P-ISSN: 1411-240X E-ISSN: 2527-9963
Accreditation No.: 200/M/KPT/2020
Accredited to Vol. 27 No. 1 (February 2025)

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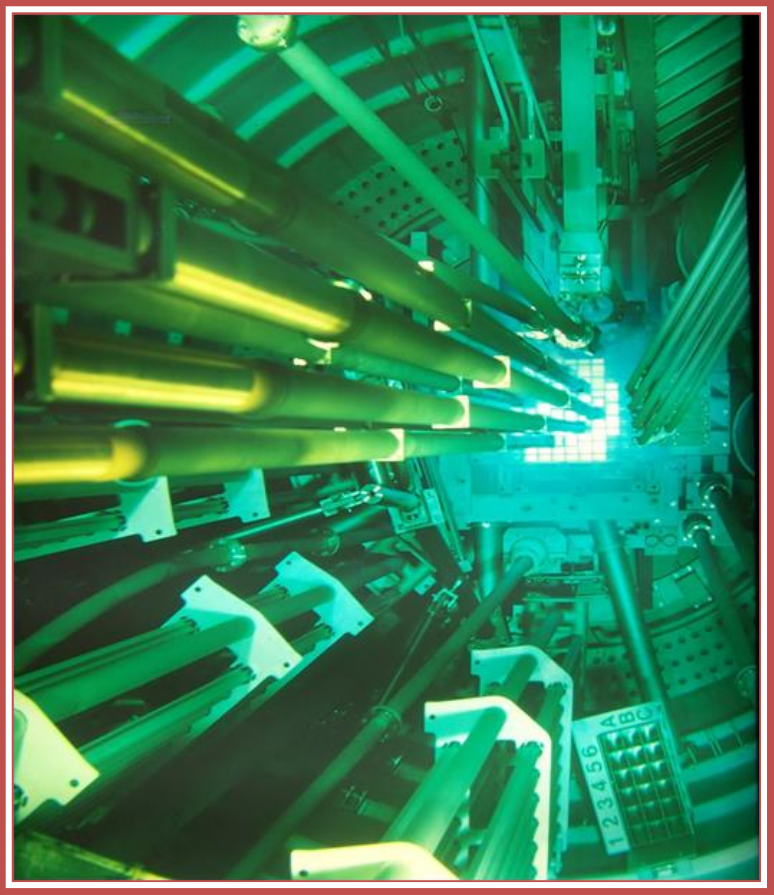
Vol. 26 No. 1 February 2024



JOURNAL OF NUCLEAR REACTOR TECHNOLOGY
TRI DASA MEGA

Tri Dasa Mega	Vol. 26	No. 1	Hal. 1 – 50	Serpong February 2024	P-ISSN: 1411-240X E-ISSN: 2527-9963

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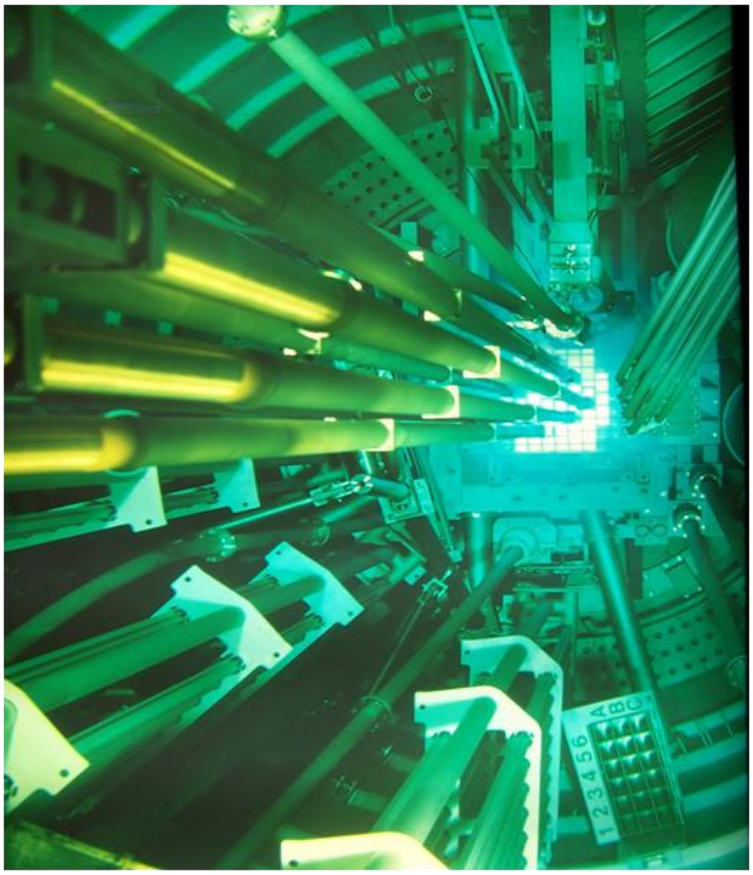

