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CREATION OF COMPOSITE MATERIALS FOR RADIATION PROTECTION SYSTEMS

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Radiation protection is an important factor in the safe operation of nuclear reactors, spent nuclear fuel and radioactive waste storage facilities, as well as scientific and medical equipment that uses sources of ionizing radiation. The reliable operation of the NPP must be ensured throughout the entire life cycle, including the phase of decommissioning. The development of compositions of a new composite material for radiation protection based on extra-heavy concrete, which can be used in biological protection systems, is relevant.

The main task of radiation protection is to ensure the safety of both personnel working in the fields of ionizing radiation and people not in contact with radiation sources by reducing individual equivalent doses below the maximum permissible levels. During the works related to the creation of nuclear weapons, the tasks of radiation protection of workers of uranium mines, gas diffusion enrichment plants and other enterprises for the production of nuclear fuel were solved, as well as the construction of multilayer protection against the radiation of powerful nuclear reactors (γ-radiation, neutrons). Thus, a new link of radiation protection was formed - the protection of the biosphere from the influence of nuclear energy, including when burying waste with high specific activity (for example, spent fuel oil) [1].

Protection against external radiation flows. When working with closed sources, that is, radioactive radiation sources, the device of which excludes the ingress of radioactive substances into the environment, personnel can be irradiated only by external radiation flows. Depending on the conditions of radiation, the nature and location of the source, various measures and methods of protection against radiation are applied: protection by time; distance protection; shielding of radiation sources; personal protective equipment; radio protectors.

Stationary protective fences can include: protective walls, floor and ceiling coverings, doors, etc. Mobile protective devices include: various types of screens and screens; diaphragms of installations and devices that limit the flow of rays; containers for transporting radioactive substances. The reliability of protective screens is controlled by appropriate dosimetric devices. Protective screens ensure safe work

with ionizing radiation. The thickness of the screens is calculated based on the laws of attenuation of radiation in the substance of the screen. The use of various shielding materials to protect against the penetration of X-rays and gamma rays depends on the density of the substance used for protection. Yes, lead is more suitable in this case than aluminum, water or paper. Screens made of materials with a large atomic number and high density are used to protect against X-ray and γ-radiation: lead, tungsten, iron. Metals of medium density can also be used: stainless steel, cast iron, copper alloys, as well as composite materials based on ultra-heavy concrete, which contains elements with a high atomic number and high density. Shielding can reduce the intensity of radiation in the workplace to any given level.

Composite materials for biological protection are heavy concrete based on special binders (density 3200 kg/m^3 and higher) [2]. Concrete is a composite material consisting of cement, water and aggregates (fillers). Also, concrete has high chemical and corrosion resistance, durability, abrasion resistance, and frost resistance. The design service life of modern NPP power units is 60 years; taking into account the time for decommissioning, it is necessary to ensure the strength and protective properties of concrete for 100 years. To increase the protective properties of concrete, special aggregates are added to it, which reduce the permeability of gamma and neutron radiation through concrete. To significantly improve the extinction of gamma radiation, a heavy aggregate, such as barite, should be added to the composition of concrete.

Therefore, the developed compositions of composite materials can be proposed for use in the synthesis of new varieties of composite construction materials for special purposes for stationary protective structures and fences for shielding from X-ray and γ-radiation.

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