CFD MODELING OF AEROSOL RESUSPENSION IN THE NSC ZONE

Krukovsky P.G., Oliynik V.S., Skliarenko D.I.
Institute of Engineering Thermophysics of NAS of Ukraine, Kyiv, Ukraine
tel.: +380444569281, e-mail: oliinyk-vlad@ukr.net

Purpose. The purpose of the work is to carry out preliminary analysis and forecasting of the resuspension of radioactive aerosols (RAs) in the New Safe Confinement (NSC) in the period of operation with typical works in the Shelter Object (OS), during dismantling of the structure with the subsequent release of RA beyond the NSC, with the help of developed a three-dimensional computer CFD (Computational Fluid Dynamic) model based on a resuspension model.

Results. The emergence of a suspension can be interpreted as a result of the competing effects of the flow dynamics on the particle and the adhesion between the particle and the surface. When the airflow is blowing above the particle, there are three possible breakaway modes: direct take-off, slip and rolling [1]. A number of resuspension models have been developed that can take into account, to a greater or lesser extent, the mechanisms of particle uplift: the movement of particles and their separation from the surface under the influence of various sizes and particle geometry, particle material, surface roughness and turbulence near the walls, as well as capillary forces that depend from humidity of air.

The paper [1] describes a particle resuspension model suitable for simulation of small and solid aerosols (up to 20 μm), which can help to evaluate the working conditions for service personnel. In Ref. [2], a model of a resuspension for large (more than 20 μm) and soft particles that can tolerate long-range radiation transfer is given.

For a detailed simulation of the distribution of aerosols in the ChNPP zone, a CFD model (Ansys Fluent) was constructed. It is based on a model of a resuspension that can take into account all the factors that influence the growth of particles in the climatic conditions of the ChNPP zone and the NFC microclimate: seasonal weather changes, air humidity, work of personnel, work of ventilation equipment, etc. The model will help predict the distribution of aerosols during dismantling of the design and provide conditions that would reduce the release of aerosols beyond the NSC.

References

1. B.V. Derjaguin, V.M. Muller, and Y.P. Toporov, “Effect of Contact Deformations on the Adhesion of Particles”, J. Colloid Interface Sci. 53, 314 (1975).
2. K.L. Johnson, K. Kendall, and A.D. Roberts, “Surface Energy and the Contact of Elastic Solids”, Proc. Royal Soc. A 324, 301 (1971).