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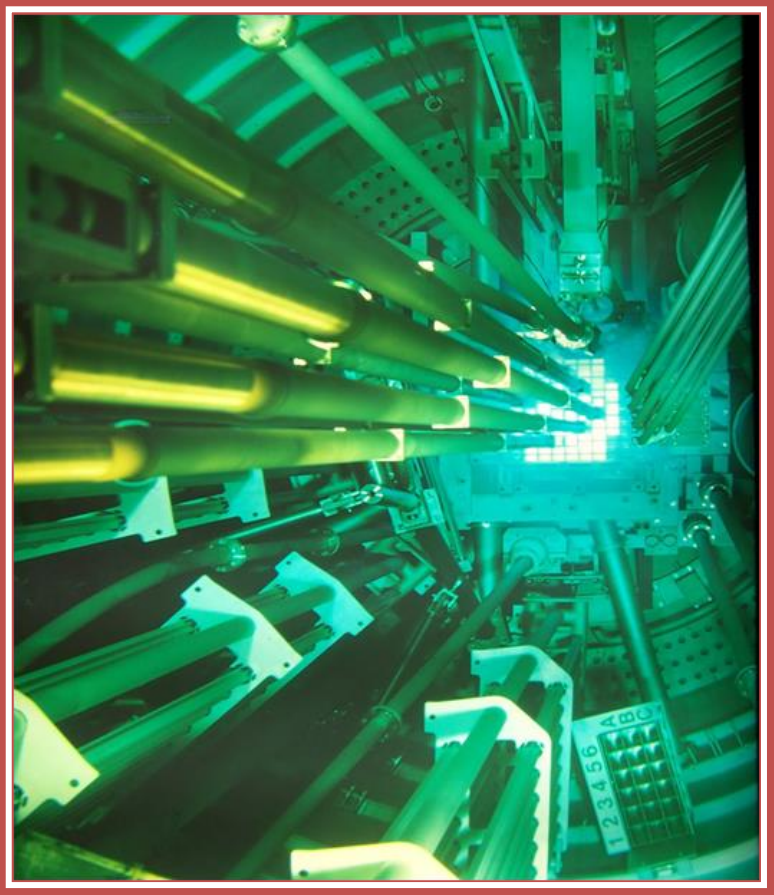

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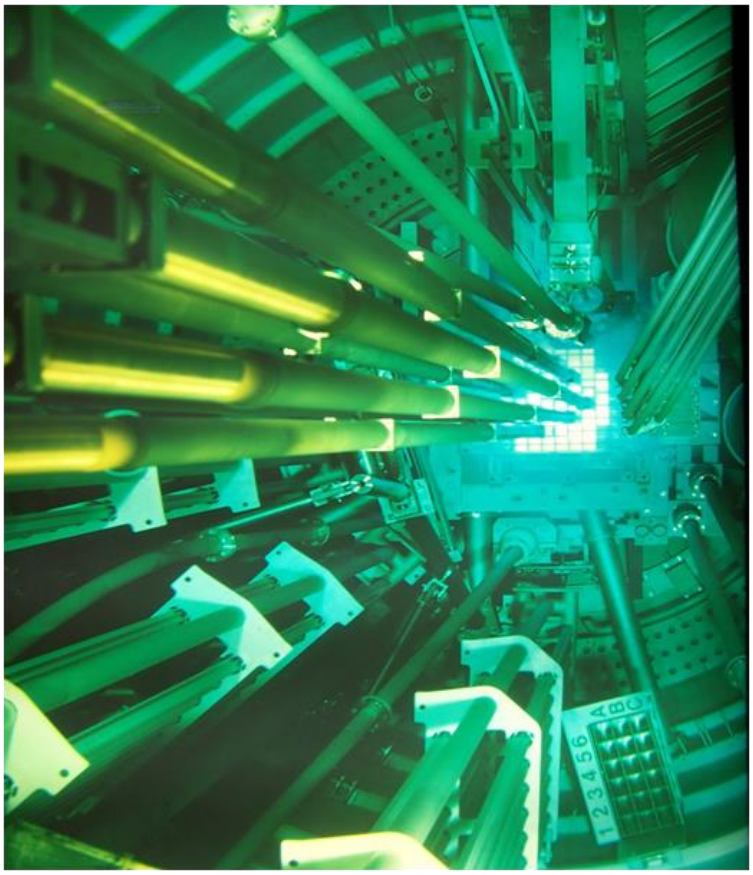

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PREFACE

Dear readers,

With great pleasure, we provide you with the third issue of the Jurnal Teknologi Reaktor Nuklir (Journal of Nuclear Reactor Technology), Tri Dasa Mega, in 2023 – Vol. 25 No. 3 (October 2023). This issue contains five articles discussing various applications of nuclear technologies and sciences.

The first article "Transmutation of Transuranic Elements as Solid Coating in Molten Salt Reactor Fuel Channel" was written by R Andika Putra Dwijayanto, Fitria Miftasani, Andang Widi Harto from the Research Center for Nuclear Reactor Technology, National Research Innovation Agency (BRIN), Tangerang Selatan, Banten, Indonesia. This paper explores the possibility of TRU transmutation using a molten salt reactor (MSR) in a heterogeneous configuration, where a solid TRU is coated inside the fuel channel filled with liquid salt fuel. Such a configuration is proposed to allow higher TRU loading into the fluoride salt mixture without compromising the safety of the reactor. TRU coating was applied in consecutively outward radial fuel channel layers with coating thicknesses of 2.5 mm and 5 mm. The calculation was performed using MCNP6.2 radiation transport code and ENDF/B-VII.0 neutron cross-section library. From the results, TRU coating with a smaller thickness and positioned closer to the center of the core exhibits higher transmutation efficiency due to exposure to the higher neutron flux.

