

## HUMAN RELIABILITY ANALYSIS ON DIGITALIZED CONTROL ROOMS OF NPP

M.U Adam, A.G Goryunov, N.M Badamasi  
National Research Tomsk Polytechnic University,  
Russia, Tomsk, Lenin Avenue, 10, 634050  
E-mail: [amu@tpu.ru](mailto:amu@tpu.ru)

In the era of digitalization, the need for electricity is growing every year. Digital instrumentation and control systems (I&C) have been in use for over three decades in various application. In advanced nuclear power plant (NPP) the main control room (MCR) has changed from analog to digital control systems (DCS). Digital technology in nuclear operations and maintenance is the key to successfully addressing challenges by nuclear operators in the power generation market. Although adopting digital technology in nuclear can be challenging due to the many technical, safety, regulatory, commercial and environmental constraints which characterize the industry. New digitalized human system interfaces (HSIs) pose challenges to traditional human reliability analysis (HRA) methods. The purpose of the work is to show the effects of digital HIS on human behavior and reliability, and the need for digitalization in nuclear power industry which studies show training and experience, quality and availability of procedures are important factors.

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## EFFECT OF ALPHA PARTICLES ON SPECIFIC IONIZATION AND DETECTION EFFICIENCY IN VACUUM WITH VARYING MESH-HOLE DIAMETERS OF A CIRCULAR MESH COLLIMATOR IN GEANT4 SIMULATION

Amoah Peter Atta <sup>1,2</sup>, M.S. Kuznetsov <sup>1</sup>

<sup>1</sup> National Research Tomsk Polytechnic University,  
Russia, Tomsk, 30 Lenin ave., 634050

<sup>2</sup> Ghana Atomic Energy Commission (GAEC),  
Ghana, Accra, PO Box LG80 Legon

E-mail: [amoah1@tpu.ru](mailto:amoah1@tpu.ru), [p.amoah@gaecgh.org](mailto:p.amoah@gaecgh.org)

A study to ascertain the effect of alpha particles on specific ionization and counting efficiency in vacuum with varying mesh-hole diameters of a circular mesh collimator in Geant4 simulation has been undertaken. Theoretically, it has already been shown that circular-shaped collimators do not present the complete surface area required to uniformly enhance the trajectory of radionuclides unto a detector. Thus, to positively enhance the main parameters being sought for like; detection efficiency along with higher resolution. An isotropic  $^{241}\text{Am}$  source was used in this study along with circular-shaped collimator geometries, with a cell height of 5 mm and diameters of; 2.5 mm, 4 mm, 5 mm and 6 mm. At the front surface of the collimator, counts of 107985, 104298, 102751 and 101943 were recorded with the cell diameters of 2.5 mm, 4 mm, 5 mm and 6 mm respectively. This shows the impact of decreasing specific ionization upon interaction with larger sized circular-shaped collimators. On the other hand, increasing counts and counting efficiencies were recorded with larger sized circular-shaped collimators. Counting efficiencies of 0.023%, 0.055%, 0.078% and 0.093% were recorded for the cell diameters of 2.5 mm, 4 mm, 5 mm and 6 mm respectively. It has been observed with this study, as shown in fig.1 that relatively smaller diameters of the circular mesh collimator do produce higher specific ionization values (counts) at the front surfaces compared to the geometries with larger diameters. Whereas, as shown in fig.2, the relatively larger diameters produced higher counting efficiencies.

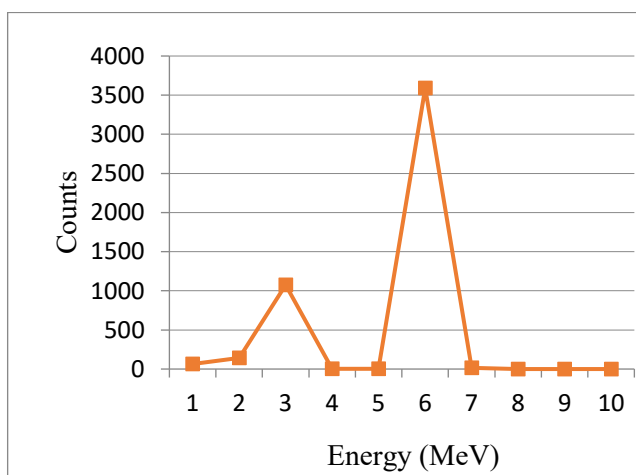


Fig. 1. Counts (at detector) as a function of Energy (MeV)

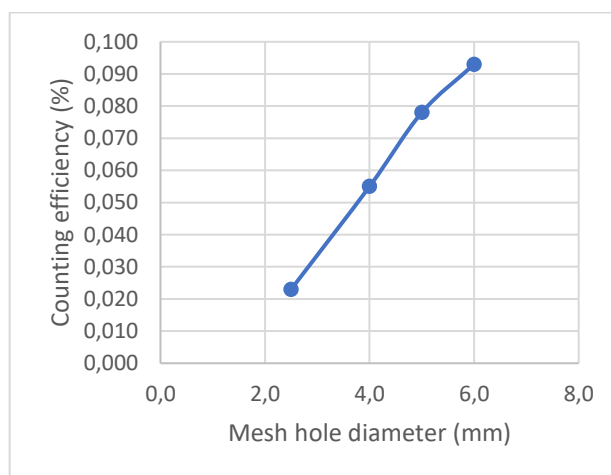


Fig. 2. Detection efficiency (%) as a function of mesh-hole diameter (mm) for a 5 mm thick collimator

## ЭКСПЕРИМЕНТАЛЬНОЕ МОДЕЛИРОВАНИЕ ОСТАТОЧНОГО ЭНЕРГОВЫДЕЛЕНИЯ КОРИУМА НА УСТАНОВКЕ «ЛАВА-Б»

М.К. Бекмулдин<sup>1,2</sup>, М.К. Скаков<sup>3</sup>, А.В. Градобоев<sup>4</sup>.

<sup>1</sup>Филиал «Институт атомной энергии» РГП НЯЦ РК,  
Казахстан, г. Курчатова, ул. Бейбіт атом 10, 071100

<sup>2</sup>Университет им. Шакарима,  
Казахстан, г. Семей, ул. Глинка 20А, 071412

<sup>3</sup>Национальный ядерный центр РК,  
Казахстан, г. Курчатова, ул. Бейбіт атом 2Б, 071100

<sup>4</sup>Томский политехнический университет,  
Россия, г. Томск, пр. Ленина 30, 634050

E-mail: [bekmuldin@nnc.kz](mailto:bekmuldin@nnc.kz)

В процессе развития тяжелой аварии на АЭС происходит образование кориума – расплава материалов активной зоны. Отличительной особенностью кориума, за счет содержания в его составе топливных элементов, является наличие остаточного энерговыделения, которое вносит значительный вклад в характер взаимодействия