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"Machinery & Equipment Failures & Analysis"

I. Machines, equipment and tools malfunction or break due to human error.

Understanding the Key Factors

First it in necessary to determine what actually happened. A true "root cause analysis" RCA may not be possible or may be cost prohibitive, however, a reasonable determination of the primary cause should be sought. The failure of a system or component can manifest in many different ways but ultimately a human somewhere was involved. Therefore, that "person" is ultimately responsible. From design, material selection, manufacturing, modifications, maintenance and operation and ultimately retirement, each aspect of a machine's life is or can be controlled.

II. Determining which human is responsible.

Drill down to the first event

In order to find the initiating action, a process of investigation determines the first event. This will assist in determination of who is responsible for the act or omission that lead to the machines inability to perform its intended function?

Determination of the first event, the primary cause or the RCA can be complicated, difficult and expensive. There are various scientific methods and failure analysis procedures that must be completed. Deciding which one is appropriate or practical requires experience and an understanding of what can be accomplished.

What could have been done differently?

In order to evaluate what was done and what could have or should have been done to prevent the failure, a consideration of the safeguards which were in place as well as the safeguards that could have been in place need exploration. During this study, alternative process procedures and options are measured.

Regulations, standards and codes can provide guidance but should not be relied upon as a sole determination as to causal responsibility. Often the regulations, standards and codes are minimal guides or assist in uniformity and ease of handling.

Every failure happens because someone somewhere has done something wrong or failed to do what was necessary. Habits, culture, awareness, attentiveness, knowledge- training are some

considerations when studying why or which human committed the error. Once a primary failure mode or RCA is established, who, how, or what can cause a piece of equipment, component or system to malfunction can be discussed and the ramifications of such a failure can be understood.

III. Strategies for the best outcome.

First, gather as much information as possible. Not everything will be pertinent, but knowing what data is available will enable a better grasp of the bigger picture. Too many times a lack of understanding of all the factors involved leads to poor decision making and results in lost time, inefficient use of resources and higher costs.

Keep on open mind and only work with experts that do the same. Preconceptions and expectation bias will cause to poor decision making, lost time, inefficient use of resources and will result in higher costs. Bring together your team of specialists / experts. Once the event occurs is not the time to start looking for or assembling a team to evaluate the failure. By the time your team is ready it will be too late. Prepare now. Formulate a plan. Vet your experts.

When assembling your team think about why machines, tools or processes break?

> Typically three broad categories are used: Design factors; Processing (manufacturing, assembly, etc); Service environment.

Within the categories, consideration of processes and handling are examined. Such as design &/or manufacturing issues, specification of material, service and maintenance issues, use, abuse, misuse, and other.

IV Interpreting the Results

Determination of why something failed can be motivated by a number of different aspects and different parties may have different motivations. But the final result should be a clear understanding of what happened and who did what.

A human designed the machine or tool and a human manufactured and assembled the components, and a human maintained, serviced, and possibly modified the machine or equipment. A tool is not needed unless a human uses it, therefore the use, service conditions, application and retirement of each tool, machine or piece of equipment can be attributed to a user.

Identifying the specific cause or chain of events that led up to and resulted in an unintended event will reveal the person that could have or should have done something differently.