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## COOLING SYSTEM OF THE BIOLOGICAL PROTECTION OF THE IRT-T REACTOR

*Introduction*

The IAEA precaution norms establish basic safety principles, provisions, and measures to curb irradiation to human beings and the discharge of radioactive material to the surroundings. They also reduce the possibility of incidents that could result to inability to manage the atomic reactor, or any activity that results to the release of radioactive substances. This includes nuclear sites, the use of radiation sources, the shipping radioactive materials, and the control of radioactive waste, among other locations and activities that include a danger from radiation [1]. Biological protection is designed to create a radiation environment at workplaces, in the reactor rooms in accordance with radiation safety standards. According to fundamental safety principles, the best possible level of safety must be provided through optimizing protection. [2]. The biological protection of the reactor includes the pool water, the concrete mass of the reactor pool protection, the gates of the horizontal experimental channels, and the protective boxes of the reactor process equipment [3]. During operation of the reactor, a lot of heat is released in the reactor vessel. With these conditions, the biological protection of the reactor absorbs heat. Therefore, there is a need to cool the protection system.

*Main components of biological protection system*

1. Pumps

Table 1

*- Characteristics of the pump*

| Pump size | flow $m^3/h$ | Head, m | Motor power kW | Rotation frequency, rpm |
|---|---|---|---|---|
| X20/31 | 20 | 32 | 5.5 | 2900 |

2. Heat exchanger

Table 2

*Characteristics of heat exchanger*

| Type of heat exchanger | Heat exchange surface | Flow rate of water |
|---|---|---|
| TO-6 water-to-water heat exchanger | 7.5 $m^2$ | 7 $m^3$ /h |

3. Coils installed for biological protection

Coils made of stainless-steel pipes with diameters of 38mm and 32mm

4. Pipelines and fittings
5. Cooling tower

*Cooling circuit of the biological protection of the IRT-T reactor*

The protection cooling circuit is designed to remove the heat released in the biological shield of the IRT-T reactor. The system is filled with demineralized water. The cooling of the biological protection of the reactor is carried out with the help of coils installed in the area of the slide gates of the horizontal experimental channels and under the bottom of the tank in the area of the core. An additional coil is installed in the area of the gates between the walls of the old aluminum tank and the stainless steel one. Water is heated in coils made of stainless-steel pipes with diameters 38mm and 32mm and poured into the concrete of the bottom and walls of the tank, as well as around the slide gates. It is supplied through a 50 mm diameter pipeline to the protection cooling pump type X20 / 31, located in the pump room of the secondary circuit. A valve 31 is installed on the suction pipeline of the pump while a manually operated valve 32 are installed on the discharge pipeline. After the pump, the demineralized water enters the TO-6 water-to-water heat exchanger with a heat exchange surface of 7.5 $m^2$, where it is cooled by the process water of the secondary circuit. The heat exchanger is fixed to the wall. Valves are installed at its inlet and outlet. Further, the cooled water is supplied through a pipe 57 mm diameter to the protection cooling coils. Valves are installed at the inlet and outlet of the

protection cooling coils. The schematic diagram of the biological protection system can be shown in the figure below.

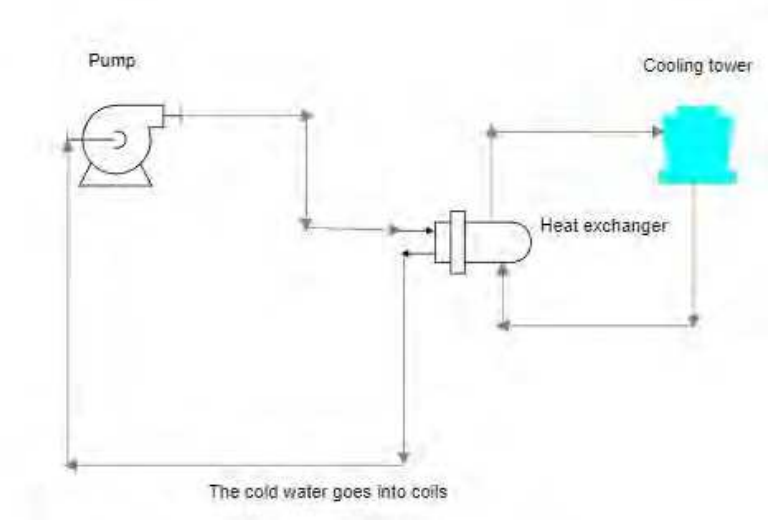


*Fig. 1. Biological protection system of IRT-T Reactor*

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