

Revision of the 2002 Medical and Dental Guidance Notes, a good practice guide on all aspects of ionising radiation protection in the clinical environment¹

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A long time ago

It was not long after the discoveries of x-rays by Wilhelm Röntgen in 1895 and of radioactivity by Henri Becquerel in 1896 that both the incredible usefulness and the not insignificant hazard of these new wonders began to be appreciated by the scientific and medical world. In the very early years, stories abounded of skin injuries associated with exposure to x-rays. One of the earliest published cases was that reported by Professor John Daniel of Vanderbilt University.² A child had been accidentally shot in the head, and Daniel was asked if the new x-rays could be used to locate the position of the bullet. The dean of the medical department Dr William Dudley volunteered to be a guinea pig so that the correct exposure could be determined, and the experiment was undertaken on the February 29, 1896. Unfortunately, despite a one-hour exposure, Daniel was unable to obtain a satisfactory image. Three weeks later a two inch (50 mm) bald spot appeared on Dudley's head. Daniel speculated that some form of quasi electrical current may have been generated in the hair, causing this depilation, and reported: "We, and especially Dr Dudley, shall watch with interest the ultimate effect."

Hundreds of cases of acute tissue damage were reported in those first few years, and a number of papers published giving tips and advice on how to minimise these harmful effects. At that time it was generally assumed that x-rays and radium emissions were harmless providing that reddening of the skin did not occur and for the first 25 years of radiology no "official" collated guidance was produced. However, by the early 1920s it had become apparent that exposures over many years had caused chronic and sometimes fatal illnesses. In 1921, highly respected and admired radiologist Dr Ironside Bruce died of aplastic anaemia at the age of 44. His obituary included a message from King George V, and concluded: "It is almost certain that he succumbed as the result of his continuous and enthusiastic work in the subject of his choice," (figure 1).^{3,4} Letters to *The Times* called for the use of x-rays to be stopped forthwith. This tragic death and the public outcry it caused stirred various radiological and other scientific bodies in the

UK to form the X-ray and Radium Protection Committee and just three months after Bruce's death the first professional radiation safety guidance was published as *X-ray and Radium Protection Committee. Preliminary Report (figure 2)*.^{5,6}

These recommendations contained many of the basic principles of radiation protection still practised today, for example:

- "Screen work to be as expeditious as possible" – ie minimise TIME exposed.
- "... to avoid injury to the fingers the radium, ... always manipulated with forceps" – ie maximise DISTANCE from the source.
- "... surround the x-ray bulb itself as completely as possible with adequate protective material, except for an aperture as small as possible for the work in hand" – ie use SHIELDING.
- "where emanation (ie radon progeny) is likely to come into direct contact with the fingers, thin rubber gloves should be worn" – ie avoid CONTAMINATION.

Professional bodies → government committee/board → professional body

The British X-ray and Radium Protection Committee produced revised professional body guidance in 1923, 1927, 1934, 1938, 1943 and 1948. During this time it received some practical support from the National Physical Laboratory (NPL) and a grant from the Medical Research Council (MRC), but was largely funded by its members and professional bodies. In the 1940s the MRC formed its own Committee on the Medical and Biological Applications of Nuclear Physics to study the scientific aspects, and in 1948 the Radioactive Substances Act established a statutory advisory committee to advise the government on radiation protection. This advisory committee then took on the role of turning the MRC's scientific findings into official codes of practice. Thus the production of guidance notes moved from the professional bodies to governmental bodies, and in 1952 the X-ray and Radium Protection Committee was wound up.

For the next 40 years, the Radioactive Substances Advisory Committee, and its successor the National Radiological Protection Board (NRPB), produced codes of practice for the broad range of uses of ionising radiation sources, with the first specific *Code of Practice for the Protection of Persons against Ionizing Radiations arising from Medical and Dental Use* published in 1957, revised 1964 and 1972 (figure 3) and the final *Guidance Notes for the Protection of Persons against Ionising Radiations arising from Medical and Dental Use* published by the NRPB in 1988 (figure 4).

