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Component Failure Analysis - What You Need to Know

If your business is affected by the failure of a metal component, the way you react can make all the difference. Below is some key information on dealing with component failures.

What is Failure Analysis?

*Failure analysis* is the process of collecting and analyzing data to find out why a component or system failed. The purpose of failure analysis is to prevent similar failures in the future.

Why Not Just Accept the Failure and Move On?

Not every failure needs to be investigated. Your decision to investigate or not should be based on the principles of risk management:

- Are the risks of repeat failures of the component acceptable?
- Do the benefits of a failure analysis justify the costs?

An assessment of risk may consider any or all of the following factors, as relevant:

- Loss of life, or other safety issues related to the failed equipment (e.g. H2S Service)
- Costly repairs to equipment
- Loss of productivity
- Loss of reputation
- Damage to the environment
- Legal or jurisdictional sanctions
- Intended use
- Frequency of failure
The diagram at right shows a typical risk evaluation matrix. Click here to see a larger version. (Source: CSA Z662-11)

An Expert Can See Much....

Successful Failure Analysis requires the following:

- Expertise
- Perseverance
- A systematic approach
- Luck (finding the proverbial needle in the haystack)

Failure analysis is not like assembling a puzzle where the pieces only fit one way. It’s more like applying a series of filters to strain off more and more of the possible causes until the only one remaining is the actual cause of failure.

*Qualimet* brings a wealth of experience and knowledge to its failure analysis work. Under the direction of a PhD in metallurgy and with a fully equipped metallurgical lab on the premises, we have a combined experience of over 100 years in the industry, including a large body of failure analysis work.

**Failure DOs and DON'Ts**

If you’ve had a failure, the most important thing to remember is: **do not contaminate the evidence!**

Much of the valuable evidence will be microscopic in scale. Therefore:

- NEVER touch failure surfaces or allow anything to touch them.
- NEVER try to reassemble the pieces - you will be destroying evidence.
- DO immediately place the failed components in a clean and dry environment where they are protected from dust, airborne contaminants, and contact with other objects.
- DO train all your workers in the correct handing of failed components.
- DO contact an expert. If you are unsure whether the risk of repeated failure justifies a failure analysis, contact *Qualimet* and we will be happy to advise you.
The Steps of a Failure Analysis

A trained investigator approaches failure analysis in a very specific way. The sequence of steps is as follows:

1. Collect background information (duty, design, maintenance, etc.)
2. Collect the evidence/samples and store in a clean, dry environment.
   **Remember**: never try to reassemble fracture surfaces. Valuable information can be destroyed.
3. Review potential safety issues with the failed components (e.g. H₂S service)
4. Establish records
5. Identify and clean samples
6. Macroscopic and microscopic evaluation
7. Nondestructive testing
8. Destructive testing
9. Determine failure mechanism
10. Analyse and formulate conclusions
11. Communicate conclusions and recommendations to client

Summary

If the risk of reoccurrence is unacceptable:

- bring in an expert
- know why failure occurred
- make informed decisions

Unless you know why a failure occurred, you can’t make informed decisions on how to prevent recurrences. Failure analysis provides the information required for effective preventive action.

The sooner you involve an expert in the failure analysis process, the more likely it will be that the root cause can be determined.

For more information on Qualimet’s failure analysis services, please contact Mike at 780-641-0750 or mike@qualimet.ca.