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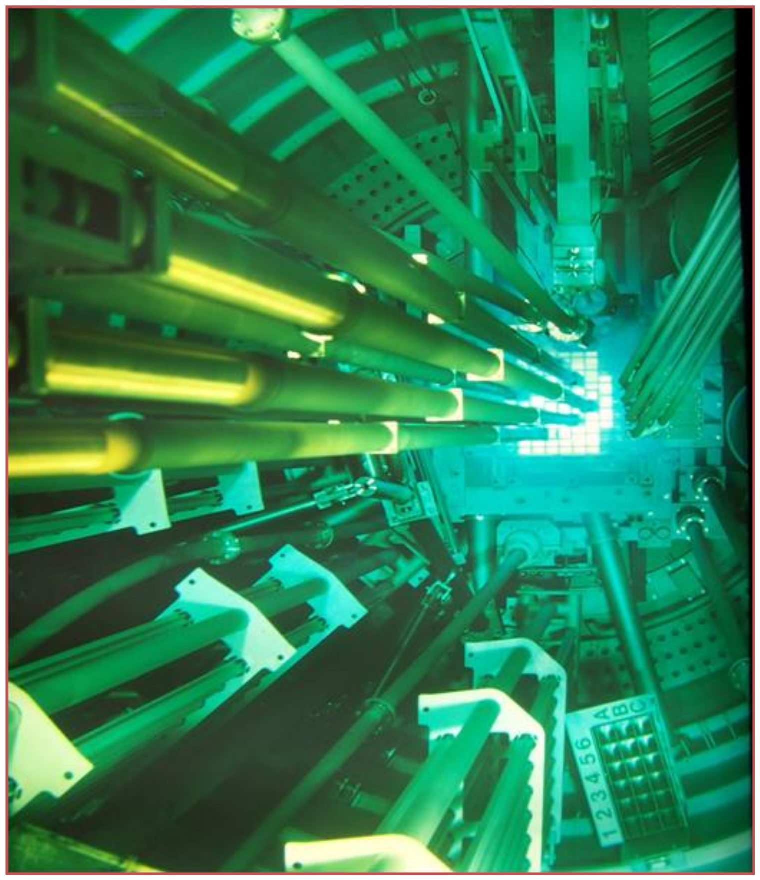

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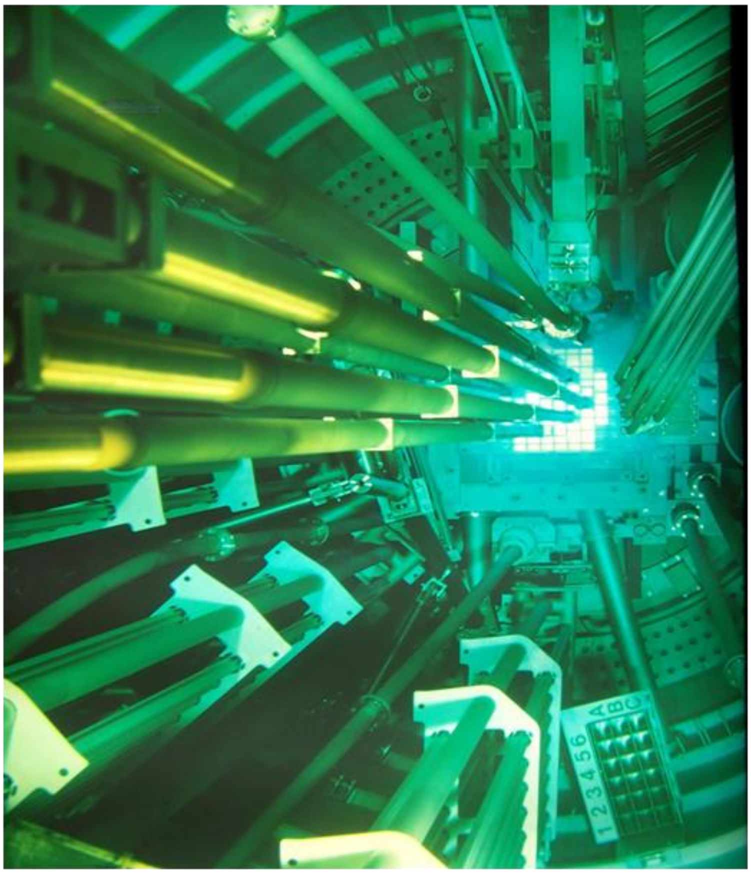

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MAILING ADDRESS :
Pusat Riset Teknologi Reaktor Nuklir, ORTN, BRIN
Gedung 80, Puspiptek Serpong 15310, Tangerang
TELP. (021) 7560912, FAX. (021)7560913, E-mail: jurtdm@batan.go.id
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PREFACE

Dear readers,

With great pleasure, we provide you with the second issue of the Jurnal Teknologi Reaktor Nuklir (Journal of Nuclear Reactor Technology), Tri Dasa Mega, in 2024 – Vol. 26 No. 2 (June 2024). This issue contains five articles discussing various applications of nuclear technologies and sciences.

