Tri Dasa Mega Vol. 26 No. 3 (2024) 145–146

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Abstract Collection

Muhammad Subhan, Topan Setiadipura, Mohammad Dhandhang Purwadi, Muksin Aji Setiawan, Tresna Priyana Soemardi, Ario Sunar Baskoro, Cecep Slamet Abadi, Evi Latifah, Nafisah Amalia, Yusi Amalia Renaningtyas, *The Study of Mechanical Failure in Helical Steam Generator of High-Temperature Gas-Cooled Reactor (HTGR).*, Tri Dasa Mega, 26 (3), 101.

This research examines mechanical damage in helical steam generators, focusing on the causes, contributing factors, and impact of damage on the performance of the steam generator (SG). The research methodology involves analyzing various data sources, including scientific literature and previous nuclear industry experiences. The analysis results indicate that thermal stress, pressure fluctuations, material wear, and design errors can cause mechanical damage in helical SGs. Volumetric defects and leaks at pipe joints or welds are also potential issues. This study provides insights into failure mechanisms and highlights the importance of routine maintenance and inspection to prevent more serious failures. By better understanding these issues, innovative solutions can be developed to improve the performance and safety of helical steam generators in nuclear reactors.

Keywords: Nuclear Reactor, Mechanical Failure, Helical, Steam Generator.

Tulis Jojok Suryono, Nuri Trianti, Sigit Santoso, Sudarno, Kiswanta, Restu Maerani, Medila Kusriyanto., *Data Visualization in The Human-Machine Interface of Reactor Protection System Simulator.*, Tri Dasa Mega, 26 (3), 107.

The Reactor Protection System (RPS) is critical to the operation of nuclear power plants as it monitors essential reactor parameters and initiates automated shutdowns when necessary. The human-machine interface (HMI) of the RPS is pivotal for enabling operators to efficiently monitor, analyze, and respond to complex data. This study aims to simulate the signal or data flow in the RPS of HTR-10, a high-temperature gas-cooled reactor (HTGR) with a thermal power output of 10 MWth, which contributes to a deeper understanding of RPS functionality and to enhance the awareness of operators regarding the plant parameters status. The HMI panels, as well as sensor input data, were generated using Python programming language. The HMI of RPS successfully and comprehensively displays the values of key sensor inputs and their trip setpoints (neutron flux, helium temperature, primary coolant pressure) both on panels and in real-time graphs. Moreover, it also shows the reactor status (normal or trip) based on the existence of an initiation trip signal in the RPS. Alarm panels are generated when the reactor is tripped. The RPS simulator can be used to guide future enhancements in reactor safety systems.

Keywords: Data visualization, Reactor protection system, Python programming language, Human-machine Interface, High-temperature Gas-cooled Reactor.

Theo Alvin Ryanto, Jupiter Sitorus Pane, Muhammad Budi Setiawan, Yarianto Sugeng Budi Susilo, Ihda Husnayani, Anik Purwaningsih., *The Development of a DISPERSIA Code Program-Air Dispersion Program for Radiological Dose Assessment of Nuclear Facilities.*, Tri Dasa Mega, 26 (3), 115.

The DISPERSIA-BRIN program, along with its sub-programs STDISPERSIA and WRDISPERSIA, was developed to enable swift and effective radiological analysis, essential for rapid decision-making during nuclear accidents. These programs were validated against SIMPACT version 1.0 confirming their accuracy and reliability. Python was selected as the primary programming language due to its simplicity and versatility. DISPERSIA-BRIN incorporates geospatial analysis tools, allowing researchers to visualize the radioactive material concentration and the dose impact on polar grids surrounding the nuclear facility. The program models the dispersion of concentrations and their dose effects, assessing their interaction with humans, livestock, and plants. This helps to identify high-dose areas, vulnerable populations, and emergency planning zones. A case study involving a hypothetical Nuclear Power Plant and site demonstrated DISPERSIA-BRIN's capability to accurately calculate and visualize radionuclide dispersion, aiding in the identification of high-radiation areas.

Keywords: DISPERSIA, Radiological Analysis, Geospatial Analysis Tool, Concentration Dispersion, Dose Effect.

