

RADIATION-HYGIENIC ASSESSMENT OF INTERNAL EXPOSURE FACTORS OF PERSONNEL WORKING AT EXPERIMENTAL FACILITIES IN THE PRODUCTION OF MIXED NITRIDE URANIUM-PLUTONIUM FUEL

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The report presents results of studies of the physicochemical characteristics of radioactive workplace aerosols formed during the production of mixed nitride uranium-plutonium fuel (activity particle-size distribution, nuclide composition, lung absorption type, elemental composition, reactive properties in the air). Taking into account these characteristics, the dose coefficients were calculated and the annual committed effective doses of internal exposure of personnel were calculated.

Next impactors were used for activity particle-size distribution analysis: AIP-2, IPHRT (developed by SRC FMBC named by A.I. Burnazyan), an electric low-pressure impactor HR-ELPI, Andersen cascade impactor and others. At the study of morphological characteristics, we used a scanning electron microscope (SEM) LYRA-3 equipped with an X-ray microanalyzer (RMA) X-max 80. X-ray structural analysis was performed on an XRD-7000 X-ray diffractometer. Analysis to determine the mass fraction of nitrogen and oxygen was carried out on the LECO analyzer; measurement of the content of uranium and plutonium was conducted on the mass spectrometer "TRITON+". Lung absorption type assessment was performed by dialysis through membrane filters in a pulmonary fluid simulator.

The high reactivity of mixed nitride uranium-plutonium (MNUP) compounds causes instant oxidation of the thoracic fraction of MNUP fuel aerosols upon contact with air, however, the intake of MNUP into the body is possible orally as part of the extrathoracic fraction (particles of 100 - 500 μm in size which have oxide film emerging upon interaction with air and inhibiting further oxidation of nitride). Dissolution of these particles in gastric juice can lead to the release of the nitride core, followed by a rapid entry of radionuclides into the organs and tissues of the body through the gastrointestinal tract.

Country/Int. organization

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