

## **Team Root Cause Investigation A New Approach to an Old Problem**

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Problem solving is as old as humanity itself. It was necessary for survival. However, it hasn't been until the last few decades that much had been done to study and document this ability. Today, you can simply surf the web for problem solving and find at least a dozen documented methods available to analyze problems. One of the more notable developments came from Dean Gano as he pondered the Three Mile Island nuclear accident. After a few years of studying problem solving, he developed the Apollo Root Cause Analysis methodology.

At The Dow Chemical Company (TDCC), we quickly adopted this problem solving methodology and taught it to the masses, myself included. We have been using the Apollo method for at least twenty years now and I have facilitated at least 400 root cause investigations (RCI's) personally. With a company as focused on continuous improvement as TDCC, you would expect that we would have solved all our problems by now. Of course, you know that's not the case at all. Although some of our businesses are very effective at applying the Apollo methodology, I have found that we routinely struggle with a variety of issues, including ineffective facilitation, ineffective corrective actions, hesitancy to deal with behavioral issues, poor event validation, the belief that event ownership and facilitation are a punishment, and more.

In one of the businesses that I support, we took a novel approach to try and address these issues. In this paper, I will explain our case for change in this particular business unit, the team facilitation concept we developed, the work process that was documented, and the results we have seen since implementation.

### **The Case for Change**

One of the greatest dangers for any organization is redefining "normal". It's amazing how quickly this can happen. In a matter of days, that new sound from a pump turns into "It's always sounded like that." That pretty much sums up where we were. We had lost the eye for small change in our business and were constantly plagued by significant failures. In hindsight, the case for change in our particular business unit was pretty obvious. It just took us years to see it.

We were experiencing a significant number of repeat events because our RCI's were not effective for a variety of reasons. Our facilitators were inconsistent. We were hesitant to address behavioral issues. The pre-RCI investigation work and evidence retention were lacking. The corrective actions we identified often didn't prevent reoccurrence. Even valid corrective actions were often closed without meeting the real intent of the action that was identified in the RCI. Sometimes they were closed without even being done. Our event validation was often a "check-the-box" exercise.

Things weren't all bad, but if you had to give us a grade, it would have been barely passing. In our relatively small business unit, the cost of waste from down time, equipment failure, and lost production was in excess of \$17MM per year. We had approximately 150 quality events per year and quite often had significant product losses associated

with them. The worst part was that this performance had become part of our culture; an expectation. Turning it around wasn't going to be done over night or simply with some new program.

## **Defining the Vision for the Future**

The EH&S Leader, Quality Leader, and myself as the Reliability Leader for the business met several times and discussed how we could take our RCI facilitation to the next level and change our culture. We talked about "certifying" our facilitators, improving our training, ensuring adequate pre-work, delivering a consistent work product regardless of who facilitated the event, creating an environment where facilitation was a desired thing, and overhauling our validation process. However, we were slow to implement anything. After months of just talking, I decided someone needed to do something. So, I approached the Business Leader and got his support to organize a formal team of facilitators. I didn't have much of a plan, just a desire to see things change. It was an easy sell. The Business Leader gave me his support and the latitude to form the team, define the work process, and identify the deliverables.

Around the same time, the Business Leader started working in parallel to change the culture. He started talking to everyone in the organization about being a highly reliable organization (from *Managing the Unexpected*, By Karl E. Weick and Kathleen M. Sutcliffe). The organization started to measure the cost of waste, monitor quality data, and share learnings. One of the most important things the Business Leader did was to emphasize the need for patience; that there were likely to be bumps in the road, but not to let that derail the organization from the journey.

## **The Results**

Before describing what was done, I would like to jump forward to the results. Since we had multiple efforts going on at the same time in the business to change the culture and turn performance around, it would be foolish to take sole credit for the results. While I can't quantify the exact impact, the facilitation team was a major force in these changes.

After just two years:

1. The cost of waste in our business went from \$17MM to under \$2MM and is still improving slightly.
2. The number of quality incidents went from 150 to under 30 events and has moved even lower since.
3. The magnitude of the events has dropped dramatically. Today, it is rare to lose a batch.
4. The number of events that hit our business RCI trigger list is declining.
5. Repeat events have dropped. Prior to implementation, we were experiencing greater than 10% repeat events. Today we are well under 5%, indicating that we are doing better at preventing reoccurrence.

