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CORE CONDITION MONITORING IN ADVANCED COMMERCIAL SODIUM BN-1200

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One of the most important criteria of successful NPP functioning is ensuring personnel and population radiation safety by defense in depth safety barrier system. Primary coolant and reactor gas radioactivity depends on condition of fuel pins, claddings of which can lose their leaktightness during operation due to various reasons (factory fault, changing of irradiation conditions). That is why, failure detection of fuel pin claddings, i.e. the main safety barrier, is of primary importance during core condition monitoring in the process of reactor plant operation.

The task of fuel pin cladding failure detection (FCFD) at sodium reactor is carried out during reactor power operation (operational in-vessel systems of FCFD) and at a shutdown reactor (non-operational in-vessel and ex-vessel systems of FCFD).

Operational FCFD systems of BN reactor plants, both operating and prospective ones, comprise several systems:

- ☒ Gas system of FCFD registers appearance of leaky fuel pins in core analyzing activity of various fission gases in reactor gas blanket;
- ☒ Sector system of FCFD registers appearance of leaky (by fuel) fuel pins recording delayed neutrons from fission fragments brought in the primary coolant through fuel pin cladding fault;
- ☒ Sodium system of FCFD registers level of primary sodium contamination by various radio nuclides (mainly by ^{137}Cs).

Non-operational systems of FCFD comprise the following ones:

- ☒ In-vessel failed fuel detection system (SODS-R) is intended to detect leaky FSAs at shutdown reactor based on the results of FCFD sector system data analysis;
- ☒ In-washing socket failed fuel detection system (SODS-GO) is intended to detect leaky FSAs measuring fission product activity in washing media (gas, water, steam).

Efficiency of FCFD system is confirmed by operating experience both in Russia and abroad. FCFD system application enables to improve operating safety, ensures monitoring of the spent fuel storage, and contributes to ensuring high operational indices of power unit.

The paper considers existing FCFD systems for fast reactors and discusses opportunities to apply experience of their design and operation to develop FCFD system for the prospective commercial sodium BN-1200 reactor.

Country/Int. Organization

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