At the final stage of work the radioactive aerosol entrainment was determined by the direct measurement of the activity of the condensed vapor phase yielded from the solidified samples in the process of drying rather then by the analysis of filters. To accomplish that, the experiment on freezing water vapors with the reservoir trap cooled by the liquid nitrogen has been performed.
A liquid nitrogen cooled trap was used in the experiment for freezing the water vapors.

Application of Polymers for the Emergency Damage Control and Remediation at Nuclear and Chemical Industry Sites

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Introduction

Among the possible causes of accidents and emergency situations are technological and waste solution spills. The resulting radioactive contamination area causes the apparent possibility of the biologically hazardous component contact with the environment. If an option to collect the spilled solution into waste tanks is not available, the primary task is to contain the solution followed by the conversion thereof into a stable form thus reducing the potential risks of the spread radioactive contamination.

We believe the spilled solutions could be effectively isolated and the obtained solid products successfully contained with the aid of the third generation of the high-tech polymers manufactured in industrial scale by the NOCHAR Company in the U.S.

On the other hand, we didn't meet any example of polymer use in case of emergency at nuclear sites or at any chemical industry objects.

Objectives of research

The presented work was aimed at the search for the simple engineering decisions that would provide the waste immobilization in case of the accidental liquid spills.

The application of polymers for the purpose indicated would allow in case of emergency to reduce the radioactive aerosol concentration in the air and prevent the distribution of aerosols on the premises and in the environment.

Experimental results

It is the high-tech polymers by Nochar Company that were used in our work

The experimental results obtained it has been shown that Nochar's polymers have a versatile affect and are capable to solidify aqueous solutions of various acidities and specific activities; organic liquids (solvents and extractants); and suspensions and sludges of different compositions.

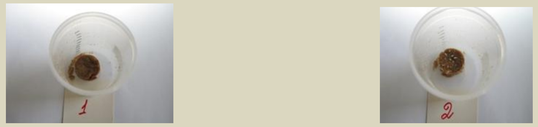
Experimental conditions		α-activity of the filter, relative units	β -activity of the filter, relative units
The composition of solution	The mass of the polymers to the mass of the liquid ratio, S/L		
The aqueous solution, α-activity $7.5\cdot10^{4}$ Bq/kg; β-activity $1.1\cdot10^{7}$ Bq/kg.	1:3	$3.0\cdot10^{-5}$	$2.0\cdot10^{-5}$
The aqueous solution, α-activity $7.5\cdot10^{4}$ Bq/kg; β-activity $1.1\cdot10^{7}$ Bq/kg.	-	$1.2\cdot10^{-4}$	$6.1\cdot10^{-6}$
An organic precipitate from the LRW collector tank, α-activity $6.6\cdot10^{6}$ Bq/kg; β-activity was $1.1\cdot10^{8}$ Bq/kg.	1:3	$2.5\cdot10^{-7}$	$7.1\cdot10^{-7}$

At the final stage of work the radioactive aerosol entrainment was determined by the direct measurement of the activity of the condensed vapor phase yielded from the samples. To accomplish that, the experiment on freezing water vapors with the reservoir trap cooled by the liquid nitrogen has been performed. The samples taken the activity was equal or less than the detection limit of 0.5 Bq/L for ^{137}Cs and 2.8 Bq/L for ^{241}Am, respectively.

Stage 1

Stage 2

Stage 3



The appearance of the sample after solidifying the evaporator cube residue. The total α-activity was $2.5\cdot10^{6}$ Bq/kg; the total β-activity was $7.3\cdot10^{7}$ Bq/kg.

Conclusion

First time substantiated and experimentally demonstrated the possibility of using polymer materials as a means of liquidation of emergency situations caused by leaks of radioactive solutions. On the whole number of reasons the economic assessment in this focus area is very hard to accomplish, but it requires very thorough and weighted approach anyway.

Another promising area of the polymer application could be the technical challenges associated with the decommissioning of NPPs and other including the large volume LRW storage tanks. Development of the *in-situ* solidification technique for the mobile (liquid) components of heterogeneous waste will provide a good option to contain the radio nuclides within the storage site boundaries.