DETERMINATION OF ELEMENTS AND RADIONUCLIDES CONCENTRATION IN REAKTOR TRIGA PUSPATI (RTP) COOLANT AND ITS CORROSION RATE ON VARIOUS METALS

NUR SYAZANA BINTI YUSRI

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ABSTRACT

DETERMINATION OF ELEMENTS AND RADIONUCLIDES CONCENTRATION IN REAKTOR TRIGA PUSPATI (RTP) COOLANT AND ITS CORROSION RATE ON VARIOUS METALS

Reaktor TRIGA PUSPATI is the only nuclear research reactor in Malaysia and started to operate since 1982. It uses light water as reactor coolant. The cooling system consists of primary cooling system, which embedded with water purification system and secondary cooling system. The systems structures are made up of metals mainly from Aluminum 6061 (Al6061), Stainless Steel 304 (SS304) and Stainless Steel 316 (SS316). In this study, primary, secondary and make-up water were sampled and went through several water quality analysis. Through in-situ measurement analysis, pH and Conductivity value in all reactor coolant samples were found to be within the acceptable operational limit which indicates the reactor water quality is excellent and sufficient for a safe reactor operation. The screening analysis of element concentration presence in primary, secondary and make-up water samples was found to be in the range of 0.01 ppb to 3.02 ppm, 0.01 ppb to >1000 ppm and 0.01 to 17.54 ppm, respectively. The elemental analysis was performed using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). The highest element concentration determined in primary, secondary and make-up water samples were found to be Sulphur, Natrium and Rubidium, respectively. The radionuclides radioactivity levels were analyzed using Hyper-pure Germanium (HpGe) gamma spectrometry. Four radionuclides were detected in primary water samples with specific activity in the range of 112.16 $Bqkg^{-1}$ to 9450.09 $Bqkg^{-1}$, namely Na-24, Ar-41, Mn-56 and W-187. Lastly, the corrosion rate analysis between reactor coolant samples and various metals was performed using Tafel extrapolation method. As for now, it was concluded that the relationship between reactor coolant sample types and corrosion rate achieved in this study is still unclear. Though, all the corrosion rate analysis results were reported low and can be considered insignificant to cause major degradation to the reactor systems, structures and components integrity during the nuclear reactor operational life time.

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