BOOK REVIEW

RADIATION SHIELDING FOR DIAGNOSTIC RADIOLOGY, 2ND EDITION.

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Radiation Shielding Design for Diagnostic Radiology (The British Institute of Radiology. London UK, 2012) is collection of technical information that is intended to be sufficient to enable a physicist to specify and assess the shielding for diagnostic radiology facilities. It has effectively become the United Kingdom diagnostic shielding design standard since its publication in 2000. Diagnostic radiology has seen substantial change since 2000, with the transition from conventional screen-film radiography to digital radiography a key factor driving this change. Computed tomography in particular has seen significant development since 2000. The 2nd Edition of *Radiation Shielding for Diagnostic Radiology* includes revisions to better address these changes. Shielding design for PET/CT suites has also been also added to the 2nd Edition.

The introductory material in Chapter 1 presents fundamental concepts, including dose, types of radiation, occupancy, and workload. Kerma area product (KAP) is recommended as the principle measure of workload, since KAP meters are common in most facilities. If historical KAP data is not available, there are a variety of published sources that can be used to estimate the KAP workload.

The introduction also presents the UK regulations, making the book particularly relevant to physicists in the UK and in other countries with similar regulations. After reviewing the regulations, the authors conclude that shielding for diagnostic radiology rooms can be based solely on the 0.3 mSv per year dose constraint, with occupancy included as appropriate. Notable is their assertion that the UK HSE Approved Code of Practice 7.5 μSv per hour instantaneous dose rate (IDR) constraint need not be considered for diagnostic facilities. This IDR requirement drives primary barrier design for radiotherapy installations, and could have had a major impact on diagnostic shielding if it was the basis for shielding design.

Following the introductory material, Chapter 2 addresses the calculation of unshielded primary and secondary radiation. The use of KAP workload provides a realistic basis for assessing scatter vs. simply designing to the maximum field size. Chapter 2 also addresses tertiary radiation, i.e., radiation that scatters around or over the primary or secondary barriers.

Chapter 3 describes the construction materials that are used to shield radiation, with particular emphasis on the materials and thickness customarily used in the UK. Chapter 4 then addresses the transmission of radiation through the shielding materials. In particular, Archer equation transmission parameters are included for commonly used shielding material in Tables 4.1 and 4.3, for primary and secondary radiation respectively. Chapter 4 recommends basing transmission calculations on the hardened half-value layer of these parameters.

Chapter 5 describes the practical assessment of shielding as performed in the UK. Survey measurements can be performed 0.3 m beyond the barriers, with the diagnostic equipment for which the room was designed serving as the source of radiation. These measurements can then be converted to annual dose based on workload, with the annual dose then compared with the dose constraint. However, Chapter 5 is devoted primarily to an alternative methodology, with a radioisotope placed at an arbitrary location within the room serving as the source of radiation. The objective of this approach is to identify crevices in the room shielding, with the source or the survey meter in some cases in direct contact with the barrier. Evaluating these results is inherently subjective. Since this is a common practice in the UK, it is important for both the physicist and the shielding contractor to be aware if such a survey may be performed, since it may impact the shielding design for the junction between barriers.

Chapter 6 builds on the principles of Chapters 1 through 4 to describe the shielding design for radiographic rooms.

This includes worked examples of the calculations. Since radiographic room shielding must include an assessment of the primary beam component, Chapter 6 introduces the concept of Entrance Surface Dose (ESD) workload, which serves as the workload basis for primary barriers instead of KAP workload. This includes providing a means for estimating ESD workload from the KAP workload, if a direct basis for predicting ESD workload is not readily available. Chapter 6 recommends basing primary barrier calculations on the maximum kV used clinically. For secondary barriers a conservative upper bound to KAP-averaged kV is recommended for transmission calculations. This provides a more realistic energy for secondary barrier calculations than simply designing to the maximum kV.

Following the format of Chapter 6, Chapters 7 through 9 present the shielding design approach for fluoroscopic, CT, and PET/CT suites, respectively. This includes worked examples for each facility type. Chapter 10 then addresses miscellaneous diagnostic rooms that require less shielding (e.g., mammography and dental).

This book is a necessary reference for anyone who designs or assesses diagnostic radiology shielding in the UK or other countries with similar regulations. It is also a useful shielding reference for virtually any country, when used in conjunction with the relevant national or IAEA standards, to provide additional perspective.

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Melissa Martin graduated from UCLA in 1975 with a M.S. in Medical Physics and was certified by the American Board of Radiology in Radiological Physics (Diagnostic, Therapeutic, and Medical Nuclear) in 1979. She became a full time consulting physicist focusing on diagnostic radiology in 1992. Melissa is very active in several professional societies including the American College of Radiology, American Association of Physicists in Medicine, and the Health Physics Society. She is the President-Elect designate of the AAPM, with her term as President-Elect beginning in 2016.