

Need to conduct Failure Analysis in India and the Middle East

A TCR Engineering Services White Paper

Despite the great strides forward that have been made in technology, failures continue to occur, often accompanied by great human and economic loss.

In countries, such as India and the Middle-East most Oil and Petrochemical Refineries, Chemical Plants and other Industrial plants are commissioned with foreign collaboration with most equipment and vessels imported from other countries. Information regarding the material of construction and component design is often a well-guarded secret. Failures are costing Indian and Middle-East plants and manufacturing units billions of dollars a year and are draining the productivity potential of the respective nations.

When routine failures occur, mechanics and operators generally make judgments about causes. It is a natural tendency for people to want to know why something happened. The problem is that most of these people are not trained to find causes. When they are trained, they are seldom given the time to practice their new skill. When given the time to do failure analysis, they have a really hard time having their analysis and recommendations taken seriously as it is not detailed or well-presented.

TCR Engineering Services (TCR) uses a methodical approach to determine the mode and root cause of a failure. At TCR, Failure analysis or problem solving is more than just brainstorming a solution to an identified problem. Successful analysis is achieved through a structured technique which uncovers the facts of the incident and adheres to every step of the analysis process.

Understanding KPI's and measuring ROI

Once TCR Engineering understands the Key Performance Indicators (KPI) that our client's management team is responsible for, we mold our failure analysis effort around to attaining those goals.

For example, if the manager at the client's site is responsible for increasing throughput through his unit by 5% in the calendar year, than that will be the scope of our business case. Following this discussion, TCR would begin to understand what is the potential design capacity of the unit in its current state and compare it against what it is actually producing on an average basis. This difference is commonly referred to as the GAP. This gap is expressed in units that the manager will understand (i.e., - tons/hour, feet per minute, barrels per day). Then these units should be converted to a rupee value based on the current market value. This value will depict the potential that is available immediately within that unit.

TCR determines the specific reasons as to why component is operating at a certain level versus its potential by conducting a detailed Failure Analysis study on the unit / component in question. This process would break down the system into subsystems.

Once these subsystems are identified, we would use historical production data (from hourly workforce and electronic data systems) to find out the specific reasons that throughput was interrupted. We would record how many times a year these events occurred and how much they cost when they did occur. Cost/occurrence include (but are not limited to) manpower dollars expended, material replacement costs and lost downtime (lost profit opportunities).

A completed failure analysis study provides a significant Return On Investment (ROI) through complete understanding towards the basic aspects of designing, operation and manufacturing to ultimately increasing the life of equipment; thereby reducing operational costs and improving the company's competitive advantage.

Indigenization of foreign equipments and material can be partially fulfilled by detailed failure analysis. Failure analysis is also advantageous for claiming insurance or vendor part replacements.

Failure Analysis Objectives

The first step in managing the actual failure analysis effort is to determine what you expect from the final outcome. During TCR's initial meeting with our clients we develop a charter that clearly delineates the terminal objective of the analysis. This is further enhanced through the development of critical success factors that outlines whether or not the terminal objectives have been obtained.

At TCR Engineering, we adopt a disciplined vertical problem solving methodology used to determine levels of root causes of specific failure events. The following process is necessary to implement a successful failure analysis project.

1. Prioritize - Determine what is most important to work on.
2. Analyze - Analyze the failure event to determine root causes.
3. Recommend - Develop recommendations as solutions to the causes discovered.

The Failure Analysis Report

The failure analysis report represents the culmination of the analysis effort and the beginning of failure elimination. The goal of any failure analysis by TCR is targeted towards the elimination of identified causes.

The final failure analysis report provides solutions with expected returns on investments but also identify's how the failure occurred in the first place. To accomplish this event summary, a description of the failure mechanism and list of recommendations are included in the report.

The event summary is nothing more than a brief description of how the failure was first noticed how long it has been going on and the method(s) used to isolate or mitigate the consequences of the failure. TCR will examine the Service condition at the time of failure and record the components Prior service history including Manufacturing and processing history of component.

The failure mechanism can be thought of as a summary of the root cause(s) that led to failure occurrence. TCR will chronologically characterize the things that must occur in order for the failure to manifest itself. The report will outline the Mechanical and metallurgical study of failure including the Metallurgical evaluation of quality.

The list of recommendations will explain what, when and who* (if TCR consultants are on the project) is going to be responsible for implementation, and also include a recommendations for prevention of similar failures.

The TCR Engineering Approach

TCR Engineering Services failure analysis team is always headed by a senior metallurgical engineer who has the following characteristics:

- Ability to remain unbiased and reject conventional wisdom.
- Ability to facilitate a group of people toward a common objective.
- Trained in logic tree approaches to failure analysis.
- Affinity for listening and questioning for understanding.
- Patience and perseverance.

The Failure analysis team is backed by our well-equipped material testing laboratory in Mumbai, India. Founded in 1973, TCR Engineering is India's foremost NABL and ISO 17025 accredited independent material testing laboratory. TCR tests ferrous and non-ferrous metal, casting & forging, sheet metal, bar, pipe, stainless steel, nuts, bolts, engineering goods, non-metallic materials such as polymer, ceramic, glass, machined parts, and machine tool components as per international specifications or client-specified standards.

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