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Fast Neutron Collar Tests at Nuclear Fuel Fabrication Plant in Brazil

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The new generation fresh fuels assemblies contain more burned poisons (gadolinium) to compensate the reactivity and the adjustment of the distribution of power in the reactor core. However, the presence of gadolinium hinders the measurement of the uranium quantity using the traditional Uranium Neutron Coincidence Collar (UNCL) in safeguards applications. This non-destructive system, based on passive and active measurements, is used to determine the linear mass of fissile isotope in fresh fuel assemblies and can operate in "fast"and "thermal"modes. In thermal mode, the presence of neutron poison affects the thermal neutrons since the thermal neutrons are captured and the measurement must be corrected using the Gd content declared by the operator, thus generating a possible diversion scenario. To solve this problem, the IAEA (International Agency of Nuclear Energy) has developed the Fast Neutron Collar (FNCL). This new equipment has low dependence to Gd, better accuracy and shorter measurement time compared to UNCL. As part of an IAEA project, the Safeguards Laboratory of the Brazilian Nuclear Energy Commission in collaboration with the Brazilian Nuclear Industry (INB), the Brazilian-Argentinean Agency of Accounting and Control of Nuclear Materials (ABACC) and the IAEA had tested this new prototype using fresh fuel assemblies, under the Brazilian Support Program to the IAEA (BRZ SP). The FNCL prototype is composed of 12 cells of liquid scintillator detector, arranged on three detection panels. In this Project, twenty-three fresh fuel assemblies were measured. The aim of this work was to evaluate the performance of the Fast Neutron Coincidence Collar to measure the linear mass density of 235U in fresh PWR assemblies, independently of the presence of gadolinium, as part of the homologation of this equipment for safeguards use. This paper presents the main results of the tests. The preliminary results indicate that the FNCL can be used for safeguards measurement of U235 mass in fresh fuel assemblies containing burnable neutron poisons without requiring the declaration of the operator on the Gd content.

Which "Key Question" does your Abstract address?

NEW1.2

Topics

NEW1

Which alternative "Key Question" does your Abstract address? (if any)

Primary author: Mr GRUND, Marcos (Comissão Nacional de Energia Nuclear)

Co-authors: Mr BONINO, Anibal (ABACC); Mr RENHA, Geraldo (Comissão Nacional de Energia Nuclear); Mr BEAUMONT, Jonathan (IAEA); Mr JEON, Jong (IAEA); Mr MACHADO SILVA, Luis (ABACC); Mr MAYOROV, Misha (IAEA); Mr LEE, Tae (IAEA)

Presenter: Mr GRUND, Marcos (Comissão Nacional de Energia Nuclear)

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