

## **Problem Solving & the “Error Pyramid” – A Synopsis**

When faced with the task of “Improving Plant Efficiency” the average plant manager breaks the task down by the five or six existing “Departmental Silos”. Each silo leader then subdivides responsibility, repeating the mistake, he then passes it on to individuals. As a result, we see young intelligent engineers overwhelmed by the task handed to them of – “Get out there and improve maintenance”. The situation is not so bad for the less intelligent or those who have become automatons – they just keep repeating what has gone on forever and collect another paycheck.

What the plant manager needs is a better way to visualize his situation, a method that will allow him to develop a new strategy. The following insights are based on work done at MIT and many other professors in “Human Error” at international centers of learning. The “Error Pyramid” is unique but the remaining techniques and technologies have been established for fifteen years or more.

**Insight # 1** – Most people are familiar with the triangle hierarchy of safety incidents that shows that for every fatality there are seven serious accidents, and dozens of minor incidents, and below that many hundreds of near misses. By reducing, the number of near misses there will be a corresponding number of minor and serious injuries.

Taking the four main activities involved with manufacturing - Safety, Reliability, Quality Assurance, and Operating Performance (Accuracy) they can all be viewed as similar triangles. When placed together they form a pyramid with a four-sided base. The Error or Issues pyramid.

**Insight #2** – People in each silo see their problems as unique and have little time or apparent incentive to work on the other guys issues. They do however use common primary methodologies for solving problems within each of them – Root Cause Analysis, Cause & Effects Analysis, FMEA, etc.

In our 30 year+ experience, we always see that any change in one area affects the remaining three. In a very specific sense, we always see an improvement in safety and quality as reliability and operational accuracy improve.

**Insight # 3** – Efficient manufacturers have small “Problem / Error Pyramids” while the less efficient have massive pyramids which overshadow everything else i.e. the classic reactive mode of operation.

The more errors, and mistakes made the larger the pyramid becomes alternatively the more problems that can be solved the smaller it becomes. Unfortunately, this is a dynamic situation and even though people solve problems every day the “Pyramid of Problems” never seems to get smaller. Insight # 4 will explain why this is.

**Insight # 4** – We, and the systems we surround ourselves, are the products of the human mind. They are by our very nature prone to make errors at a constant rate ( See David L Weiner’s books on the human mind). Having an understanding of how and why we make mistakes is therefore critical to the task of reducing their frequency and effect.

**Insight # 4A** – Nobody ever deliberately makes a mistake particularly those working among a group of peers. As an example football players often drop passes but nobody does so deliberately.

## Reducing the Number of Errors Made

To effectively reduce the size of the Error Pyramid we need to not only get better at solving problems, but also to take some action that will reduce the number of new problems being created.

**Insight # 5** – “Error Proofing” is a series of proven methodologies that will help to - clearly identify the sources of errors and - methods to minimize and reduce their impact on the organization.

**Insight # 6** – To be most effective the system needs to be “non penal” so that it allows us to see all the errors which are then classified by type. With this information, responses can be formulated to address the issues across the organization. Not surprisingly, you will find that 90% of the issues identified can be considered as Latent or Systemic.

Things are slow to change in most organizations. Many old systems were driven by veiled versions of “The beatings will continue until performance improves” and we have seen just how ineffective this has been. As one Director of Manufacturing of a plant with an excellent error proofing program said “I can see the value of this non penal system but if the screw up was big enough ..... someone would still have to go”

Let us assume that your company has one of the few problem-solving methodologies (RCA etc) that produces documented multiple root causes that also include the latent and systemic issues. (Even though the team is impotent in initiating corrective actions ). What’s next?

**Insight #6** – having achieved awareness of a primary issue, you need a formal program of “Error Proofing”. The methodologies are applicable across all four silo’s and the training involved should go some way to eliminating the existing silo mentality.

Developed in aviation industry and rapidly adopted by the Nuclear and Health Care businesses the techniques are saving billions of dollars each year. Our experience using formal error proofing techniques in the process industry has produced some amazing improvements.

In light of this information what should our intelligent young engineer be doing?

Volunteer his services on problem solving teams in other disciplines; Help the teams differentiate the latent and systemic causes from the incident detailed causes; Promote the use of simple barriers to errors such as “Poka Yoke”(Fool Proofing) and the use of checklists for critical actions; Finally – bring an understanding that by reducing the number of errors made we are in effect turning off a faucet running into a bath we are trying to drain.

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