Summary

Contract no.: FIGD-CT2000-00053 — **BIODOS**
Title: **Biokinetics and Dosimetry of Internal Contamination**

Assessments of doses and risks to workers and to the public exposed to radionuclides require biokinetic models which describe the behaviour of the radionuclides from their entry into the body until their final elimination and dosimetric models for calculating doses within tissues. Biokinetic models describing the absorption of radionuclides after ingestion or inhalation and subsequent systemic behaviour, published by the International Commission on Radiological Protection (ICRP), are widely used in dose calculations but are subject to revision as knowledge improves.

The overall objective was to improve the scientific basis of existing biokinetic and dosimetric models and to provide new and improved models. The work comprised two parts focused respectively on the delivery of new systemic, alimentary tract and breast-milk models, and on improvement of the HRTM. It combined established experimental and mathematical modelling expertise, including human, animal and *in vitro* studies. The work was divided into 9 work packages (WPs). WPs 1 and 5 were designed to provide new data for inclusion in the models whereas the others were aimed at developing the models described above.

WP 1 aimed to provide experimental data for model development. Human volunteer studies were performed on the biokinetics of Mo, Co, Zr, and Ru. Studies using genetically altered mice investigated the effect of radiation quality on intestinal tumour induction. Additional studies were performed *in vitro* to assess both speciation of U and Cs in the GI tract and deposition of energy in cells from short-range emitters.

WP 2-4 aimed to produce new physiologically-based models and dosimetric methods. Efforts were focused on describing the behaviour of radionuclides after entry in the alimentary tract, transfer to systemic compartments and then to breast-milk. The objectives were to produce age- and sex-dependant dosimetric models and consider the effect of uncertainties in the model parameters on the resulting doses.

WP 5 aimed at examining the importance of heterogeneous distribution of dose within tissues and cells. Two particular configurations of non-uniform exposure relevant to radiation protection were investigated, i.e. radon progeny in epithelial cells of bronchial airways and Auger emitters in cellular systems.

WP 6-9 aimed at improving the HRTM. Studies focused on deposition and particle transport of ultrafine particles (UFP) in the human respiratory tract, inter-subject variation amongst healthy people and patients with lung diseases, determination of factors that affect the clearance of radionuclides from the lungs by absorption to blood and mechanisms of clearance of inhaled particles from the different regions of the human respiratory tract.

BIODOS has provided substantial input to the development of a new biokinetic and dosimetric model of the human alimentary tract, and models for the transfer of radionuclides in breast milk, together with dose coefficients for infants consuming milk following radionuclide intake by the mother. ICRP reports have been prepared in both cases and will be published during 2005. Another important development is the provision of voxel phantoms of the body and its organs based on computed tomographic data. These more realistic phantoms will replace mathematical phantoms in future ICRP calculations of photon doses. It also provided new data that could be used in the future for improvement of the existing Human Respiratory Tract Model. Experimental studies have provided data that underpin the development of biokinetic and dosimetric models. Overall, BIODOS has successfully contributed to improvements in dose assessments for radionuclide exposures of workers and members of public and therefore contributed to the improvement of radiation protection.