## **The Team Concept**

One of the over-arching goals I had for this team was to deliver a consistent, high-quality RCI no matter who facilitated. While each facilitator has their own style, the work process we follow from initial notification of an event to the post-RCI documentation is identical. Using the RealityCharting® software tool from Apollo makes this much easier to achieve. Every one of our team facilitators uses RealityCharting and must be proficient with it before independently facilitating an event. This allows me to assign any facilitator to any event and they will provide the same top-notch facilitation to the customer. I wanted to avoid the customer developing a preference for certain facilitators because they delivered something different than other facilitators.

One of my other goals was to make facilitation a fun and desirable skill. In our business, event ownership and facilitation had become a burden and a real negative experience. Basically, one person was responsible for investigating, facilitating, documenting, communicating, and validating the event. In addition, they ended up with most of the action items. As you might expect, RCI effectiveness was low and repeat events were common. Operations viewed them as a witch hunt for the guilty. RCI's were not a positive thing for anyone.

We did a number of things to address this. First, we made a distinction between the event owner and the facilitator and created a partnership. The event owner, typically a plant engineer, would take care of pre-investigation work and set up the formal RCI meeting. The facilitator came in and did just that, facilitated. The facilitator is a neutral third party which frees up everyone else to participate in the RCI. After the formal RCI meeting, the facilitator provides all the reports from the RealityCharting tool. The event owner agrees to complete the documentation in our company tracking tool.

Secondly, I assign facilitators to events outside of their area of expertise. For example, my background is mechanical. However, I facilitate mostly quality and safety related events. A quality person might facilitate an equipment failure. This frees me up to participate in mechanical failure RCI's and not worry about facilitating, and when I do facilitate outside of my area of expertise, it's a learning experience for me as well. Another side benefit is that it allows the facilitator to get away with asking some very naïve questions about things people have taken for granted for years. (i.e. For a pump seal failure – The pump exists. Why do you have a pump? The seal failed. Why do you have a seal?)

Next, we recognized that serving on the team is an additional role. Facilitators need to lead enough RCI's to stay sharp on their skills, but not get burned out. We studied the number of events that had been occurring in the business and recruited sufficient facilitators so that they wouldn't have to facilitate more than two RCI's per month. We started with six facilitators on the team, but have since been able to reduce that to four. Most importantly, they needed to know there was an end date. Team membership is two years and we have an active succession plan to make sure this happens.

Finally, we changed our approach to behavior issues. We recognized that people don't intentionally make mistakes, but they do happen. So, we made sure supervision dealt with blatant behavior issues outside and prior to the RCI. This was very liberating to the involved persons. Since consequences of their behavior had already been dealt with, it allowed them to share freely in the RCI with much less fear. The most important thing we have learned is to always try and go three "whys" beyond the behavior on the cause and effect chart. Instead of stopping at Joe Operator closed the wrong valve, we are now asking Joe what led him to close that valve. This usually leads to identifying a management system failure like Joe was following the procedure and it was wrong. It was wrong because we never validated it correctly. Naturally, Joe feels a whole lot more positive about the RCI experience.

## **Assembling the Team**

Putting the initial team of facilitators together was relatively simple. The business leaders got together and discussed potential candidates for facilitators. We took several things into consideration; aptitude, people skills, work load, desire, previous training, leadership ability, and their role in the organization.

Since this team was new, there were a number of tasks occurring concurrently. We developed the training curriculum, documented the team charter and the work process that would guide the team, revisited our business RCI trigger list, started having team meetings bi-weekly (now monthly), and started tracking effectiveness metrics. Each of these items will be described in more detail in following sections.

## **Team Leadership**

Because I had the most facilitation experience in the business and the vision for where the team was headed, I was asked to assume leadership of the team. As the team leader, I am accountable to business leadership for results and I share metrics with them.

I became the focal point for all RCI's in the business. When a RCI trigger is met, I am contacted by email. I forward pre-investigation documents to the Event Owner for them to complete while I work to identify a facilitator in parallel. I forward the name of the facilitator to the Event Owner and the formal RCI meeting is scheduled when the pre-investigation work is done.

I have never had to tell anyone on the team they were going to facilitate. I send a request to the team and they volunteer. We do monitor how many each person has facilitated and it has stayed very consistent over the years with very little intervention on my part.

