Compartmental Models Software for Internal Dosimetry

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Abstract

The assessment of internal occupational radiation exposures is generally based on evaluating the retention of radioactive materials in the regions of the body and their elimination through excreta. The mathematical methodology to assess the internal dose from the incorporation of radionuclide is based in compartmental models which simulate the transport and the retention of the materials in the organs. The ICRP publications show the compartmental models to the respiratory and gastrointestinal systems, and the systemic distribution for distinct radionuclide which is of concern to the radiation protection.

In this work, it is proposed a computational program to create and solve compartmental models to be used in different applications. The main objective of this software is to be used as a rapid development tool for building news compartmental models, visualization and modification of the transfer rate for sensitivity analysis studies.

The code was developed in the C# programming language, taking into account the interface usability and easy models updates. The models are able to be stored in different databases as Microsoft Access and SQL Server and exported in XML format. The calculation engine module is based in semi-analytical algorithm for solving first-order equation system.

The software was tested using the Human Respiratory and Human Alimentary Tract Models with uranium biokinetic model presented in ICRP Publication 78. The results obtained considering an acute intake by inhalation were in accordance with predicted values presented by ICRP.

Keywords: compartmental analysis; internal dosimetry; database.

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