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Radiological risk assessment for hot cells decontamination

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The paper describes the radiological impact on the workers who perform the decontamination of a hot cell from the VVR-S nuclear research reactor (NR), used for production of radioisotopes during the operation of the NR. The assessment of dose equivalent takes into account the used manual procedure to make the floor decontamination, due to the fact that the handling devices are broken. Due to the contamination of the cell's floor, three methods were used to determine the high radiation areas: (i) Ambient dose equivalent measurements performed with portable digital survey meter with a gamma dose rate probe placed less 1 cm above the surface; (ii) thermoluminescent dosimeters placed directly on surface; (iii) From each high radiation area, (about 100 cm^2 square surface) were taken samples and measured by gamma spectrometry to determine the radionuclides and corresponding activity used to calculate the equivalent dose rate at the point where the operator was placed (about 70 cm from the measurement point). Six hot points having the same order of magnitude for activity were identified and a seventh one with an activity with three order of magnitude higher was identified. Although the measurement conditions were difficult, the results were in a satisfactory agreement, validating the measurement. The dose rate assessment is for the worker who performs direct measurements of the ambient dose equivalent and for that one who performs the decontamination of the contaminated area. The calculation hypotheses: (i) Sampling yield for activity measurement is 10%; (ii) the activity is concentrated in the highest activity point, having a total activity equal with the sum of all hot points. For the worker who measures contamination, the external penetrant dose equivalent is less than 0.13 mSv for 5 minutes (3.78 mSv/h). For the worker who performs the decontamination (placed at about 45 cm from the contaminated area): i) The external irradiation is 0.34 mSv (operation at about 12 minutes) and dose rate is 1.717 mSv/h; ii) the internal committed effective dose, E(50) received by worker due to air inhalation is about 2.40 μSv based on the assumption that in the hot cell is spread just 10^{-4} of the total activity and the worker wears a mask having a filter with a retention efficiency at 99%.

Recent Publications

1. R Deju, M Dragusin, I Robu, C Mazilu, C Tuca (2013) Review on radioactive concrete recycling methods. Romanian Reports in Physics 65(4):1485-1504.
2. R Deju, I Robu, M Dragusin, C Mazilu, C Tuca (2015) Selection tests for recycled radioactive sand obtaining method. Romanian Report in Physics 67(2) (accepted for publishing).
3. R Deju, M Dragusin, I Robu, C Mazilu, C Tuca (2015) Tests regarding filling performance of the mortars obtained by radioactive recycled sand. Romanian Reports in Physics 67(3):1159–1175.
4. C Tuca, A Stochioiu, M Sahagia, D Gurau, M Dragusin (2015) Assessment of derived emission limits for radioactive effluents resulted from the decommissioning activities of the VVR-S nuclear research reactor. Journal of Environmental Radioactivity 148:130-136.
5. A Stochioiu, C Tuca, R Deju, F Mihai (2016) Radiological risk assessment of workers for radioactive liquid effluents transfer. Romanian Reports in Physics 68 (4) (In Press).

Biography

Carmen Tuca has completed her Master's in Theoretical Physics and Mathematics at University of Craiova, Faculty of Physics. Currently, she is a PhD student in Nuclear Physics at University of Bucharest, Faculty of Physics. She is Scientific Researcher of IFIN-HH, at the Reactor Decommissioning Department, responsible for environmental, occupational health and safety problems. She has published more than 15 papers in scientific journals.

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