Rahmania Serli Assifa, R. Andika Putra Dwijayanto, Fajar Arianto., *Neutronic Analysis of the NuScale Fuel Assembly using Accident Tolerant Fuel with SiC-Coated Alumina Cladding.*, Tri Dasa Mega, 26 (3), 125.

Nuclear fuel design influences a nuclear reactor's performance and safety. Accident Tolerant Fuel (ATF) is a novel concept in nuclear fuel technology developed to improve the performance and safety of a nuclear power reactor. Different ATF materials can impact the neutronic aspect of a nuclear reactor and thus must be analyzed accordingly. This research is a neutronic analysis of an ATF design using alumina (Al2O3) and outer silicon carbide (SiC) coating implemented in NuScale SMR fuel assembly. MCNP6.2 code was utilized to perform neutronic calculations. Standard M5 cladding in NuScale was compared with Al2O3 and Al2O3+ SiC cladding. Analyzed parameters were fuel burnup, kinetic parameters, Doppler temperature coefficient, moderator temperature coefficient, and the evolution of several radionuclides. The results show no significant differences in the neutronic performance of the Al2O3 cladding compared to the standard M5 cladding. Therefore, Al2O3 cladding has the potential for application in pressurized water reactor (PWR) fuel.

Keywords: Accident Tolerant Fuel, Pressurized Water, Reactor, NuScale, Cladding, Alumina, Silicon Carbide.

Rizky Mu’amanah, Mokhamad Tirono, Yohannes Sardjono, Isman Mulyadi Triatmoko, Gede Sutrisna Wijaya., *Dose Analysis of Boron Neutron Capture Therapy (BNCT) for Breast Cancer Based on Particle and Heavy Ion Transport Code System (PHITS) V.3.34.*, Tri Dasa Mega, 26 (3), 133.

Breast cancer is one of the most common types of cancer, with a high incidence and mortality rate worldwide, including in Indonesia. Boron Neutron Capture Therapy (BNCT) has been formulated as a promising method of radiation therapy in the treatment of breast cancer due to its ability to deliver high doses to target lesions with minimal damage to healthy tissue. This study aims to analyze the BNCT dose in breast cancer and evaluate the irradiation time in two directions: anterior-posterior (AP) and left lateral (LLAT). This research utilizes the PHITS version 3.34 simulation tool to define the geometry of breast cancer, the surrounding organs, and the radiation sources used. The phantom used was an ORNL adult woman with a 2 cm tumor. The neutron source was an accelerator with a 30 MeV proton beam. Boron concentrations were 30, 60, 90, 120, and 150 μg/g of cancer tissue. This research shows that the higher the boron concentration, the shorter the irradiation time required, thereby minimizing side effects and the risk of damage to Organ at Risk (OARs). For the AP irradiation technique, the resulting irradiation times were 27.62 minutes, 16.14 minutes, 13.12 minutes, 11.05 minutes, and 9.54 minutes. Meanwhile, in the LLAT direction, the resulting times were 135.23 minutes, 113.46 minutes, 78.23 minutes, 59.70 minutes, and 48.27 minutes. A boron concentration of 150 μg/g was chosen as the optimal concentration in this simulation because it results in a short irradiation time from each irradiation direction and ensures a safe dose for Organs at Risk (OARs). In the AP irradiation technique, the dose absorbed by the skin was 0.46 Gy, the ipsilateral lung was 1.01 Gy, the contralateral lung was 0.16 Gy, the ribs were 0.61 Gy, and the heart was 0.11 Gy. Meanwhile, in the LLAT irradiation technique, the dose absorbed by the skin was 1.03 Gy, the ipsilateral lung was 2.19 Gy, the contralateral lung was 0.72 Gy, the ribs were 1.62 Gy, and the heart was 0.40 Gy.

Keywords: Breast Cancer, BNCT, PHITS, Dosimetry.

Tri Dasa Mega Vol. 26 No. 3 (2024) 147-148

Jurnal Teknologi Reaktor Nuklir

Tri Dasa Mega

Journal homepage: jurnal.batan.go.id/index.php/tridam

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Tri Dasa Mega Vol. 26 No. 3 (2024) 149–150

Jurnal Teknologi Reaktor Nuklir

Tri Dasa Mega

Journal homepage: jurnal.batan.go.id/index.php/tridam

Author Index

Jurnal Teknologi Reaktor Nuklir

Tri Dasa Mega

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