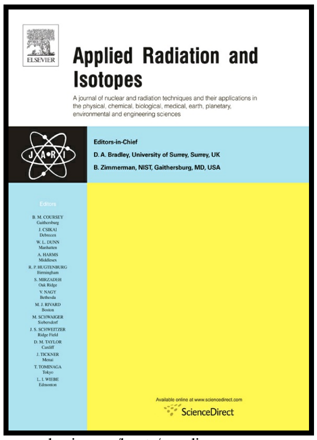

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Study of Neutron Fields around an Intense Neutron Generator

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Abstract

Neutron fields in the vicinity of the newly built neutron facility, at the University of Ontario Institute of Technology (UOIT), have been investigated in a series of Monte Carlo simulations and measurements. The facility hosts a P-385 neutron generator based on a deuterium-deuterium fusion reaction. The neutron fluence at different locations around the neutron generator facility has been simulated using MCNPX 2.7E Monte Carlo particle transport program. To characterize neutron fields, three neutron sources were modeled with distributions corresponding to different incident deuteron energies of 90 kV, 110 kV, and 130 kV. Measurements have been carried out to determine the dose rate at locations adjacent to the generator using bubble detectors (BDs). The neutron intensity was evaluated and the total dose rates corresponding to different applied acceleration potentials were estimated at various locations.

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Keywords: neutron generator, neutron, bubble detector, Monte Carlo Simulations, Fluence, Dose

1. Introduction

Fusion-based deuterium-deuterium and deuterium-tritium neutron generators are valuable devices in creating directionally dependent mono-energetic neutrons. The particular reaction chosen for an application is determined by the intensity and neutron energy required. Recently, at UOIT, a deuteron-deuteron based neutron generator P-385 has been installed at the Energy Research Center (ERC) to support the nuclear engineering and radiation science program. The neutron fields in the facility create a potentially hazardous ambient dose and pose a risk to operational and research staff. This requires utilizing a shielding room of particular composition and thickness.

This paper summarizes the results of experiments and Monte Carlo simulations recently carried out to characterize neutron fields in the vicinity of the newly installed facility. Monte Carlo code MCNPX 2.7E has been used to evaluate the neutron flux, ambient dose rate, and neutron spectra at different locations. After the installation of the neutron generator, experiments using neutron bubble detectors, have been carried out. The intensity of the generator was extracted from the experimental data and compared to the simulations.