When all the documentation was in place and the team members were trained, the new work process for facilitation was communicated through our business 'management of change' system. All business employees were required to acknowledge they had read the change and were aware how to request a facilitator when a trigger has been met.

## **Training**

Achieving consistent delivery of facilitation has its foundation in our training program. Our team developed the training curriculum and it has been slightly refined over the last couple of years. Most of the training items address understanding internal company work process issues, but the two most important items are the two-day Apollo "RCA for Practitioner" facilitator training with RealityCharting software, and our mentoring process.

After new team members complete the Apollo training course, which includes the hands-on RealityCharting training and a copy of the software, we immerse them in our mentoring process. A new facilitator will sit in a couple of formal RCI's and observe a trained facilitator. Then the new facilitator will be moved to the computer where they will use the RealityCharting software to document a RCI while a trained facilitator leads the meeting. Next, they will be moved to the facilitator role while a seasoned facilitator documents the RCI with the software. Finally, the new candidate will facilitate and document a couple of formal RCI meetings with the Team Leader present as an observer. When the Team Leader determines the trainee is ready to facilitate independently, the formal training is done.

The mentoring process takes a month or two and is pretty extensive. A lot of coaching is done throughout the process. My goal is for each new facilitator to be able to facilitate and use the RealityCharting software at the same time. It is not something everyone can do, so the mentoring process is designed to ensure we have selected people that are capable of performing both tasks. Informal mentoring continues in our monthly team meetings where facilitators will mention issues they encounter in a roundtable session.

When the formal training program has been completed and the Team Leader has put the stamp of approval on the new facilitator, they are recognized with a monetary award recognizing the completion of their training and their commitment to the team.

## **Work Process Details**

### **RCI Trigger Criteria**

The RCI trigger list is one of the most important tools for the Team Leader. In Dow, we have a very long global trigger document with dozens upon dozens of ways to hit a trigger that initiates the need for a RCI. Each business can add business specific triggers as well.

I took our business trigger list, which included all the global triggers, and modified it to help guide me as the Team Leader. The first thing I did was draw a distinction between the serious and minor events. Serious events are facilitated by our team, while minor events are given to back to the business to facilitate with someone outside of our team. Minor events quite often don't go through the formal RCI process, but they are studied and addressed as needed. Occasionally, I will agree to assign a team facilitator to a minor event if there is significant learning value in doing so. The trigger document is my guide.

There were two obvious directions available when I modified the trigger list for our business. Our business, having multiple plants and a fair number of staff people could handle a larger number of RCI's without it being a burden to the business or the facilitation team. Had there been too many events or a small staff, we would have had to modify the trigger list to set the thresholds higher in order to focus on the highest priority issues. For example, an appropriate trigger might be any unplanned event that takes the plant off-line for greater than 24 hours. As the number of events hitting the trigger starts to go down, the trigger threshold can be lowered as needed. This has been done in other Dow businesses successfully.

One important note is that our trigger list is not limited to things that go wrong. We also have a trigger to facilitate successes. In other words, we want to understand the causes for success so we can replicate and leverage them. In the recent past, our team has facilitated events for a highly successful plant turnaround, for a reduction in the site safety incidents, and even as a compare and contrast exercise between a highly successful campaign and one that was not. Facilitating events related to successes are notably different, but really help reinforce that tool is not about finding the guilty to punish them.

### **RCI Preparation and Pre-investigation**

The communication from the RCI Team Leader to the Event Owner is documented in the form of a template. A pre-investigation template is provided to the Event Owner to prompt them to make sure computer data has been saved, evidence has been preserved and analyzed, subject matter experts have been consulted, and more. Once the pre-work has been completed it is shared with the facilitator and the formal RCI meeting is scheduled. We require that a minimum of two hours be reserved for the meeting. Initially, we found that a high percentage of RCI's needed a follow up session to complete due to incomplete investigation.

### **RCI Facilitation**

RealityCharting is our tool of choice. I find that it speeds up the creation of the cause and effect summary dramatically, but it does require you to take more time in the solution generation and evaluation process. I have absolutely no problem with this. That's the way it should be. The RealityCharting software also makes it fairly easy to perform a dynamic analysis, the study of several related events. We were able to do this with all of our quality events in our business unit to find common root causes. We also did this on our site to find common root causes for our loss of primary containment events.

