Ex-core Neutron Flux Instrumentation in PWRs

Inevitable to control and protect a pressurized water reactor

The reactor neutron flux is a measure for the instantaneous nuclear power. The continuous measurement and processing of the neutron flux provides further information on power fluctuations as well as the radial and axial power distribution of the core. A safe and reliable ex-core neutron flux instrumentation is thus inevitable to protect and control a reactor.

Based on more than 30 years of operational experience AREVA has the expertise to design ex-core neutron flux instrumentation which complies with customer-specific reactor types, covering the whole neutron flux measuring range from refueling, start-up operation up to full power.

Additionally, the ex-core neutron flux instrumentation is qualified to perform under accident conditions of up to 159°C, 6 bar abs, 100% relative humidity and 1.1 MGy radiation dose.

Ex-core neutron flux measurement ranges versus their possible application

Power Range Detectors are used for the protection and limitation of the nominal reactor power and the power density distribution.

Task

Mode of operation

Reactor power [%]

Power Range Detectors are used during the protection and limitation of the nominal reactor power and the power density distribution.

Start-up

Sub-critical

Wide Range or Source Range and Intermediate Range Detectors are used for start-up surveillance.

Source Range Detectors are used during fuel loading activities and Intermediate Range or Wide Range Detectors for the detection of re-criticality.

Qualified combinations adjustable to plant specific needs

A variety of qualified combinations of coaxial cable assemblies, detectors and analog or digital signal conditioning can be offered to meet plant specific requirements.

• Coaxial cables (super-screened, low noise, metal sheath mineral-insulated)
• Connectors (HN, coaxial)
• Detectors (counter tubes, ionization chambers w/o gamma compensation, fission chambers)
• Analog or digital signal conditioning including customized software and customized maintenance equipment
• Customized maintenance program and optional on-site support

Key Facts

• More than 30 years of operational experience in various types of reactors
• Full-service maintenance possible
• Training program of maintenance activities for plant personnel
• Qualified detectors, cables and connectors
• Qualified digital and analog platform for signal processing
• Software filtering of neutron flux noise signals for stable power operation
• Significant reduction of start-up time with reactimeter by up to 75%
AREVA’s ex-core neutron flux instrumentation is designed for simple operation, easy diagnostics and maintenance while providing the highest level of safety.

Your advantages at a glance

- Tailor-made ex-core neutron flux instrumentation
- Qualified up to severe accident conditions
- Simple operation and easy to maintain
- Training of personnel up to full-support including maintenance activities
- Reactimeter – reduction of start-up operation by up to 75%
- Software filtering of neutron flux noise

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