

the greatest source of exposure to ionising radiation for people living in Ireland and the leading cause of lung cancer after smoking. It is estimated that exposure to radon accounts for approximately 14% of all lung cancers in Ireland, which equates to around 300 lung cancer cases annually. In November 2011 the then Minister for the Environment, Community and Local Government, announced the Government decision to establish an Inter-Agency (IA) group to develop a national radon control strategy (NRCS) for Ireland. The purpose of the strategy is to reduce the number of lung cancers in Ireland that are caused by radon. The IA group comprises experts from the key Government Departments and State Agencies relevant to tackling the radon problem in Ireland. A Research Working Group (RWG) was established by the IA group to identify knowledge gaps and to point to areas where further targeted research could support and improve the effectiveness of the NRCS. The RWG reviewed the research ideas collected during the development of the NRCS including those raised in the stakeholder and public consultations. The research ideas were divided into four thematic areas, this paper will present an overview of the EPA funded radon research that falls under the theme that focuses on radon preventive measures and also outline the impact of this work at a national and international level.

<https://doi.org/10.1016/j.ejmp.2019.09.197>

History of Medical Physics and Physics in Medicine in Ireland

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Medical Physics and contributions from physics to medicine are relatively well developed in Ireland, although no comprehensive account of both is available. This paper will endeavour to address both, emphasising the former, but not overlooking the latter. The methods employed include documentary research and interviews with some of those that made significant contributions from time to time. Documentary evidence for historical aspects of the development of medical physics is relatively sparse. However, several good sources have been identified and accessed covering periods C, D, and E below. Good sources for Irish contributions/contributors from physics to medicine have been identified and are available over a longer period since the seventeenth century British enlightenment, and especially for the nineteenth and early twentieth centuries. Sources for G and H, education/training and international contributions, are limited but archival material is available. Professional bodies will be treated, where relevant, under each heading. This paper will present a summary of findings from these sources under headings including: A. The Enlightenment (17th century) period (Multiple sources) B. Nineteenth and early twentieth centuries (Multiple sources) C. Twentieth century up to late 60's/early 70's (>5 sources) D. Twentieth century from 70's to 90's (>3 sources) E. Period since the 90's (>3 sources) F. Statutory developments and National Benchmarks (Multiple sources) G. Education and training initiatives (>3 Sources and archival material) H. Contributions to the international community (Archival material) The findings from this investigation provide a rich context and heritage for medical physics in Ireland.

<https://doi.org/10.1016/j.ejmp.2019.09.198>

Poster Session : P1

Yttrium-90 selective internal radiation therapy: Are patient radiation protection contact restrictions necessary?

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Yttrium-90 (90Y) microspheres are used for selective internal radiation therapies (SIRTs) to treat patients with hepatocellular carcinoma (HCC) or metastatic colon cancer to the liver, with doses of up to 150 Gy delivered per treatment. 90Y is a pure beta emitter with a decay energy of 0.94 MeV and half-life of 64.2 h. While external beta exposure from the patient is negligible, there can be a considerable associated Bremsstrahlung radiation exposure component. Previous studies in the US, towards establishing radiation dose rates from patients, have deemed radiation protection precautions post-therapy to be unnecessary in most cases; however, the question remains as to whether precautions are necessary within the EU, where more conservative dose constraints are employed. Accordingly, dose rates from 28 patients, treated over a three year period (2016–2018) were measured post therapy at distances of 0.3 m and 1 m, and in contact with the patients' upper abdomen. Dose rates were compared with theoretical predictions and used as model inputs for calculating radiation doses received by family members and carers based on interaction patterns previously described in the literature. The work demonstrated restrictions to be advisable considering the dose constraints employed within the EU. Indeed, while this study examined dose rates for 90Y Therasphere patients, another 90Y therapeutic pharmaceutical, namely SIRSpheres, require reportedly similar treatment activities, leading to similar Bremsstrahlung radiation dose rates. Thus, in accordance with EU dose constraints, radiation protection precautions are necessary for those individuals in regular contact with patients having undergone SIRT procedures.

