**RPV Surveillance Program**

Irradiation surveillance program to support the RPV materials assessment

**The challenge**

The irradiation by fast neutrons (E > 1 MeV) has a significant effect on the microstructure of the RPV material in the RPV beltline region resulting in material property changes for neutron fluence > $10^{17}$ n/cm². In particular, the strength of the material increases and fracture toughness decreases with increasing neutron fluence. Neutron-induced embrittlement of vessel materials is mainly measured by increase in nil ductility transition reference temperature ($T_{NDT}$). The basis for demonstrating an absence of brittle fracture risk is predicting the allowable end of life $T_{NDT}$ under irradiation. This requirement is ensured by the RPV irradiation surveillance program.

**The solution**

The objective of a surveillance program is to measure the strength and toughness properties of the RPV materials in the core beltline region as a function of neutron irradiation. For this purpose capsules containing specimens are placed between core and inner RPV wall for accelerated irradiation. AREVA provides the full scope of services for RPV irradiation surveillance programs in light water reactors (LWR). This allows to experimentally verify the tensile and fracture toughness properties of the RPV material at assessment fluence (neutron fluence used in the assessment against brittle fracture) and to provide reference temperatures required for RPV integrity assessment.

**Turnkey irradiation surveillance programs for RPV in LWRs**

- Consultation, planning, coordination, execution
- Close collaboration with independent experts and authorities
- Manufacturing of specimens and capsules
- Baseline testing
- Delivery of capsules to the power plant
- Withdrawal of capsules from the RPV
- Post-examination of irradiation capsules
  - Transport to the hot cells test lab
  - Dismantling of capsules, specimen testing
  - Examination of temperature and fluence monitors
  - Fluence calculations
  - Safety results assessment
  - Documentation of the entire project and compilation of the necessary documents in licensable form.

**Additional specific services such as**

- Sampling and analysis of the RPV stainless steel cladding after cladding for experimental fluence determination
- Conceptual consulting for plant life extension and mitigation measures
- Qualified manufacturing of new specimens from irradiated specimen already tested (reconstitution technique)
Your benefits at a glance

• Comprehensive monitoring of RPV materials behavior depending on time of operation and neutron irradiation
• Customized irradiation surveillance programs for all types of RPVs up to the end of operating life
• State-of-the-art facilities and highly skilled and experienced staff
• Provision of supplementary capsules for extended surveillance programs

Surveillance programs in line with the latest safety standards:

• Germany: KTA 3203 “Surveillance of the Irradiation Behaviour of Reactor Pressure Vessel Materials of LWR Facilities”
• France: RCC-M and RSE-M code

AREVA Capabilities:

• Strong partner with extensive experience in the field of aging management of nuclear components
• Capsule manufacturing facilities
• Integrated solution competence from one single source
• State-of-the-art facilities and highly skilled and experienced staff
• Manufacturing and testing activities on site in certified and accredited laboratories including material testing, hot cells and radiochemistry.
• Good knowledge of requirements of inspection bodies and nuclear authorities

Hot and semi-hot cells work