

# Using Monte-Carlo Simulation for Risk Assessment: Application to Occupational Exposure During Remediation Works

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The aim of this study was to apply the Monte-Carlo techniques to develop a probabilistic risk assessment.

The risk resulting from the occupational exposure resulting from the activities involved in the remediation of a uranium tailings disposal, in an abandoned uranium mining site, was assessed. A hypothetical exposure scenario was developed and two different exposure pathways were compared: internal exposure through radon inhalation and external exposure through gamma irradiation from the contaminated tailings material.

The input variables, such as the inhalation rate and the external exposure parameters, were considered as specific probabilistic distributions, each one characterized by its central tendency and dispersion parameters. Using the cumulative distribution function a probabilistic value for each variable can be generated using a single random number. As a consequence, this methodology allows performing a probabilistic risk assessment, generating a risk distribution.

In general terms radon inhalation contributed up to 52% of the total risk while external gamma radiation contributed up to 48%. The results showed that the median (50th percentile) of the carcinogenic annual risk of the workers directly involved in the remediation was 0,000103, while considering the individual increment lifetime risk the median was 0,0072.

Comparative risk significance with calculated deterministic doses was also performed and the results showed that the highest contribution to the dose, the external gamma irradiation, does not correspond to the highest probabilistic risk originated by radon inhalation. The latter should be taken in consideration when assessing human health exposure.