In the year 2000, new UK legislation came into force with significant changes. By that time it had been decided that government agencies would no longer take responsibility for publishing such guidance. Nearly 50 years before Mr Cuthbert Andrews, one of the ten original members of the X-ray and Radium Protection Committee, had commented that in the production of the original guidance: "... generally the physicists were the most vocal of the partners."⁷ Some things never change, and it was the Institute of

Physics and Engineering in Medicine (IPEM) that picked up the baton and, with the support of the NRPB, the Health and Safety Executive, the health departments and the environment agencies, produced the current 2002 edition of *Medical and Dental Guidance Notes, a good practice guide on all aspects of ionising radiation protection in the clinical environment* (figure 5).¹ These 2002 guidance notes followed the established format of the 1988 NRPB guidance notes, but increased the information given from 87 to 225 pages, as well as the price from £9 to a still very reasonable £20.

And now?

Since 2002, much has changed. PETCT, IGRT, CBCT, Ra-223, FFF, RWA are just a few of the abbreviations with which we are now familiar, but which do not appear in the 2002 guidance notes, and all of these require radiation protection guidance. In the light of this, and with the imminent publication of the new Euratom Basic Safety Standard,⁸ IPEM established a working party to review and revise the guidance notes.

The working party consists of five radiation protection advisers: Will Mairs (general chapters), Philip Mayles (radiotherapy), Lisa Rowley (nuclear medicine), Mark Worrell (diagnostic imaging), myself as chair and the support of observers from regulatory bodies. The new guidance notes will be in the same general format as the 1988 and 2002 editions, and a substantial part of the basic guidance will not need to be changed. Much work has already been undertaken to draft new guidance for new techniques, and to improve guidance where it is felt that this would be useful. In summer 2016 an invitation for comments and suggestions for the new guidance notes was presented at a number of conferences and sent to a large number of professional bodies and several email lists. Nearly one hundred comments

were received, and we would like to thank all those who took the time to reply.

It has recently been announced that the UK government aims to publish draft replacements for the Ionising Radiations Regulations (IRR99) in early 2017, and for the Ionising Radiation (Medical Exposure) Regulations (IRMER) in spring 2017, with new regulations coming into force in early 2018. The working party aims to provide a draft of the new guidance notes to referees and regulators in early summer 2017. As well as acting on comments received from the referees and regulators, this draft may also need to be tweaked when the regulations are finally published at the end of 2017. We hope then to publish the new guidance notes as soon as reasonably practicable in 2018.

References

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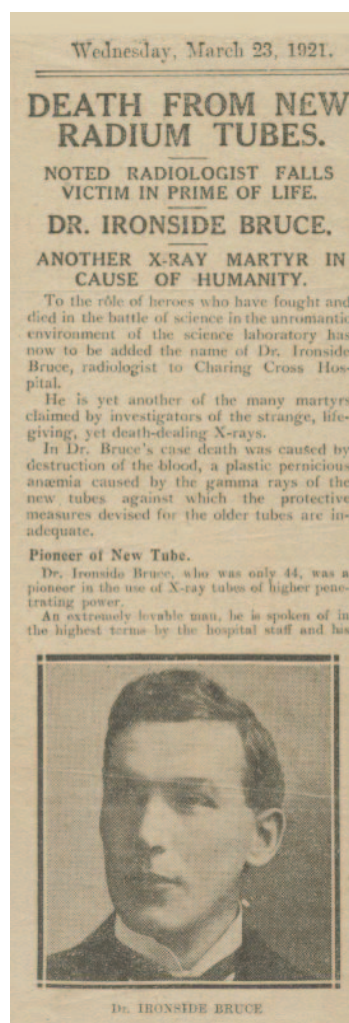


