



PROJECT GRETE : EVALUATION OF NON DESTRUCTIVE TESTING TECHNIQUES FOR MONITORING OF MATERIAL DEGRADATION

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INTRODUCTION

The material aging of major critical components of nuclear installations due to in-service conditions may lead to a degradation of their mechanical characteristics. The early detection of material changes and their monitoring using innovative non destructive testing techniques would allow to plan actions in order to prevent the apparition of macroscopic damage (e.g. cracks).

One major difficulty in using these particular techniques is to correlate the changes in the measured NDT signals to the microstructural changes in the material due to aging. This problem may be solved through careful microstructural examinations of the material damage.

The objective of the project GRETE is to illustrate the potential use of NDT techniques for the monitoring of material degradation through two examples :

- neutron irradiation of reactor pressure vessel steel :

In the framework of a surveillance programme, the effect of irradiation damage on the mechanical characteristics of the reactor pressure vessel is anticipated through the expertise of irradiated specimens set close to the core of the reactor. These specimens are then broken during mechanical testing.

The monitoring of irradiation damage by non destructive techniques would limit the destruction of the specimens, making possible their re-insertion in the reactor for further regular non destructive measurements.

- thermal fatigue of piping :

Cyclic thermal and/or mechanical loads may generate fatigue in the material. Two cases of leakage caused by high cycle thermal fatigue in the nuclear industry were recently reported : in 1998 on the reactor heat removal system of a French 1,450 MWe PWR (CHOOZ-B) and in 1999 on the chemical and volume control system of a Japanese 1,160 MWe PWR (TSURUGA-2).

The monitoring of fatigue damage by non destructive techniques would prevent any unexpected leakage by the early detection of any significant microstructural changes.

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