

OPTIMIZATION OF THE RADIATION PROTECTION AT OPERATION OF NUCLEAR OBJECTS OF THE MARINE TECHNOLOGY

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Russia takes a leading place in the world by the quantity of nuclear objects of marine technology (NOMT). Application of sources of ionizing radiation (SIR) at NOMT has potential danger of radiation exposure for the personnel of the vessel, the population and the environment. The source of potential radiation exposure is the radioactive substances which are situated in nuclear power reactor (NPR), in radioactive waste (RW) storage and the spent nuclear fuel (SNF) storage.

In Russia the system has been created for designing, building and operation NOMT that includes legal, organizational, technical, medical-sanitary and other elements which the interaction of which provides effective and safe application of SIR.

A RW considerable quantity of RW is formed at operation, repair and recycling of NOMT. Specialized vessels of atomic-technological service are used for treatment of RW, including SNF, carrying out transshipment of active zones of nuclear vessels, reception, processing and transportation of RW to points of their storage. Vessels of this class can be a source of not less strong radiation influence on the person and the environment, than vessels with NPR.

Operation of the NOMT has led to the growth of traditional and appearance of specific potential threats to the person and the environment. Domestic experience testifies that radiation influence of NOMT that are maintained in a normal mode, on the person and the environment is considerably below the natural background. The situation differs greatly in cases connected with loss of control of SIR, that caused by malfunction of the equipment, wrong actions of the personnel, acts of nature or other causes.

In the radiation safe condition of NOMT the influence of radiation factors

on the personnel and the population doesn't exceed the established hygienic standards. Achievement of this condition and its maintenance is a complex problem including a series of measures of legal, organizational, technical, sanitary-and-hygienic, medical-preventive, educational and educational character.

The modern estimation of the condition of system of radiation safety (SRS) at NOMT is based on the following indicators:

- characteristic of radioactive environmental contamination;
- level of maintenance of actions for radiation safety and performance of norms, rules and hygienic specifications in the field of radiation safety;
- probability of radiation failures and their scale;
- the level of readiness to liquidate radiation failures and their consequences;
- sizes of doses of the irradiation received by the personnel and separate groups of the population from all sources of ionizing radiation;
- number of persons, irradiated above the established limits;
- an indicator of radiation risk.

It is very difficult to make estimation by applying these indicators. It doesn't allow to estimate NOMT condition and to optimize its system of radiation safety.

For this purpose it is necessary to develop the structural-functional model of SRS. It will allow to formalize and describe the organization of communications and relations between subsystems and system of elements, and structure of these subsystems and elements as well. Taking into account features and levels of SRS it will be characterized by the multilevel hierarchical structure, which allows to describe interaction of different quality the subsystems functioning within the limits of uniform system.

From positions of the system approach the following structure of subsystems of SRS is offered: an organizational subsystem, engineering – a technical subsystem and medical-sanitary subsystem.

Standard character of basic principles of technical and hygienic levels of SRS defines the stability and the adjustable character of functional

communications between the considered subsystems. At the same time, some communications may be temporary, depended on radiation situation and the maintenance of problems on its normalization, priority and importance of function also can either increase, or reduce the value.

The purpose of functioning of system of radiation safety of NOMT is prevention or decrease in harmful influence of ionizing radiation on the personnel of the enterprise and the population, by observing of main principles and norms of radiation safety.

The functions of subsystems of the SRS are united by the general aim, they are interconnected and complementary. However the objective function of SRS is characterized by the presence of two components.

The first component of the system is determined by the presence of elements that reduce the intensity of injurious effect on the personnel and thus expand area of safe conditions of SIR. To increase the limits of safe operation (LSO) of the SIR the passive elements of SRS are applied, their function consists in radiation absorption (biological protection SIR), clearing of the polluted environments (activity filters) and creation insurmountable distance barriers.

If the operation of the SIR lasts long, the protective barriers are deteriorated and radionuclides are accumulated. It leads to the growth of levels of radiation and achievement of limiting values of LSO. After that operation of the SIR becomes impossible.

These elements of SRS are technical level of the system the basis of which are LSO. The principal value at this level of safety carries out control of the radiation parameters reflecting the effectiveness of passive elements of SRS. It allows to identify the transition of supervised SIR in the area of inadmissible conditions (dangerous in the radiation field).

The second component includes the elements reducing negative consequences of influence of ionizing radiation on the person.

To reduce the unfavorable impact of IRS on the person active elements of SRH are used, their function consists in limitation of the working time in

conditions of influence of radiation factors, on the use of individual protective equipment, on the sanitary zoning, on the sanitary-epidemiological supervision and monitoring of the health status of the personnel and the population.

These elements of SRS are considered to be hygienic level of the system, which basis hygienic specifications. The principal value has control of an individual equivalent of a dose of an internal and external irradiation. It shows efficiency of active elements SRS and allows to identify transition of supervised SIR in the area of inadmissible conditions (a system condition leading to excess of the established limits of doses).

The increase of efficiency of system considered levels of interaction is the basis of its optimization. The substantiation and a the choice of the concrete method of optimization can be made on the basis of model of the system that gives the grounds to consider such work as one of the most topical ways of the improvement of system of radiation safety of the enterprise. Besides that, application of model of system gives the chance to estimate efficiency of its functioning that is an important practical problem in the field of sanitary-and-epidemiologic supervision of the enterprises of nuclear shipbuilding and ship repair.