

# Analysis of OREDA Data for Maintenance Optimisation

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SINTEF Industrial Management

Safety and Reliability

## ABSTRACT

This paper provides estimates for the average Rate of Occurrence of Failures, RO-COF ("failure rate"), for *critical* failures when also *degraded* failures are present. The estimation approach is exemplified with a data set from the offshore equipment reliability database "OREDA". The suggested modelling provides means to predict how maintenance tasks will affect the rate of critical failures.

## 1. INTRODUCTION

OREDA (Offshore Reliability Data) <sup>1</sup> is a data collection programme that has been going on since the early eighties. Reliability data has been collected for some 24,000 offshore equipment units comprising approximately 33,000 failures. The project is supported by ten oil companies: AGIP, BP, Elf, Esso, Norsk Hydro, SAGA, Shell, Statoil, and Total. SINTEF has been the main contractor since 1990.

The project is now in its fourth phase ('96). In this phase data is collected by more automatic means, and the data collection specification, and the data collection and analysis software program have been revised in this phase.

The participating oil companies use the data in the development of new oil fields and improving existing facility operation. The reliability data are typically used as input to safety and reliability analysis. Some benefits are: safer operations, increased production availability, and optimised maintenance. Analysis of reliability data is one of several key factors in choosing cost-effective solutions. Two examples recently reported, have shown that savings of about \$60 millions can be achieved compared with the cost of the original design. Lately experiences and data from this project are also exchanged with the manufacturers in order for them to improve future designs.

Typical analyses where the data have been applied are: QRA, RAM, RCM, LCC and various maintenance planning assessments. A project on using the data in more advanced reliability analysis has also been undertaken by SINTEF.

The present paper describes a model where OREDA failure event data has been used to predict how maintenance tasks will affect the rate of critical failures, and it is argued that a *model* for the failure mechanisms should be provided. There are two obvious types of such mechanisms:

- the failure occurs immediately (as a "shock"), directly giving a *critical* failure
- the failure is caused by deterioration, so that the item first experiences a *degraded* failure, until finally an essential function is lost and the item is defined to have a *critical* failure.

This modelling of failure mechanisms to utilise the information on the *severity classes* (usually denoted *degraded/non-critical* and *critical*) is the topic of <sup>2</sup> and <sup>3</sup>. These papers, however, focus on *dormant* failures, i.e. failures detected by periodic (functional) testing, only. The present paper considers *all* failure modes and general principles of failure detection.

OREDA failure data on gas turbines are utilised giving estimates for critical failure rates as a function of the preventive maintenance interval  $\tau$ , and the critical failure rate given that no preventive maintenance is performed (as  $\tau \rightarrow \infty$ , this is denoted "the naked failure rate").

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**Leo Kounis**



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**NIST Special Publication**, 1992

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