Figure 1

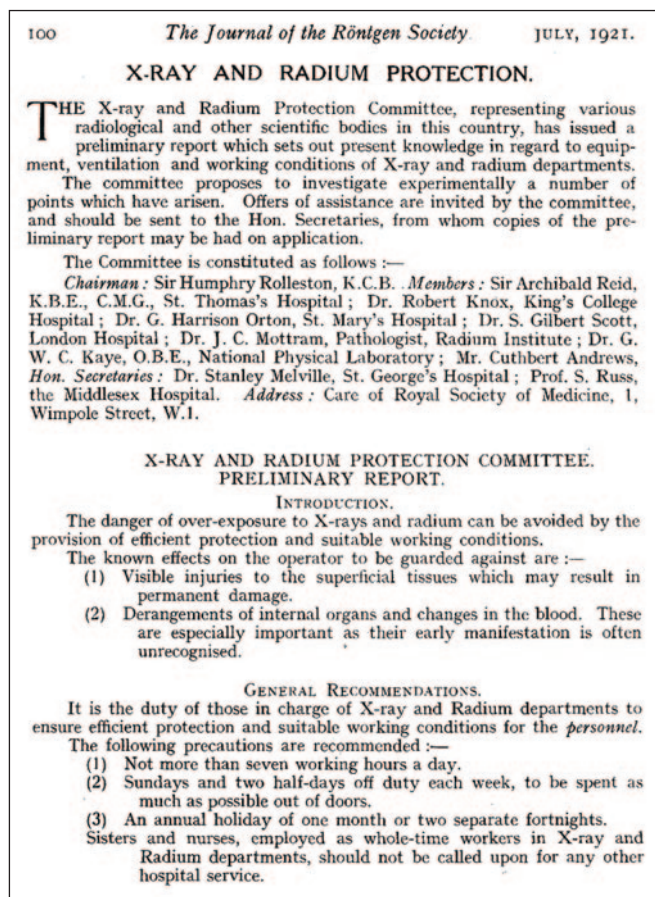


Figure 2

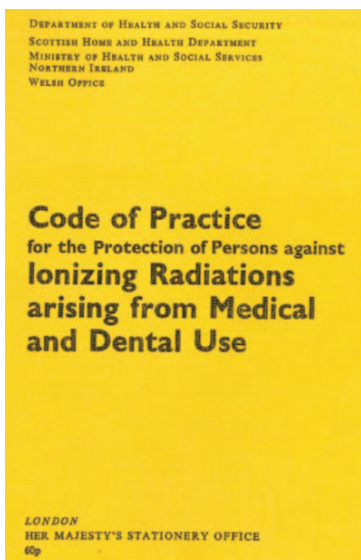


Figure 3

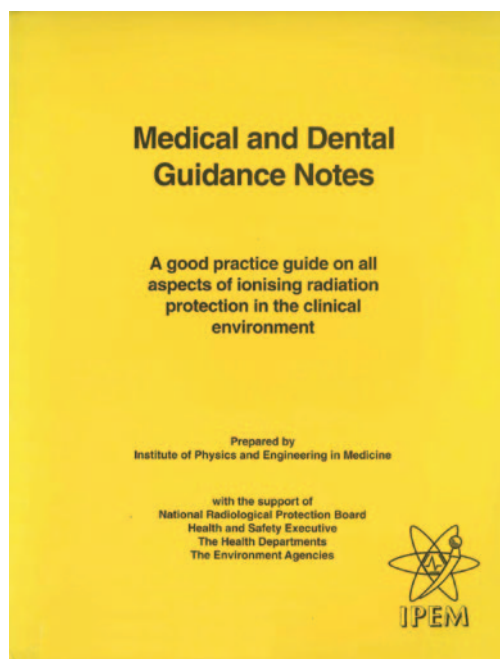


Figure 5

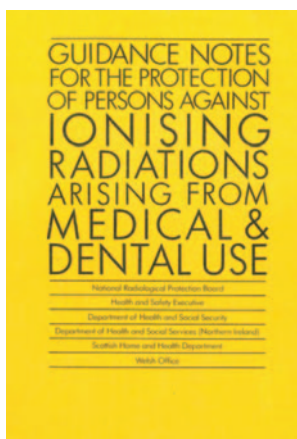


Figure 4