The second article "Study of Alternative Shielding Material for Gamma Radiation using Monte Carlo Simulation" was written by Gusti Atika Urfa, Totok Wianto, Tetti Novalina Manik, Amar Vijai Nasrulloh from the Physics Department, Faculty of Mathematics and Natural Sciences, Lambung Mangkurat University, Banjarbaru, Indonesia. This research aims to identify alternative, lead-free, and non-toxic materials for gamma radiation shielding using Monte Carlo simulations. Bismuth Oxide (Bi2O3), Barium Oxide (BaO), Tungsten Trioxide (WO3), Tungsten Dioxide (WO2), and Molybdenum Trioxide (MoO3) were selected as potential substitutes for lead. Pure lead (Pb) and Lead Oxide (PbO) were used for comparison. The simulations were performed using Particle Heavy Ion Tracking System (PHITS) software, with a gamma energy of 662 keV. Meanwhile, the simulation results of those simulated materials that are closest to Pb and PbO are Bi2O3 and WO2 with an attenuation coefficient of 0.71 mm-1. This simulation shows that for non-lead materials, BiO2 and WO2 have potential as alternatives for non-lead radiation shielding.

The third article "An Ergonomic Approach in Designing Nuclear Reactor Simulator Console for Local Operator" was written by Muksin Aji Setiawan, Sigit Santoso, Tulis Jojok Suryono, Kiswanta, Anik Purwaningsih, Restu Maerani, Adhika Enggar Pamungkas, Dian Fitri Atmoko, Dhanu Dwiardhika from the Research Center for Nuclear Reactor Technology, National Research Innovation Agency (BRIN), Tangerang Selatan, Banten, Indonesia. They study the SMR design as an advanced generation reactor with high safety and utilization features, especially for the electricity needed and industry. Its modular size can also be applied to remote areas with lower construction costs compared to other types of power plants. Considering the geographical location and territory of Indonesia, which is an archipelagic country, this type of reactor is suitable for application in Indonesia. To ensure the safety and increase in mastery of the technology, it is necessary to create a simulator to support this program. However, specific regulations governing human-machine interactions (HMI) that cover nuclear reactor simulators are not yet available in Indonesia. This research reviews the US regulations regarding the design of reactor main control rooms, offering options for Indonesian operators by considering

anthropometric and ergonomic aspects. In conclusion, the research presents a set of recommendations for developing an appropriate simulator based on these factors.

The fourth article “The Development Process of Human Machine Interface of Plant Protection System of a Small Modular Reactor” was explored by Tulis Jojok Suryono, Sigit Santoso, Restu Maerani, Sudarno, Pandhu Ardita Dharma Pratama, from the Research Center for Technology Nuclear Reactor, Research Organization for Nuclear Energy, National Research and Innovation Agency, South Tangerang, Banten, Indonesia. Their research is a Plant Protection System (PPS), which consists of Reactor Protection Systems (RPS) and Engineered Safety Actuated Systems (ESFAS), one of the most important safety systems in nuclear reactors, including Small Modular Reactors (SMRs). The RPS generates a signal to trip the reactor if the measured reactor parameters exceed the trip setpoint, and then the ESFAS is actuated to mitigate the consequences of the accident by minimizing fuel damage and radioactivity release into the environment. Therefore, a comprehensive Human-Machine Interface (HMI) is essential for monitoring and controlling the PPS to ensure its reliability and enhance the operators' situational awareness. This study discusses the development process of the HMI for the digital PPS of an SMR. Various standards, guidance, and design criteria for PPS and HMI are incorporated and applied to ensure that the proposed design meets the required level of reliability. The proposed design is intended to assess the functionality and reliability of the PPS. Moreover, in the future, it will play an essential role in the design phase of the HMI for the PPS of an SMR in Indonesia

The fifth article “The Study of Multiaxial Loading and Damage to the Structure and Materials in the PWR Steam Generator of Nuclear Reactor” was investigated by Muhammad Subhan, Tresna Priyana Soemardi, Topan Setiadipura, Farisy Yogatama Sulistyo, Hana Subhiyah from the Research Center for Technology Nuclear Reactor, Research Organization for Nuclear Energy, National Research and Innovation Agency, South Tangerang, Banten, Indonesia. The paper has studied the steam generator in Pressurized Water Reactor (PWR) Nuclear Power Plants (NPPs), which is crucial for transferring heat from the primary to secondary cooling systems, vital for steam production to drive turbines, and central to nuclear power safety. This study explores recent research on multi-axial loading, structural integrity, and material durability in PWR steam generators, shedding light on key factors affecting these systems. Common corrosion-related degradation in steam generators often arises from design, material, and water chemistry factors. However, the shift to All Volatile Treatment (AVT), the development of advanced material alloys, and enhanced water quality control in primary and secondary systems have significantly reduced instances of steam generator degradation. These findings promise to enhance the reliability and safety of steam generators in future nuclear applications.

On behalf of the Jurnal Teknologi Reaktor Nuklir (Journal of Nuclear Reactor Technology) Tri Dasa Mega, I would like to thank all Editors, Reviewers, Managements, Authors, and Readers for your endless support.

Editor in Chief