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Abstract Collection

Ign. Djoko Irianto, Sukmanto Dibyo, Sriyono, Djati H. Salimy, Rahayu Kusumastuti, Marliyadi Pancoko., *Performance Analysis of RDE Energy Conversion System in Various Reactor Power Condition.* Tri Dasa Mega, 21 (3), 99.

Reaktor Daya Eksperimental (RDE) is an experimental power reactor based on High Temperature Gas-cooled Reactor (HTGR) technology with thermal power of 10 MW. As an experimental power reactor, RDE is designed for electricity generation and provides thermal energy for experimental purposes. RDE energy conversion system is designed with cogeneration configuration in the Rankine cycle. To ensure the effectiveness of its cogeneration, the outlet temperature of the RDE is set at 700°C and steam generator outlet temperature is around 530°C. Analysis of the performance of the energy conversion system in various power levels is needed to determine the RDE operating conditions. This research is aimed to study the performance characteristics of RDE energy conversion systems in various reactor power conditions. The analysis was carried out by simulating thermodynamic parameter calculations on the RDE energy conversion system and the overall cooling system using the ChemCad program package. The simulation is carried out by increasing the reactor power from 0 MW to 10 MW at constant pressure and constant mass flow rate. The simulation results show that the steam fraction at the steam generator outlet increases starting from 3 MW reactor power and reaches saturated steam after the thermal power level of 7.5 MW. From the results, it can be concluded that with constant mass flow rate and operating pressure, optimal turbine power is obtained after the reactor thermal power reached 7.5 MW.

Keywords: RDE, Energy Conversion System, Performance, Reactor Power, ChemCad

V. Indriati Sri Wardhani, Henky Poedjo Rahardjo, Rasito Tursinah**,** *Routing Design on The Primary Cooling Piping System in Plate-type Converted TRIGA 2000 Reactor Bandung.* Tri Dasa Mega, 21 (3), 107.

In 2015, research activities to modify TRIGA 2000 Reactor Bandung fuel element from cylindrical to plate-type have been initiated. By using plate-type fuel elements, core cooling process will be altered due to different generated heat distribution. The direction of cooling flow is changed from bottom-to-top natural convection to top-to-bottom forced convection. This change of flow direction requires adjustment on the cooling piping system, in order to produce simple, economical, and safe piping route. This paper will discuss the design of suitable piping routing based on pipe stress and N-16 radioactivity. The design process was carried out in several stages which include thermal-hydraulic data of reactor core to determine the process variables, followed by modeling various pipeline routes. Based on available space and ease of manufacture, four possible alternative routings were determined. Four routings were produced and analyzed to minimize the amount of N-16 radioactivity on the surface of the reactor tank, prolonging the cooling fluid travel time to reach at least five times of N-16 half-life. Subsequent pipe stress analysis using CAESAR II software was conducted to ensure that the piping system will be able to withstand various loads such as working fluid load, pipe weight, along with working temperature and pressure. The results showed that the occurred stresses were still below the safety limit as required in ASME B31.1 Code, indicated that the designed and selected pipeline routing of primary cooling system in the Plate-type Converted TRIGA 2000 Reactor Bandung has met the safety standards.

Keywords: TRIGA reactor, Cooling system modification, Pipeline routing design, Pipe stress analysis, N-16 radioactivity

Pande Made Udiyani, Ihda Husnayani, M. Budi Setiawan, Sri Kuntjoro, Hery Adrial, Amir Hamzah., *Estimation of The Radioactive Source Term from RDE Accident Postulation.* Tri Dasa Mega, 21 (3), 113.

