify and track the value of their efforts to management.

For those employees who are not motivated when they see how their problem solving efforts contribute to the business success, informal recognition, when attached to the RCA team's efforts may do the trick. It could be as simple as verbal recognition of the RCA team at a tail gate meeting, or it could be through a more formal method such as a memo. There are many ways to recognize employee's contributions to the RCA program, without issuing monetary rewards, that are just as meaningful. The key is to recognize the behaviors you would like to see continued.

How do I keep my RCA program vibrant and evergreen?

Value drives the RCA process. When people see how they add value to the bottom line of the business, they create the energy and enthusiasm to maintain the program. If the participants are being recognized and rewarded for eliminating the defects in their processes through RCA, and the successes of the RCA's are visible, they will continue its use.

Another key element to sustaining the program is for the area manager to provide feedback on the process both positive and constructive. If results are not being obtained, the causes need to be investigated and course corrections should be made quickly. If results are being obtained, the occasional support statement or recognition can be a powerful reinforcement to keep the energy high.

What benefits can you expect from RCA?

The benefits you should expect after implementation of an RCA program include:

- Elimination of Waste
- Improved Analysis
- Clear & Concise Reports
- Establishing a Prevention Culture
- Improved Cross-functional teamwork
- Improved Understanding of problems, others roles and other functions
- Improved Communication by Reducing Story Telling
- Reactive to Proactive transition

Becoming Proactive

While RCA is viewed by many as primarily a reactive tool, it becomes a proactive tool when applied properly. For example, consider a premature gearbox failure due to poor lubricant because no oil analysis was in place to monitor oil quality. Subsequently, foreign particles contaminated the oil and resulted in premature wear. If it is further discovered that there was no oil analysis program to detect contamination, one of the corrective actions from this RCA should be to implement an oil analysis program for

all critical equipment at the site. In this situation, many other pieces of equipment will be proactively addressed as a result of the findings from just one RCA.

Close

The key to an effective RCA is to assure that: 1) The problem is defined, 2) The analysis breaks down a problem into its individual causes, both actions and conditions, and documents them on a cause and effect chart, and 3) Solutions attack and eliminate the causes.

The key is for people to think about the causes and resist the temptation to blindly accept that “stuff happens”.

Once the RCA method is understood within an organization, the RCA program will serve as the foundation to support the RCA process. Defining the RCA program goals, roles and responsibilities, training strategy, threshold criteria, action tracking system and effectiveness metrics will be the first step towards assuring the success of the program.

APPENDIX 1 – APOLLO RCA PROCESS SUMMARY

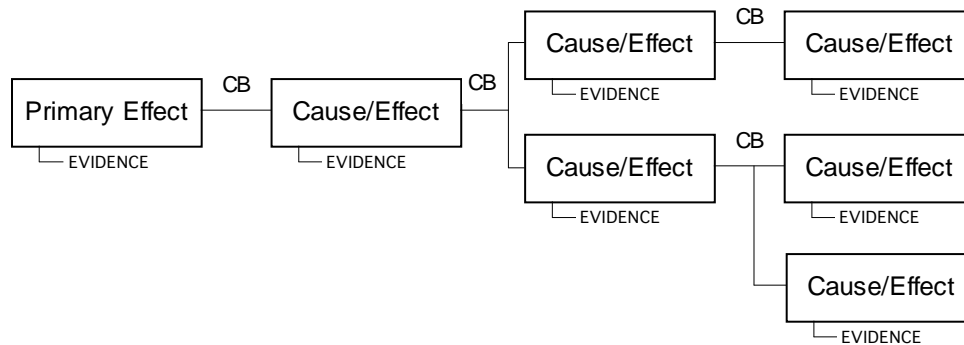
Apollo Root Cause Analysis

FIX THE CAUSES, NOT THE BLAME

Step I. Define the Problem

- **What:** Primary Effect - What you want to prevent from occurring.
- **When:** Date? Time? Status?
- **Where:** Physical Location? Process Location?
- **Significance**
 - Safety: Injuries? Potential?
 - Environmental: Regulations? Spills? Potential?
 - Revenue: Pounds? Rates? Delay? Hours? Quality? Dollars?
 - Customer Service: Delay? Customer Satisfaction?
 - Cost: Materials? Labor? Dollars?
 - Frequency: Occurrences? Timeframe?

Step II. Create an Apollo Cause & Effect Chart



- For Every Effect Ask “Why?”
- Look for Causes in Actions & Conditions
- Connect Causes with “Caused By”
- Support Causes With Evidence or Use a “?”

Step III. Identify Effective Solutions

Challenge Each Cause, Offer Possible Solutions & Be Creative

The Best Solutions Must:

- Prevent Recurrence
- Be Within Your Control
- Meet Your Goals and Objectives

Step IV. Implement the Best Solutions

Table & Track the Corrective Actions

Causes	Solution / Corrective Actions	Name	Date
--------	-------------------------------	------	------

APPENDIX 2 - EFFORT vs. PAYBACK FOR RCA

Data gathered on approximately 100 Apollo RCA's as applied in the chemical industry has shown the following averages:

Average cost/RCA

Team meeting to develop C/E chart (5 people @ 1 hr)	=	5	Hrs/RCA
Report writing, communication, action implementation	=	10	Hrs/RCA
Misc. (Lab failure analysis, testing, etc)	=	5	Hrs/RCA
<hr/>			
Total Person hours/RCA	=	20	Hrs/RCA
Total Cost/RCA (\$75/hr)	=		\$1,500

Payback within first year after implementation

Average value* (\$ profit) returned/RCA within one year	=		\$17,000
---	---	--	-----------------

Return on Effort

Payback/RCA = \$17,000/\$1,500 = 11 fold after 1 year

*Value is defined as the combined profit from decreased maintenance costs and increased profit from improved production for sold out plants. The number shown, \$17,000, represents an average of both sold-out and non-sold out plants in the chemical industry. The "average value" figure also incorporates the cost of the solutions.

For plants that weren't sold out, the "Average Value" number included only the maintenance and operational savings numbers and no additional profit from sales were realized. In sold out plants, it was not uncommon to see \$50,000 - \$75,000 value returned/RCA within the first year; this included additional sales on production when the RCA solutions increased capacity.

In some cases, this savings number can be substantial--one systemic problem that was solved in a plant resulted in an annual added value (pure profit) of approximately \$1,000,000/year. The problem had existed for seven years and had never been solved until the RCA was completed.

Normally, when RCA's are applied to systemic problems, the payback occurs EVERY year through the life of the solution and consequently, the overall payback greatly exceeds this one-year payback value that is shown in the table below.

APPENDIX 3 – EXAMPLE THRESHOLD CRITERIA

Shown below is the suggested format for assembling and communicating your threshold criteria; in other words, when you expect your organization to perform an RCA

(Note: The values and categories used below are for illustration purposes only. The categories and values should be adapted to reflect the goals of your organization)

