# New software tool for dynamic radiological characterisation and monitoring in nuclear sites

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The Halden Reactor Project (HRP) is a jointly sponsored international cooperation, under the aegis of the Organisation for Economic Co-operation and Development - Nuclear Energy Agency. Extensive and valuable guidance and tools, connected to safe and reliable operation of nuclear facilities, has been elaborated throughout the years within the frame of this programme. The HRP has particularly high level results in virtual-reality based tools for real-time areal and personal monitoring. The techniques, developed earlier, are now being supplemented to enhance the planning and monitoring capabilities, and support general radiological characterisation connected to nuclear sites and facilities.

Due to the complexity and abundance of the input information required, software tools, dedicated to the radiological characterization of contaminated materials, buildings, land and groundwater, are applied to review, evaluate and visualize the data. Characterisation of the radiation situation in a realistic environment can be very complex, and efficient visualisation of the data to the user is not straight forward. The monitoring and planning tools elaborated in the frame of the HRP feature very sophisticated three-dimensional (3D) high definition visualisation and user interfaces to promote easy interpretation of the input data. The visualisation tools permit dynamic visualisation of radiation fields in virtual or augmented reality by various techniques and real-time personal monitoring of humanoid models. In addition new techniques are being elaborated to visualise the 3D distribution of activities in structures and materials.

The dosimetric algorithms, feeding information to the visualisation and user interface of these planning tools, include deterministic radiation transport techniques suitable for fast photon dose estimates, in case physical and radio- and spectrometric characteristics of the gamma sources are known. The basic deterministic model, implemented in earlier versions of these tools, is suitable for quick estimates in simple irradiation situations. Through joint research of member institutions of the HRP, an additional deterministic Point Kernel based dosimetric algorithm has been developed and implemented, to supplement the basic approach. The new model is more accurate and suitable for better estimates in more complex environments.

Furthermore, additional methods dedicated to the geostatistical analysis and processing (kriging) of the data measured, and other dosimetric methods are being added, to extend the software tools for cases when less other type on input information is provided.

In this paper, the visualisation and dosimetric algorithms implemented in the complex software tools, developed within the HRP, for radiological panning, monitoring and characterisation are presented.