<https://doi.org/10.1016/j.ejmp.2019.09.199>

Poster Session : P2

Quantifying tumor heterogeneity from multi parameter magnetic resonance images for prostate using texture analysis

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Tumor spatial heterogeneity is a key prognostic indicator, which is reflected in medical images. Heterogeneity in tumor images can be

assessed by texture analysis which can be applied to routinely acquired clinical sequences. The aim of this work is to quantify tumor heterogeneity from multi parameter magnetic resonance images (MP-MRI) for prostate using texture analysis. Method: T1-weighted, T2-weighted imaging and apparent diffusion coefficient maps (ADC) were acquired on a Siemens 1.5T using a surface coil. MP-MRI texture analysis comprising of filtration histogram technique was applied. This included an initial filtration step that highlights image features of a specified size, followed by histogram analysis of the filtered image. The size of the image features highlighted by the filter is denoted by the spatial scaling factor (SSF). The histograms of the pixel values in the filtered images are quantified using standard descriptors, specifically: entropy, skewness and kurtosis. Result: All analyses were performed on a whole prostate on a single patient. Kurtosis of ADC, T1 and T2 was -0.02 , 1.35 and 0.4 , respectively, for whole prostate (WP). Additionally, skewness of ADC, T1 and T2 were 0.69 , 0.37 and -0.53 , respectively, WP. Furthermore, Entropy of ADC, T1 and T2 were 0.84 , 0.9 and 1.2 , respectively, WP. As result, ADC kurtosis was significantly lower for whole prostate. In addition, T2 kurtosis was significantly lower for WP. Notably, there were no significant differences between the three groups in terms of entropy.

<https://doi.org/10.1016/j.ejmp.2019.09.200>

Poster Session : P3

Building for the future – The Medical Physicist Role

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The new national children's hospital will consist of a main site on a shared campus with St James's Hospital along with two Outpatient and Urgent Care Centres at Connolly and Tallaght. While the main site is expected to open by 2022, Connolly is almost complete and due to open in summer 2019. In projects such as these, medical physics input is essential. The RPA of the project was appointed in 2015 and was involved from the very beginning in decisions of room layouts and imaging equipment requirements. Since the Connolly side of the project has begun, medical physics have undertaken shielding assessments and radiation risk assessments. They partook in numerous site visits and meetings with builders, architects and contractors. Technical dialogues were undertaken with equipment vendors, along with meetings with clinical staff to ascertain their needs and requirements for the future sites. Regular update meetings with the EPA ensured that all relevant legislation requirements are met to ensure the licencing process could proceed. By the end of 2018, the shielding has been installed in the X-ray rooms at Connolly. The imaging equipment has been selected after undergoing an evaluation by the relevant users and the EPA licence application for Custody and Commissioning has been submitted. The medical physicist's role in ensuring that these milestones were reached was essential in this project. This work outlines the procedures that occurred and demonstrates the need for medical physics to be part of the multidisciplinary environment required for any project involving imaging equipment.

<https://doi.org/10.1016/j.ejmp.2019.09.201>

Poster Session : P4

Scatter reduction from an O-arm imaging system

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Scanner detectors and gantry hardware in a typical fixed CT attenuate the primary beam. Typical isodose curves at 2 metres for a fixed CT installation show scatter air kerma distributions to be reduced by a factor of almost 100 at the 0° angle compared to the front 90° angle. However, unlike a fixed CT gantry, O-arm covering contains little beam attenuating material. Scatter measurements behind the control panel of the O-arm (the 0° angle) are low but only extend to the height of the control panel and therefore not the full height of a person. Overall, our scatter measurements for our O-arm imaging system indicated that personnel should not remain in the theatre operating room while imaging is taking place. This is a particular issue for anaesthetists during complex spinal surgery. During this type of surgery, the patient is required to do a breath hold during the cone beam CT imaging rotation and the anaesthetist is required to leave the theatre for up to two minutes. Ideally the anaesthetist could remain in the theatre to closely observe the patient. This study investigates the effect and feasibility of attaching lead drapes to the O-arm cover in the sterile theatre environment in order to determine whether scatter can be reduced to a level that will allow an anaesthetist to remain in the operating theatre during the complex O-arm procedures.

<https://doi.org/10.1016/j.ejmp.2019.09.202>

Poster Session : P5

Radiation Protection advice for hospital laboratory staff dealing with samples from diagnostic nuclear medicine patients

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Staff in hospital laboratories may be required to work, knowingly or unknowingly, with radioactive samples from patients who have been administered with radiopharmaceuticals. In general, radioactive samples should be labelled as such prior to arrival for processing in the hospital laboratory, however this may only be discovered after the work has been performed if proper protocols have not been followed. This can cause unnecessary alarm and anxiety for staff who are unfamiliar with ionising radiation, in particular for female staff who may be pregnant. In preparation for a Radiation Protection educational talk to Laboratory staff, dose rates for several radioactive activities commonly used in a local diagnostic nuclear medicine department were measured. This allowed calculation of the number of samples laboratory staff would be required to handle before reaching the annual public dose limit of 1mSv , with variation in sample size, distance and processing duration. Laboratory staff could then be educated about the results of these measurements for a better understanding of potential risk involved in working with such specimens and best practice in radiation protection techniques specific to this area.

<https://doi.org/10.1016/j.ejmp.2019.09.203>