Our facilitator training emphasizes that the facilitator is in control of the formal meeting. In the past, I have observed many RCI's where the bulk of the meeting time is consumed discussing evidence and creating the cause and effect summary, only to rush through solution generation and do a really poor job of it. A natural breaking point in the formal RCI process is after the cause and effect summary is done. If there is inadequate time to complete the solution portion of the RCI, our facilitators are empowered to stop the RCI and request a follow up session to complete it appropriately. We refuse to rush the RCI process.

### **RCI Effectiveness**

A few years ago, one of our Reliability Leaders led a Six Sigma project to determine what constituted a high quality RCI and what impact high quality RCI's had on plant performance. The results were quite interesting. The project identified seven key elements to a high quality RCI, such as having a trained facilitator, pre-investigation work completed in a timely manner, having key personnel in the formal RCI meeting, etc. The most exciting result was that about six months after the quality of the RCI's improved (by measuring the seven key elements), the asset capability and asset mechanical reliability of the plant started to improve. We have seen this in our business unit as well.

The seven key measures are now tracked by the majority our businesses in a web-based tool which makes data entry and reporting very simple.

### **Documenting the RCI**

After the formal RCI has been completed, the facilitator generates reports from the RealityCharting software and pastes them into a standard communication template that is sent to the Event Owner via email. This includes the

original RealityCharting file, a .pdf copy of the cause and effect chart, a Word file containing the final report with solutions, and a Word file of the action item list, if there are any.

The Event Owner completes the documentation of the event in our internal web-based tool. Solutions are cut-and-pasted from the final report into our tool where they are managed until completed.

## **Leveraging RCI Learnings**

Leveraging the learnings from the RCI is just as important as preventing recurrence of the original event. There are few things more frustrating than sitting through a RCI, when another plant had the exact same event a few months earlier and you didn't know about it.

We do a number of things in our business unit to share the learnings from our RCI's. As we are developing solutions in our formal RCI meeting, we will also discuss if there are other situations similar to the one we are investigating. If there is an opportunity to share with other plants in our business unit or the greater company, we will capture an action item to leverage the learning to them. In our web-based documentation tool, we can simply check a box to have a summary of the event added to a shared learning database that is easily searched by anyone in the company.

In our particular business unit, we also have a monthly sharing session with the engineering staff where the event owner will share a summary of the event and the key learnings. Key learnings that need to be shared with the entire business unit, including the operations staff are identified and included in weekly safety tailgate meetings.

In addition to leveraging event learnings, we are also leveraging this team facilitation concept. In the last year, we have helped four other business units develop the team facilitation concept. We provide copies of all the documentation and help the new business unit customize it for the specific needs of their business unit. Most of these leveraging opportunities are the result of one of our team members succeeding off the team and moving to a new business unit where they promote the concept.

Our facilitation team is also being expanded to include a couple of related business units. We are currently adding six more facilitators and starting the training and mentoring process to be able to handle the extra demand for facilitators. As a side benefit, our facilitators will get exposure and experience working in a business unit outside of their own.

## **Event Validation**

For our business unit, event validation was the last piece of the puzzle to be put in place. We improved our facilitation with the team concept, but we hadn't received all the benefit we thought we should have. As we started digging into the issue, we found that event validation, in our web-based tool, had become a check-the-box exercise. We started auditing some closed and "validated" events and found that many of the solutions that were identified during the RCI were not completed as intended, many were just closed saying the solution had been considered, but was not implemented. In many cases, the RCI that should have prevented recurrence of the event was negated by poor implementation of solutions and inadequate validation.

To resolve the validation issue, a two person team was formed. Every completed event is now reviewed by this team and each solution is reviewed to ensure the action taken was appropriate. An appropriate time lag is needed between the completion of the solutions and the validation to ensure the solutions have been effective. We use six months as our guide before trying to validate an event. Now that everyone knows the validation team is going to hold them accountable, the follow through on solutions has improved and validation is much more effective. We anticipate that we will see another step change in repeat events due to having the validation process in place.

## **Conclusion**

In our business unit, improvement of the RCI work process has truly been a team effort. While we still have room for improvement, we have proven that RCI facilitation can be less of a burden to the organization, done effectively, and even be a positive experience. The team facilitation concept certainly has helped paved the way to better plant performance, less severe events, reduced waste, and a much more positive RCI experience. If root cause investigation at your company isn't meeting your expectations, maybe it's time for a new approach.