The design process of Experimental Power Reactor (ReaktorDayaEksperimental/RDE) has been carried out by BATAN for the last five years, adopting HTGR-type reactor with thermal power of 10 MW. RDE is designed with the reference of similar reactor, namely HTR-10. During this process, source term estimation is required to prove the safety of RDE design, as well as to fulfill the concept of As Low As Reasonably Achievable (ALARA) in radiation protection. The source term is

affected by the magnitude of the radioactive substances released from the reactor core due to an accident. Conservative accident postulations on the RDE are water ingress and depressurization accidents. Based on these postulations, source term estimation was performed. It follows the mechanistic source term flow, with conservative assumptions for the radioactive release of fuel into the coolant, reactor building, and finally discharged into the environment. Assumptions for the calculation are taken from conservative removable parameters.The result of source term calculation due to the water ingress accident for Xe-133 noble gas is 8.97E+12 Bq, Cs-137 is 3.59E+07 Bq, and I-131 is 4.34E+10 Bq. As for depressurization accident, the source term activity for Xe-133 is 3.90E+13Bq, Cs-137 is 1.56E+07 Bq, and I-131 is 1.89E+10Bq. The source term calculation results obtained in this work shows a higher number compared to the HTR-10 source term used as a reference. The difference is possibly due to the differences in reactor inventory calculations and the more conservative assumptions for source term calculation.

Keywords: RDE, HTGR, Radioactive, Source term, accident

Alexaandre Ezzidi Nakata, Masanori Naitoh, Chris Allison., *Need of a Next Generation Severe Accident Code.* Tri Dasa Mega, 21 (3), 119.

Two international severe accident benchmark problems have been performed recently by using several existing parametric severe accident codes: The Benchmark Study of the Accident at the Fukushima Daiichi Nuclear Power Plant (BSAF) and the Benchmark of the In-Vessel Melt Retention (IVMR) Analysis of a VVER-1000 Nuclear Power Plant (NPP). The BSAF project was organized by the Nuclear Power Engineering Center (NUPEC) of the Institute of Applied Energy (IAE) in Japan for the three Boiling Water Reactors (BWRs) of the Fukushima NPP. The IVMR Project was organized by the Joint Research Center (JRC) of the European Commission (EC) in Holland (Europe) for a Pressurized Water Reactor (PWR). The obtained results of both projects have shown very large discrepancies between the used severe accident codes for both reactor types BWR and PWR. Consequently, the results for a real plant analysis by these integral codes, may not be correct after the beginning of core melt. Discrepancies of results of ex-vessel phenomena in the containment between the codes are in general larger. Therefore, there is a stong need for a reliable new generation mechanistic severe accident code which can simulate severe accident scenarios from an initiating event till containment failure with better accuracy not only for existing light water reactors but also for new generation IV reactor types. SAMPSON mechanistic ex-vessel modules coupled with SCDAPSIM and a new thermal-hydraulic module ASYST-ISA with particularly newly developed options for the reactor coolant system (RCS) and material properties applicable to new reactor deigns, is proposed as a best etimate new generation severe accident code for several reasons which are described in this paper.

Keywords: Severe accident, SAMPSON, SCDAPSIM, ASYST-ISA, Fukushima, Steam explosion, Hydrogen detonation

Hardi Hidayat, Budi Setyahandana, Yohannes Sardjono, Yulwido Adi., *The Effect of Beach Environment and Sea Water on Nickel Corrosion Rate as a Collimator Material for the Application of Boron Neutron Capture Therapy.* Tri Dasa Mega, 21 (3), 127

The purpose of this study is to determine the value of corrosion rate influenced by coastal environment and seawater to nickel as a collimator base material for the application of boron neutron capture therapy (BNCT). In this research, the authors used 99.9% pure nickel as the reference material. Corrosion testing was carried out to determine the rate of corrosion of nickel as a base material for BNCT. After the specimens were formed, the test specimens were then corroded for 12 weeks, with various conditions such as indoor, outdoor environment, static seawater, and moving seawater. The results of this study indicated that in corrosion testing with indoor condition, the corrosion rate values are 0.61-1.00 mpy. For outdoor condition, the corrosion rate is 0.89-1.34 mpy. Meanwhile, at static seawater conditions, the corrosion rate is 0.97-1.24 mpy. Lastly, for moving seawater condition, the corrosion rate is 1.64-1.91 mpy. The results showed that corrosion resistance was relatively the same for all nickel exposed to corrosion in the coastal environment. Therefore, in regards to corrosion resistance, using nickel as a collimator base material for BNCT applications is considered as safe

Keywords: BNCT, Nickel, Corrosion, Coastal Environtment, Sea Water

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