

14 June 2005

### **Getting the Best Out Of Failure Analyses!**

*Failure Mode and Effects Analysis (FMEAs) have been used by many organizations for long. The question is...are they being used correctly?*

Failure Mode and Effects Analysis (FMEAs) is not a new concept or buzzword that can be used to achieve instant benefits. It is an interesting quality tool, which has been used by many organizations over the years. Apart from the automobile industry, industries like aerospace and electronics have been using FMEAs successfully.

The problem however, is that most organizations that implemented FMEAs have failed to realize the expected benefits. Despite having read a number of books and publications detailing the use of FMEAs and undergoing sufficient training sessions, FMEA teams have not achieved absolute success. Informal surveys reveal that most organizations using FMEAs do so in order to meet a quality audit or a customer requirement.

A negligible number perceive FMEAs as a powerful tool for improving organizational performance. Such companies have reported higher levels of customer satisfaction and greater financial benefits, thanks to FMEAs.

One of the major reasons for not achieving the complete benefits of FMEAs is that they are used and performed incorrectly.

FMEAs can and should form part of an organization's advanced quality planning process. This article presents a brief overview on FMEAs while highlighting the various stages of FMEA implementation.

#### **Understanding FMEAs!**

Derivatives of FMEAs are numerous, but there are two basic types: Design and Process FMEAs.

Design FMEAs are used to verify if a product has been properly designed to meet all of the customer requirements and to check if it can be manufactured at a target cost, rate and yield.

Design FMEAs capture:

- The relationship between customer requirements and how a product could fail to meet them
- Effects of the failures and design problems that cause the failures
- How the defective designs can be validated to prevent failures

The effects of failure, probability of failure and effectiveness of design validation are rated in columns in a tabular format. These ratings are multiplied together to achieve a Risk Priority Number (RPN) for every product failure-loss combination.



## TenStep Supplemental Paper

---

The ratings typically range from one to five or one to ten. A higher RPN value designates unacceptable conditions. The table also contains a class column, which serves to identify design characteristics that require special attention. It also has an improvement section to identify and track attempts to improve design.

Process FMEAs are used to assess the adequacy of a process involved in producing the product whose design is validated by design FMEAs. Process FMEAs also identify the process and product controls required to ensure that products can be manufactured as per specifications.

Process FMEAs capture:

- The relationship between every process step and the unacceptable process outputs that can be created at every step.
- Effects of the unacceptable process outputs and their causes
- How the unacceptable outputs can be detected /prevented when they occur

Ratings are tabulated in columns for the effects/severity of unacceptable process outputs, probability of their occurrences and the effectiveness of the prevention and detection methods. Just as in design FMEAs, these ratings are multiplied together to arrive at an RPN for every unacceptable output-cause combination.

A class column serves to identify design aspects that demand special attention. Moreover, the table contains an improvement section to identify and track attempts to improve the process.

### **Successful implementation of FMEAs!**

Organizations implementing FMEAs can be classified into one of the five stages of implementation. Those that record measurable monetary benefits from FMEA implementation fall in stage four or five. Unfortunately, most of the others fall in stage one, with very few in stages two and three.

#### **Stage One**

Listed below are some typical happenings in organizations implementing FMEAs in stage one.

- FMEAs are implemented to fulfill a customer's paper requirements or quality standards.
- FMEAs are performed at the final stages, just before the product is delivered to the customer, too late to be of any use.
- Often, the wrong personnel perform FMEAs. In many cases, the quality department develops the FMEA documents instead of the design engineers (for design FMEAs) and operating personnel (for process FMEAs).
- Management support for FMEAs is very poor.



## TenStep Supplemental Paper

---

- Conflicts and confusion prevail when individuals attempt (mostly by inaccurate guesses) to develop ratings for occurrence and detection numbers.
- With inaccurate ratings, erroneous RPNs are calculated based on which corrective/remedial actions are recommended.
- When there are too many recommended actions, the organization 'adjusts' the ratings to reduce RPNs below trigger level

The entire FMEA process becomes futile. Problems remain unsolved at a high cost to the organization. FMEA is not a quality tool here, but a mere paper requirement.

### Stage Two

Typical occurrences in such organizations could be:

- Adequate management support for FMEA.
- Employees assigned to perform design FMEAs are product experts. Likewise, process experts are assigned to perform process FMEAs.
- Personnel performing and using FMEA data are well trained.
- Everyone involved in the FMEA process has a thorough understanding of ratings and class column and their use in prioritizing issues.
- It is well understood that the class column needs greater priority than RPN.
- Management realizes that systems are inadequate to generate data to determine accurate ratings.
- With limited objective data, it is understood that ratings can be determined using product and process knowledge.

A lack of objective data leads to substantial loss of time to determine ratings. With shortage of time and resources, the organization may sadly slide back to results of stage one.

### Stage Three

The organization begins to use FMEAs correctly on a targeted product.

- As the FMEA process moves ahead, worry sets in when the FMEA uncovers and documents the complexity of the product/process being analyzed.
- Often, the FMEA documents grow in size from 5-10 pages to almost 75-100 pages.
- Many of the problems uncovered during FMEAs must be solved if an organization has to emerge as the best. However, resource and time crunch prevents this.
- Employees then tend to believe that their time and hard work was wasted.

After all, what good is it to know what is wrong if it cannot be rectified?



## TenStep Supplemental Paper

---

### Stage Four

- It is understood that the length of an FMEA cannot be predetermined. This depends on the complexity of the product/process being analyzed.
- It is accepted that all problems uncovered during FMEA cannot be solved in one product launch. Objective decisions on problems that require immediate attention and what can be delayed are taken.
- When problems occur in areas not worked on, they are handled efficiently, without chaos.
- After the first product launch, long-term plans are made to improve design and manufacturing systems.

### Stage Five

- The organization has implemented new designs and processes to address majority of problems FMEAs identified. Adequate data systems are available to set accurate occurrence-detection ratings.
- This accuracy of ratings helps in making vital predictions about field failures and yields.
- With the class column being accurate, actions for improvement can be prioritized. Design engineers review design FMEAs before making design changes. If changes are made, operating personnel review process FMEAs to determine the impact of the design change on the process.
- When problems occur, the concerned personnel consult the FMEAs.
- FMEAs are used as training tools as they contain collective knowledge of an organization's experts.

### Conclusion

If used appropriately, the FMEA process can be a very powerful quality improvement tool. However, organizations should be prudent enough to fully understand and commit to the FMEA process to use it well. The resulting product and process improvements not only bring monetary benefits, but also customer and market appreciation...After all, is this not what every organization yearns for?