ID příspěvku: **77** Typ: **Poster**

A CFD analysis of Rn-222 dispersion in the vicinity of an uranium mining waste rock dump site

středa 21. září 2022 10:07 (3 minuty)

Computational fluid dynamics (CFD) techniques are widely used for the prediction of radioactive gas release and transport in complex environments such as the vicinity of a nuclear power plant or within underground mines. In the present study, the CFD technique is applied to perform sensitivity analysis for simulation of Rn-222 dispersions in the area surrounding the Pribram shaft No. 15 –applying a sample geometry derived from the waste rock dump site (Brod, Czech Republic). The influence of meteorological conditions, seasonal variations in land cover properties, chosen turbulence models, atmospheric stability and selected further properties of the environment, on the Rn-222 concentration dispersions are evaluated. Preliminary results of the simulations performed are presented and discussed.

A 3D CFD-based code Fluidyn-PANEPR, which uses a finite volume method for numerical solutions of Navier-Stokes equations is utilized. The geometry is constructed from publicly available data (ČÚZK, OpenStreetMap) and published findings. Further, the governing Rn-222 transport equations are used to predict Rn-222 activity concentration dispersions in the vicinity of the waste rock dump. The work aims to identify key elements of the case setup that influence the simulation outcomes and provides a basis for the construction of advanced setups complementing in-situ measurements.

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Zařazení sekce: Radón a prírodné zdroje ionizujúceho žiarenia

Tematická klasifikace: Radón a prírodné zdroje ionizujúceho žiarenia