Multidisciplinary Root Cause Failure Analysis

Maximizing the reliability of your equipment

IDENTIFYING THE TRUE CAUSE OF ANY TECHNICAL PROBLEM

When your equipment does not operate within the expected specifications or experiences a breakdown, it is important to identify the root cause of the problem. Only in this way, a durable solution can be worked out to prevent reoccurrence of the problem and minimize future costs. A correct root cause failure analysis also provides vital information for the insurance company. Finally, if the root cause is identified, similar equipment can be screened for the same problem and preventive maintenance can be executed. But what is the best approach to identify the true cause of the problem?

STANDARDIZED APPROACH BASED ON EXPERIENCE AND MULTIDISCIPLINARITY

ENGIE Lab Laborelec uses a standardized method to efficiently and effectively identify the root cause of any type of equipment failure. Our expertise in multiple domains, our vast range of test facilities, and our many years of experience ensure a thorough inspection at all times. The benefits of this combination are widespread:

ROOT CAUSE FAILURE ANALYSIS VALUE CHAIN

FACT FINDING → PROBLEM ANALYSIS → LABORATORY ANALYSIS → RISK MITIGATION → EVALUATION

ENGIE Lab Laborelec uses a standardized approach for finding the actual root cause of a failure. Our approach leads to practical advice and reduces the risk of failure and maintenance costs.

> Multidisciplinarity is the key to a correct root cause failure analysis

Even seemingly simple cases often require expertise in different domains, such as material science, chemistry, electrical science, mechanics... ENGIE Lab Laborelec has the experts and the tools to conduct investigations in any domain.

> Unique approach for an efficient investigation

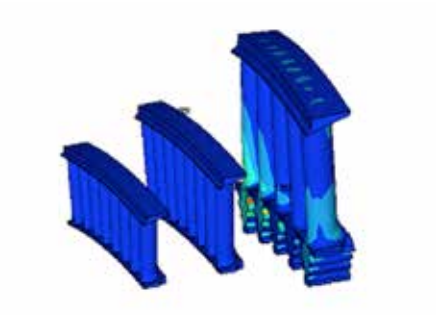
We use a standardized method for conducting root cause failure analyses. It takes into account all potential causes and investigates them with the proper priority and based upon facts.

> Minimizing costs for operation and maintenance

Only if you tackle the root cause of the problem, instead of the symptoms, you can enhance your maintenance activities and reduce future costs.

> Maximizing fleet availability and reliability

ENGIE Lab Laborelec's root cause failure analyses provides a solid basis for finding the true root cause of the problem and consequently for the appropriate risk mitigation measures. It also enables you to screen similar equipment for the same problem and take preventive measures.



The modification of a blade design is evaluated by calculating the distribution of resonant stress through modelling.

INTERNATIONAL REFERENCES

Over the years, Laborelec has conducted over hundreds of root cause failure analyses on various types of equipment around the world:

- Thailand: broken gas turbine blade
- Belgium: coating anomalies and premature corrosion of industrial equipment
- Italy: wind turbine cable connection failure
- Panama: cracked component of an industrial diesel engine
- Brazil: high vibrations of a steam turbine since first start-up
- Belgium: large high-voltage motor stator winding failure

A standardized, comprehensive approach reduces the risk of failures

ENGIE Lab Laborelec helps identify the root cause of failing equipment. Our standardized, multidisciplinary approach enables us to correctly identify the problem and offer advice to reduce the risk of similar failures.

FAILURE SCENE INVESTIGATION AND EVALUATION OF THIRD-PARTY INVESTIGATIONS

The first step in conducting the root cause failure analysis, is documenting the defect by collecting facts on site, gathering historical and operational data, and preserving relevant damaged hardware for further investigation. This takes place in close collaboration with the equipment owner and operator. All this information is structured in well-arranged diagrams and tables in order to keep track of the likeliness of potential causes throughout the investigation. If the root cause failure analysis is performed by the manufacturer or a third-party contractor, we can assist you in witnessing their investigation to ensure that the investigation is conducted correctly.

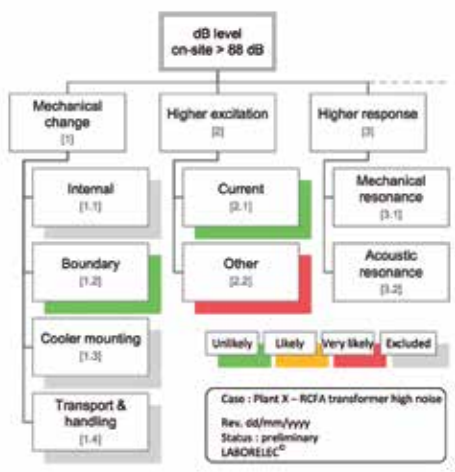
MULTIDISCIPLINARY PROBLEM ANALYSIS

We can perform various types of tests in our laboratories as well as on site:

> Metallurgic inspections (SEM), fractography, advanced creep and/or stress relaxation testing, etc.
> Non-destructive testing
> Material identification (X-ray diffraction, infrared spectro-scopy, on-site optical emission spectrometry, etc.)
> Comprehensive oil analysis
> Electrical tests (partial discharge measurements, dielectric withstand test, etc.)
> Other physical measurements (vibrations, deformations, strain, etc.)

We have experts in each domain working closely together, which makes it possible to address all aspects of the problem.

Risk mitigation measures and evaluation
Upon root cause identification, we propose the appropriate risk mitigation measures. We also offer an evaluation of the applied mitigation measures to ensure the best action was taken.



The fault tree for a transformer noise emission problem illustrates our standard root cause failure analysis method and enables you to follow the progress of the investigation.

Five reasons for you to choose Engie Lab

- Wide range of technical competencies in Electricity Generation, Grids and End-Use
- Increased profitability and sustainability of your energy processes and assets
- Unique combination of contract research and operational assistance
- Independent advice based on certified laboratory and field analyses all over the world
- More than 50 years of experience

Contact

ENGIE Lab Laborelec
Rodestraat 125
1630 Linkebeek

T. +32 2 382 02 11
info.laborelec@engie.com