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Liquid waste treatment of Tehran research reactor using vacuum evaporation system and ion exchange column

Tehran Research Reactor is an MTR type reactor with a thermal power of 5 megawatts, which was built for the purposes of education, research, radioisotope production and irradiation. The core of this reactor is inside the water pool. This water is light water and is used for cooling, reflection, shielding and moderator. Therefore, this water should be used pure and without mineral so that it can be effective for the mentioned purposes. On the other hand, the presence of water impurities causes them to become active and increase the level of radiation. Ion exchange purification method is used to maintain the required water quality. These columns lose their efficiency after some time and it is necessary to recover their purification and ion exchange capability through the regeneration process. In this process, some liquid waste is produced, which is actually the main part of the production waste of the reactor. In order to prevent environmental contamination and reuse this polluted water, this waste is cleaned using a liquid waste treatment system.

This system works on the basis of vacuum evaporation. The liquid waste first passes through the filter and after removing the suspended material, it enters the evaporation tank. In this tank, water boils at a temperature of about 36 degrees Celsius. The vapor phase is collected in the upper part of the tank and is liquefied using the cooling system. This water is purified to a significant extent and can be used for the next steps. The electrical conductivity of this water is between 20 and 30 μS/cm.Since the water required for the reactor pool should have an electrical conductivity of less than 1 μS/cm, it is necessary to purify it again and enter the primary circuit of the reactor. For this purpose, ion exchange resin is purified using a mixed column and its electrical conductivity reaches the specified limits. The analysis of the water output from this system indicates that it is not contaminated with radioactive materials and can enter the primary water circuit of the reactor.

By using this method, in addition to reducing the cost of transferring liquid waste to the waste management company for treatment and final disposal, the water required for the primary circuit of the reactor is also supplied to a significant extent and can reduce costs while preserving resources and the environment.

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