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JURNAL
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Vol. 26 No. 1 February 2024

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PUBLISHER
Research Center for Nuclear Reactor Technology and Safety
National Research Innovation Agency (BRIN)

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Situs Web: http://jurnal.batan.go.id/index.php/tridam

*Published three times a year in **February**, **June,** and **October***

P-ISSN: 1411-240X E-ISSN: 2527-9963
Accreditation No.: 200/M/KPT/2020
Accredited to Vol. 27 No. 1 (February 2025)

JURNAL
TEKNOLOGI REAKTOR NUKLIR
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P-ISSN: 1411-240X E-ISSN: 2527-9963
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TEKNOLOGI REAKTOR NUKLIR
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Accreditation No.: 200/M/KPT/2020
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PREFACE

Dear readers,

With great pleasure, we provide you with the first issue of the Jurnal Teknologi Reaktor Nuklir (Journal of Nuclear Reactor Technology), Tri Dasa Mega, in 2024 – Vol. 26 No. 1 (February 2024). This issue contains five articles discussing various applications of nuclear technologies and sciences.

The first article "Insider Intervention Model in the Sabotage Attack Scenario of a Nuclear Reactor Facility" was written by Dinan Andiwijayakusuma, Teguh Asmoro, Alim Mardhi, Topan Setiadipura, from the Research Center for Computing - Research Organization for Electronics and Informatics, National Research and Innovation Agency (BRIN), KST Soekarno, Bogor, Jawa Barat, Indonesia. They study the Physical Protection System (PPS) at nuclear facilities. This paper presents the PPS to prevent intrusions into nuclear facilities that cause sabotage attacks or illegal theft of nuclear material. Our previous study evaluated PPS' effectiveness in scenarios of sabotage attacks by outsiders. However, sabotage attacks can involve insiders and have a worse impact on the effectiveness of the PPS. How far are the negative impacts caused by insiders colluding with outsiders for PPS effectiveness? In this study, they developed two models in the form of insider intervention and collusion with outsiders, and then we analyzed how insider involvement impacts PPS' effectiveness. The first is a model that reduces the performance of the protection parameters, and the second is a model that eliminates the performance of the protection parameters. The protection parameters observed in this study are the probability of detection (P_D) and the time delay (t_d). In certain conditions, the frequency analysis shows that insider intervention in the time delay might have fatal consequences and drastically reduce the effectiveness of PPS performance. Therefore, PPS designers need to pay more attention to the delay element to mitigate the potential negative impacts of insider intervention on the effectiveness of the PPS.

The second article "Evaluation of Pixelated Plastic Scintillators Coupled to Multi-Channel Silicon Photomultipliers for Beta-Ray Detection and Source Localization" was investigated by Agus Nur Rachman, Rusbani Kurniawan, Egnes Ekaranti, Wahyudi, Eka Djatnika Nugraha, I Wayan Ngarayana, Moh Hamdan from the Research Center for Nuclear Safety, Metrology, and Quality Technology, Research Organization for Nuclear Energy, National Research and Innovation Agency, BJ Habibie Integrated Science Area, Tangerang Selatan, Indonesia. This paper presents a novel detector design for radiation detection technology, based on pixelated plastic scintillators coupled to multi-channel silicon photomultipliers (SiPMs). This study investigated the performance of a detector that combines the efficiency of plastic scintillators with the sensitivity and versatility of SiPMs, overcoming the limitations of traditional photomultiplier tubes in terms of durability, power consumption, and sensitivity. The compact and modular nature of the detector makes it suitable for diverse environments and applications, such as portable radiation monitoring devices or integration into existing experimental setups. The performance of the detector was evaluated using beta-ray sources of 36Cl and 90Sr, and it was demonstrated that the detector can detect and localize the point source with high accuracy and resolution.

