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Implementation of thermal neutron radiography at medium and low power research reactors in Iran

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Research reactors have been used as good neutron sources for neutron radiography systems during last decades. Although these reactors have many disadvantages, such as lack of portability, high cost and high waste production, these sources can provide high and stable neutron flux and also have some equipments such as beam tubes in order to extract neutron beams through the biological shield. In recent years, a thermal neutron beam was designed and implemented in the radial “E” beam tube of Tehran Research Reactor (TRR). TRR is a 5 megawatt research reactor and equipped with seven beam tubes. Characterization of this thermal neutron radiography beam was done using the Image Quality Indicators (IQI) of American Standard and Testing Materials (ASTM). Besides that, during the past year, another thermal neutron beam is implemented at the Miniature Neutron Source Reactor (MNSR). MNSR is a 30 kilowatt research reactor and compared to the TRR, it has not external beam tube. Therefore, in this case an external beam tube is designed and constructed in order to achieve an appropriate neutron radiography beam. Some samples like IQIs, fresh nuclear fuel rods, ancient pottery, plant roots and soil, graphite box are studied using these two neutron radiography beamlines. In this paper, the design details of these neutron radiography beamlines, the parameters of these beamlines, the result of beam characterizations and some experiments that are done at these facilities are presented.

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