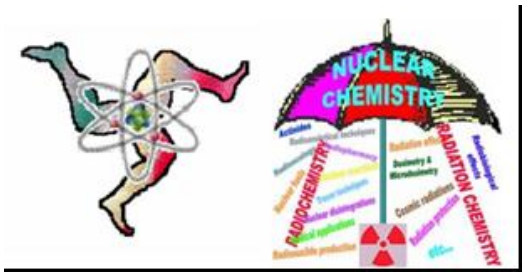

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The granular sorbents for passive environment protection system during severe accidents with total loss of power supply at NPPs

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The problem of reliable environmental protection measures in the event of severe nuclear power plant accidents appears to be an important factor restraining the development of nuclear energy. It is known that a hypothetic severe accident accompanied by a partial or complete destruction of the reactor's active zone, bring about the formation of large quantities of gaseous products. This leads to an abrupt increase in pressure inside the containment and there is a risk of its destroying. For decreasing of the pressure inside the containment, the some nuclear power plants are equipped with pressure release system. The modern designs of new-generation nuclear power plants with two protective shells do not provide for pressure release systems [1 - 3]. It is planed that during hypothetical severe accidents all radioactivity will be localized inside containment. To prevent radioactive contamination of the environment, modern designs are equipped with active venting filtering systems, which require regular electric power supply. However, in accordance with the general requirements for safety systems, alongside active ventilation systems for intercontainment space, nuclear power plants should include a passive ventilation system, which can be used during hypothetical severe accident with a complete loss of power supply.

Based on the fundamental studies on localization of volatile fission products the new passive environment protection system during severe accidents at new generation NPPs is suggested. The basic purpose of developed passive filtration system is creation of a rarefaction in an intercontainment space due to the organized removal of the radioactive steam-air mixture from an intercontainment space at full loss of all power sources. Steam-air mixture containing radioactive aerosols and flying fission products removal from an intercontainment space is passed through the special filtering module. Efficiency of cleaning of a radioactive steam-air mixture is determined by filtration and sorption properties of used filtering elements.

On the basis of fundamental researches on localization of molecular and organic forms of radioactive iodine from a steam-air flow in operating conditions of passive filtering system during severe accidents the granulated sorbents "Fizkhimin"TM, containing particles of Ag or Ag-Ni compounds with nanometric sizes, were selected for given filtering module.

The granulated sorbent "Fizkhimin"TM represents silica impregnated by Ag or Ag-Ni and modified on technique of IPCE RAS. The sorbent is issued as several types and represents granules of dark color with the sizes of particles 0.5-6.0 mm. The studies of sorbent properties have shown, that it radiationally stable at a doze 500 MRad and does not initiate ignition of hydrogen. The given sorbents have high sorptive efficiency in relation to molecular iodine and iodide methyl. At that it is necessary to note, that they do not lose the sorptive efficiency up to temperature 300oC and up to temperature 600oC from them does not occur the desorption of radioactive iodine in a gas phase.

Taking into account novelty of development and an opportunity of the international application of passive filtering system (the Russian project of the NPP WWER-1000 in India), expert international tests of efficiency of sorbents "Fizkhimin"TM based on Ag nanometric compounds on absorption of volatile radioactive iodine compounds at the stand of "TUV Energie und System Technic" (TUV ET) (Karlsruhe, Germany) have been carried out. Testing passed on localization most difficult sorptive form of the radioactive iodine - methyl iodide. Results of tests have shown that sorbents have very high sorptive efficiency relative to most difficult localize form - to methyl iodide, at various experimental parameters.

In conclusion, it is necessary to note, that the granulated sorbents "Fizkhmin"TM have very high sorptive efficiency in a wide range of experimental parameters and consequently they can be used for localization of volatile radioactive iodine compounds not only in passive filtering system, but also in other filtering devices, for example in the filters of emergency pressure release from containment operational NPPs during severe

accidents.

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