THERMAL SCHEMES OF NUCLEAR POWER PLANTS

Tyutyunik L.I.
National Technical University
"Kharkiv Polytechnic Institute", Kharkiv

Nuclear power is based on the conversion of intranuclear energy into other types: thermal, mechanical and electrical, and then using it for industrial and domestic needs. A nuclear power plant uses the heat generated in nuclear reactors as a result of a chain reaction of fission of the nuclei of some heavy elements, and then converts it into electrical energy. Nuclear power is not only nuclear power plants, but also a complex of enterprises that are needed to provide them with fuel. These are mines where uranium ore is mined, plants for its processing and the extraction of uranium oxide, enterprises where uranium isotopes are separated and fuel elements are created. After these elements with uranium are used at a nuclear power plant, they are transported to a plant where fission fragments and unburned fuel are separated from this used fuel. This cycle ends with the disposal or utilization of fission residues and other radioactive elements. Nuclear energy is the most concentrated form of energy used by humans. When the nuclei of heavy atoms are split into two, energy is released: instantaneous or explosive - in atomic bombs, and slow, controlled - in nuclear reactors. There is only one element in nature that fissiles itself - uranium. Uranium ore consists of three isotopes: uranium-234, uranium-235 and uranium-238; and only uranium-235 is suitable as fuel for nuclear power plants. The ore contains no more than 0.7% uranium-235. The amount of the isotope increases during enrichment to approximately 90% uranium-235. To prevent uranium fuel and harmful and highly radioactive fission products from entering the environment and affecting humans and all other living things, it is placed in thin, pencil-like shells. These are steel columns with a wall thickness of 20-30 mm, made of stainless steel. They are also called heat-releasing elements, which are usually installed vertically so that the flow of water or gas flowing between them absorbs the heat released during the separation. Passing between the hot fuel elements, the coolant heats up, is discharged outside and is used to produce steam, which is necessary to drive the CHP turbogenerator. At nuclear power plants, the heat obtained in the reactor is converted into electricity using steam turbines and electric generators. Steam turbines use water vapor as the working fluid. The principle of obtaining thermal energy in reactors of different types is the same, but the use of heat in relation to its purpose is different. According to the number of circulation circuits for transferring the removed heat through the working fluid, single-, double- and three-circuit thermal schemes are distinguished. Single-circuit nuclear power plants, where the coolant, which continues the heat in the reactor core, enters the turbine as a working fluid. Double-circuit nuclear power plants, where the circuit consists of two circuits, and the coolant circuit is called the first, and the working fluid circuit is the second. In three-circuit nuclear power plants, sodium coolant is used, which is needed to prevent contact in the steam generator of radioactive sodium in the first circuit with water and their release in the nuclear power plant premises.