The first article "Experimental Study of The Influences of Inclination Angle and Heat Load on Loop Heat Pipe Thermal Performance" was written by Afifa Pramesywari, Mukhsinun Hadi Kusuma, Berkah Fajar Tamtomo Kiono, Khoiri Rozi, Haura Emara, Giarno, Yoyok Dwi Setyo Pambudi, Muhammad Mika Ramadhani Restiawan, Sumantri, from Department of Mechanical Engineering, Diponegoro University, Jl. Prof. Sudharto, S.H., Tembalang-Semarang, Indonesia. They study the utilization of nuclear power which brings out a lot of benefits in fulfilling human needs for power. The thermal accident caused by the failure of an active cooling system due to an earthquake followed by a tsunami, such as in the Fukushima Dai-Ichi Nuclear Power Plant, Japan, could be taken as a lesson learned to keep improving the operation safety aspects of nuclear installation. Loop heat pipe (LHP), as an alternative cooling system technology, could be utilized to handle thermal problems on nuclear installations. This research aims to understand the influence of the inclination angle and heat load on the thermal performance of LHP. The experimental investigation was performed with varying inclination angles and hot water temperatures. The LHP used demineralized water as the working fluid. The result of this experiment showed that LHP has the best thermal performance with the lowest thermal resistance of 0.0043 °C/W. This result was obtained when the LHP operated with a 5° inclination angle and hot water at a temperature of 90 °C. The conclusion from this research shows that LHP thermal performance is better as the inclination angle increases on LHP because the steam velocity formed is bigger, and condensate flows back to the evaporator faster.

The second article "Experimental Investigation of Natural Circulation Stability Phenomena in a New Loop Heat Pipe Model" was studied by Alif Rahman Wirza, Mukhsinun Hadi Kusuma, Khoiri Rozi, Berkah Fajar Tamtomo Kiono, Muhammad Mika Ramadhani Restiawan, Giarno, Yoyok Dwi Setyo Pambudi, Muhammad Yunus, Sofia Loren Butarbutar, Sumantri Hatmoko, Nanang Apriandi, Afifa Pramesywari from the Department of Mechanical Engineering, Diponegoro University, Jl. Prof. Sudharto, S.H., Tembalang-Semarang, Indonesia. This research about the severe accident at the Fukushima Dai-ichi Nuclear Power Plant in Japan in 2011 highlighted the critical need for a passive cooling system to dissipate residual decay heat following the failure of active cooling systems in the nuclear facility. The loop heat pipe (LHP) is a promising technology for such applications. The objective of this research is to understand the natural circulation stability phenomena of the new LHP model under various conditions of filling ratio and heat load. The experimental methodology employed a laboratory-scale LHP model made of copper with an inner diameter of 0.104 m. The experiments were designed with filling ratios of 20%, 40%, 60%, 80%, and 100%, and hot water temperature as the evaporator heat source with variations of 60 °C, 70 °C, 80 °C, and 90 °C. The initial operating pressure was 10665.6 Pa, with a 5˚ inclination angle, demineralized water as the working fluid, and cooled by air at a velocity of 2.5 m/s. The results show that LHP natural circulation happens in two phases and stays stable. The best performance was seen at 90 °C and an 80% filling ratio. The conclusion of this research indicates that natural circulation stability in LHP operates well and occurs in two phases. This demonstrates that LHP effectively acts as a heat absorber and heat dissipator.