The third article "HAZOP-Based Risk Assessment of Pebble Bed Fuel Handling Systems Design" was studied by Rusbani Kurniawan, Egnes Ekaranti, Agus Nur Rachman, Eka Djatnika Nugraha, I Wayan Ngarayana, Zulkifli Djunaidi from the Research Center for Nuclear Safety, Metrology, and Quality Technology, Research Organization for Nuclear Energy, National Research and Innovation Agency, BJ Habibie Integrated Science Area, Tangerang Selatan, Indonesia. They study the High-Temperature Gas-Cooled Reactor (HTGR), a promising candidate for Generation IV nuclear reactors, boasting

superior inherent passive safety features and a continuous fuel handling system. This system employs multi-pass cycles, utilizing pneumatic and gravitational mechanisms to feed, circulate, and unload the pebble bed fuel element. This paper presents a descriptive analysis assessing the safety risk of the fuel handling system design in HTR-10. The Hazard and Operability Study (HAZOP) methodology is employed to identify hazard parameters, deviation limitations, causes, impacts, and potential risks to the system's main components. The establishment of probability scales, consequence criteria, risk level ratings, and control activities adheres to the ISO 31000 standard. Primary data were gathered through expert judgment, while secondary data were sourced from design layout documentation, literature reviews, and safety analysis reports. Six main components, namely the elevator, core, singulator, failed fuel separator, burnup measurement, and distributor, were selected as assessment nodes from the piping and instrumentation diagram. The assessment revealed that each node initially presented a moderate to extreme risk potential (risk level rating C to E). However, after assuming the implementation of various control measures outlined in the design, the residual risk for all nodes was reduced to an acceptable limit (risk rating A - very low). Therefore, the fuel handling system design already incorporates adequate control activities to mitigate potential safety risks due to system component failure. Safety risk assessment is a dynamic process; it should be reviewed periodically or whenever there are design changes at any project stage. This ensures the safety risk magnitude is consistently known and managed effectively.

The fourth article "Advancements in Accident Tolerance Fuel: A New Horizon in Nuclear Safety" was explored by I Wayan Ngarayana, Rusbani Kurniawan, Agus Nur Rachman, Eka Djatnika Nugraha, Egnes Ekaranti, Ika Wahyu Setya Andani, from the Research Center for Nuclear Reactor Technology, Research Organization for Nuclear Energy, National Research and Innovation Agency, BJ Habibie, Serpong, Tangerang Selatan, Indonesia. Their research is about Accident Tolerant Fuels (ATFs) that a breakthrough in nuclear safety that can reduce the hazards of nuclear reactor accidents by preventing core meltdowns and withstanding extreme conditions. This paper provides a comprehensive overview of the development and current state of ATF technology, tracing its evolution and highlighting key technological milestones. We used different case studies to assess how ATFs work and perform in actual situations. Despite the promising capabilities of ATFs, they face difficulties in their development and deployment. We delve into the technical, regulatory, and economic hurdles that must be overcome to realize the full potential of ATFs. Looking ahead, we explore the prospects of ATFs, discussing potential advancements and their implications for the nuclear industry. The findings of this paper underscore the transformative role of ATFs in enhancing nuclear reactor safety and charting a new horizon in nuclear technology.

The fifth article "Techno-Economic Assessment and Optimization of a Standalone System in Sebira Island, Indonesia" was studied by Laili Farah, Yus Rusdian Akhmad, Rezky Mahardika Saryadi, Amil Mardha, Mudjiono, Nuryanti, Kurnia Anzhar, Airine Hijrah Handayani from the Research Center for Nuclear Reactor Technology, National Research and Innovation Agency, Gedung B.J. Habibie, Jakarta Pusat, Indonesia. The paper presents Nuclear Power as a baseload generator in a centralized power network, but its implementation is too large for microgrid applications. Despite this challenge, nuclear power is being considered a potential source of electricity for microgrid applications due to its ability to produce emission-free energy. This research discusses the techno-economic analysis and optimization of a hybrid energy system design on Sebira Island, Indonesia, using a multi-year module in HOMER Pro software. Two scenarios were created: diesel-PV-battery and nuclear-PV-battery, with the baseline system being a diesel generator (DG) only. The research results show that with the optimal use of the nuclear-PV-battery system, The CO2 emissions generated in the optimal nuclear-PV-battery system are zero, making this system far more viable than other hybrid system schemes

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