IMPROVING RADIATION DOSE MEASUREMENTS FOR PRE-CLINICAL RADIOBIOLOGICAL STUDIES

ANNA SUBIEL, AMANDA TULK, CHRIS CAWTHORNE, GEORGIOS SOULTANIDIS, JOHN GREENMAN, VICKY GREEN, ILEANA SILVESTRE PATALLO1 AND GIUSEPPE SCHETTINO

National Physical Laboratory, Xstrahl Ltd, University of Hull,

Supported by the technical development of the last decades, radiotherapy is currently one of the most cost-effective curative treatments for cancer (>50% of patients require radiotherapy at some time during their illness). Improvement of our understanding of radiation effects can make a major contribution and there are enormous potential benefits from combining radiotherapy with chemotherapy and molecular targeted drugs. This is leading a large increase in the number of radiobiological experiments carried out in animal models. However, contrary to clinical practice, there are currently no regulations or directives to control the quality of radiation exposure in pre-clinical experiments and trials. Current radiobiological experiments rely on local expertise, available dosimetry equipment (rarely calibrated to traceable standards) and manufacturer information regarding the radiation source which may not be relevant to the specific research. Surveys have reported dosing errors up to 50% for studies where ICRU recommendations are <5%. The lack of standards and guidelines for assuring precision and accuracy of dose measurements undermines the reliability and reproducibility of the findings and leads to greater numbers of animals used.

Supported by InnovateUK and the NC3Rs, the National Physical Laboratory has established a dosimetry service for pre-clinical X-ray radiation units traceable to the UK national standard. The service is based on a bespoke anatomically correct tissue equivalent mouse phantom mimicking bone, lung and soft tissue structures in which dosimeters can be inserted. The phantom and detectors can be irradiated following typical experimental procedures and the administered doses reported with uncertainty <5%. Measurements performed at 5 leading UK radiobiological centres demonstrate how dosage errors and inter-centre variation can be reduced from >10% to less than 2%.

The poster will illustrate the needs and challenges of accurate monitoring radiation exposure for pre-clinical studies and provide an overview of the measurement service together with the impact it can generate on the quality of the research data and the reduction of the number of animal required for statistically significant studies.