The third article “Computational Fluid Dynamics Simulation of Temperature Distribution and Flow Characterization in a New Loop Heat Pipe Model” was explored by Muhammad Mika Ramadhani Restiawan, Mukhsinun Hadi Kusuma, Khoiri Rozi, Berkah Fajar Tamtomo Kiono, Muhammad Yunus, Alif Rahman Wirza, Yoyok Dwi Setyo Pambudi, Sofia Loren ButarButar, Giarno, Sumantri Hatmoko, from the 1Department of Mechanical Engineering, Diponegoro University, Jl. Prof. Sudharto, S.H., Tembalang-Semarang, Indonesia. Their research is about The loop heat pipe (LHP) being considered for passive cooling systems in nuclear installations. A combined approach of simulation and experimentation is essential for achieving comprehensive knowledge of the LHP. Research on the LHP using Computational Fluid Dynamics (CFD) is necessary to understand phenomena that are challenging to ascertain experimentally. This study examines the temperature distribution and flow characteristics in a new LHP model. The method used in this research is simulation using CFD Ansys FLUENT software. In the simulation, the LHP has an inner diameter of 0.1016 m. This LHP features a wick made from a collection of capillary pipes without a compensation chamber. Demineralized water is used as the working fluid with a filling ratio of 100% of the evaporator volume. The hot water temperature in the evaporator section is set at 70 °C, 80 °C, and 90 °C. The temperature on the outer surface of the condenser pipe is determined using experimental temperature inputs. An inclination angle of 5° and an initial pressure of 12,100 Pa are applied to LHP. The CFD simulation results show that the temperature distribution profile under steady-state conditions in the loop heat pipe appears almost uniform. The temperature difference between the evaporator and condenser remains consistent. The flow of working fluid in the LHP is driven by buoyancy forces and fluid flow, allowing the working fluid in the LHP to flow in two phases from the evaporator to the condenser and then condensate from the condenser back to the evaporator. In conclusion, the temperature distribution and flow patterns in the LHP are consistent with common phenomena observed in heat pipes. This modeling can be used to determine the profiles of temperature distribution and flow in LHP of the same dimensions under various thermal conditions

The fourth article “Investigation of Natural Circulation Flow Under Steady-State Conditions Using a Rectangular Loop” was studied by Iwan Roswandi, Dimas, Hyundianto Arif Gunawan, Arif Adtyas Budiman, Almira Citra Amelia, Sanda, Hendro Tjahjono, Mulya Juarsa. from the Nuclear Reactor Thermal-Fluids System Development (NRTFSyDev.) Research Group, Research Center for Nuclear Reactor Technology, Research Organization for Nuclear Energy, National Research and Innovation Agency (BRIN), KST. B.J. Habibie, Setu, Tangerang Selatan, Banten, Indonesia. The paper presents Passive safety systems, particularly during active system failures, which have become a significant concern. Understanding natural circulation phenomena is crucial for developing passive cooling systems in nuclear power plants. With its significant findings, this study examines the flow patterns under steady-state conditions and assesses the Grashof number. The experimental approach involved maintaining temperature differences of 60 °C, 70 °C, 80 °C, and 90 °C for 3 hours, with three replications. The temperature alterations impact water's physical properties, such as density, viscosity, and specific heat. The calculations reveal that the minimum Grashof number that occurs at 60 °C is 2.49×1012, while the maximum observed at 90 °C is 9.42×1012, with an R2 value of 0.96533. The observation of turbulent flow patterns during each temperature fluctuation, which aligns with previous research on the Ress value of Grm/NG, has significant implications for the design and operation of passive safety systems in nuclear power plants

The fifth article “Analysis of the Reactivity Coefficient of the PWR Thorium Fuel Cell” was investigated by Santo Paulus Rajagukguk, Purwadi Purwadi, Syaiful Bakhri from the UNIMED FMIPA Jurusan Fisika, Medan, Indonesia. This paper presents an analysis of the Reactivity Coefficient parameter Of PWR using Thorium fuel. The purpose of this work is to determine the value of the reactivity coefficient at the Beginning of the Cycle (BOC) and End of the Cycle (EOC) using the WIMSD code based on ENDF/B-VIII.0 nuclear data files. The PWR-1175 MWe experiment critical reactors, which use Th-UO2 fuel pellets, are a set of light water-moderated lattice experiments that were used for this purpose. The study applied the new cross-section libraries for WIMSD-5B with ENDF/B-VIII.0 lattice code. The results showed that the fuel temperature reactivity coefficients for the PWR reactor at BOC and EOC using new libraries are negative. Moderator Temperature

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Reactivity Coefficient at BOC and EOC are also negative. Compared to the experimental data of the reactor core, the difference is in the range of 5.0 %. It can be said that the PWR using thorium fuel as a model, all reactivity coefficients are negative and it is a good design for the safety of operation.

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