Correlating reactor power with detector noise and Characterizing a D-T Neutron Generator

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Abstract

With the onset of newer technologies in the nuclear industry to produce and transport nuclear materials, it is imperative new technologies and methods are created. Based on this, two studies were conducted related to this idea, the first consisted of monitoring reactor core power using noise measurements from sensors placed outside of primary shielding. The second consisted of characterizing the neutron spectra and flux of a pulsed Deuterium-Tritium (D-T) neutron generator used in experiments related to nuclear security. During the power measurements, sensors were placed around a Mark II TRIGA reactor and collected data during the normal operation of the reactor. From this it was discovered that the neutron field is negligible outside of primary shielding and the core power can be monitored using the count rate from the photon field, as well as the movement of the reactor within the reactor pool. A Thermo Scientific P 211 pulsed D-T neutron generator is characterized, a Bonner Sphere Spectroscopy system was used for the neutron spectra and fast neutron foils are used for the neutron flux determinations. Based on these measurements it was determined that there is a strong thermal neutron field presence due to scattering inside the neutron vault. As well as the manufacturer and experimental results for the neutron flux differed, possibly based on the age or settings of the generator. Nonetheless the D-T generator is well prepared for use as a dual energy neutron source with energies around 1eV and 14 MeV.