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New mobile manipulator for VVER-440 reactor coolant cleaning and filtering

Reactor primary circuit materials undergo general corrosion by temperature and chemical stress. Corrosion products are released from the corroded surfaces, transported by reactor coolant and particles are re-deposited on fuel assemblies, reactor internals and entire primary circuit. Products of corrosion and coolant impurities cause higher radiation doses for personnel during regular outages for refuelling, inspections and modifications. Moreover, sedimented particles may reduce fuel cooling, movement of control assemblies and may have negative effect on nuclear safety of the reactor.

Mechanical impurities and corrosion product particles in VVER-440 reactor sedimented on reactor pressure vessel bottom and on control rod dumpers are regularly on an 8-year basis cleaned by a manipulator. However, VVER-440 reactor design does not have in-built filtering system for cleaning reactor coolant during refuelling procedure.

In order to enhance nuclear and radiation safety, new mobile manipulators for VVER-440 reactor coolant filtering during refuelling procedure were designed and to be installed during each refuelling outage of the reactor. This manipulator is composed of pump and mechanical filters, which capture all impurities up to 0,5µm and lead to cleaning of reactor coolant. Filtered radioactive waste will be either stored or treated and disposed of based on resulting radiological characterization.

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