Agenda

Discussion on collaboration with the NIST Center for Neutron Research

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August 17, 2016

10:00-10:15 am	Introduction
10:15 am	Presentation – Neutronics and Safety Studies on a New Research Reactor at NIST for Advanced Neutron Sources (attachment)
11:15 pm	NSEL-VT3G – RAPID code system
12:00 pm	Working lunch
1:00 – 1:45 pm	Discussion on potential areas for collaboration
2:00 pm	Adjourn

Attachment

Abstract

Neutronics and Safety Studies on a New Research Reactor at NIST for Advanced Neutron Sources

Neutronics and thermal-hydraulics safety analysis were performed for a LEU-fueled research reactor being designed and studied at NIST. The main goal of the research reactor is to provide advanced neutron sources for scientific experiments with a particular emphasis for high intensity cold neutron sources. A tank-in-pool type reactor with a horizontally split compact was developed in order to maximize the yield of the thermal flux trap in the reflector area. The reactor was designed with 20 MW thermal power and 30 days operating cycle. For non-proliferation purposes, the LEU fuel (U_3Si_2-Al) with enrichment 19.75 wt% was used. The core performance characteristics of an equilibrium cycle with several representative burnup states including startup (SU) and end of cycle (EOC) was obtained using the Monte-Carlo code MCNP6. The estimated maximum thermal flux of the core is $\sim 5\times10^{14}$ n/cm^2-s. The surface current at the exit of the cold neutron source (CNS) as well as the brightness of the CNS demonstrates the superiority of the cold neutron performance of the design. Sufficient reactivity control worth and shutdown margins were provided by hafnium control elements. Reactivity coefficients were evaluated to ensure the negative feedback. Thermal-hydraulics (T/H) safety studies of the reactor were performed using the multi-channel safety analysis code PARET/ANL. Steady-state analysis showed that the peak cladding temperature (PCT) and minimum critical heat flux ratio (MCHFR) were less than design limits with sufficient margins. Detailed transient analyses for a postulated reactivity insertion accident and a loss of flow accident showed that no fuel damage or cladding failure would occur with the protection of reactor scram.