Failure Analysis Aproach

Failure Analysis Objectives
The first step in managing the actual failure analysis effort is to determine what you expect from the final outcome. During initial stage, investigator should 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. Failure Analysis should 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.

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

Procedure to conduct a Failure Analysis
Cause of failure is determined using state-of-the-art analytical and mechanical procedures and often includes simulated service testing. A combination of analysis and physical testing locates problems and provides recommendations for solutions. In the course of the various steps listed below preliminary conclusions are often formulated. If the probable fundamental cause of the metallurgical failure becomes evident early on in the examination, the rest of the investigation focuses on confirming the probable cause and eliminating other possibilities. The metallurgical failure analyst compiles the results of preliminary conclusions carefully considering all aspects of the failure including visual examination of a fracture surface, the inspection of a single metallographic specimen, and the history of similar failures.
The complete evaluation sequence is summarized as under:
• Collection of background data and selection of samples
• Preliminary examination of the failed part
• Complete metallurgical analysis of failed material
• A through examination of the failed part including Macroscopic and Microscopic examination and analysis (electron microscopy, if needed)
• If necessary tests may also include Weld Examination, Case Depth, Decarburization Measurement, Coating/Plating Evaluation, Surface Evaluation and/or Grain Size Determination
• Chemical analysis (bulk, local, surface corrosion products, deposits or coating and microprobe analysis)
• Tests to simulate environmental and physical stress that may have played a role in the failure
• Analysis of fracture mechanics.
• Selection and testing of alternative products and/or procedures that will significantly improve performance
• On-site evaluation and consulting services and Formulation of conclusions and writing the report (Including recommendations)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 is targeted towards the elimination of identified causes.
The completed failure analysis report includes the following sections:
a) Description of the failed component
b) Service condition at the time of failure
c) Prior service history
d) Manufacturing and processing history of component
e) Mechanical and metallurgical study of failure
f) Metallurgical evaluation of quality
g) Event Summary of failure causing mechanism
h) Recommendations for prevention of similar failuresThe final failure analysis report provides solutions with expected returns on investments but also identifies 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. Investigator 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. Engineer 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 whois going to be responsible for implementation, and also include a recommendations for prevention of similar failures.